

PART I
Epidemiology,
Consequences, and Risk
Factors

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1

Prevalence and Consequences of College Student Alcohol Use

Ralph W. Hingson and Aaron M. White

Since 1976, when the National Institute on Alcohol Abuse and Alcoholism (NIAAA) issued its first report on abusive drinking by college students, research advances have transformed our understanding of alcohol abuse and related problems among college students. Several national surveys indicate that about 80% of college students drink alcohol each year. Many first-year students come to college with an established pattern of drinking developed in high school and even middle school. Further, we now know that a broad array of factors affect college student drinking behaviors and the consequences that follow. These factors include an individual's genetic susceptibility to the positive and negative effects of alcohol, campus norms related to drinking, expectations regarding the benefits and detrimental effects of drinking, penalties for underage drinking, parental attitudes about drinking while at college, whether one is member of a Greek organization, and conditions within the larger community that determine how accessible and affordable alcohol is. Together, these influences and others contribute to a culture of drinking that, in the end, can be more damaging and deadly than previously recognized.

HEAVY DRINKING AT COLLEGE

Research suggests that a large percentage of college students who drink do so to excess. National surveys indicate that from 1999 to 2007 (Substance Abuse and Mental Health Services Administration, 2000, 2002, 2006, 2008) the percent of 18- to 24-year-old college students who drank five or more drinks on an occasion in the previous 30 days increased from 41.7% to 43.8%, a significant 5% proportional increase.

Among 18- to 24-year-olds not in college, the percent increased from 36.5% to 40.7%, a significant 12% proportional increase.

For the majority of drinkers, five drinks in a 2-hour period, often referred to as heavy episodic or binge drinking, would produce a blood alcohol concentration (BAC) at or above 0.08%, a level at which driving-related abilities are markedly impaired, decision making and impulse control are dulled, and memory starts to fail. This is the legal limit of intoxication for adults in all 50 states. The odds of a fatal car crash are elevated significantly here, as are the chances of suffering from alcohol blackouts, being sexual assaulted, physically injured, and suffering various other harms (Hingson & White, 2010).

A greater percentage of 18- to 24-year-old college students compared with non-college respondents engage in binge drinking. However, because only 36% of 18- to 24-year-olds are in college, the number not in college who consumed five or more drinks on an occasion in 2007 exceeded the number of college students who did so by a large number (7,705,578 vs. 4,564,861). From 1999 to 2007, among 18- to 24-year-olds, the proportion of college students who drove under the influence of alcohol decreased slightly from 26.1% to 25.2%. Among those in the same age-group who are not in college, the proportion increased significantly from 19.8% to 21.0%.

Those old enough to drink legally drink more heavily and are more likely to drink and drive than students who are underage based on current law (i.e., < 21 years old). The largest increase in binge drinking occurred among 21- to 24-year-olds (43% in 1999 and 48% in 2007), not 18- to 20-year-olds (38% in 1998 and 39% in 2007), who currently are prohibited from drinking legally. Similarly, the percentages of those who drove under the influence were highest in the 21- to 24-year-old group at 30% in both 1999 and 2007. In the 18- to 20-year-old group, the percent declined from 24% to 21% during those years.

Concerns have been raised that the legal drinking age of 21 drives drinking by underage persons into unsupervised settings where very heavy drinking is apt to occur. Analyses of the National Longitudinal Alcohol Epidemiologic Study (NLAES) and National Epidemiologic Study on Alcohol and Related Conditions (NESARC) national surveys conducted 10 years apart in 1991 to 1992 and 2001 to 2002 reveal increases in consuming 10 or more drinks or 21 or more drinks, the latter being the equivalent of one fifth of distilled spirits, occurred among 21- to 24-year-olds, particularly those in college, not 18- to 20-year-olds (see Figure 1.1). Among 21- to 24-year-old college students, the percentages consuming 10 or more drinks on an occasion rose from 27% to 40%, and the percent consuming 21 or more drinks on an occasion rose from 8% to 15%.

ALCOHOL-RELATED CONSEQUENCES

Drinking to intoxication leads to widespread impairments in cognitive abilities, such as decision making and impulse control, and impairments in motor skills, such as balance and hand-eye coordination, thereby increasing the risk of injuries and various

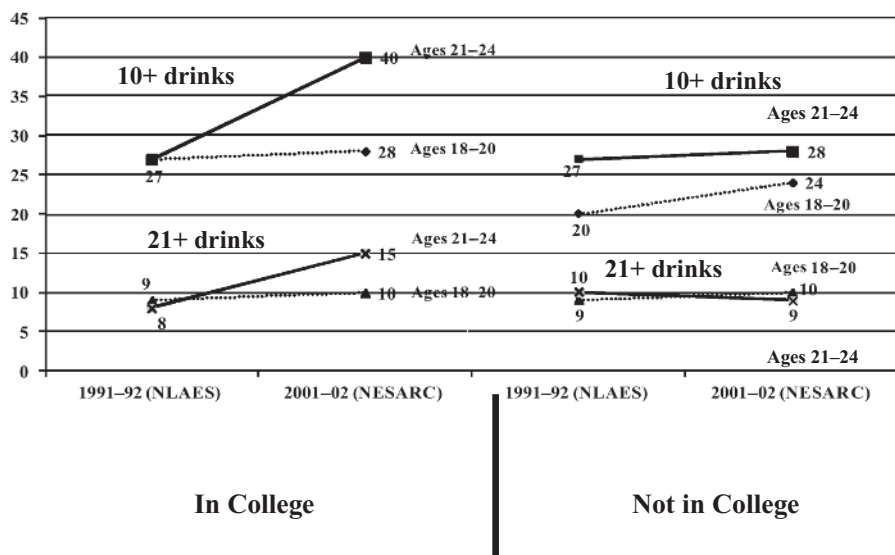


Figure 1.1 Consumption of 10+ Drinks or More or 21+ Drinks on an Occasion in Past Year by U.S. 18- to 20-year-olds and 21- to 24-year-olds, 1991–1992 versus 2001–2002

