Early Substance Use and Subsequent DUI in Adolescents

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abstract

OBJECTIVE: Little is known about risk factors in early adolescence that lead to driving under the influence (DUI) and riding with a drinking driver (RWDD). In a diverse group of adolescents, we longitudinally explored the influence of alcohol and marijuana (AM) use, AM beliefs, and peer and family factors (including familism) on DUI/RWDD in high school.

METHODS: We conducted 3 surveys 2 years apart of 1189 students recruited from 16 middle schools in Southern California. We used multivariable models to evaluate the effects of AM use, AM beliefs, and peer and family factors at ages 12 and 14 on DUI/RWDD at age 16.

RESULTS: At age 12, adolescents with more positive beliefs about marijuana (odds ratio [OR] = 1.63, 95% confidence interval [CI]: 1.20–2.20) and more ability to resist marijuana offers (OR = 1.89, 95% CI: 1.22–2.92) had significantly higher risk of DUI/RWDD 4 years later. At age 14, youth with more past month alcohol use (OR = 2.10, 95% CI: 1.07–4.11), positive beliefs about marijuana (OR = 1.67, 95% CI: 1.31–2.13), exposure to peer AM use (alcohol: OR = 1.01, 95% CI: 1.00–1.02; marijuana: OR = 2.41, 95% CI: 1.28–4.53), and family marijuana use (OR = 1.54, 95% CI: 1.12–2.11) had higher risk of DUI/RWDD at age 16.

CONCLUSIONS: Findings indicate a need to target adolescents as young as sixth grade at multiple levels to help prevent DUI/RWDD in high school. Given recent changes in legislation in several states, research should begin to focus on the distinction between DUI/RWDD of AM.

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WHAT'S KNOWN ON THIS SUBJECT: Research demonstrates that substance use, beliefs about use, and influence from family and friends can put young adults at risk for DUI and RWDD. Much of this research is cross-sectional and focuses on risk factors identified in young adults.

WHAT THIS STUDY ADDS: This longitudinal study emphasizes the importance of prevention efforts in early adolescence at multiple levels to reduce high school DUI/RWDD, because marijuana beliefs and marijuana use by peers and family members during middle school were associated with high school DUI/RWDD.

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The Centers for Disease Control and Prevention estimate that 1 in 10 high school students admits to driving under the influence (DUI) of alcohol in the past 30 days.[1] Additionally, almost 22% of adolescents reported riding with a drinking driver (RWDD) in the past 30 days.[1] Alcohol and marijuana (AM) use increases substantially during the period leading up to 10th grade, the grade when many teenagers begin driving; for example, past 30-day use increases from 10% in eighth grade to 26% in 10th grade for alcohol and from 7% to 18% for marijuana.[2] Thus, middle school represents a crucial developmental period to intervene on the early initiation of AM use and related risk factors for DUI and RWDD.[3–5]

Previous literature in high school and college populations has identified several risk factors for DUI and RWDD, such as AM use and AM beliefs. For instance, AM use and early initiation of AM use is associated with DUI/RWDD.[6–10] Positive beliefs about AM use[11,12] has shown to be a risk factor for AM use, whereas the ability to refuse AM when offered, or resistance self-efficacy,[13–15] is protective.

Peer and family factors also influence adolescent AM use and may in turn affect DUI/RWDD.[16–20] Time spent around teenagers who are using AM[21,22] and perceived AM use among one's peers[23–25] have been identified as risk factors for AM use. In contrast, increased friend disapproval of DUI is a protective factor for DUI.[6] Finally, there is evidence that family values and greater adolescent involvement with family serve as protective mechanisms against peer influence over adolescents' AM use and DUI/RWDD.[26,27] Adolescents who report stronger feelings of familism and parental respect engage in less AM use,[28] which could be protective for DUI/RWDD. In contrast, studies of adolescent DUI/RWDD have revealed that low levels of parental

involvement,[29] parental permissiveness,[8] and exposure to adults who use AM[30,31] are associated with an increased likelihood of risky driving and potentially serious offenses and crashes.

