Teenage Alcohol Use and Educational Attainment*

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ABSTRACT. Objective: Using data from the National Child Development Study, an ongoing longitudinal birth cohort study of British youth born in 1958 (N = 9,107), we investigated the long-term impact of heavy alcohol use at age 16 years on educational qualifications in adulthood. **Method:** We used a propensity score matching approach to examine whether and for whom heavy alcohol use predicted reduced adult educational attainment. Because of gender differences in both heavy drinking and adult socioeconomic attainment, we examined the effects of heavy drinking on educational outcomes separately for females and males. **Results:** Heavy drinking in adolescence (measured in 1974) had a direct negative effect on the receipt of postsecondary educational credentials by age 42 years among males but not females, independent of child and adolescent risk factors correlated with both heavy drinking and educational attainment. In particular, males from working-class backgrounds were most affected by heavy drinking. **Conclusions:** Drawing on a life span developmental contextual approach, we find that heavy teenage alcohol use and disadvantaged social origins combined to diminish male educational attainment. In contrast, heavy alcohol use had little effect on female educational attainment. (*J. Stud. Alcohol Drugs* **69:** 848-858, 2008)

PROSPECTIVE STUDIES HAVE DOCUMENTED that heavy alcohol use in adolescence is associated with lower enrollment in postsecondary education, reduced earnings, and heightened job instability in young adulthood (Bachman et al., 1997, 2008; Cook and Moore, 1993; Koch and Ribar, 2001; Renna, 2007). We use data from a 42-year longitudinal study of British youth to explore the long-term impact of heavy teenage alcohol use on educational attainment in adulthood. In contrast to the majority of prior studies, we focus on child and adolescent risk factors that may make heavy alcohol use more hazardous for some youth than for others. Longitudinal research has identified a substantial set of variables predicting teenage alcohol use (see the reviews by Donovan, 2004; Hawkins et al., 1992; Jacob and Johnson, 1999; Petraitis et al., 1995; Wills and Yaeger, 2003), including gender; socioeconomic background; nonintact family structure; parent substance use; family conflict and low parental monitoring; difficult child temperament, aggressiveness, and negative affect; low academic motivation, aspirations, and school grades; and associations with deviant peers. Based on a life span developmental contextual approach (e.g., Baltes et al., 1998; Cairns et al., 1996; Schulenberg et al., 2003), we emphasize the dynamic interplay between social context and child characteristics as joint determinants of attainment and adjustment across the life span.

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Although teenage alcohol use is a well-known correlate of school failure and reduced educational attainment (Cook and Moore, 1993; Williams et al., 2003; Yamada et al., 1996), it is unclear whether this relationship is causal or spurious. According to human capital models, teenage alcohol use is expected to have a direct negative effect on educational attainment. Heavy alcohol use, in particular, detracts from the time that young people could spend studying, completing homework, or getting help from teachers (see Lynskey and Hall, 2000, for a review; see also Krohn et al., 1997). In addition, heavy alcohol use in adolescence may diminish educational attainment by affecting brain structure, brain functioning, and neuropsychological performance (e.g., National Institute on Alcohol Abuse and Alcoholism, 2004; Spear, 2000; Tapert et al., 2004/2005). Heavy alcohol use may also reduce long-term attainment through its impact on intervening variables. For instance, heavy alcohol use increases the likelihood of motor vehicle accidents, physical and mental health problems, and violence (Bachman et al., 1997; Hansell and White, 1991; Kandel et al., 1986; Maggs et al., 1997; Mensch and Kandel, 1988; Newcomb, 1987, 1994; Newcomb and Bentler, 1985, 1988; Yamaguchi and Kandel, 1985). The increased likelihood of injury, criminal justice involvement, and adjustment problems among heavy drinkers may jeopardize their school achievements and long-term attainments (Moffitt et al., 2002; Tanner et al., 1999). Adolescent alcohol use may also impede developmentally appropriate task completion (Gotham et al., 2003) and lead to premature transitions to the labor force (Schulenberg et al., 2003). In the long term, such a process would reduce educational attainment, and could lead to precocious adoption of spousal and parental roles (Newcomb and Bentler, 1988). Heavy alcohol use in adolescence also increases the

likelihood of alcohol problems and alcohol dependence in adulthood (Bonomo et al., 2004), which in turn could interfere with the ability to further education, develop job skills, and gain experience in the workforce.

