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### Association between self-reports of being high and perceptions about the safety of drugged and drunk driving

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#### Abstract

This study examines the relationship between selfreports of being high on marijuana and perceptions about driving high or drunk. Data were collected in 2014 from an online convenience sample of adult, past 30-day marijuana and hashish users in Colorado and Washington (n = 865). Respondents were asked, "Were you high or feeling the effects of marijuana or hashish when you took this survey?" Logistic regression was used to assess the relationship between being high and beliefs about driving high, controlling for demographics and marijuana use. Respondents who reported being high at the time of survey administration had higher odds of agreeing with the statements, "I can safely drive under the influence of marijuana" (OR = 3.13, P < 0.001) and "I can safely drive under the influence of alcohol" (OR = 3.71, P < 0.001) compared with respondents who did not report being high. Respondents who were high also had higher odds of being open to driving high under certain circumstances. Being high may influence perceptions about the safety of drugged and drunk driving. The effectiveness of public health messages to prevent drugged and drunk driving may depend in part on how persuasive they are among individuals who are high.

#### Introduction

Over the past decade, nearly half of U.S. states have legalized marijuana for medical or recreational

purposes, and at least 10 states are currently considering recreational marijuana ballot initiatives [1]. The long-term public health implications of legalizing marijuana for recreational use are unknown, and may include both positive and negative outcomes. However, one concern is that widespread legalization of marijuana may increase incidence of drugged driving [2]. More readily available marijuana may also play a role in incidence of driving under the influence of alcohol. A study based on National Alcohol Survey data from 2005 and 2010 indicates that 7.5% of current drinkers nationwide "usually or sometimes" use alcohol and marijuana simultaneously and that simultaneous use doubles the odds of drunk driving [3].

A robust body of evidence shows that driving under the influence of alcohol is a cause of car crashes [4]. The evidence related to marijuana use and car crashes is less clear. For example, two recent meta-analyses [5, 6] and a review of the literature [7] indicate that use of marijuana prior to driving approximately doubles the risk of a crash. In contrast, a recent case-control crash-risk study conducted by the NHTSA indicates that marijuana use does not increase the likelihood of a car crash and that crashes occurring under the simultaneous influence of marijuana and alcohol are attributable solely to alcohol [8]. Discrepant findings may stem in part from the complexity of measuring the degree to which an individual is impaired by marijuana at a given moment in time [9–13].

A key question is whether legalization of marijuana for recreational use will change patterns of

behavior and social norms in ways that will affect the likelihood of driving high, the likelihood of driving under the simultaneous influence of marijuana and alcohol and the incidence of marijuana-related car crashes. Evidence from alcohol research clearly shows that individuals who are intoxicated underestimate the likelihood of negative consequences of risky actions [14]. Experimental studies show that individuals who are intoxicated perceive drunk driving to be less dangerous than sober individuals [15] and have an increased willingness to drive drunk under certain conditions, such as "a short distance" [16]. These studies, conducted in carefully controlled settings, highlight a basic precept underlying campaigns to prevent drugged and drunk driving: the decision to drive or refrain from driving while under the influence of drugs such as marijuana and alcohol may be made in a moment of intoxication, when assessment of risk is less likely than usual to cohere with reality [14].

Using a survey of marijuana users in Colorado and Washington, we examined the association between self-reported marijuana and hashish highs and marijuana-related safety perceptions, including the perception that drugged driving is safe and that getting caught is unlikely. We also explored whether self-reports of being high are associated with openness to driving high in certain situations. Finally, we examined the association between these risk perceptions and self-reported levels of marijuana consumption.

#### Methods

#### Study design and sample

Data are from an online survey, administered in September 2014 to a convenience sample of pastyear marijuana or hashish users, aged 18 and older, living in Colorado or Washington. Respondents were recruited from the Global Market Insite (GMI) online panel which is an established panel of U.S. adults. The survey took  $\sim$ 20 min to complete. The study design and instrument were approved by RTI's federally sanctioned institutional review board. The total study sample consisted of 1352 respondents, with 634 from Colorado and 718 from Washington. For the purpose of this analysis, we further limited the sample to the 865 respondents reporting past 30-day marijuana or hashish use, which consisted of 399 respondents from Colorado and 466 from Washington.

#### Measures

Self-reported assessment of being high was measured by asking respondents, "Were you high or feeling the effects of marijuana or hashish when you took this survey?" Response options were "yes," "no," and "don't know/prefer not to answer."