Existing literature is cross-sectional and focuses mainly on older adolescents, which limits predictive ability and generalizability of findings. We are aware of no work examining whether risk factors might exist as early as middle school to predict later DUI/RWDD. We address these gaps by longitudinally evaluating whether DUI/RWDD during high school (mean age 16) is predicted by AM use, negative consequences from AM use, AM beliefs, peer influence, and family factors assessed during early (mean age 12) and late middle school (mean age 14) among adolescents who have already initiated alcohol use. This study focuses on a school-based, ethnically diverse population in Southern California at an age when they and their peers are acquiring driving licenses. Findings could provide information regarding behaviors and beliefs of early adolescents that put them at greater risk for DUI/RWDD as they begin to drive, thus providing insight into potential intervention approaches for adolescents and their families.

METHODS

Sample and Study Design

Participants were a part of a substance use prevention program, CHOICE, conducted in 16 middle schools in the greater Los Angeles area.[32] Analyses focus on students in sixth and seventh grades who completed surveys in school in 2009 and Web-based surveys in 2011 and 2013. The analytic sample focused on students who completed the Spring 2013 survey and also reported lifetime alcohol use at Spring 2009 (n = 343), Spring 2011 (n = 625), or

Spring 2013 (n = 1189). Our final samples consisted of 1124 participants in early-middle school (completed Spring 2009 and Spring 2013) and 972 participants in late-middle school (completed Spring 2011 and Spring 2013). During middle school, follow-up rates ranged from 83% to 95%. As youth transitioned from 16 middle schools to over 200 high schools nationally and internationally, we used online surveys and were able to follow-up with 60% of the eligible sample during this transition. Dropout was not associated with demographics or AM use. A Certificate of Confidentiality was obtained, and all materials and procedures were approved by the school districts and the institution's review board.

Measures

Sociodemographic characteristics included age, gender, mother's education, and race/ethnicity. Race/ethnicity was included as dummy variables for Hispanic, non-Hispanic white, and other race. Mother's education was coded as a dichotomous indicator of greater than or equal to high school completion. We also controlled for CHOICE participation. Of note, there were no intervention effects on DUI/RWDD, and initial intervention effects on alcohol use were no longer significant after wave 3 (Fall 2009) of the study.

DUI/RWDD items asked adolescents how often they had "driven a car, motorcycle or other vehicle after drinking alcohol or using drugs" and "been a passenger in a car or other vehicle with a driver who has been drinking alcohol or using drugs."[33] Response options ranged from 0 = "not at all" to 6 = "20 or more times." We created dichotomous indicators of DUI and RWDD in the past year because of the skewed distribution. Because both behaviors pose incredible risk to the adolescent and only 5.9% of the sample endorsed DUI, we combined DUI and RWDD.

Sensitivity analyses were conducted to evaluate this decision (see below).

AM use and consequences were assessed by using well-established measures (eg, California Healthy Kids Survey).[33,34] For past month use, we asked: "During the past month, how many days did you (drink at least 1 full drink of alcohol) (use marijuana)?" To evaluate effects of using more than 1 substance on DUI/RWDD, we created a variable that categorized past month use into marijuana use only, alcohol use only, AM use, and no AM use.

Respondents rated how often they experienced negative consequences from AM use (eg, "doing something they regretted") over the past year from 0 = "never" to 6 = "20 or more times scale."[35] Items were recoded to 0 = "no consequences" and 1 = "any consequences" and summed to create a total score (alcohol αs > 0.76; marijuana αs > 0.45).

AM beliefs included positive (eg, "alcohol [marijuana] relaxes you") and negative beliefs (eg, "alcohol [marijuana] makes you do things you might regret"), and ability to resist AM.[33] Three items each assessed positive beliefs and negative beliefs from 1 = "strongly disagree" to 4 = "strongly agree."[36] Average higher scores indicated stronger agreement (alcohol αs > 0.78; marijuana αs > 0.87). Resistance self-efficacy comprised 3 items rated from 1 = "I would definitely use" to 4 = "I would definitely not use" and focused on adolescents' ability to resist AM in different situations in which their peers were using. Average higher scores indicated greater ability to refuse (alcohol αs > 0.93; marijuana αs > 0.96).

