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Associations between driving under the influence or riding with an impaired driver and future substance use among adolescents

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Abstract

Objective.—Risky driving behaviors among adolescents, such as riding with a drinking or impaired driver (RWID) or driving while under the influence (DUI) of alcohol or drugs are significant public health concerns. Few studies have examined associations of RWID and DUI with future substance use and problems after controlling for baseline substance use. Given that the DUI/RWDD event may be a teachable moment to prevent future consequences (e.g., when injured or arrested), it is important to understand how this risk behavior relates to subsequent use and problems. This study therefore examined characteristics of adolescents who reported DUI and RWID and assessed their risk of future alcohol and marijuana use and consequences six months later.

Methods.—Participants were 668 adolescents aged 12 to 18 (inclusive) recruited at one of four primary care clinics in Pittsburgh and Los Angeles as part of a larger randomized controlled trial. They completed surveys about their health behaviors at baseline and six months after baseline. We examined baseline characteristics of adolescents who reported DUI and RWID, and then assessed whether past-year DUI and RWID at baseline were associated with alcohol and marijuana use and consequences six months after baseline.

Results.—Participants were 58% female, 56% Hispanic, 23% Black, 14% White, 7% multiethnic or other, and had an average age of 16 years (SD = 1.9). At baseline, participants who reported RWID or DUI were more likely to be older, report past year use of alcohol and marijuana, and were also more likely to have an alcohol use disorder or cannabis use disorder versus those who did not report RWID or DUI, respectively. At six-month follow-up and after controlling for baseline demographics and baseline alcohol use, RWID was associated with more frequent drinking episodes in the past three months and greater number of drinks in the past month when they drank heavily. DUI at baseline was associated with more frequent heavy drinking episodes and alcohol and marijuana consequences six months later.

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Conclusions.—RWID and DUI are significantly associated with greater alcohol and marijuana use over time. This study highlights that teens may be at higher risk for problem substance use in the future even if they ride with someone who is impaired. Prevention and intervention efforts for adolescents need to address both driving under the influence and riding with an impaired driver to prevent downstream consequences.

Keywords

Adolescent; impaired driving; DUI; substance use; alcohol; marijuana

INTRODUCTION

The relative inexperience adolescents have with driving and substance use (alcohol or other drug use) places them at greater risk for driver fatality compared to adults when they use substances and drive. For example, adolescents aged 16 to 19 are three times more likely to experience a fatal car crash compared to drivers 20 years and older regardless of substance use (Insurance Institute for Highway Safety, 2018). Although adolescents are less likely to drive under the influence of alcohol than adults, their risk of crash is substantially higher than adults when they do drive under the influence (Insurance Institute for Highway Safety, 2018). Adolescents are at higher odds of experiencing crashes when under the influence of substance use because of a combination of risk factors that increase overall crash risk, including risky driving behaviors (e.g., speeding, unsafe passing, distraction with phones), personality factors (e.g., risk-taking, sensation seeking, susceptibility to peer pressure), and behavioral factors (e.g., inexperience with driving and substance use; Shope & Bingham, 2008).

Policies to reduce adolescent substance use-related fatalities, such as zero-tolerance, minimum drinking age, and graduated driver licensing programs have been associated with reduced overall and fatal crashes among 16-year old drivers (Shope & Bingham, 2008). The minimum drinking age of 21 has effectively lowered access to alcohol for underage youth, and zero tolerance policies make it illegal for those under 21 to drive with any alcohol in their system. Graduated licensing requires a minimum number of supervised driving hours and other state-specific restrictions (e.g., curfew), and delayed full licensure has extended the age when youth can have full license privileges. Other underage drinking prevention policies, including alcohol compliance checks and responsible beverage service training have also been associated with steady decreases in driving under the influence (DUI) of alcohol and riding with an impaired driver (RWID) in recent years (Institute of Medicine, 2004). Despite the progress in policymaking, rates of DUI and RWID remain a significant public health issue, and continued prevention efforts are important.