Alternatively, there is reason to believe that some findings concerning the negative effects of heavy alcohol use on school success and long-term attainment may be spurious. Research has long shown that youths' schooling intentions and prior achievements have powerful effects on their postsecondary attainment (Duncan et al., 1972). Because low school commitment and academic failure increase the risk of heavy adolescent drinking, some scholars suggest the relationship between heavy alcohol use and educational attainment reflects mostly preexisting and unobserved differences between students in prior achievements (Chatterji, 2006; Dee and Evans, 2003; Koch and Ribar, 2001). In fact, many of the established risk factors for heavy alcohol use also predict reduced status attainment in adulthood, such as low parental educational aspirations for the child, nonintact family structure, economic deprivation, and peer rejection (see Hawkins et al., 1992). In addition to the differences between heavy drinkers and other youth with respect to early educational promise, these childhood and adolescent factors may further account for the observed correlation between teenage alcohol use and attainment.

A third view is that the alcohol-education relationship is a contingent one. For instance, Rehm et al. (2004) argued that differences in substance use–related harm cannot be accounted for solely by characteristics of the agent (e.g., alcohol) itself. Environmental factors and personal characteristics moderate the existence and the seriousness of substance use–related consequences (Berkman and Kawachi, 2000; Evans et al., 1994; Tapert et al., 2004/2005). If heavy alcohol use poses a probabilistic risk for negative outcomes, individuals may vary in their vulnerability to experiencing potential negative effects. Models of human capital highlight the importance of educational, social, and personal factors as psychosocial resources during the transition to adulthood (e.g., Bynner, 1998). Although heavy alcohol use is hypothesized to represent a potential threat to successful negotiation of developmentally normative tasks during this transition (Newcomb and Bentler, 1988), disadvantaged youth may be affected more negatively by heavy drinking in adolescence compared to individuals with greater buffering resources (Krohn et al., 1997; Wills and Yaeger, 2003).

Socioeconomic background, in particular, is likely to moderate the long-term impact of heavy alcohol use on attainment. Research shows that social origins have powerful effects on child and adolescent school performance, completed schooling by adulthood, and adult labor market success (Bynner and Joshi, 2002; Bynner and Parsons, 2002; Corcoran, 1995; Duncan et al., 1998; Schoon, 2006; Schoon et al., 2002). In contrast, economic disadvantage in childhood is not a consistent predictor of heavy alcohol use in adolescence (Wiles et al., 2007), and, in fact, some research shows a *positive* correlation between parents' education and teenage drinking and substance use (Bachman et al., 1981; Murray et al., 1987; Zucker and Harford, 1983). Unlike other risk factors that predict heavy alcohol use, more advantaged social class origins have positive long-term benefits to attainment. Thus adolescents with college-educated parents may attend college regardless of periodic and even serious alcohol infractions. In contrast, adolescents whose parents have working-class jobs may be more vulnerable to the risks of heavy adolescent drinking because they have fewer psychosocial resources during development. In particular, education researchers have long shown the important role that heavy alcohol use plays in the rebellion of working-class boys against teacher authority and the educational system (MacLeod, 1987; Willis, 1977). For working-class boys who believed that high occupational status would never be gained through education, especially given the limited prospects of good jobs in their neighborhoods, heavy drinking was a "decisive signal" to teachers, principals, parents, and other students that these individuals had little interest in continuing their education (Willis, 1977, pp. 19-20).

In summary, most research linking economic disadvantage with alcohol-related harm has focused on adulthood or, at the earliest, on adolescence (e.g., Jefferis et al., 2003), and has not examined how the effects of adolescent heavy alcohol use on adult attainment may be associated with childhood factors. Adolescence is a time in which pivotal decisions about education are made, increasing the potential long-term impact of lifestyle and health behaviors. We hypothesized that youth from disadvantaged backgrounds would experience an increased likelihood of alcohol-related harm in the domain of educational attainment. Children with greater individual risk were expected to be more vulnerable to the risks of adolescent heavy drinking, because they were hypothesized to have fewer childhood resources to successfully enter and complete postsecondary education. We investigated this key hypothesis using a major long-term longitudinal study of British youth.

Method

Participants

Data for this analysis come from the National Child Development Study (NCDS), an ongoing longitudinal study of *all* children who were born in England between March 3 and March 9, 1958 (Bynner et al., 2000; Ferri, 1993; Ferri et al., 2003; Fogelman, 1983). Following the initial assessment of more than 17,000 babies in 1958 (98% of births), the cohort was followed up at ages 7, 11, 16, 23, 33, and 42 years. In the child and adolescent follow-ups, longitudinal tracking used school records and the National Health Service Central Register. Immigrants born the same week were also

added at ages 7, 11, and 16 years. The primarily medical focus on health at birth has expanded with each wave to include broader measures of physical, educational, and social development in childhood and adolescence, adding family, work, and civic roles in adulthood. A multi-method, multi-informant approach was taken, with data collected from parents, teachers, and cohort members, as well as physical exam data from health professionals, cognitive ability tests, and national exam results.