Risk perception items related specifically to the safety of driving under the influence of marijuana or alcohol and the risk of being caught driving high. Belief items examined respondents' willingness to drive high in certain contexts. We measured risk perceptions by asking respondents whether they agreed or disagreed with the statements, "I can safely drive under the influence of marijuana," "I can safely drive under the influence of alcohol," and "If I drove high I would probably not get caught." We measured beliefs about driving high in certain situations by asking respondents whether they agreed or disagreed that "It is OK to drive a little bit stoned," "In certain situations I might drive high," and "I would never consider driving high." Response options were measured on a 5-point scale ranging from strongly agree to strongly disagree, with an option for "neither agree nor disagree" and a "don't know/prefer not to answer" option. Data were collapsed into dichotomous variables representing agreement (including those who strongly agreed or agreed with statements) and disagreement (including those who strongly disagreed, disagreed, or were neutral in regard to statements). Responses of "don't know/prefer not to answer" were set to missing for this analysis.

Demographic data were collected using items from the 2012 U.S. Census Bureau. Measures of marijuana and hashish use—ever use, past year use, and past 30-day use—are from the 2012 National Survey

Perceptions about drugged driving

on Drug Use and Health. These measures consist of the following questions: "Have you ever, even once, used marijuana or hashish?" and "How long has it been since you last used marijuana or hashish?" Number of days used in the past month was measured by asking, "Now think about the past month, from (DATEFILL) through today. On average, how many days did you use marijuana or hashish during the past month?" Respondents were able to enter a number from 1 to 31.

Consumption was measured as follows: "Now we are going to show you five pictures of marijuana. Thinking about the last day you used marijuana, how much did you personally use that entire day? Please check the box next to the photo that best represents how much you used." Images showed 1/8, 1/16, 1/32, 1/64 and 1/128 oz. of marijuana. Hashish consumption was measured similarly, with images showing 1/2, 1/4, 1/8, 1/16 and 1/32 g. For both items, respondents could also select the following responses: "Less than these amounts," "I have not used marijuana/hashish in the past year" or "Don't know/prefer not to answer." We used ounces as the unit of marijuana measurement and grams as the unit of hashish measurement because these are the metrics by which they are commonly sold. Because a gram is much smaller than an ounce (1 g = 0.035 ounces), it is better suited for the purchase of hashish, which is typically purchased in smaller quantities relative to marijuana due to its higher THC level. Marijuana and hashish consumption were combined to form an overall individual consumption variable. For the purpose of analysis, the sample was split into tertiles, with approximately one-third of the sample in each consumption category (low, medium and high).

#### Analysis

Analysis consisted of six logistic regression models, each of which examined the association between self-reports of being high at the time of survey administration and the risk perception and belief outcomes described above. Each model controlled for state of residence, gender, age, education, mental health status, number of days of marijuana or  
 Table I. Unweighted sample characteristics, past 30-day marijuana or hashish users

Measure	Overall $(n = 865)$ (%)			
High while taking survey	16.4			
Gender				
Female	60.4			
Male	39.7			
Age group				
18–24	8.7			
25–34	21.2			
35–54	38.4			
55+	31.8			
Race/ethnicity				
White	79.3			
Black	3.4			
Hispanic	7.5			
Other	9.8			
Education				
Did not graduate high school	1.6			
High school degree or GED	13.6			
Some college, no degree	29.4			
College degree or higher	55.4			
Days during past 30 that mental he	ealth was not good			
0 days	42.5			
1–7 days	36.7			
8–13 days	8.5			
14–21 days	6.0			
22–29 days	4.0			
30 days	2.4			

hashish use in the past 30, and amount of marijuana or hashish consumed in the past month. Analysis was completed using Stata 13.1.

### Results

#### Sample characteristics

Sample characteristics are presented in Table I. All respondents were past 30-day marijuana or hashish users. A substantial proportion of the sample (16.4%) reported being high at the time of survey administration. Females represented 60.4% of the sample. The sample was generally older (70.2% were aged 35 or older), largely white (79.3%) and well educated (55.4% had a college degree or more education). In terms of mental health status, 42.5% reported no days in the past 30 during which their

mental health was "not good," and 36.7% reported having 1–7 days during which their mental health was not good.