About 17% of high school seniors in the United States report RWID in the past two weeks, and 12% of seniors report DUI (Cavazos-Rehg et al., 2016). Another nationally representative study of 11th graders found that 24% of students reported past year RWID and 13% reported past year DUI (Li, Simons-Morton, & Hingson, 2013). Thus, fewer adolescents report driving after using substances than riding with someone who is under the influence, which suggests that teens may see the dangers of driving after using substances

for themselves, but may be less likely to see the danger of getting in the car with someone who is impaired (Nygaard, Waiters, Grube, & Keefe, 2003). The characteristics of adolescents who RWID and/or DUI have been studied in several large cross-sectional surveys. For example, in a cross-sectional national probability sample of 11th graders, risky driving (e.g., reading/sending texts while driving; driving after midnight) was associated with RWID and DUI in the past month after controlling for heavy drinking and drug use (Li et al., 2013). In another cross-sectional study of 1,534 15 to 20 year-olds in California, past year alcohol-related RWID and DUI were associated with being male and older, engaging in heavy episodic drinking in the past year, drinking in cars, peer and parental modeling of DUI, DUI beliefs/approval, and drinking in unstructured situations (e.g. parties, outdoor events where parents were unlikely to be present; Chen, Grube, Nygaard, & Miller, 2008). In this same study, heavy drinking and drinking in cars or restaurants were both shown to mediate the relationship between alcohol consumption and driving under the influence. Furthermore, RWID is a significant predictor of future DUI. For example, in one longitudinal study, adolescents who rode with someone under the influence when they were aged 12-17 were two times more likely to report DUI in young adulthood (18-24 year old) than adolescents who did not RWID (Evans-Whipp et al., 2013).

Longitudinal studies have examined several risk and protective factors that may be associated with future DUI and RWID. According to nationally representative data from the Add Health Study, parental alcohol use or peer alcohol use (for those without parents who drank) were significantly associated with DUI six years later (Maldonado-Molina, Reingle, Delcher, & Branchini, 2011). In a study of 1189 adolescents in 16 middle schools in California, 14 year-olds who reported past month drinking, positive beliefs about marijuana use, exposure to alcohol and marijuana use, and family marijuana use were more likely to engage in both RWID and DUI at age 16 (Ewing et al., 2015). These studies provide insights into the characteristics of those teens who may engage in future RWID and DUI, however, to date, research has not examined how RWID and DUI may affect future substance use and consequences.

Understanding the continued substance use patterns and consequences *after* adolescents RWID and DUI may offer insight for indicated prevention strategies with adolescents at high risk of future problems. Further, it is important to examine associations between DUI/RWID and future substance use problems using longitudinal data to better elucidate long-term effects of DUI/RWID, and to inform the field about temporal consequences of DUI/RWID. The DUI/RWID event may be an important opportunity or teachable moment (e.g., times when the adolescent experienced consequences, such as an accident or getting caught). Adolescents may be more receptive to reducing risk behaviors such as DUI/RWID given that these behaviors are associated with severe consequences. Furthermore, if DUI/RWID behaviors are predictive of future use and consequences, then indicated prevention strategies specifically targeting DUI/RWID reduction would be an important contribution to the field. Adolescents may experience consequences or remorse from the DUI/RWID that may increase their willingness to change, or the salience of the event may help target the harmful thoughts that precipitated the risk behavior (e.g., believing they could drive safely.

The purpose of the current study was to understand the effects of RWID and DUI among a diverse sample of adolescents aged 12 to 18 seeking primary care services. Several studies have established that many teens with substance use see a primary care provider, and that rates of substance use disorder in primary care are similar, if not higher than national norms (Center for Behavioral Health Statistics and Quality, 2017). Thus, the American Academy of Pediatrics (2010) recommends that youth be screened for substance use in primary care. In this paper, we examined characteristics of adolescents who reported DUI and RWID in the past year using a baseline survey, and then assessed associations between baseline reports of DUI and RWID with reports of alcohol and marijuana use and consequences six months later.