other harms. Among 18- to 24-year-old college students, deaths from all alcohol-related unintentional injuries, including traffic and other unintentional injuries, increased from 1,442 in 1998 to 1,870 in 2007, corresponding to a 1% increase in rates of death among students per 100,000 from 18.5 to 18.6. Among all 18- to 24-year-olds, alcohol-related unintentional injury deaths increased from 4,809 in 1998 to 5,502 in 2007. Most of the injury deaths resulted from traffic crashes involving alcohol (1,395 among college students ages 18 to 24 and 4,103 among all individuals in that age group) in 2007. Alcohol-related traffic deaths involving college students increased from 1,135 to 1,395 and from 3,783 to 4,103 among all 18- to 24-year-olds. Nontraffic unintentional injury deaths increased from 308 to 531 among 18- to 24-year-old college students and from 1,026 to 1,562 among all persons that age. Most of that increase resulted from increases in poisoning deaths involving alcohol, up from 62 to 262 among college students and from 207 to 770 among all 18- to 24-year-olds from 1998 to 2007.

NIAAA reports have documented that heavy-drinking college students not only place their own health at risk, they jeopardize the well-being of others. As many as 46% of the 4,553 people killed in 2007 in crashes involving 18- to 24-year-old drinking drivers were people other than the drinking driver. Further, a national survey in 2001 indicated that more than 690,000 college students that year nationwide were hit or assaulted by a drinking college student, and 97,000 students were the victim of a date rape or assault perpetrated by a drinking college student (Hingson & Zha, 2009).

Below are recent statistics summarizing alcohol-related harm involving college students:

- ♦ **Death:** More than 1,800 college students between the ages of 18 and 24 die each year from alcohol-related unintentional injuries, including motor vehicle crashes (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson, Zha, & Weitzman, 2009, Hingson & White, 2010). Nearly one half of people 18 to 24 who die in crashes involving alcohol are persons other than the drinking driver.
- ♦ **Injury:** 599,000 students between the ages of 18 and 24 are unintentionally injured under the influence of alcohol (Hingson et al., 2005).
- ♦ **Physical assault:** More than 696,000 students between the ages of 18 and 24 are assaulted by another student who has been drinking (Hingson et al., 2005).
- ♦ **Sexual assault:** More than 97,000 students between the ages of 18 and 24 are victims of alcohol-related sexual assault or date rape (Hingson et al., 2005).
- ♦ **Unsafe sex:** 400,00 students between the ages of 18 and 24 had unprotected sex and more than 100,000 students between the ages of 18 and 24 report having been too intoxicated to know if they consented to having sex (Hingson, Heeren, Winter, & Wechsler, 2003).
- ♦ **Health problems/suicide attempts:** More than 150,000 students develop an alcohol-related health problem (Hingson, Heeren, Zakocs, Kopster, & Wechsler, 2002) and between 1.2% and 1.5% of students indicate that they tried to commit suicide within the past year due to drinking or drug use (Presley, Leichliter, & Meilman, 1998).
- ♦ **Drunk driving:** 2.7 million students between the ages of 18 and 24 drove under the influence of alcohol last year.
- ♦ **Memory loss:** National estimates suggest that 10% of nonbinge drinkers, 27% of occasional binge drinkers, and 54% of frequent binge drinkers reported at least one incident in the past year of blacking out, defined as having forgotten where they were or what they did while drinking (Wechsler, Lee, Kuo, & Lee, 2000; White, 2003).
- ♦ **Property damage:** More than 25% of administrators from schools with relatively low drinking levels and more than 50% from schools with high drinking levels say their campuses have a “moderate” or “major” problem with alcohol-related property damage (Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998).
- ♦ **Police involvement:** About 5% of 4-year college students are involved with the police or campus security as a result of their drinking (Wechsler et al, 2002) and an estimated 110,000 students between the ages of 18 and 24 are arrested for an alcohol-related violation such as public drunkenness or driving under the influence (Hingson et al., 2002). A more recent national study reported 8.5% were arrested or reported other trouble with the police because of drinking (Presley & Pimentel, 2006).

- ♦ **Alcohol abuse and dependence:** 31% of college students met criteria for a diagnosis of alcohol abuse and 6% for a diagnosis of alcohol dependence in the past 12 months, according to questionnaire-based self-reports about their drinking (Knight et al., 2002).

Clearly, alcohol use by college students is viewed by some people as normative, but alcohol is associated with a variety of negative outcomes on college campuses. We explore some of these negative outcomes in detail in this chapter.