#### **Findings**

## Proportion of the sample that endorsed risk perception and belief items

One-third of all respondents (33.4%) agreed or strongly agreed with the statement "I can safely drive under the influence of marijuana," whereas only 8.3% agreed or strongly agreed they could safely drive under the influence of alcohol (data not shown). More than one-third of respondents (37.9%) agreed or strongly agreed that if they drove high, they would probably not get caught. Substantial proportions of respondents believed it was acceptable to drive high in certain contexts, such as "a little bit stoned" (30.5%) and "in certain situations" (38.8%). More than half of the sample (53.0%), however, reported that they would never consider driving high.

#### Association between being high and perceptions of risk associated with driving high or drunk

Respondents who reported being high at the time of survey administration were more likely to agree with the statements, "I can safely drive under the influence of marijuana" (OR = 3.13, P < 0.001) and "I can safely drive under the influence of alcohol" (OR = 3.71, P < 0.001) compared with respondents who reported not being high (see Table II). Respondents who were high were also more likely than those who were not to agree with the statement, "If I drove high I would probably not get caught" (OR = 1.98, P < 0.01).

The perceived safety of driving under the influence of marijuana did not differ significantly by state of residence, age, gender, education or mental health status (see Table II). Only high frequency of marijuana use (21–30 days per month compared with 1– 10 days) and heavier marijuana use (high and medium usage tertiles compared with the low use tertile) were associated with greater odds of

agreeing that "I can safely drive under the influence of marijuana." In contrast, perceptions about the safety of driving under the influence of alcohol differed significantly by gender, education and mental health status, as well as by frequency and heaviness of marijuana use. Males (compared to females), individuals with a college education or more (compared with less education) and individuals reporting poor mental health on 8 or more days during the past month (compared with those with no days of poor mental health) were more likely to agree with the statement, "I can safely drive under the influence of alcohol." Heavy marijuana users (high usage tertile) were also more likely to agree that they could drive safely under the influence of alcohol, in contrast with frequent marijuana users (21-30 days per month) who were less likely to agree with the statement. Males and heavy marijuana users were also more likely to agree with the statement, "If I drove high I would probably not get caught."

# Association between being high and openness to driving high

Respondents who reported being high at the time of survey administration were significantly more likely than those who were not to agree with the statements, "It is OK to drive a little bit stoned" (OR = 2.74, P < 0.001) and "In certain situations I might drive high" (OR = 2.17, P < 0.001) (Table III). Respondents who were high were significantly less likely than those who were not high to agree with the statement, "I would never consider driving high" (OR = 0.65, P < 0.05).

Males, individuals younger than age 35, those with poor mental health on 8 or more days during the past month, and those who used marijuana frequently (on 21–30 days during the past month) or heavily (high and medium usage tertiles) were more likely to agree that it is okay to drive a little stoned (see Table III). Males and frequent users (11–20 and 21–30 days per month) were more likely to say "In certain situations I might drive high." Frequent marijuana users (21–30 days per month) and heavier marijuana users (high and medium usage tertiles)

Independent variables	I can safely drive under the influence of marijuana		I can safely drive under the influence of alcohol		If I drove high I would probably not get caught	
	OR	P value	OR	P value	OR	P value
High while taking survey	3.13	P = 0.000	3.71	P = 0.000	1.98	P = 0.001
Colorado	1.09	P = 0.614	0.87	P = 0.615	1.04	P = 0.813
Age 35 or older	0.82	P = 0.287	0.79	P = 0.432	0.74	P = 0.075
Male	1.30	P = 0.126	2.71	P = 0.001	1.51	P = 0.009
College degree or more	0.96	P = 0.810	2.09	P = 0.019	1.01	P = 0.966
Mental health (ref: 0 days)						
1–7 days	1.08	P = 0.676	0.94	P = 0.868	0.90	P = 0.541
8+ days	1.13	P = 0.572	3.34	P = 0.000	1.26	P = 0.255
Days used (ref: 1-10 days)	)					
Used 11-20 days	1.54	P = 0.066	0.80	P = 0.550	0.92	P = 0.708
Used 21-30 days	2.66	P = 0.000	0.34	P = 0.002	1.14	P = 0.472
Mean amount marijuana/ha	ishish					
used (ref: low)						
Medium amount used	1.48	P = 0.049	0.92	P = 0.817	1.05	P = 0.797
High amount used	2.30	P = 0.000	2.57	P = 0.011	1.74	P = 0.007

Table II. Effect of being high on perceptions of risk associated with driving high or drunk

were less likely to agree with the statement, "I would never consider driving high."