Peer influence factors were assessed by: best friend AM use, friend approval of AM use, perceived prevalence of AM use, and amount of time spent with AM-using peers. Adolescents were asked separately whether their best friend uses alcohol or marijuana (1 = "yes"; 0 = "no").

Separate questions asked whether a teenager's friends would approve if they found out that he/she used alcohol or marijuana.[36] Response options ranged from 1 = "they would disapprove" to 3 = "they would approve or wouldn't care." Perceived prevalence of AM use was assessed by asking adolescents to think about a group of 100 students in their grade and how many of these drank alcohol at least once a month or had ever tried marijuana.[34] Responses were rescaled to 0 to 100. Time spent around teenagers who use AM was assessed with 2 separate questions and scores ranged from 1 = never to 4 = often.[33] Original values were recoded to create separate indicators of peer exposure to using AM often.

Family factors were assessed by asking respondents whether they had an older brother or sister who used alcohol (or marijuana) sometimes (1 = yes, 0 = no), as well as how often the adult who is most important to them used alcohol (or marijuana; scale from 0 = never to 3 = "4–7 days per week"). Adult alcohol use frequency (0 = "<4–7 times a week"; 1 = "4–7 times a week") and marijuana use were both dichotomized (0 = never, 1= "ever"). We examined the influence of family members AM use as a cohesive unit by summing sibling use and adult use indicators. A value of 0 = "no family use," 1 = "use by either a sibling or adult," and 2 = "use by both."

Four items assessed familism[28,37,38] on a 4-point scale (1 = "definitely no" to 4 = "definitely yes"; eg, "If anyone in my family needed help, we would all be there to help them."; αs > 0.80). Parental respect used the same 4-point scale ("I want to be a good person so that people know that my parents raised me right."; αs > 0.90).[39] Average higher scores indicated higher levels of familism and respect.

Statistical Analyses

We focused on AM use and consequences, AM beliefs, peer influence, and family factors in our analyses. For each sample, we initially conducted fully interacted logistic regression models clustered at the respondent level. We entered each block of variables separately to evaluate potential differences between RWDD and DUI. These models included an indicator for type of risky behavior (DUI/RWDD) and this indicator was interacted with each of the predictor variables so that we could evaluate whether there were differences in how the predictors influenced DUI and RWDD behaviors. Next we ran the same clustered logistic regression models without the interaction terms and compared model fit using a likelihood ratio test. These sensitivity analyses revealed that models with interactions did not fit significantly better than those without interactions. Thus, we selected the simpler main effect clustered models. Predictors identified in block models as statistically significant at the $P < .1$ level were entered into the final multivariable, clustered logistic regression models. Analyses control for age, gender, race/ethnicity, mother's education, and CHOICE intervention school.

RESULTS

Sample

The sample was 43.3% boys and 49.6% Hispanic participants (white = 24.1%, Asian = 13.7%, other = 12.5%; Tables 1 and 2). Mean age in Spring 2009 was 12.2 (SD = 0.7), Spring 2011 = 14.3 (SD = 0.8), and Spring 2013 = 16.3 (SD = 0.7). In Spring 2013, when our DUI/RWDD outcome was measured, 88% of the sample was of legal driving age in the state of California (16 years old as reported by the California Office of Traffic Safety).