Participation has remained high across more than 4 decades, with more than 70% of respondents taking part in the age 42 survey. Bias owing to childhood nonresponse has been concluded to be minimal (Davie et al., 1972; Fogelman, 1976), with a slight underrepresentation of males and the most disadvantaged groups (see Shepherd, 1993). In adulthood, Chase-Lansdale et al. (1995) found modest differences in attrition in the NCDS, such that those retained at age 23 were somewhat more middle class and educationally successful. The magnitude of differences was very small; for example, 9.2% of those remaining at age 23 had received free school meals at age 11 in comparison with 10.4% of attriters. Minimal differences were also found in fathers' occupational status at age 11: 36% of those present at age 23 had fathers in nonmanual occupations (indicating higher status) compared with 35% of attriters. Hawkes and Plewis (2006) found a small difference (.025) in the predicted probability of nonresponse at age 42.

Measures

Our longitudinal analyses are based on measures of adult educational qualifications; teenage alcohol use; and childhood aspirations, academic ability, adjustment, and family background. Table 1 shows descriptive statistics separately for females and males. Our analysis sample is based on the 12,006 respondents who were not missing data on alcohol use at age 16, gender, or father's occupational standing. Some respondents were missing information on childhood predictor variables. Our final sample size was 9,107 (51% male).

Educational qualifications achieved by age 42 are based on Makepeace et al.'s (2003) five-level categorization of National Vocational Qualification (NVQ) levels. We distinguished respondents who attained postsecondary academic and vocational credentials (NVQ4 or NVQ5) from those who attained two or more A levels (NVQ3), academic or vocational qualifications equivalent to the General Certificate of Secondary Education (GCSE) or O-levels of grades A-C (NVQ2), lower grades of GCSE and O-levels or the lowest levels of vocational certificates (NVQ1), or no educational diploma (see Schoon, 2006). By age 42, 30% of females and 32% of males had completed postsecondary credentials, which is comparable to the percentage of adults who hold baccalaureate or higher-level degrees in the United States (National Center for Education Statistics, 2008).

Table 1. Descriptive statistics by gender

	Female		Male	
Variable	*n*	Mean or %	*n*	Mean or %
Educational attainment by age 42				
Postsecondary degree, 1 = NVQ4 or NVQ5; 0 = lower qualifications	4,878	30%	4,818	32%
Heavy alcohol use at age 16				
≥4 drinks per week, 1 = yes; 0 = no	5,860	13%		
≥5 drinks per week, 1 = yes; 0 = no			6,146	25%
Childhood school achievement at age 11, *z* scores				
High reading and mathematics scores	5,077	-.011	5,296	.010
Teacher-rated good academic ability	5,063	.048	5,275	-.046
Childhood behavioral adjustment at ages 7 and 11, *z* scores				
Parent-rated externalizing problem behaviors	5,557	-.180	5,803	.173
Parent-rated internalizing problem behaviors	5,556	.042	5,802	-.040
Teacher-rated adjustment problems, Bristol Social Adjustment Scale	5,077	-.156	5,295	.149
Childhood leisure activities at age 11, *z* scores				
Unstructured socializing	4,958	-.050	5,150	.048
Reading, listening to music, drawing, and writing	5,010	.233	5,194	-.224
School clubs and sports	5,006	-.046	5,195	.044
Childhood school and work aspirations at age 11				
Get a job, 1 = yes; 0 = no	4,983	17%	5,163	23%
Continue full-time study, 1 = yes; 0 = no	4,983	33%	5,163	28%
Uncertain, 1 = yes; 0 = no	4,983	51%	5,163	48%
Mother's cigarette use, *z* score				
Maternal cigarette smoking during pregnancy	5,453	.003	5,682	-.003
Family background, birth to age 11				
Father ever employed in manual occupation, 1 = yes; 0 = nonmanual only	5,860	79%	6,146	79%
Parent continued education past age 15, 1 = yes; 0 = left school by age 15	5,786	58%	6,069	56%
Resided in nonintact family, 1 = yes; 0 = intact family	5,666	6%	5,916	5%
Received free school meal, 1 = yes; 0 = no free meal	5,006	9%	5,216	9%

Note: NVQ = National Vocational Qualification.

Approximately 14% of females and 20% of males attained NVQ3 qualifications (i.e., slightly higher than a U.S. high school diploma), 30% of females and 24% of males had achieved NVQ2 qualifications (i.e., age 16 school-leaving exams), and 13% of males and females had attained NVQ1 status. Nearly 13% of females and 11% of males had no educational qualifications.

Heavy alcohol use during adolescence is our key predictor variable in this study. Britain has one of the highest rates of alcohol use and heavy drinking in Europe (Kuntsche et al., 2004). Like their American counterparts, the majority of older adolescents in Britain drink alcohol. For example, 80% of 16-year-olds in the cohort analyzed here reported some drinking in the past 30 days, compared with 68% of 12th graders in the United States born the same year (Johnston et al., 2003). In this study, respondents at age 16 reported the recency of drinking and the units of alcohol consumed in the prior 7 days. Approximately half (52%) reported drinking alcohol in the past week. Respondents who reported drinking in the past week were then asked to report the number of drinks they had in the past week and what they were (e.g., one whisky and two half pints of beer).

To create a measure of heavy alcohol use, we first calculated the total units of alcohol consumed in the past week, where one unit is equal to a half pint of beer (284 ml), small glass of wine (125 ml), standard pub measure of distilled spirits (25 ml), or small glass of vermouth or sherry (50 ml). We considered "heavy" drinkers as females who had consumed four or more units of alcohol in the past week and males who had consumed five or more units of alcohol in the past week. Females who consumed three or fewer drinks and males who consumed four or fewer drinks were considered lower risk because they could not have engaged in what is defined as a heavy episodic drinking event during that week. These cutoffs were based on research suggesting the need for gender-specific indicators of heavy alcohol use because of gender differences in typical weight and ability to metabolize alcohol (Wechsler et al., 1995). At age 16, 13% of females reported four or more drinks and 25% of males reported five or more drinks in the previous week.

As background covariates, we used three childhood measures of academic ability in our analyses to gain additional leverage on whether the alcohol-attainment relationship is spurious to prior achievements. We included standardized scores from math and reading comprehension tests that were administered at age 11. These exam scores were first standardized and then averaged. In addition, teachers reported the academic progress of the child in relation to all children of his or her age. The measure of teacher-rated academic ability is a summary composite of whether the respondent is "exceptionally or extremely good," "above average," "average," "below average," or "very poor" in general knowledge, number work, use of books, and oral ability. Each of these items was first standardized and then averaged.

At ages 7 and 11, parents rated children's and adolescents' behavioral and emotional difficulties using short forms of Rutter et al.'s (1970) Health and Behavior Checklists (Buchanan et al., 2002; Chase-Lansdale et al., 1995). The measure of externalizing behavior was based on the average scores of six items: whether the parent believes the child has difficulty in settling to anything for more than a few minutes, destroys own or others' belongings, is squirmy or fidgety, is irritable and "quick to fly off the handle," fights with other children, and is disobedient at home (responses to each item included "never," "sometimes," and "frequently"). A principal components analysis of the externalizing behavior items showed that approximately 40% of the variance was accounted for by one factor, with loadings ranging from .57 to .68. The composite measure of internalizing behavior was based on three items: whether the child is miserable or tearful, worries about many things, and is upset by new situations. For each item, the parent could indicate "never," "sometimes," or "frequently." A principal components analysis of the internalizing behavior items showed that approximately 53% of the variance was accounted for by one factor, with loadings ranging from .60 to .82. In general, Elander and Rutter (1996) reported good psychometric properties across a variety of studies, especially for antisocial problems. At age 11, teachers also rated adolescents' behavioral and attitudinal adjustment using the Bristol Social Adjustment Guide (Stott, 1963). Based on these teacher ratings of the child, we included a summary composite of items indicating the extent to which the child was withdrawn, unforthcoming, depressed, untrustworthy, hostile toward adults and other children, restless, immature, unconcerned with approval by adults, and overly concerned with acceptance by other children. Higher scores on this scale indicate adjustment problems. Each of these measures was standardized.

At age 11, respondents described their future aspirations and leisure activities. Adolescents were asked, "When you leave secondary school, which of these things do you think you will do?" Future aspirations were coded as a series of dummy variables indicating whether the respondent believed they would "go straight to a job," "continue full-time study (for example, at a college or university)," or "don't know." At age 11, respondents were also asked about activities they liked to do and how often they did these activities (ranging on a three-point scale from "never or hardly ever" to "nearly every day"). Unstructured socializing is a composite measure of two items: how often they played and talked to friends outside of school hours and how often they went to the cinema. We also created a measure based on how often they read books (apart from schoolwork or homework), newspapers, magazines, or comics; listened to music (not "pop" music); wrote stories, plays, or poems; and drew or painted pictures. Finally, we created a composite measure of school clubs and sports, which included participation in extracurricular clubs

outside of school, going to school clubs, or playing sports. Each of the measures of leisure activities was standardized.