ACADEMIC PERFORMANCE

About 25% of college students report academic consequences of their drinking including missing class, falling behind in class, doing poorly on exams or papers, and receiving lower grades overall (Engs, Diebold, & Hanson, 1996; Presley, Meilman, & Cashin, 1996a; Presley, Meilman, Cashin, & Lyster, 1996b; Wechsler et al., 2002). Although some published research studies have not found a statistically significant association between binge drinking and academic performance (Howland et al., 2010; Paschall & Freisthler, 2003; Gill, 2002; Wood, Sher, & McGowan, 2000), studies linking binge drinking to poorer academic performance outnumber the former studies 2 to 1. Presley and Pimentel (2006) report that, in a national survey of college students, those who engaged in binge drinking and drank at least three times per week were 5.9 times more likely than those who drank but never binged to perform poorly on a test or project (40.2% vs. 6.8%), 5.4 times more likely to have missed a class (64.4% vs. 11.9%), and 4.2 times more likely to have had memory loss as a result of drinking (64.2% vs. 15.3%) (Thombs et al., 2009). Singleton (2007) and Singleton and Wolfson (2009), in separate prospective studies, both found negative associations between heavy alcohol use and grade point average. Jennison (2004), based on a national prospective study reported binge drinkers in college were more likely to drop out of college, work in less prestigious jobs, and experience alcohol dependence 10 years later. Wechsler et al. (2000) and Powell et al. (2004), based on a national survey of full-time students at four year colleges and universities, found frequent binge drinkers were six times more likely than nonbingers to miss class and 5 times more likely to fall behind in school. White, Jamieson-Drake, and Swartzwelder (2002) observed that the number of blackouts, a consequence of heavy drinking, students reported was negatively associated with GPA. Collectively, the existing research suggests that heavier drinking is associated with poorer academic success.

ALCOHOL BLACKOUTS

Heavy episodic drinking can lead to a form of memory impairment known as a blackout. Blackouts are periods of amnesia during which a person actively engages

in behaviors (e.g., walking, talking) but the brain is unable to create memories for the events. Blackouts are quite different from “passing out,” which means either falling asleep from excessive drinking or literally drinking oneself unconscious. During blackouts, people are capable of participating in events ranging from the mundane, such as eating food, to the emotionally charged, such as fights and even sexual intercourse, with little or no recall (Goodwin, 1995). Like milder alcohol-induced short-term memory impairments caused by one or two drinks, blackouts are primarily “anterograde,” meaning that they involve problems with the formation of new memories rather than problems recalling memories made prior to intoxication. For this reason, during a blackout, an intoxicated person is able to discuss events that happened before the drinking session commenced even if the discussion itself is not stored in memory.

Blackouts are quite common among college students who consume alcohol. White et al. (2002) reported that half (51%) of roughly 800 college students who had ever consumed alcohol at any point in their lives reported experiencing at least one alcohol-induced blackout, defined as awakening in the morning not able to recall things one did or places one went while under the influence. The average number of total blackouts in those who experienced them was six. Of those who had consumed alcohol during the 2 weeks before the survey was administered, 9% reported blacking out.

Blackouts tend to occur following consumption of relatively high doses of alcohol. In a study by White, Signer, Kraus, and Swartzwelder (2004), in which students with a history of blackouts were interviewed about their most recent blackout, estimated peak BACs during the night of the last blackout were generally similar for males (0.30%) and females (0.35%). A study of amnesia in people arrested for either public intoxication, driving under the influence or underage drinking found that the probability of a blackout was 50% at BAC levels of 0.31% or higher (Perry et al., 2006). In their study of blackouts in college students, Hartzler and Fromme (2003) noted a steep increase in the likelihood of blackouts above a BAC of 0.25%. Thus, from existing research, it appears the odds of blacking out increase as BAC levels climb and become quite common at BAC levels approaching or exceeding 0.30%, which is almost 5 times the legal limit for operating a motor vehicle for those aged 21 and older. As such, the high prevalence of blackouts in college students points to the magnitude of excessive consumption that occurs on college campuses.

ALCOHOL AND ADOLESCENT NEUROCOGNITIVE DEVELOPMENT

Although acute alcohol use produces short-term impairments in cognitive functions, such as attention and memory, related to academic success, a growing body of research suggests that heavy drinking during the adolescent years could produce lingering deficits that might further compromise academic achievement. In a longitudinal study,

Squeglia, Spadoni, Infante, Myers, and Tapert (2009) assessed cognitive functions in healthy subjects at ages 12 to 14 and then during a follow up session on average 3 years later. For females, more drinking days in the year before follow-up and more drinks per month predicted deficits in visuospatial memory. For males, greater hangover symptoms in the year before the follow-up predicted impairments in attention. In a longitudinal study beginning when subjects were ages 13 to 18 and spanning the next 10 years, Hanson, Medina, Padula, Tapert, and Brown (2011) reported that greater alcohol use independently predicted declines in verbal memory over time relative to controls. In a cross-sectional study of college students, Parada et al. (2011, 2012) observed that, compared to controls, students with a history of recent binge drinking exhibited deficits in the ability to remember items on lists, a fundamental skill critical to academic achievement.

Brain research is beginning to shed light on the potential mechanisms underlying the lingering cognitive deficits observed in heavy drinking adolescents, though such work remains in the early stages. Some researchers report decreased activity in frontal lobe regions during tests of memory in binge drinking adolescents compared to controls (Crego et al., 2010), while others report increased activation the frontal lobes in binge drinkers compared to controls (Schwiensburg, Mcqueeny, Nagel, Eyler, & Tapert, 2010). Anatomically, a wide array of structural changes have been observed in adolescents who drink heavily, including reduced frontal lobe gray and white matter volumes in females (Medina et al., 2008; Squeglia, 2011) and increased gray and white matter volumes in males (Medina et al., 2008; Squeglia et al., 2011).

Collectively, the findings of this relatively new area of research suggest that alcohol can impact academic-related cognitive functions long after acute intoxication wears off and that such impairments might stem from alcohol-induced changes in brain morphometry and function during adolescent development.