TABLE 1 Demographic Characteristics for Our Adolescent Sample

	Full Sample, n = 1189, %	Spring 2009: Early Middle School, n = 1124		Spring 2011: Late Middle School, n = 972	
		%/Mean	SD	%/Mean	SD
Demographics					
Boy	43.3				
Race					
Hispanic	49.6				
Non-Hispanic white	24.1				
Other	26.2				
Age		12.2	0.7	14.3	0.8
AM use (past month) and consequences (past year)					
Alcohol use only		6.7	—	10.8	—
Marijuana use only		1.1	—	3.7	—
AM use		2.0	—	6.1	—
No alcohol or marijuana use		90.0	—	79.1	—
Alcohol negative consequences		0.2	0.8	0.3	0.9
Marijuana negative consequences		0.04	0.3	0.1	0.9
AM beliefs and ability to resist use					
Alcohol negative beliefs		3.1	1.0	3.2	0.9
Alcohol positive beliefs		1.6	0.8	2.1	1.0
Alcohol resistance self-efficacy		3.4	0.8	3.0	1.0
Marijuana negative beliefs		3.2	1.1	2.0	1.1
Marijuana positive beliefs		1.6	0.9	2.1	1.1
Marijuana resistance self-efficacy		3.7	0.7	3.4	1.0
Peer influence factors					
Best friend alcohol use		19.8	—	35.6	—
Friend approval of alcohol use		1.9	0.7	2.3	0.7
Alcohol perceived prevalence		14.4	20.6	31.0	27.5
Exposure to peer drinking		4.8	—	13.4	—
Best friend marijuana use		8.7	—	23.4	—
Friend approval of marijuana use		1.7	0.7	2.1	0.7
Marijuana perceived prevalence		12.2	19.3	32.6	29.3
Exposure to peer marijuana use		3.9	—	16.1	—
Family factors					
Alcohol use		0.3	0.5	0.4	0.6
Marijuana use		0.2	0.6	0.3	0.7
Familism		3.6	0.6	3.6	0.6
Parental respect		3.8	0.5	3.7	0.6

Early Middle School (Spring 2009) Predictors of DUI/RWDD in High School

Block models identified 6 significant (P < .1) predictors of DUI/RWDD. In the AM use/consequences block, experiencing more negative consequences from alcohol was associated with increased risk of DUI/RWDD (odds ratio [OR] = 1.33, 95% confidence interval [CI]: 0.96–1.83). In the AM beliefs block, more positive beliefs about marijuana (OR = 1.80, 95% CI: 1.26–2.57) and stronger belief in one's ability to resist marijuana use (OR = 1.59, 95% CI: 1.05–2.41) were associated with increased risk of DUI/RWDD. For the peer influence block, greater friend approval of alcohol use (OR = 1.52, 95% CI: 0.96–2.43) and being around peers who use (OR = 4.16, 95% CI: 1.18–14.68) were associated with increased risk of DUI/RWDD 4 years later. In the family block, we found an association between respect and DUI/RWDD such that greater parental respect was a protective factor against DUI/RWDD (OR = 0.54, 95% CI: 0.31–0.94). The final multivariable model included each of the significant predictors above; the only statistically significant predictors (P < .05) of DUI/RWDD were positive beliefs about marijuana (OR = 1.63, 95% CI: 1.20–2.20) and

stronger belief in one's ability to resist marijuana use (OR = 1.89, 95% CI: 1.22–2.92).

Late Middle School (Spring 2011) Predictors of DUI/RWDD in High School

Our late middle school block models identified 5 significant (P < .1) predictors of DUI/RWDD. Adolescents who drank alcohol only (OR = 3.07, 95% CI: 1.52–6.19) and used both AM (OR = 2.94, 95% CI: 1.14–7.56) had a greater risk of DUI/RWDD 2 years later compared with those who did not use either substance. There was not a significant difference between past month marijuana use only and no past month AM use. In the AM beliefs block, more positive beliefs about marijuana in late middle school predicted DUI/RWDD in high school (OR = 2.03, 95% CI: 1.48–2.79). In our peer influence block, greater perceived prevalence of alcohol among one's peers (OR = 1.01, 95% CI: 1.00–1.03) and more frequently time with teenagers who use marijuana often were significant predictors of DUI/RWDD (OR = 3.25, 95% CI: 1.41–7.51). In the family factors block, perception of more family members using marijuana was a risk factor for DUI/RWDD (OR = 1.92, 95% CI: 1.36–2.73). Our final multivariable model included each of the significant predictors above and found past month alcohol use (compared with no AM use) significantly predicted DUI/RWDD in high school (OR = 2.10, 95% CI: 1.07–4.11). Also, positive beliefs about marijuana served as a risk factor for DUI/RWDD (OR = 1.67, 95% CI: 1.31–2.13). Both peer influence variables, perceived prevalence of alcohol (OR = 1.01, 95% CI: 1.00–1.02) and being around peers who use marijuana often (OR = 2.41, 95% CI: 1.28–4.53), significantly predicted DUI/RWDD. The perception of family members using marijuana in late middle school (OR = 1.54, 95% CI: 1.12–2.11) also