The father's occupational standing was assessed at the child's birth (1958), and at ages 7, 11, and 16 by the Registrar General's social class measure (RGSC), which codes the job status of the current or most recent job along with associated education, prestige, and lifestyle (Marsh, 1986; Office of Population Censuses and Surveys, 1980). The categories are I, professional, high level managers, and administrators; II, lower level managerial or technical positions; IIINM, clerks and other skilled nonmanual occupations; IIIM, skilled manual workers and supervisors; IV, semiskilled occupations and service workers; and V, unskilled workers (see also Schoon, 2006). We coded categories I through IIINM as nonmanual (or middle class) jobs; skilled manual, partly skilled, and unskilled were classified as manual (or working class) jobs. Approximately 79% of respondents ever resided in a working-class family during childhood. These are similar to U.S. census categories (Krieger et al., 1997). Father's or mother's educational level indicates whether one or more of the respondent's parents had continued their schooling past the age of 15 (coded 0 = no, 1 = yes). We also included a standardized measure of whether the mother of the child smoked during pregnancy (0 = no, 1 = variable, 2 = medium smoker, 3 = heavy smoker), and measures indicating whether the respondent had resided in a nonintact family at some point during childhood or received a free school lunch at age 11 (both 0 = no, 1 = yes).

Plan of analysis

Simple comparisons of the long-term educational attainment between heavy drinking youth and other youth may be misleading if youth who drink heavily are systematically different from those who do not. Adolescents self-select into drinking behavior for a variety of reasons. When these reasons are also associated with the outcome of interest, namely adult educational attainment, the association between drinking and attainment is confounded.

In the statistics literature, causal analysis of observational studies is often built on an analogy to experimental design, where a treatment (i.e., heavy alcohol use) would ideally be randomly assigned, to balance on all confounding variables. The use of propensity scores (Imai and van Dyk, 2004; Rosenbaum and Rubin, 1983) to balance groups of "treated" and "untreated" individuals on observed characteristics is increasingly common in medical, epidemiological, and social science research as an effort to approximate an experimental design. It is well understood that blocking on a small set of covariates can help reduce bias and increase efficiency for estimating effects. However, finding matched pairs grows exponentially more difficult as the number of potentially confounding covariates increases. The propensity score is a simple technique to balance different treatment groups by reducing the (usually high) dimension of covariates to a single dimension, which is then used for matching. Matching subjects on the propensity score avoids some of the inherent problems of standard analysis of covariance (e.g., hidden extrapolations, assumptions of linearity, model complexity).

In this study, we matched heavy drinkers with nonheavy drinkers similar in observed background characteristics using a logit model. The potential confounders in Table 1 were used to predict treatment status (heavy drinking versus non-heavy drinking at 16). We then used the program PSMATCH2 in Stata Release 10 (StataCorp LP, College Station, TX) to perform one-to-one nearest neighbor matching without replacement to pair treated and untreated individuals on their propensities to drink heavily at age 16 (Leuven and Sianesi, 2003). In this study, we used a common-support match, meaning that heavy drinkers who did not have a match within the specified interval on the propensity score were not paired with anyone from the nonheavy drinking group. These cases were considered "off-support." We carried out the above analysis for males and females separately because of differences in body size and metabolism of alcohol as well as gender roles and educational attainment. We then repeated the analysis for the possible combinations of gender (male/female) and social class (working class/nonworking class).

Results

Effects of heavy drinking on educational attainment by gender

To generate propensity scores for each respondent that we used for matching, we estimated logit models predicting heavy alcohol use at age 16 separately for females and for males. The odds ratios and standard errors from these equations modeling heavy alcohol use are reported in Table 2.

For both females and males, externalizing behaviors increased the risk of heavy alcohol use, whereas youth who received a free school lunch were less likely to drink heavily. Higher teacher rankings of good academic ability positively predicted heavy alcohol use in adolescence, which is also consistent with other research (Fleming et al., 1982). The logistic regression models also revealed some gender differences in the childhood risk factors associated with teenage alcohol use. For instance, social time spent with peers predicted male heavy drinking, whereas maternal smoking during pregnancy increased the chances of female heavy drinking in adolescence. Males who were miserable, tearful, worried, and upset by new situations in childhood were less likely to drink heavily at age 16. Females who resided in working-class families were also approximately 27% less likely to drink heavily than females from more advantaged socioeconomic origins ($p < .01$). By comparison, the