#### Discussion

This study finds that current marijuana and hashish users who reported being high or feeling the effects of marijuana or hashish at the time of survey administration had substantially higher odds than those who reported not being high of believing that they could safely drive while under the influence of marijuana or alcohol. They also had higher odds than those who reported not being high of saying that if they drove under the influence of marijuana they would "probably not get caught" and that it is okay to drive "a little bit stoned" or "in certain situations." Those who reported taking the survey high had lower odds than those who did not of ruling out driving high altogether. These findings are consistent with the idea that being high may influence risk perceptions about driving under the influence of marijuana and alcohol in potentially meaningful ways.

One-third (33.4%) of the overall sample of past 30-day users—including both those who were high and those who were not—agreed with the statement

"I can safely drive under the influence of marijuana," whereas only 8.3% agreed that they could safely drive under the influence of alcohol. The difference in perceptions may be explained in part by the existence of prominent, ongoing public health campaigns and messages about the dangers of drunk driving, widespread knowledge about laws prohibiting drunk driving, and strong social norms against drunk driving, all of which are rooted in a well-established body of scientific research. In contrast, drugged driving, and driving under the influence of marijuana specifically, has been a lesser focus of public health campaigns and findings from research on the effects of marijuana use on driving are somewhat inconsistent.

The primary limitation of this study is that the data are from a convenience sample that is not necessarily representative of the populations of Colorado or Washington or of the populations of past 30-day marijuana or hashish users in those states. Our findings are not generalizable to these populations or to marijuana users elsewhere. A population-based study that examined cognitions and behaviors related to marijuana use in the context of the legalization of recreational use would represent a valuable contribution to

Independent variables	It is OK to drive a little bit stoned		In certain situations I might drive high		I would never consider driving high	
	OR	P value	OR	P value	OR	P value
High while taking survey	2.74	P = 0.000	2.17	P = 0.000	0.65	P = 0.040
Colorado	1.23	P = 0.222	1.14	P = 0.371	0.86	P = 0.319
Age 35 or older	0.66	P = 0.025	0.75	P = 0.098	1.05	P = 0.772
Male	1.62	P = 0.005	1.55	P = 0.005	0.93	P = 0.655
College degree or more	1.05	P = 0.796	1.21	P = 0.215	1.20	P = 0.226
Mental health (ref: 0 days)						
1–7 days	1.05	P = 0.783	1.10	P = 0.587	0.86	P = 0.368
8+ days	1.73	P = 0.012	1.40	P = 0.097	1.10	P = 0.641
Days used (ref: 1–10 days)						
Used 11–20 days	1.40	P = 0.162	1.76	P = 0.008	1.10	P = 0.643
Used 21-30 days	2.15	P = 0.000	1.55	P = 0.016	0.55	P = 0.001
Mean amount marijuana/hasl	nish used (re	f: low)				
Medium amount used	1.88	P = 0.003	1.00	P = 0.997	0.70	P = 0.035
High amount used	2.87	P = 0.000	1.49	P = 0.053	0.64	P = 0.027

Table III. Effect of being high on openness to driving high

the evidence in this area and would help inform policy and public health campaigns. The study design limits what we may conclude from the findings in another important way as well. Because the study is cross-sectional rather than a longitudinal study or an experiment the findings do not indicate that being high increases the risk for driving high or drunk; only that being high is associated with risk perceptions about the safety of driving high or drunk. Future studies are needed to determine whether there is a causal effect of being high on marijuana or hashish on risk perceptions about driving, and whether these risk perceptions are, in fact, related to driving behavior. However, these findings are consistent with studies of the effects of alcohol consumption on risk perceptions, which show that intoxicated individuals underestimate the likelihood of negative consequences of risky actions [14-16]. Specifically, alcohol studies with experimental designs show that individuals who are intoxicated perceive drunk driving to be less dangerous than sober individuals [15] and have an increased willingness to drive drunk under certain conditions, such as "a short distance" [16]. These findings are also consistent with research showing that simultaneous use of marijuana and alcohol increases the odds of drunk driving [3].

This study has several additional limitations. First, the primary independent variable used in this analysis is being high or feeling the effects of marijuana or hashish at the time of survey administration. