



## Full length article

## Continuity of drunk and drugged driving behaviors four years post-college



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## ABSTRACT

**Background:** Driving under the influence of alcohol is a leading cause of injury and premature death among young adults, and college-educated individuals are at particularly high risk. Less is known about driving under the influence of other drugs, which is on the rise.

**Method:** This study describes prospective seven-year trends in alcohol and other drug (AOD)-involved driving among a young-adult sample beginning with their second year of college (i.e., Years 2–8), and documents the extent of continuity in such behaviors across time. Originally recruited as incoming first-year students at one large public university, participants ( $n = 1194$ ) were interviewed annually about how frequently they drove while drunk/intoxicated (DWI), after drinking any alcohol (DAD), and/or while under the influence of other drugs (DD). Follow-up rates were high ( $> 75\%$  annually).

**Results:** Among participants with access to drive a car, annual prevalence peaked in Year 4 (modal age 21) for both DWI (24.3%<sub>wt</sub>) and DD (19.1%<sub>wt</sub>) and declined significantly thereafter through Year 8 (both  $ps < 0.05$ ). DAD was far more prevalent than DWI or DD, increasing from 40.5%<sub>wt</sub> in Year 2 to 66.9%<sub>wt</sub> in Year 5, and plateauing thereafter. Among marijuana-using participants, likelihood of DD was consistently greater than the likelihood of DWI among Heavy Episodic and Light-to-Moderate drinkers, and it declined significantly during Years 5–8 ( $p < 0.05$ ).

**Conclusion:** Post-college declines in heavy drinking and DWI prevalence were encouraging but did not necessarily translate to reductions in likelihood of engaging in DWI, depending on drinking pattern. College-educated individuals represent an important target for AOD-involved driving prevention.

## 1. Introduction

Driving under the influence of alcohol and other substances is a very serious public health problem (Asbridge et al., 2012; Brady and Li, 2014; Chou et al., 2006; Hingson et al., 2009; Laberge and Ward, 2004). In 2015, 10,265 fatalities occurred because of alcohol-impaired driving, representing 29% of all traffic-related deaths (National Highway Traffic Safety Administration, 2016), and drunk driving is a leading risk factor for premature death during adolescence and young adulthood (Feigelman and Gorman, 2010).

While the prevalence of drunk driving has been well documented, driving under the influence of other substances, specifically marijuana, either alone or in combination with alcohol has gained increasing attention during the last few years in the U.S. (Brady and Li, 2014; Li et al., 2013; Office of National Drug Control Policy, 2014; Voas et al., 2013a; Voas et al., 2013b) and internationally (Brubacher, 2015; Elvik,

2013; Fischer et al., 2014; Senna et al., 2010). Such concerns are fueled in part by increases in perceived availability of marijuana and related declines in risk perceptions and disapproval (Okaneku et al., 2015; Salas-Wright et al., 2015; Schuermeyer et al., 2014). Not surprisingly, according to national roadside survey data, the proportion of weekend night-time drivers testing positive for THC recently increased 48%, from 8.6% in 2007 to 12.6% in 2013–2014 (Berning et al., 2015). Equally concerning is the corresponding growth in the proportion of fatally injured drivers in the U.S. who test positive for substances other than alcohol (i.e., from 16.6% in 1999 to 28.3% in 2010), with marijuana being the most common (Brady and Li, 2014).

Considerable epidemiologic and experimental evidence suggests that marijuana use impairs driving performance (Lenne et al., 2010; Menetrey et al., 2005; Papafotiou et al., 2005; Ramaekers et al., 2006; Ronen et al., 2008; Sewell et al., 2009) and increases crash risk (Asbridge et al., 2012; Dubois et al., 2015; Hall, 2009; Laberge and

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Ward, 2004). In one large study of fatally injured drivers, the presence of any detectable THC was associated with more than a two-fold increase in the odds of culpability for a fatal crash, even after accounting for blood alcohol concentration (BAC) and other substances (Drummer et al., 2004). When THC concentrations were at or above 5 ng/ml, the odds of culpability increased more than six-fold, comparable with a BAC of 0.15%.

From college entry through the transition to young adulthood, risk for alcohol and other drug (AOD)-involved driving is high. Multiple cross-sectional studies on AOD-involved driving among college students (Fairlie et al., 2010; Kenney et al., 2013; Kohn et al., 2014; McCarthy et al., 2007; Treloar et al., 2012; Whitehill et al., 2014; Zakletskaia et al., 2009) have documented the high prevalence of drunk driving (LaBrie et al., 2011; Paschall, 2003) and driving under the influence of other drugs (Benotsch et al., 2015). Among this population, prevalence estimates for driving after drinking (DAD) during the past three months range from 15% (Kenney et al., 2013) to 43% (McCarthy et al., 2007). Longitudinal research on AOD-involved driving is available among three college student samples, including the cohort that is the subject of the present study (Arria et al., 2011; LaBrie et al., 2012; Quinn and Fromme, 2012). Results show an increase in the prevalence of DAD across the college years (LaBrie et al., 2012; Quinn and Fromme, 2012) and that past DAD is a strong predictor of future DAD (LaBrie et al., 2012), indicating persistence over time. Research with the current cohort has documented the trends in driving while intoxicated (DWI), DAD, and drugged driving (DD) during college (Arria et al., 2011; Beck et al., 2010). Significant increases were observed at age 21 in prevalence and frequency of both DWI and DAD (Beck et al., 2010), even after accounting for age-related changes in access to drive a car, whereas DD was equally prevalent but remained stable throughout college (Arria et al., 2011).