Table 2. Logistic regression models predicting heavy drinking at age 16

Childhood predictors of teenage heavy drinking[a]	Female Odds (SE)	Male Odds (SE)
Childhood school achievement at age 11, *z* score		
High reading and mathematics scores	1.14 (0.088)	1.10 (0.062)
Teacher-rated good academic ability	1.17* (0.090)	1.22‡ (0.070)
Childhood behavioral adjustment at ages 7 and 11, *z* score		
Parent-rated externalizing problem behaviors	1.20‡ (0.062)	1.08* (0.040)
Parent-rated internalizing problem behaviors	0.94 (0.045)	0.91† (0.033)
Teacher-rated adjustment problems	1.11 (0.062)	1.04 (0.038)
Childhood leisure activities at age 11, *z* score		
Unstructured socializing	1.09 (0.049)	1.25‡ (0.046)
Reading, listening to music, drawing, and writing	0.95 (0.044)	0.95 (0.036)
School clubs and sports	1.01 (0.046)	1.13‡ (0.040)
Childhood school and work aspirations at age 11, vs uncertain		
Get a job	1.12 (0.143)	1.15 (0.100)
Continue full-time study	1.02 (0.103)	0.99 (0.082)
Mother's cigarette use, birth, *z* score		
Maternal smoking during pregnancy	1.12† (0.048)	1.06 (0.037)
Family background, birth to age 11		
Father ever employed in manual occupation, vs nonmanual only	0.73† (0.081)	1.04 (0.094)
Parent continued education past age 15, vs left school by age 15	0.98 (0.093)	0.92 (0.066)
Resided in nonintact family, vs intact family	0.81 (0.172)	1.20 (0.181)
Received free school meal, vs no free meal	0.69* (0.124)	0.73* (0.097)
Sample size, *n*	4,479	4,628

[a]Heavy drinking for females is defined as four or more units in the past week, whereas heavy drinking for males is defined as five or more units.
*$p < .05$; †$p < .01$; ‡$p < .001$ (two-tailed tests).

association of social origins with male heavy drinking was small and statistically nonsignificant.

A key advantage of matching on a propensity score is to minimize the observed differences on the childhood predictors of heavy alcohol use (Joffe and Rosenbaum, 1999; Rubin and Thomas, 1996). Table 3 shows the mean differences (and *t* tests) in childhood measures between heavy alcohol users and other youth both before and after being matched on the propensity score, separately for females and males. In the unmatched sample of females, there were statistically significant differences in test scores, teacher-rated ability, externalizing behaviors, maternal smoking, and family background between the female heavy drinkers and the control group (i.e., moderate drinkers and nondrinkers). After matching, bias owing to differences in all of the pretreatment measures between heavy drinkers and nonheavy drinkers was reduced. The goal of the balancing was to create matched subsamples of heavy and nonheavy drinkers for males and females, respectively, with reduced bias owing to observed background covariates, so the analysis could proceed as if the data were from a randomized experiment.

Table 4 shows the percentages of female and male respondents who completed a postsecondary degree for the heavy drinkers and control group both before and after we performed one-to-one nearest neighbor matching without replacement. After matching, female heavy drinkers were *not* significantly less likely to complete a postsecondary degree than females who drank moderately or not at all ($t = -0.91$, $p > .05$, two-tailed test). Among males, heavy drinking in adolescence has a negative effect on the receipt of postsecondary credentials by age 42 ($t = -3.43$, $p < .05$, two-tailed test), independent of childhood risk factors that are correlated with both heavy drinking and school success. The results suggested that heavy alcohol use has little effect on female educational attainment. However, heavy drinking in adolescence has a direct negative effect on the receipt of postsecondary credentials for male respondents.

Effects of heavy drinking on educational attainment by gender and social origins

We hypothesized that socioeconomic background may moderate the effect of alcohol on long-term educational attainment. Again, to generate propensity scores, we estimated four logit models predicting heavy alcohol use at age 16 separately for females and for males from working-class and nonmanual family backgrounds. Table 4 shows the percentages of respondents who completed a postsecondary degree for the treatment (i.e., heavy drinkers) and control groups (i.e., moderate and nondrinkers) by gender and by social class background. Rates of completing a postsecondary degree were very different across social class, with men and women from families of manual workers about half as likely to earn a degree. For females from both social class backgrounds, heavy drinking did not significantly diminish the chances of completing a degree. For males, the effect of heavy drinking on postsecondary degree completion was similar for youth from working-class and middle-class

TABLE 3. Comparing heavy drinkers and moderate/nondrinkers at age 16 on childhood background factors, by gender, before and after one-to-one nearest-neighbor matching without replacement