TABLE 2 Longitudinal Predictors of DUI in an Adolescent Sample

	Early Middle School (Mean Age = 12.2)				Late Middle School (Mean Age = 14.3)			
	Block Models		Multivariable Model		Block Models		Multivariable Model	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
AM use and consequences								
Past month alcohol use only	1.65	0.67–4.06	—	—	3.07	1.52–6.19***	2.10	1.07–4.11**
Past month alcohol and pot use	1.66	0.33–8.45	—	—	2.94	1.14–7.56**	1.05	0.42–2.65
Past month pot use only	4.92	0.57–42.44	—	—	1.91	0.60–6.07	0.52	0.16–1.67
No past month alcohol or pot use	—	—	—	—	—	—	—	—
Negative consequences of alcohol	1.33	0.96–1.83*	1.31	0.94–1.84	1.21	0.94–1.56	—	—
Negative consequences of marijuana	1.19	0.50–2.82	—	—	1.43	0.93–2.19	—	—
AM beliefs and ability to resist use								
Alcohol negative beliefs	0.78	0.58–1.05	—	—	1.02	0.75–1.39	—	—
Alcohol positive beliefs	1.08	0.73–1.60	—	—	0.89	0.64–1.24	—	—
Alcohol resistance self-efficacy	0.84	0.59–1.21	—	—	0.82	0.60–1.12	—	—
Marijuana negative beliefs	0.98	0.75–1.28	—	—	0.81	0.62–1.05	—	—
Marijuana positive beliefs	1.80	1.26–2.57***	1.63	1.20–2.20***	2.03	1.48–2.79***	1.67	1.31–2.13***
Marijuana resistance self-efficacy	1.59	1.05–2.41**	1.89	1.22–2.92***	0.96	0.71–1.30	—	—
Peer influence factors								
Best friend alcohol use	1.22	0.62–2.41	—	—	1.14	0.60–2.18	—	—
Friend approval of alcohol	1.52	0.96–2.43*	1.25	0.88–1.79	1.23	0.71–2.13	—	—
Alcohol perceived prevalence	1.01	0.99–1.02	—	—	1.01	1.00–1.03*	1.01	1.00–1.02**
Exposure to peer drinking	4.16	1.18–14.68**	1.57	0.51–4.81	1.07	0.46–2.46	—	—
Best friend marijuana use	1.07	0.42–2.72	—	—	1.34	0.66–2.74	—	—
Friend approval of pot	0.86	0.55–1.35	—	—	1.39	0.84–2.30	—	—
Marijuana perceived prevalence	1.00	0.98–1.02	—	—	1.00	0.98–1.01	—	—
Exposure to peer marijuana use	0.42	0.09–1.96	—	—	3.25	1.41–7.51***	2.41	1.28–4.53***
Family factors								
Alcohol use	1.47	0.93–2.33	—	—	1.32	0.85–2.04	—	—
Marijuana use	1.36	0.91–2.04	—	—	1.92	1.36–2.73***	1.54	1.12–2.11***
Familism	1.46	0.89–2.40	—	—	1.15	0.71–1.86	—	—
Respect	0.54	0.31–0.94**	0.73	0.46–1.14	0.83	0.51–1.34	—	—

All models control for age, gender, race/ethnicity (dummy indicators for Hispanic and non-Hispanic white, reference group is other), mother's education greater than or equal to high school, and intervention assignment. Multivariable analyses were conducted only if associations in the block models were significant at $P < .05$. *$P < .05$. **$P < .01$. ***$P < .001$.

put adolescents at risk for later DUI/RWDD.

DISCUSSION

The current longitudinal study addresses several gaps in the literature by evaluating risk and protective factors in middle school for subsequent DUI/RWDD during high school among a multiethnic sample of adolescents as they reach legal driving age. Results emphasize the importance of identifying and evaluating factors in early adolescence other than AM use behavior among at risk youth, such as AM beliefs, peer factors, and family factors.