MATERIALS AND METHODS

Participants

Participants were adolescents 12 through 18 (inclusive) who were seen for a primary care appointment (e.g., feeling sick or getting a physical exam) in one of four clinics serving predominantly minority and lower income individuals in the Pittsburgh and Los Angeles areas. This study was conducted as part of a larger randomized controlled trial (D'Amico et al., 2016). In the larger trial, we approached all youth age 12 through 18 (inclusive) that came for an appointment (D'Amico, Parast, et al., 2016; D'Amico et al., 2018)). A total of 3,310 adolescents were asked to participate; 27% (n = 892) were ineligible (e.g., because they were not between 12 and 18 years old, were not at the clinic for their own appointment); 18.5% (n = 614) declined to participate (largely due to time constraints). This resulted in 1,803 adolescents who enrolled in the study, and 1,573 of them (87.1%) completed a baseline survey (D'Amico et al., 2018).

Procedures

Adolescents (N=1,573) were screened using the two-item NIAAA Screening Guide (NIAAA, 2011). Adolescents who identified as moderate or higher risk according to the NIAAA Screening Guide (n = 294) were randomized to either usual care or a 15-20 minute individual brief motivational interviewing substance use intervention called "CHAT." RAND research staff conducted randomization and intervention delivery to prevent issues such as intervention contamination. They completed web surveys at 6 months after baseline. CHAT is a brief intervention delivered by a facilitator trained in motivational interviewing who assessed motivation for change by discussing adolescents' personal pros and cons of alcohol and other drug use, what their friends think about substance use, and how the information discussed might affect their own use (D'Amico et al., 2018). The focus is on the adolescent's alcohol and other drug use and included a discussion of how to avoid substance use related consequences, such as impaired driving, depending upon the specific consequences that adolescents brought up during the session. A random subsample of the remaining 1,279 lower risk or no risk adolescents were followed for 6 months for observation/control purposes (n=518), which was specified a priori in the original grant design.

A total of 668 of 812 adolescents screening from no risk to highest risk completed the 6-month follow-up web survey (82% retention rate). The current study focuses on the sample that completed 6-month follow-up. We obtained parental consent and adolescent assent (under 18 years) or consent (18 years). Parental consent and adolescent assent/consent were conducted in English and Spanish; however, to be in the study, adolescents had to be English speaking. All procedures were approved by the institution's Internal Review Board and each of the four clinics. We also obtained a certificate of confidentiality from the funding institute.

Setting

We collaborated with four family-based community health clinics in the Los Angeles and Pittsburgh areas. Clinics in both cities serve a high proportion of largely minority and low-income patients.

Measures

Screener: We utilized NIAAA's two-question screening guide (NIAAA, 2011) that asks: "In the past year, on how many days have you had more than a few sips of beer, wine, or any drink containing alcohol?", and "Do any of your friends drink alcohol?" Questions were ordered differently depending on age – adolescents 12-14 years of age were asked the two questions in reverse order (question about friends and then self-consumption to reduce assessment reactivity); adolescents 15 and older (and 14 year olds in high school) were asked the two questions in the order above. Youth were categorized into 4 risk categories using age-specific cut offs: no risk, lower risk, moderate risk, and highest risk. This screener is well-established and is associated with alcohol-related outcomes (D'Amico et al., 2016).

Socio-demographic characteristics: Items included age, gender, race/ethnicity, and mother's education. Race/ethnicity was categorized as Hispanic, non-Hispanic White, non-Hispanic Black, and non-Hispanic other/multi-racial. Mother's education, a commonly used proxy measure of socioeconomic status, was categorized into the following groups: did not finish high school, graduated from high school, some college, graduated from college, and "don't know." Past-year alcohol and marijuana use were also measured at baseline using well-established measures (Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003).

Diagnosis: Alcohol abuse disorder (AUD) and cannabis use disorder (CUD) were measured at baseline using the Diagnostic Interview Schedule for Children Version IV (DISC-IV), which uses criteria from the Diagnostic and Statistical Manual of Mental Disorders-5 (DSM-5; to identify adolescents with AUD or CUD). If 2 or more of the 11 criteria were met for either disorder, adolescents were classified as having an AUD or CUD.