ALCOHOL AND DRUG USE AMONG COLLEGE STUDENTS

A smaller percentage of college students use either illicit drugs or misuse prescription drugs than engage in binge drinking. However, compared with students who do not binge drink, those who do are considerably more likely to engage in prescription drug misuse or use illicit drugs. More than one third of binge drinkers also use drugs, and the combination of alcohol with prescription or illicit drugs can increase significantly the risk of harm. See Table 1.1.

ALCOHOL OVERDOSES

When consumed in large quantities during a single occasion, such as a binge episode, alcohol can cause death directly by suppressing brain stem nuclei that control vital reflexes, like breathing and gagging to clear the airway (Miller & Gold, 1991). Even

Table 1.1 Drug Use Among College Students and College Students Who Binge Drink, Ages 18–25

		1999	2001	2005	2007	2009
All Respondents	Prescription Drug Misuse*	4				
	Total	3	5	7	6	7
	College	4	5	6	5	6
	Non-College		6	7	7	7
	Illicit Drug Use†					
	Total	19	21	22	21	23
	College	20	22	21	21	24
	Non-College	18	21	22	22	23
	Any Drug Use					
	Total	20	23	24	24	26
	College	21	23	23	23	26
	Non-College	20	23	25	24	26
Respondents Who Binge	Prescription Drug Misuse*					
	Total	6	8	10	9	10
	College	6	7	9	8	10
	Non-College	7	9	10	10	10
	Illicit Drug Use†					
	Total	30	32	31	31	34
	College	32	33	32	31	36
	Non-College	29	31	30	31	33
	Any Drug Use					
	Total	32	34	34	35	37
	College	33	34	35	34	39
	Non-College	31	34	34	35	36

National Household Survey on Drug Use and Health, 2011

*Illicit drug use: marijuana, cocaine, crack, heroin, hallucinogens, and inhalants

†Prescription drug misuse: pain relievers, tranquilizers, and stimulants/sedatives

a single session of binge drinking causes inflammation and transient damage to the heart (Zagrosek, Messroghli, Schulz, Dietz, & Schultz-Menger, 2010). The acute toxic effects of alcohol in the body can manifest in symptoms of alcohol poisoning, which include vomiting, slow and irregular breathing, hypothermia, mental confusion, stupor and death (NIAAA, 2007; Oster-Aaland, Lewis, Neighbors, Vangness, & Larimer, 2009). Using data from the Global Burden of Disease study, the World Health Organization (WHO) estimated that, in 2002, alcohol poisoning caused 65,700 deaths worldwide, with 2,700 poisoning deaths occurring in the United States (WHO, 2009b). It has become increasingly common to read news stories about alcohol overdoses among college students and their non college peers, a fact that is perhaps not surprising given the tendency toward heavy drinking in this age group.

Alcohol interacts with a wide variety of illicit and prescription drugs, including opioids and related narcotic analgesics, sedatives and tranquilizers (NIAAA, 1995; Tanaka, 2002). Importantly, blood alcohol concentrations (BAC) required for fatal overdoses are lower when alcohol is combined with prescription drugs. An analysis of 1,006 fatal poisonings due to alcohol alone or in combination with other drugs revealed that the median postmortem BAC in those who overdosed on alcohol alone was 0.33%, compared to 0.13% to 0.17% among those who overdosed on a combination of alcohol and prescription drugs (Koski, Ojanperä, & Vuori, 2003; Koski, Vuori, & Ojanperä, 2005). The combined use of alcohol and other drugs peaks in the 18- to 24-year-old age group (McCabe, Cranford, & Boyd, 2006).

To investigate the prevalence of hospitalizations for alcohol overdoses—which stem from excessive intoxication or poisoning—among college-aged young people in the United States, White and colleagues (2011) examined rates of inpatient hospitalizations for 18- to 24-year-olds between 1999 and 2008 using data from the Nationwide Inpatient Sample, which contains hospital discharge records from roughly 20% of all hospitals in the country. Hospitalizations for alcohol overdoses without any other drugs involved increased 25% among 18- to 24-year-olds from 1999 to 2008, highlighting the risks involved in heavy drinking. In total, nearly 30,000 young people 18 to 24, more males (19,847) than females (9,525), were hospitalized for alcohol overdoses in 2008. Hospitalizations for overdoses involving drugs only increased 55% over the same time period, while those involving alcohol and drugs in combination rose 76%. All total, 59,000 hospitalizations in 2008 of 18- to 24-year-olds for alcohol overdoses only or in combination with drugs occurred (nearly 30,000), approximately one third of whom were college students, 35.6% of the population that age.

Data from the Drug Abuse Warning Network (DAWN) indicate that emergency department (ED) visits for alcohol-related events exhibited increases similar to those observed for inpatient hospitalizations. Among those ages 18 to 20, ED visits for alcohol-related events with no other drugs increased 19% from 67,382 cases in 2005 to 82,786 cases in 2009. Visits related to combined use of alcohol and other drugs increased 27%, from 27,784 cases in 2005 to 38,067 cases in 2009. In 2009, 12% of ED visits related to alcohol involved use of alcohol in combination with other drugs (Substance Abuse and Mental Health Services Association, 2011).

The above findings reflect the fact that heavy consumption of alcohol quickly can become a medical emergency. One does not need to get behind the wheel of a car after drinking or jump off a balcony into a swimming pool on a dare to risk serious harm. Simply drinking too much alcohol is enough to require hospitalization and potentially cause death. Further, combining alcohol with other drugs can increase substantially the risk of requiring medical intervention. Thus, efforts to minimize the consequences of alcohol-related harms on college campuses should not lose sight of the fact that alcohol often is combined with other drugs and, when this is the case, the risks can be greater than when alcohol or drugs are used alone.