Early Middle School

The strongest predictors, in our multivariable models, of DUI/RWDD in the 12-year-old sample were positive marijuana beliefs and ability to resist marijuana. These youth are already drinking and although not using marijuana frequently, they endorse more positive beliefs about marijuana, which may be due to recent legislation and increased media coverage of this drug.[40] This highlights the need to address these types of beliefs as early as sixth grade. At the same time, youth with a stronger belief in their ability to resist marijuana use were more likely to report DUI/RWDD. This was an unexpected finding because previous literature has revealed that lower resistance self-efficacy is associated with greater AM use[13,41,42]; thus, we hypothesized that believing that one could resist AM use would be protective against DUI/RWDD.

However, another recent study revealed that adolescents' self-efficacy in their ability to stop using marijuana was associated with both greater consequences and greater willingness to use. In this case, youth expressed that if they had to stop using marijuana that they had confidence in their ability to stop, although they were not necessarily willing to stop their use.[43,44] Future studies need to further investigate the association between adolescents' ability to resist marijuana use, positive beliefs for marijuana, and DUI/RWDD. This is particularly important in light of changes in legalization of medical and recreational marijuana.[40]

Late Middle School

As youth aged, AM use by peers and family members had a stronger

influence on their risk for DUI/RWDD in our multivariable models, with youth exposed to marijuana use at age 14 in their peer networks and at home being more vulnerable. Given that perceptions of harmfulness and disapproval of marijuana are declining,[2] and youth view marijuana use as less dangerous than drinking,[45] we must begin to address how changing views of marijuana might increase risk for not only marijuana use, but other behaviors such as DUI/RWDD of marijuana.[46] Additionally, past month alcohol use and perceived peer use of alcohol predicted DUI/RWDD. It is well established that alcohol use is predictive of DUI/RWDD in high school and college populations,[6–10] and that perceived peer use predicts drinking behaviors.[23–25]

Comparing Findings Between Two Age Cohorts

Predictors of DUI/RWDD in high school shifted from greater positive beliefs about marijuana and higher perceived ability to resist marijuana use to greater exposure to alcohol use, and perceptions about greater marijuana use by peers and family. Prevention programs must not only focus on individual use but must also address beliefs that youth have about AM use as these beliefs develop early on from peers, parents, and media and are strongly related to use.[47] For example, programs that challenge perceptions of use and positive beliefs about AM use[32,48] have been shown to decrease rates of initiation[3] and use.[32]

Limitations and Future Directions

All outcomes were self-report; however, we are confident that study procedures (eg, discussing confidentiality) allowed us to collect accurate data,[13,49,50] and previous studies have revealed that self-report of AM use behaviors is generally valid.[51] Our rates of AM use were comparable with national samples[2];

however, there are no national past year rates of DUI/RWDD for direct comparison. Past year rates of DUI in our 10th graders (4.4%) were similar to past 30-day estimates from a national survey of 10th graders (6.2%), making us believe that rates of DUI were lower in our sample than what would be nationally reported.[1] Past year rates of RWDD in our study (24.5%) were comparable with that of a California survey of youth who had ever RWDD (20.7%).[52] This might indicate some hesitation to report DUI in the sample versus RWDD, because DUI puts the responsibility of the dangerous behavior with the adolescents themselves. We also did not ask about DUI of AM separately. As medical and recreational marijuana legalization increases in our country, adolescents are becoming more accepting of marijuana use,[2] and studies have revealed that high school students report DUI of marijuana more frequently than DUI of alcohol.[53] Thus, it is crucial to begin to tease this apart; we have changed our survey to address this concern so that youth are now asked about these substances separately in future study waves.

CONCLUSIONS

In sum, positive beliefs and ability to resist marijuana in early adolescence, not actual AM use, had the strongest association with DUI/RWDD ~4 years later. This identifies a potential indicator, above and beyond simply early AM use, for targeted interventions for those adolescents just starting middle school. As adolescents progress through middle school, the influence of those around them who use AM becomes more important. Findings from our 2 age cohorts provide evidence of the need for targeted interventions for youth as young as sixth grade to help prevent DUI/RWDD later in high school.

ABBREVIATIONS

AM: alcohol and marijuana
CI: confidence interval
DUI: driving under the influence
OR: odds ratio
RWDD: riding with a drinking driver

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