Riding with an impaired driver (RWID): RWID was assessed at baseline using one question (Ellickson et al., 2003) that asks how often in the past year the participant had "been a passenger in a car or other vehicle with a driver who has been drinking alcohol or using drugs." Response options ranged from "not at all" to "20 or more times"; any response other than "not at all" was considered having ridden with an impaired driver.

Driving under the influence (DUI): DUI was assessed at baseline using one question (Ellickson et al., 2003) that asks how often in the past year the participant had "driven a car, motorcycle or other vehicle after drinking alcohol or using drugs," with responses ranging from "not at all" to "20 or more times"; any response other than "not at all" was considered having driven under the influence.

Outcomes

Substance Use: We used well-established measures to measure one quantity outcome (number of drinks on peak occasion) and four frequency outcomes [number of times drank alcohol, number of times drank heavily (5 or more drinks in a row, within a couple of hours), number of times used marijuana, number of times used marijuana on the days they used] (Ellickson et al., 2003). At baseline, we asked about peak quantity in the past month and about frequency in the past year. At 6-month follow-up, we asked about peak quantity in the past month and about frequency of use in the past three months.

Peak quantity of alcohol in the past month was assessed at baseline and follow-up using one item that asked, "What is the largest number of drinks that you've had on any day in the past 30 days?" Respondents could enter any value from 1 to 15. Frequency of alcohol use was assessed by asking adolescents how many times they tried or had at least one drink of alcohol in the past year (baseline) or in the past three months (follow-up). Frequency of heavy alcohol use and marijuana use was asked in a similar way using the same response options and the same recall windows, at both baseline and follow-up. We transformed the original response scale for these three frequency of use items, which ranged from 0 = "Never" to 5 = "More than 20 times," to pseudo-continuous variables using established methodology (Dawson, 2003); the mid-point of the original response range was set as the new value (e.g., if the response range was 3-10 days, we set the "pseudo-continuous" value as 6.5), resulting in responses ranging from 0 to 20 (i.e., the number of times an adolescent tried or used the substance). Lastly, frequency of marijuana use on days they used was assessed using one item that asked, "On the days you use marijuana, how many times do you use it?" Response options ranged from 0 = "I don't use marijuana at all" to 3 = "3 or more times" (Ellickson et al., 2003).

Substance Use Consequences: Respondents reported how often they experienced a series of negative consequences due to alcohol and marijuana use, ranging from "never" to "20 or more times," using well-established measures for adolescents (D'Amico et al., 2016). At baseline, we asked how often they experienced these consequences in the past year. At 6-month follow-up, we asked about consequences experienced in the past three months. There were six negative consequences for alcohol, including "felt really sick because of drinking" and "got into trouble because of drinking," and four negative consequences for marijuana use, including "had trouble concentrating because of marijuana use" and "did something you later felt sorry for because of marijuana use." The original consequence items were re-scaled to pseudo-continuous versions whereby the mid-point of the range of original responses was set as the new value (e.g., 6-9 times was recoded as 7.5 times), resulting in variables ranging from 0 to 20. The recoded items were then summed to create a total score representing the

frequency of negative consequences experienced (baseline: alcohol α=0.87; marijuana α=0.86).

Statistical Analysis

To compare baseline characteristics of adolescents who RWID versus did not, we performed t-tests when comparing continuous variables, such as age, by RWID status, and chi-square tests for categorical variables, such as race/ethnicity and gender. We conducted the same analyses to examine characteristics by DUI status.

To examine associations between baseline DUI or RWID and 6-month outcomes, we used linear regression models for each outcome. An indicator for DUI or RWID was included as the primary independent variable. We controlled for the baseline value of the outcome of interest (e.g., if the outcome was marijuana use in the past three months at the six-month follow-up, we controlled for marijuana use in the past year as reported at baseline) as well as CHAT intervention, race/ethnicity, age (continuous), gender, mother's education, and site (Los Angeles vs. Pittsburgh). For the models examining the negative consequence outcomes, we additionally adjusted for baseline substance use; for example, for alcohol-related consequences at 6 months, the model adjusted for baseline alcohol-related consequences *and* baseline alcohol use. Item missingness was accounted for by using multivariate imputation by chained equations (MICE) to create 40 imputed datasets. Results were pooled across analyses performed on each of the imputed datasets. We used an alpha level of .05 for all statistical tests.