STUDENTS AT HIGH RISK

The proportion of college students who drink varies depending on where they live. Drinking rates are highest in fraternities and sororities, followed by on-campus housing (e.g., dormitories, residence halls) (Presley et al., 1996a, 1996b; Wechsler et al., 1998; Wechsler et al., 2000a). Students who live independently off-campus (e.g., in apartments) drink less, while commuting students who live with their families drink the least (O'Hare, 1990; Wechsler et al., 2002).

A number of environmental influences working in concert with other factors may affect students' alcohol consumption (Presley et al., 2002). Colleges and universities where excessive alcohol use is more likely to occur include schools where Greek systems dominate (i.e., fraternities and sororities), schools where athletic teams are prominent, and schools located in the Northeast (Presley et al., 1996a, 1996b; Wechsler, Kuh, & Davenport, 1996; Wechsler, Davenport, Dowdall, Grossman, & Zanakos, 1997; Wechsler et al., 1998; Wechsler et al., 2000b; Werner & Greene, 1992).

Among college student males, Caucasians, members of fraternities and sororities, and athletes have the highest percentages of students who drink the most (Johnston, O'Malley, & Bachman, 2001a, 2001b; Meilman, Leichliter, & Presley, 1999; Meilman, Presley, & Lyerla, 1994; Presley et al., 1996a, 1996b; Presley & Pimentel, 2006; Wechsler et al., 1996, 1997, 1998, 2000b). The least amount of drinking occurs in 2-year schools, religious schools, commuter schools, and historically black colleges and universities (Meilman, Presley, & Cashin, 1995; Presley et al., 1996a, 1996b; Wechsler et al., 2000a, 2000b).

Some first-year students who live on campus may be at particular risk for alcohol misuse. During their high school years, those who go on to college tend to drink less than their noncollege-bound peers. But during the first few years following high school, the heavy drinking rates of college students surpass those of their noncollege peers, and this rapid increase in heavy drinking over a relatively short period of time can contribute to difficulties with alcohol and with the college transition in general (Schulenberg et al., 2001; Timberlake et al., 2007). Anecdotal evidence suggests that the first 6 weeks of enrollment are critical to first-year student success. Because many students initiate heavy drinking during these early days of college, the potential exists for excessive alcohol consumption to interfere with successful adaptation to campus life. The transition to college is often so difficult to negotiate that about one third of first-year students fail to enroll for their second year (Upcraft, 2000).

INTERVENTIONS TO REDUCE COLLEGE DRINKING

The increase in the past 7 years in alcohol-related traffic and other unintentional injury deaths among 18- to 24-year-olds, both in college and not in college, underscores the need for colleges and their surrounding communities to expand and strengthen

interventions demonstrated to reduce excessive drinking among college students and those in the same age-group who do not attend college. Numerous individually oriented counseling approaches, web-based educational programs, environmental interventions, and comprehensive community interventions can reduce drinking and related problems among college students and the college-aged population. Information on individually oriented interventions, web-based educational programs, family interventions, and campus/community comprehensive interventions are covered in detail in other chapters of this book. This chapter examines environmental policy intervention.

Environmental interventions: Legal drinking age of 21. In 1984, when 17 states had a legal drinking age of 21, the U.S. Congress passed legislation that would withhold highway construction funding for states that did not make it illegal to sell alcohol to people younger than age 21. By 1988, all states adopted the law (Fell, Fisher, Voas, Blackman, & Tippetts, 2009).

However, there are some important exceptions. In 24 states, individuals under 21 can possess alcohol with parental or guardian consent and/or presence. In 31 states, parents can legally furnish alcohol to their children who are under 21. Only 31 states and the District of Columbia explicitly prohibit consumption by a person under 21. In 47 states, people under 21 can serve alcohol (NIAAA, 2010).

In August 2008, a group of 130 college presidents called for a debate about whether the drinking age should be lowered to age 18. Some suggested, after receiving education about safe drinking levels, that 18-year-olds should be given drinking licenses that would be rescinded if their drinking posed dangers to themselves or others. Given this widely publicized challenge to the legal drinking age of 21, it is worth reviewing evidence on the topic. Figure 1.2 examines trends in the frequency of binge drinking from 1982 to 2007 (five or more drinks on an occasion) from Monitoring the Future, a yearly survey assessment of the attitudes, behaviors, and values of nearly 50,000 8th, 10th, and 12th graders (Johnston, O'Malley, Bachman, & Schulenberg, 2007). According to the survey data, binge drinking among high-school seniors dropped from 40% to just over 25%. Among individuals 1 to 4 years past high school, the declines were less, from 40% to just under 35%. Little change was seen among full-time college students. Figure 1.3 examines trends in alcohol-related traffic fatalities among individuals aged 18 to 20 targeted by the drinking age changes and those aged 21 to 24 not targeted. Both groups experienced proportional declines, but the declines were greater in the 18- to 20-year age group than in the 21- to 24-year age group (60% vs. 44%).