	Female			Male		
		Moderate drinkers and nondrinkers			Moderate drinkers and nondrinkers	
Variable	Heavy drinkers	Before matching	After matching	Heavy drinkers	Before matching	After matching
Childhood school achievement at age 11, *z* score						
High reading and mathematics scores	.19	.03§	.21			
Teacher-rated good academic ability	.25	.10§	.26	.21	.07§	.20
Childhood behavioral adjustment at ages 7 and 11, *z* score						
Parent-rated externalizing problem behaviors	-.12	-.22§	-.09	.14	.13	.15
Parent-rated internalizing problem behaviors	.03	.05	.06	-.09	.01§	-.10
Teacher-rated adjustment problems	-.19	-.20	-.20	.05	.10	.06
Childhood leisure activities at age 11, *z* score						
Unstructured socializing	.02	-.05	.01	.23	-.02§	.24
Reading, listening to music, drawing, and writing	.22	.25	.20	-.20	-.24	-.21
School clubs and sports	-.01	-.04	.04	.19	.01§	.17
Childhood school and work aspirations at age 11						
Get a job	15%	16%	15%	23%	22%	23%
Continue full-time study	34%	32%	35%	29%	28%	28%
Uncertain	50%	52%	50%	48%	50%	48%
Mother's cigarette use, birth, *z* score						
Maternal smoking during pregnancy	.09	-.01§	.03	.00	-.06§	-.03
Family background, birth to age 11						
Father ever employed in manual occupation	73%	80%§	73%	78%	78%	78%
Parent continued education past age 15	61%	59%	61%	59%	58%	62%
Resided in nonintact family	4%	5%	4%	5%	4%	5%
Received free school meal	7%	9%§	7%	6%	8%§	5%

§Differences between heavy drinkers and moderate and nondrinkers are statistically significant, $p < .10$ (two-tailed tests).

TABLE 4. Average effect of heavy drinking on postsecondary degree receipt, by gender and socioeconomic background based on one-to-one nearest-neighbor matching without replacement

						Sample size, *n*	
Variable	Heavy drinkers[a]	Moderate and nondrinkers	Difference	SE	*t*	Treated	Total
By gender							
Females							
Unmatched	.292	.309	-.017	.021	-0.78		
Matched	.292	.318	-.025	.028	-0.91	554	3,804
Males							
Unmatched	.293	.339	-.046	.017	-2.67*		
Matched	.293	.365	-.072	.021	-3.43*	1,000	3,727
By gender and socioeconomic background							
Females							
Working class							
Unmatched	.219	.251	-.032	.023	-1.39		
Matched	.219	.239	-.020	.030	-0.67	402	2,996
Nonmanual							
Unmatched	.487	.538	-.051	.045	-1.14		
Matched	.487	.500	-.013	.058	-0.23	152	808
Males							
Working class							
Unmatched	.236	.275	-.039	.018	-2.1*		
Matched	.236	.317	-.080	.023	-3.57*	783	2,911
Nonmanual							
Unmatched	.498	.568	-.070	.039	-1.77		
Matched	.498	.553	-.055	.048	-1.15	217	816

[a]Heavy drinking for females is defined as four more or units in the past week, whereas heavy drinking for males is defined as five or more units. We used the "psmatch2" command in Stata 10.0 to estimate the matching procedure.
*$p < .05$ (two-tailed test).

backgrounds, but the effect was statistically nonsignificant for the latter (t = -1.15, p > .05, two-tailed test). For male youth from working-class backgrounds, heavy drinking has a direct negative effect on long-term educational attainment, independent of other childhood background characteristics. Among working-class youth, heavy drinkers were approximately 25% less likely to graduate with a postsecondary degree, whereas for middle-class youth the relative percentage reduction was approximately 10%.

Discussion

Standard regressions of educational attainment on heavy drinking in adolescence can lead to biased estimates of the causal effects because of strong assumptions about the appropriate model for controlling for covariates. Therefore, we matched females and males based on their propensity for heavy drinking as indexed by numerous family background, childhood, and adolescent risk factors. We then examined the association between heavy drinking status at age 16 and educational outcomes within demographic subgroups of the sample with similar propensities for drinking. The results suggest that male heavy drinking in adolescence has a negative effect on the receipt of postsecondary qualifications by age 42, independent of childhood risk factors correlated with both heavy drinking and school achievement. In particular, males from working-class families were the most impacted by heavy alcohol use in adolescence. In contrast, heavy alcohol use had little effect on female educational attainment.