RESULTS

Overall, the sample included 668 adolescents; 429 were low to no risk adolescents, and 239 were moderate to higher risk adolescents. Participants were 58% female, 56% Hispanic, 23% Black, 14% White, 7% multiethnic or other, with an average age of 16 years (SD = 1.9); 188 teens were age 12-14 at baseline, and 480 were 15-18 at baseline. At baseline, adolescents reported having used or tried at least one drink of alcohol an average of 4.4 times (SD = 6.7) in the past year, five or more drinks of alcohol in a row 2.2 times (SD = 4.9) in the past year, and marijuana 4.7 times (SD = 7.3) in the past year; they also reported that the largest number of drinks on an occasion in the past 30 days was an average of 1.6 drinks (SD = 3.3) and that they used marijuana an average of one time (SD = 1.1) on the days they used marijuana. Participants also reported experiencing an average of 2.8 (SD = 9.6) negative alcohol consequences and 1.6 (SD = 7.0) negative marijuana consequences in the past year. Finally, 6.7% of the study sample met criteria for AUD, and 18.5% met criteria for CUD at baseline.

Baseline characteristics

At baseline, one-third of the sample reported RWID in the past year (n=220; 32.9%), and 37 participants reported DUI in the past year (5.6%). Adolescents who reported RWID were more likely to also report DUI (15.5%) compared to those who did not report RWID (0.7%) at baseline ($X^2 = 61.50$, $p < .0001$). In addition, adolescents who reported RWID in the past year were significantly more likely to be older ($t = -6.77$, $p < .0001$), female (38.5% vs.

24.9% male; $X^2 = 13.54$, $p = 0.0002$), and Hispanic (36.9% vs. 34.7% White; $X^2 = 6.05$, $p = 0.0139$), and less likely to be Black than those who did not report RWID (23.9%; $X^2 = 7.51$, $p = 0.0061$). Among those under 16 years of age, 22.7% (n = 69) reported RWI whereas 41.5% (n = 151) reported RWID among those age 16 and older (p <0.0001).

Adolescents who reported RWID in the past year at the baseline assessment were also more likely to report more frequent alcohol ($t = -12.41$, $p < .0001$), heavy alcohol ($t = -9.94$, $p < .0001$), and marijuana use in the past year ($t = -11.55$, $p < .0001$); have a larger number of drinks on their peak occasion in the past month ($t = -9.15$, $p < .0001$); report a greater number of times using marijuana on the days used ($t = -12.40$, $p < .0001$); report more negative consequences experienced due to alcohol use ($t = -6.16$, $p < .0001$) and marijuana use in the past year ($t = -4.66$, $p < .0001$); and have a diagnosis of past year AUD ($X^2 = 56.84$, $p < .0001$) and CUD ($X^2 = 93.51$, $p < .0001$) at the baseline assessment than those who did not report RWID. See Table 1.