A review of 49 studies of the legal drinking age changes revealed that in the 1970s and 1980s, when many states lowered the drinking age, alcohol-related traffic crashes among people younger than 21 increased 10%. In contrast, when states increased the legal drinking age to 21, alcohol-related crashes among people younger than 21 decreased 16% (Shults et al. 2001). Wagenaar and Toomey (2002) reviewed 48 studies of the effects of drinking-age changes on drinking and 57 studies on traffic crashes. They concluded that increases in the legal age of alcohol purchase and consumption

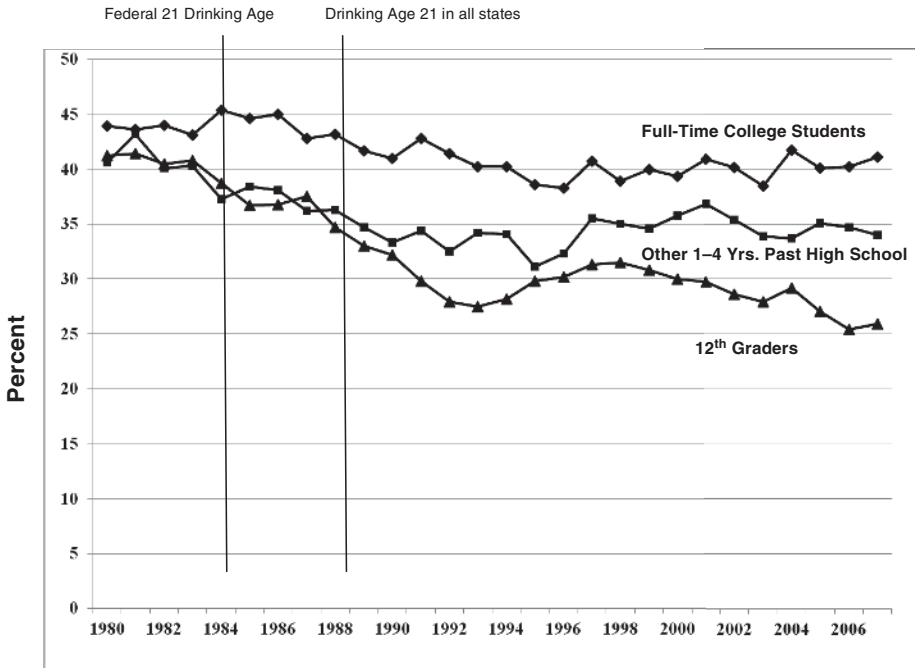


Figure 1.2 Alcohol: Trends in 2-Week Prevalence of 5 or More Drinks in a Row Among College Students versus Others 1–4 Years Beyond High School

Source: Monitoring the Future, 2007.

have been the most successful interventions to date in reducing drinking and alcohol-related crashes among people under 21.

Miron and Tetelbaum (2009) found significant declines in traffic fatalities among individuals under 21 in states that changed the minimum legal drinking age to 21 prior to the 1984 federal mandate to raise the drinking age to 21. However, in states that raised the drinking age after the federal legislation, the minimum legal drinking age increases were not associated with significant declines in traffic deaths. Miron and Tetelbaum's analyses controlled for whether states had a seatbelt law, the legal blood alcohol limit, beer taxes, and vehicle miles traveled. Of note, Miron and Tetelbaum did not explore whether the traffic deaths were alcohol-related. After adjusting for changes in the population for that age during the time period 1982 to 2007, alcohol-related traffic fatalities among people aged 16 to 20 declined 64%, whereas those that did not involve alcohol increased 17% (see Figure 1.4) (Hingson & White, 2010).

In 2009, Fell, Fisher, Voos, Blackman, and Tippetts examined trends in the ratio of drinking to nondrinking drivers in fatal crashes in each state annually from 1982 to 2004 (unlike Miron and Tetelbaum's [2009] analyses). This analysis controlled for

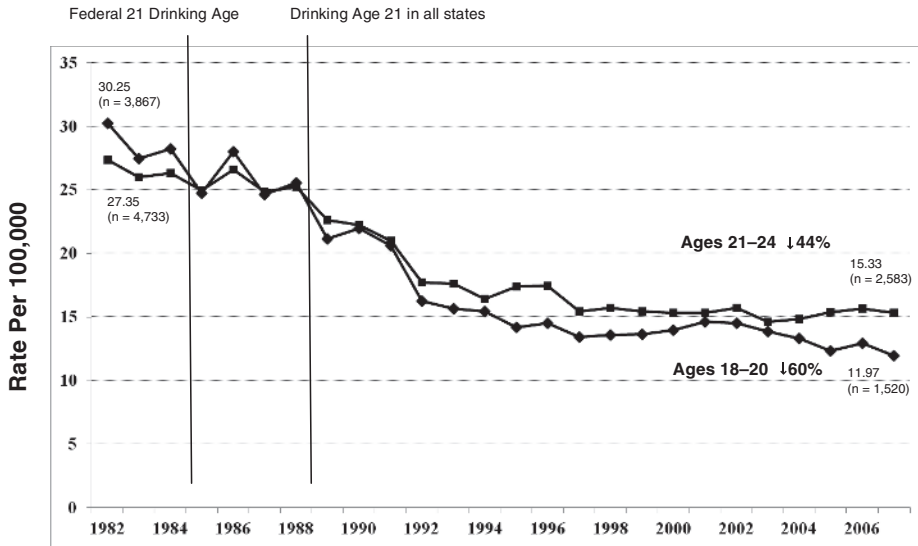


Figure 1.3 Alcohol-Related Traffic Fatalities, Rate per 100,000, Ages 18–20 versus 21–24, United States, 1982–2007

Source: U.S. Fatality Analysis Reporting System, 2009; U.S. Census Bureau, 2009.

zero-tolerance laws, graduated license night restrictions, and use/lose laws that target drivers under 21 and could influence their involvement in alcohol-related crashes. Fell et al. (2009) also controlled for 0.10% and 0.08 BAC per se laws, legal limits, mandatory seatbelt laws, per capita beer consumption, unemployment rates, vehicle miles traveled, frequency of sobriety checkpoints, number of licensed drivers, and the ratio of drinking to nondrinking drivers aged 26 or older in fatal crashes.