Social class background can exacerbate the harm of heavy alcohol use through two complementary processes (Fitzgerald and Zucker, 1995; Rehm et al., 2004). These dual processes have been described as "double jeopardy" in poverty research (Brooks-Gunn et al., 1995). First, social background may impact the likelihood of alcohol use itself through its impact on intervening variables (e.g., Droomers et al., 2003; Mäkelä, 1999). Second, social background may alter the link between alcohol use and negative consequences (e.g., Cahalan and Room, 1974; Harrison and Gardiner, 1999; Schulenberg et al., 2003). Our results suggest that social origins alter the link between alcohol use and longer-term attainments.

As previously described, there are at least three views on the associations between alcohol use and educational attainment. First, drinking may impede developmentally appropriate task completion and lead to premature transitions to adult roles (Gotham et al., 2003). Evidence to support this perspective as a primary explanation would be strongest if the effect of alcohol use was consistent across gender and social class, which was not the case. Second, the negative effects of alcohol use on attainment may be spurious; "third variable" differences between individuals may explain both drinking and attainment (Chatterji, 2006; Dee and Evans, 2003). The propensity score approach we have taken minimizes the risk of a spurious association by matching individuals on a range of observed variables. The potential for an *unobserved* third variable explanation still exists, however. Finally, the alcohol-education association may be contingent on characteristics of the environment (Berkman and Kawachi, 2000; Evans et al., 1994; Rehm et al., 2004). Findings from the current study are consistent with the final explanation because the effects of alcohol use during adolescence vary depending on the social background of the individuals. Specifically, heavy alcohol use during adolescence appears to be more hazardous for working-class males than for males from more advantaged backgrounds or for females. Therefore, as suggested by the developmental contextual approach, the combination of an individual's context and personal behavior most accurately indicates the risk for negative adult outcomes (e.g., Baltes et al., 1998; Cairns et al., 1996).

Adolescent drinking was not associated with educational attainment of women in part because alcohol use for females in this cohort was associated with childhood social advantage, rather than disadvantage (Maggs et al., 2008). However, for men, alcohol use in adolescence and social disadvantage combined nonadditively to negatively affect life chances. These results do not necessarily imply that among socially disadvantaged men drinking has a direct causal effect of lower educational attainment. Rather, for working-class males, alcohol use may be a part of the process of teenage rebellion against school. Ethnographic research suggests that working-class males use delinquency and substance use to compensate for status they are unlikely to gain through more traditional means (i.e., through educational achievement and successful careers) (MacLeod, 1987; Willis, 1977). Furthermore, boys from more advantaged backgrounds can overcome the negative effects of drinking because they have social advantages (e.g., knowledge and social connections of parents) that allow them to navigate the education system.

Limitations

Our study does have some limitations. First, alcohol use at age 16 was assessed as the number of drinks consumed in a single week. The extent to which this week was similar to or different from other weeks, and therefore may mischaracterize an individual's alcohol use pattern, is unknown. We take the measure as an indicator of early onset of heavy drinking, but we acknowledge that it does contain measurement error that is likely to attenuate observed effects. Second, no data on participants' drinking before age 16 were available, and therefore we cannot extend our investigation to examine earlier onset than age 16. Third, our efforts to reduce bias in matching the sample are only as good as the available confounders. Unlike most studies, we had the benefit of a rich set of covariates measured from birth to age 16, and therefore we were able to balance on family characteristics, academic ability and performance, externalizing and inter-

nalizing behaviors, and educational aspirations. Nevertheless, other confounders, particularly ones more salient at the time of drinking onset, might have been able to assist in matching the samples even better.

Conclusions and future directions

Despite these limitations, our study is among the first to show that childhood risk factors play an important role in moderating the impact of heavy alcohol use on later life outcomes. The majority of research linking social or economic disadvantage with alcohol-related harm has focused on adulthood or, at the earliest, on adolescence (e.g., Jefferis et al., 2003). Using national data from a British birth cohort study spanning more than 4 decades, we were able to use childhood factors to match individuals and isolate the effect of heavy drinking during adolescence as a predictor of adult educational attainment. In Britain, it is still true that age 16 is the year in which pivotal decisions about educational attainment are made, increasing the long-term impact of concurrent behaviors such as heavy drinking. After matching individuals on indicators of family background, academic ability, behavior, future aspirations, and activity participation, the effect of heavy drinking in adolescence on educational attainment remained, especially for working-class men.

Future long-term longitudinal research is needed to replicate these findings for more recent birth cohorts and for populations outside of Britain. The potential moderating effect of social background on adolescent alcohol use for additional adult outcomes, including interpersonal relationships, physical health, and adult alcohol use disorders, should also be investigated. Propensity score matching is a technique that may be especially useful for investigating these associations by matching individuals on background and personal characteristics to estimate more confidently the effects of substance use during adolescence.

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