The majority of adolescents who reported DUI in the past year at the baseline assessment also reported RWID in the past year (91.9%) compared to those who did not report DUI (29.5%) ($X^2 = 61.50$, $p < 0.0001$). Those who reported past year DUI at the baseline assessment were similar to those who reported RWID in that they were more likely to be older (16.9 years old (SD = 1.40) vs 15.54 years old (SD = 1.85), $t = -5.47$, $p < .0001$); report more frequent alcohol use (13.42 (SD = 7.84) times vs. 3.86 (SD = 6.24) times, $t = -7.29$, $p < .0001$), heavy alcohol use (9.19 (SD = 7.30) times vs. 1.81 (SD = 4.35) times, $t = -6.09$, $p < .0001$), and marijuana use in the past year (14.05 (SD = 7.68) times vs. 4.10 (SD = 6.93) times, $t = -8.43$, $p < .0001$); larger number of drinks on their peak occasion in the past month (6.51 (SD = 5.19) vs 1.36 (SD = 2.94), $t = -5.98$, $p < .0001$); report a greater number of times using marijuana on the days used (2.16 (SD = 1.01) vs. 0.70 (SD = 1.02), $t = -8.45$, $p < .0001$); report more negative consequences experienced due to alcohol (11.59 (SD = 18.53) vs. 2.30 (SD = 8.58), $t = -3.03$, $p = 0.0044$) and marijuana use in the past year (8.81 (SD = 17.79) vs. 1.20 (SD = 5.54), $t = -2.60$, $p = 0.0135$); and have a diagnosis of past year AUD (44.4% (n = 16) vs 4.5% (n = 28), $X^2 = 86.53$, $p < 0.0001$) and CUD (71.4% (n = 25) vs 15.6% (n = 96), $X^2 = 68.40$, $p < 0.0001$), relative to those who did not report past year DUI. There were no statistically significant differences by gender ($p = 0.6569$), race/ethnicity ($p = 0.3564$), or mother's education ($p = 0.2575$) for those who reported DUI or no DUI at the baseline assessment.

Six-Month Outcomes

After controlling for covariates and the baseline value of each substance use outcome, we examined associations of baseline reports of past year RWID and DUI and six-month substance use outcomes. We found that participants who reported RWID in the past year at baseline reported more frequent drinking episodes and a greater number of drinks when they drank heavily. These participants reported drinking alcohol 1.50 times more frequently in the past three months ($p < 0.01$); on their heaviest drinking occasion in the past month, they reported drinking 1.08 more drinks ($p < 0.01$), relative to those who did not report RWID at the baseline assessment (Table 2). We did not find significant associations between baseline

RWID and frequency of heavy alcohol use, marijuana use, number of times using marijuana on days used, or negative consequences at the six-month follow-up (ps > 0.05).

Associations between reports of DUI at the baseline assessment and six-month outcomes are summarized in Table 3. After controlling for covariates and the baseline value of each substance use outcome, adolescents who reported past year DUI at baseline reported 2.63 more frequent episodes of heavy alcohol use in the past three months (p <.0001), had 3.64 more negative alcohol consequences (p <.0001) in the past three months, and had 2.46 more marijuana negative consequences in the past three months (p < .0001) at six-month follow-up compared to adolescents who did not report DUI at baseline.

DISCUSSION

Although there have been great strides in the literature to understand adolescent characteristics associated with RWID and DUI, these studies are largely cross-sectional and examine RWID and DUI as the outcome. The current study is novel because we used longitudinal data to understand what happens *after* teens engage in RWID/DUI while controlling for predictors, such as baseline drinking and consequences, and we conducted the study within a primary care setting where substance use screening is recommended as a standard practice (Center for Substance Abuse, 2010).

Cross-sectionally, participants who reported DUI and RWID in the past year at baseline also reported more frequent alcohol and marijuana episodes, experienced more consequences, reported a greater number of drinks when they drank heavily, and were more likely to have alcohol and cannabis disorder. We also found longitudinal associations after controlling for demographics and covariates at baseline. Adolescents who reported past year DUI at baseline continued to report 2-3 times more frequent heavy drinking episodes and 2-4 times more alcohol- and marijuana-related consequences six months later. In addition, those who reported past year RWID at baseline continued to report 1-1.5 times more frequent drinking episodes and a greater number of drinks during the occasion when they drank heavily six months later.

Results highlight the importance of indicated prevention campaigns to intervene not only for adolescents who DUI, but also for those who RWID as both behaviors were strongly associated with future heavy drinking. Event-specific interventions are well-established. For example, those that target youth during known peak drinking times, such as a college student's 21st birthday (Neighbors et al., 2007), or after an alcohol related injury in the emergency room (Spirito et al., 2004), may be particularly relevant for preventing future RWID/DUI. Screening and asking about RWID/DUI could also be incorporated into primary care and other settings where adolescents are asked specifically about these behaviors, providing an opportunity to engage in a discussion similar to the CHAT intervention. RWID/DUI could also be addressed in other teachable moments, such as when adolescents receive a first-time alcohol or drug offense (D'Amico, Hunter, Miles, Ewing, & Osilla, 2013). In addition, as parents are often involved when adolescents are adjudicated for substance use and DUI offenses, offering parental monitoring resources that target positive

role-modeling, expression of DUI disapproval, and monitoring of adolescent drinking in settings that increase the likelihood of RWID or DUI (e.g., parties) may be helpful.