Fell et al.'s (2009) findings are quite informative. Adoption of the minimum legal drinking age of 21 was associated with a 16% decline in the ratio of drinking to non-drinking drivers in fatal crashes involving those under 21, even after controlling for all the other factors listed above. Of note, other laws targeting drivers under 21 independently predicted lower involvement of drinking drivers in fatal crashes. Use/lose laws and zero-tolerance laws were each associated with 5% declines. Further, laws aimed at adult drivers also independently contributed to declines in the ratio of drinking to nondrinking drivers in fatal crashes: 0.08% BAC laws were independently associated with an 8% decline, 0.10% BAC laws a 7% decline, administrative license revocation a 5% decline, and seatbelt laws a 3% decline. Thus, the preponderance of evidence suggests that raising the drinking age to 21 reduced alcohol involvement in fatal crashes involving drivers under 21 and that other laws aimed at drivers of all ages can also reduce alcohol-related fatal crashes involving drivers under the age of 21.

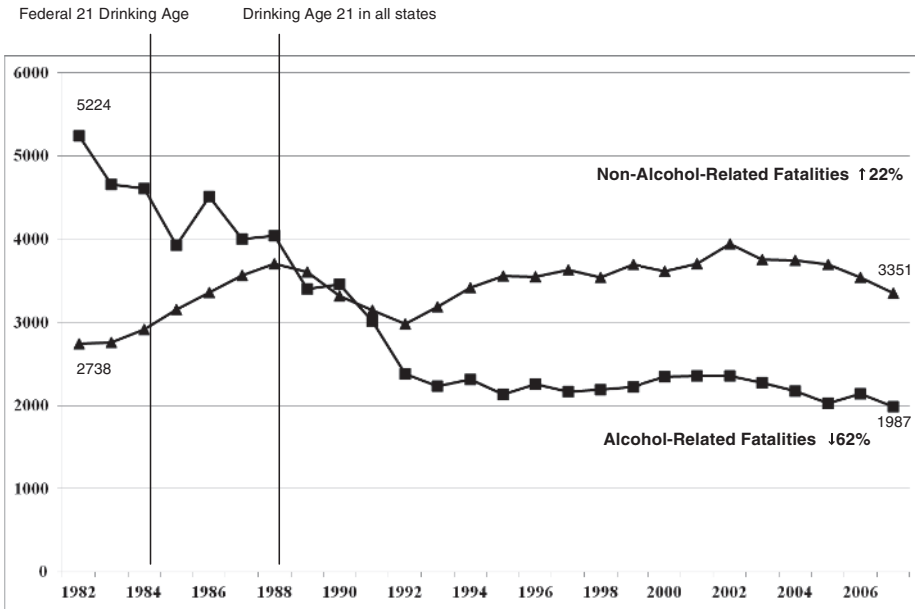


Figure 1.4 Trends in Alcohol-Related and Non-alcohol-Related Traffic Fatalities, Persons Ages 16–20, United States, 1982–2007

Source: U.S. Fatality Analysis Reporting System, 2009.

Carpenter and Dobkin (2011) explored data from 1975 to 1993 from the Fatality Analysis Reporting System and Vital Statistics. They also looked at national annual Monitoring the Future survey data. They found that lowering the drinking age was associated with a 17% increase in 18- to 20-year-old involvement in nighttime fatal crashes, the fatal crashes most likely to involve alcohol. Daytime fatal crash rates did not change. No other age group experienced an increase in nighttime fatal crashes. In the 18- to 20-year-old age group, suicides increased 10%, past month drinking increased 17%, and binge drinking increased 3%. Because suicides are not consistently tested for alcohol, any direct causal link between drinking age and that outcome should be cautiously interpreted.

Of note, an analysis (Norberg, Bierut, & Grucza, 2009) of more than 33,000 adult respondents in two national surveys 10 years apart compared respondents who grew up in states where they legally were allowed to drink prior to age 21 with respondents who grew up in states where the legal drinking age was 21. The analysis, which controlled for numerous potential confounding variables, found that those allowed legally to drink prior to age 21 were more likely as adults to meet alcohol and drug use disorder criteria.

Zero-tolerance laws. Zero-tolerance laws, which make it illegal in every state for those under the age of 21 to drive after any drinking, also have contributed to declines in alcohol-related traffic deaths among people younger than 21 (Hingson, Heeren,

& Winter, 1994; Liang & Huang, 2008; Voas, Tippetts, & Fell, 2000; Wagenaar, O'Malley, & Lafond, 2001). Unfortunately, despite their demonstrated benefits, legal drinking age and zero-tolerance laws generally have not been vigorously enforced (Jones & Lacey, 2001). Young drivers are substantially underrepresented in the driving-while-intoxicated (DWI) arrest population relative to their contribution to the alcohol-related crash problem (Voas & Williams, 1986). Stepped-up enforcement of alcohol purchase laws aimed at sellers and buyers has been shown to be effective in reducing alcohol misuse and related problems (Preusser, Ulmer, & Preusser, 1992; Wagenaar, Murray, & Toomey, 2000). More enforcement could further reduce college drinking problems.

Price of alcohol. The majority of published studies have reported an inverse relation between the tax on or price of alcohol and alcohol misuse and related negative health outcomes. The National Academy of Sciences (National Research Council Institute of Medicine of the National Academies, 2004) reviewed the literature on price of alcohol and alcohol-related problems and recommended that Congress and State legislatures raise excise taxes to reduce underage alcohol consumption and to raise additional revenues to reduce underage drinking problems.