To extend the current knowledge base about AOD-involved driving among college students, this study examined the continuity of such behaviors four years beyond college. With the transition from college to young adulthood comes an increase in responsibility and independence, and declines in heavy drinking, drug use, and other risky behaviors are known to coincide with conventional “adult” milestones like cohabitation, marriage, and parenthood (Duncan et al., 2006; Eitle et al., 2010; Leonard and Rothbard, 1999; Oesterle et al., 2011). We recently demonstrated how frequency of drinking increases in the post-college period in tandem with decreases in quantity (Arria et al., 2016). Moreover, declines in heavy drinking and other substance use during the middle and late twenties have been documented previously among both college-educated and other young adult populations (Brodbeck et al., 2013; Gotham et al., 1997; Jackson et al., 2001; Johnston et al., 2014), but have yet to be confirmed for AOD-involved driving. The present analyses will enable us to examine whether AOD-involved driving declines in a similar fashion.

Specifically, this study aims to (1) describe trends in AOD-involved driving during and after college; (2) examine the correspondence between changes in AOD-involved driving and concurrent changes in heavy episodic drinking and marijuana use; and (3) describe the degree of continuity of AOD-involved driving.

## 2. Methods

### 2.1. Sample

The College Life Study is a longitudinal prospective study of 1253 individuals who were recruited in 2004 during their first year of college at a large, public university. After screening the entire population of incoming first-year students ages 17–19 (89% response rate) during the summer prior to college entry, a sample was selected for longitudinal follow-up. To ensure adequate statistical power, individuals whose screening responses indicated illicit drug use or nonmedical use of a prescription drug at least once during high school were oversampled

with 100% probability, and all others at 40%, while stratifying by race and sex to ensure demographic representativeness. Eight annual personal interviews were administered beginning with a baseline assessment during their first year of college. The baseline response rate was 87%, and subsequent follow-up rates were high (e.g., 91% in Year 2, 76% in Year 8). Follow-up continued regardless of academic status. The study was approved by the university’s IRB, and participants received cash incentives for each assessment completed. Interviewers were trained extensively in confidentiality protection. More information on recruitment and sampling can be found in previous publications (Arria et al., 2008; Vincent et al., 2012).

Participants were demographically similar to the target population of full-time undergraduate students at the university (49% male, 72% non-Hispanic white). Seventy-four percent had a mother with a Bachelor’s degree or higher, and 83%–97% had access to drive a car, annually. By design, participants were ages 17–20 at their Year 1 assessment (modal age 18, 71%); thus, annual follow-up assessments correspond to modal ages 19–25, respectively.

The present analyses were based on annual data from Years 2–8, because past-year driving was not assessed in Year 1. Relative to the 59 participants who completed none of the follow-up assessments, the 1194 with one or more follow-ups overrepresented women (52% vs. 36%,  $p < 0.05$ ) but were similar with respect to race/ethnicity, mother’s education, and baseline alcohol or cannabis use disorder. Most (87%) had graduated from college by Year 5.

### 2.2. Measures

#### 2.2.1. Access to drive a car

Participants were asked annually about their access to drive a car during the past 12 months. During Years 2–4, the response was dichotomous (“Yes”, “No”), and during Years 5–8, five ordinal responses were used (ranging from “Not at all” to “Daily”). For the present study, individuals who responded “No” or “Not at all” were excluded from analyses for that year.

#### 2.2.2. AOD-involved driving

Consistent with prior research (Arria et al., 2011; Beck et al., 2010), participants were asked annually about three different driving behaviors they might have engaged in during the past year, using the format: “How many times did the following things happen to you during the past 12 months? You drove while drunk on alcohol; you drove after drinking alcohol; you drove while high on other drugs”. Ordinal response options ranging from never (0) to 10 or more times (4) were later recoded to derive annual dichotomous variables (i.e., once or more vs. never) for driving while intoxicated (DWI), driving after drinking (DAD), and drugged driving (DD). DD was assessed as broadly as possible to include any type of DD. When asked to specify which drug (s) they had used during their DD episodes, most mentioned only marijuana (80%–90% of those who endorsed DD in any given year), while several mentioned both marijuana and other drugs (7%–17% annually). Individuals who only mentioned drugs other than marijuana were scarce ( $\leq 5\%$  annually).

#### 2.2.3. Alcohol and marijuana use

Past-year alcohol and marijuana use frequency were assessed annually, as well as typical alcohol quantity (number of drinks/drinking day). Later, drinking patterns for non-abstainers were defined as Heavy Episodic [typical consumption  $\geq 4$  drinks (women) or  $\geq 5$  drinks (men)] and Light-to-Moderate [typical consumption 1–3 drinks (women) or 1–4 drinks (men)]. Membership in a drinking category was allowed to vary over time. Thus, an individual who was categorized as a Heavy Episodic drinker in Year 2 might have been a Light-to-Moderate drinker in Year 3.

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