Although the current study provides important insights on how RWID and DUI among adolescents may affect future substance use and problems, there are several limitations. First, we rely on participants' reports of DUI and RWID in the past year. Future research could examine administrative records of DUI arrest, convictions, and traffic violations for another measure of driving behaviors and effects of arrest/convictions on future behaviors, and specifically measure these behaviors prospectively to determine causality. However, given that arrests are much lower than the number of times that a person may DUI, it is important to understand how frequently the behavior is occurring. In addition, although teens report engaging in RWID and DUI, these behaviors have low base rates, particularly at younger ages, thus, we examined DUI and RWID as binary variables. Presumably, higher frequencies of DUI and RWID may be associated with more negative outcomes. We used a purposive stratified sampling design. Thus, the sample is not representative of adolescents in the general population. Finally, our measures of RWID and DUI ask about impairment of both alcohol and drug use, and thus we are not able to tease apart how impairment for different substances, such as alcohol versus marijuana may affect rates of use and consequences. Longitudinal research is needed to examine the long-term trajectory and effects of marijuana-impaired driving versus alcohol impaired driving, particularly given rapid marijuana legislation changes and a growing concern about the rise in marijuana-impaired driving among adolescents (Berning, Compton, & Wochinger, 2015). In addition, future research could address how variables highly correlated with RWID/DUI (e.g., sensation seeking; impulsivity) affect the association between RWID/DUI and future behaviors. Finally, future longitudinal work could examine moderators of continued risk, and how RWID/DUI associations with other substance use variables may vary over time.

Risky driving behaviors among adolescents are a significant public health concern because novice driving is already associated with increased risk of crash risk, and the use of alcohol and drugs compound this risk. Our study finds that even riding with someone who is impaired puts adolescents at higher risk for greater substance use in the future. Thus, prevention and intervention efforts for adolescents need to address both driving under the influence and riding with an impaired driver given that teens who engage in these behaviors are at increased risk of future substance use and consequences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Baseline characteristics stratified by group

	Overall	RWID (n = 220)	No RWID (n = 448)	
		Mean (SD) or N%	Mean (SD) or %	P-value
Demographics				
Age	15.6 (1.86)	16.25 (1.60)	15.31 (1.89)	<.0001
Female	382 (57.6%)	147 (67.7%)	235 (52.7%)	0.0002
Race				0.0267
White	95 (14.2%)	33 (15.0%)	62 (13.8%)	
Black	155 (23.2%)	37 (16.8%)	118 (26.3%)	
Hispanic	374 (56.0%)	138 (62.7%)	236 (52.7%)	
Multi/Other	44 (6.6%)	12 (5.5%)	32 (7.1%)	
Mom's Education >=Some college	164 (30.1%)	53 (27.0%)	111 (31.8%)	0.2445
Behaviors				
Past Year Use (# of times)				
Alcohol	4.38 (6.69)	9.18 (8.02)	2.02 (4.28)	<.0001
Heavy Alcohol	2.21 (4.85)	5.38 (6.87)	0.66 (2.17)	<.0001
Marijuana	4.65 (7.33)	9.50 (8.54)	2.27 (5.21)	<.0001
Past Month Alcohol Max (#drinks)	1.64 (3.32)	3.57 (4.41)	0.70 (2.05)	<.0001
Marijuana (# of times)	0.78 (1.08)	1.46 (1.15)	0.45 (0.86)	<.0001
Past Year DUI	37 (5.6%)	34 (15.5%)	3 (0.7%)	<.0001
Past Year Consequences (#)				
Alcohol	2.81 (9.62)	7.01 (14.79)	0.75 (4.23)	<.0001
Marijuana	1.62 (7.01)	3.89 (10.41)	0.50 (4.04)	<.0001
Diagnoses				
Past Year Diagnoses				
Alcohol	44 (6.7%)	37 (17.3%)	7 (1.6%)	<.0001
Marijuana	121 (18.5%)	84 (39.8%)	37 (8.4%)	<.0001

Note: This sample is not representative.