Three recent extensive literature reviews examined the relation of alcohol price and tax with consumption and related harms (Elder et al., 2010; Wagenaar, Salois, & Komro, 2009; World Health Organization Regional Office for Europe, 2009). Wagenaar et al.'s (2009) analysis of 1,003 separate estimates from 112 studies reported "overwhelming evidence of the effects of alcohol prices on drinking. Price affects drinking of all types of beverages and across the population of drinkers, from lightest to heavy drinkers." They concluded, "We know of no other preventive intervention to reduce drinking that has the numbers of studies and consistency of effects seen in the literature on alcohol taxes and prices." Minimal research regarding price and alcohol has examined college students. Further research is needed about the effects of price increases on (1) college students relative to others the same age and (2) college-age people relative to older people. Similar to Wagenaar et al. (2009), Elder et al.'s (2010, p. 226) review of 78 alcohol tax studies found "consistent evidence that higher alcohol prices and taxes are associated with reductions in both excessive alcohol consumption and related subsequent harms. Results were robust across different countries, time periods, study designs, analytic approaches, and outcomes."

A World Health Organization review (2009) concluded,

When other factors are held constant, such as income and the price of other goods, a rise in alcohol prices leads to less alcohol consumption and less alcohol-related harm, and vice versa. . . . Policies that increase alcohol prices delay the time when young people start to drink, slow their progression towards drinking large amounts, and reduce their heavy drinking and volume of alcohol drunk on an occasion. (p. 13)

Although very high prices for alcohol might stimulate illegal production, in the United States alcohol prices have not kept pace with inflation over the past 60 years.

Alcohol outlet density. Higher alcohol outlet density has been associated with increased alcohol-related problems in both cross-sectional and prospective studies, and reducing outlet density may reduce drinking-related problems (Campbell et al., 2009). Alcohol outlet density around college campuses has been found to be related to higher levels of alcohol problems among college students (Reboussin, Song, & Wolfson, 2011; Scribner et al., 2008; Weitzman, Folkman, Folkman, & Wechsler, 2003), including higher campus rape offense rates (Scribner et al., 2010) and in one study, was linked to alcohol misuse prevention programs having lower positive benefit (Scribner et al., 2011). Prospective research is needed to specifically test whether reducing outlet density will reduce consumption, related problems, and specific effects on college students.

CONCLUSIONS

Alcohol misuse on college campuses continues to be a significant problem, and one complicated by the increase in prescription and illicit drug use among students, and the combination of alcohol with these substances. Despite considerable expansion of the scientific literature and knowledge base regarding how to reduce drinking and related harms among college students, binge drinking, driving under the influence of alcohol, and unintentional injuries attributable to alcohol have not declined. An important research question is how to translate our new knowledge into reductions in alcohol misuse and related problems in the future. Research also is needed in colleges and universities that serve minority populations, an area that has been underrepresented in college research initiatives.

As documented in other chapters in this book, there is now a sizable scientific literature, which demonstrates that individually oriented approaches such as screening and brief motivational interventions can reduce drinking not only among students who voluntarily seek out these programs but also among those mandated to receive counseling because of alcohol-related disciplinary actions. Unfortunately, these interventions are not reaching a sizeable portion of college students with problematic drinking practices. Persons age 18 to 24 nationwide are least likely to be asked by physicians about their drinking and advised about drinking patterns that pose risk to health (Hingson, Heeren, Edwards, & Saitz, 2011).

Although nearly 20% of college students meet *DSM-IV* alcohol dependence or abuse criteria, less than 5% of them have sought counseling or treatment (NIAAA, 2007). An important challenge is to sufficiently expand screening and counseling so that these effective individually oriented interventions can achieve general population-level effects. Establishing alcohol screening and brief intervention as a routine part of student health service encounters and use of the Internet screening and advice might help remedy this situation.

Also, a variety of environmental policy interventions that reduce availability of alcohol and deter driving while impaired by alcohol have been shown to be effective in reducing drinking and driving and alcohol-related crash involvement of college-aged individuals. These policies must, however, be implemented and enforced at the community level. Recent research evidence now indicates that colleges and universities can reduce harmful drinking and drinking and driving among college students through the use of comprehensive cooperative college–community multicomponent approaches that include heightened enforcement of the legal drinking age and other laws aimed to reduce drinking and driving.

But clearly colleges by themselves cannot resolve the alcohol problems of all college-aged people. For every 18- to 24-year-old college student, two 18- to 24-year-olds are not in college. Further, many college students develop problematic drinking habits before they enter college. Analyses of the national College Alcohol Survey indicates that the younger college students were when they first drank to intoxication, the greater the likelihood that they experienced alcohol dependence while they were in college, rode with drinking drivers, drove after drinking, were injured under the influence of alcohol, and had unplanned and unprotected sex after drinking (Hingson, Heeren, Winter, & Wechsler, 2003; Hingson, Heeren, Zakocs, Kopster, & Wechsler, 2002). Hence, community conditions and the availability of alcohol to those under 21 contribute to college drinking problems. Further, many of the problems experienced as a result of excessive college student alcohol consumption affect people other than the college drinkers themselves.

Consequently, colleges and surrounding communities need to work together to implement multifaceted programs at various levels of intervention. Collectively, they need to involve multiple departments of city government as well as concerned private citizens and organizations and multiple sectors of the college community, presidents, deans, other administrators, campus security, residence counselors, health service providers, alumni, faculty, and students if they want to most effectively reduce harmful drinking and the myriad of health and social problems linked to harmful drinking.

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