Table 2.

Association between RWID at baseline and 6-month outcomes

	RWID At Baseline	No RWID At Baseline	RWID effect[1]	
Behaviors at 6 month follow-up	**Mean (SD)**	**Mean (SD)**	**Coefficient (SE)**	**p-value**
Past 3 Month Use (# of times)				
Alcohol	5.47 (6.56)	1.32 (3.09)	1.50 (0.42)	**0.0004**
Heavy Alcohol	2.74 (4.76)	0.64 (2.48)	0.51 (0.31)	0.1026
Marijuana	5.74 (7.62)	1.62 (4.46)	−0.08 (0.45)	0.8635
Past Month Alcohol Max (#drinks)	4.67 (3.66)	2.43 (2.30)	1.08 (0.29)	**0.0002**
Marijuana (# of times)	1.17 (1.19)	0.40 (0.82)	0.10 (0.07)	0.1569
Consequences at 6 month follow-up	**Mean (SD)**	**Mean (SD)**	**Coefficient (SE)**	**p-value**
Past 3 Month Consequences (#)				
Alcohol	2.90 (7.43)	0.70 (2.10)	0.50 (0.43)	0.239
Marijuana	1.26 (4.74)	0.25 (1.44)	0.47 (0.28)	0.0912

[1] Coefficients are from linear regressions controlling for the baseline value of the outcome (e.g., if outcome is negative marijuana-related consequences in the past three months at six-month follow-up, we control for negative marijuana-related consequences in the past year as reported at baseline, the CHAT intervention, race/ethnicity, age, gender, mother's education, and site (Los Angeles vs. Pittsburgh). For the models examining the negative consequences outcomes only, we additionally adjusted for baseline substance use; for example, for alcohol-related consequences at 6 months, the model adjusted for baseline alcohol-related consequences *and* baseline alcohol use.

Table 3.

Association between DUI at baseline and 6-month outcomes

	DUI At Baseline	No DUI At Baseline	DUI effect[1]	
Behaviors at 6 month follow-up	**Mean (SD)**	**Mean (SD)**	**Coefficient (SE)**	**p-value**
Past 3 Month Use (# of times)				
Alcohol	7.76 (7.52)	2.39 (4.58)	1.54 (0.81)	0.0563
Heavy Alcohol	5.79 (6.24)	1.07 (3.13)	2.63 (0.63)	**<.0001**
Marijuana	9.04 (8.57)	2.62 (5.64)	0.84 (0.83)	0.3089
Past Month Alcohol Max (#drinks)	5.65 (4.32)	3.03 (2.85)	0.34 (0.52)	0.5104
Marijuana (# of times)	1.68 (1.32)	0.60 (0.97)	0.09 (0.13)	0.5073
Consequences at 6 month follow-up	**Mean (SD)**	**Mean (SD)**	**Coefficient (SE)**	**p-value**
Past 3 Month Consequences (#)				
Alcohol	6.73 (13.32)	1.12 (3.41)	3.64 (0.84)	**<.0001**
Marijuana	3.73 (10.41)	0.40 (1.65)	2.46 (0.55)	**<.0001**

[1] Coefficients are from linear regressions controlling for the baseline value of the outcome (e.g., if outcome is negative marijuana-related consequences in the past three months at six-month follow-up, we control for negative marijuana-related consequences in the past year as reported at baseline, the CHAT intervention, race/ethnicity, age, gender, mother's education, and site (Los Angeles vs. Pittsburgh). For the models examining the negative consequences outcomes only, we additionally adjusted for baseline substance use; for example, for alcohol-related consequences at 6 months, the model adjusted for baseline alcohol-related consequences *and* baseline alcohol use.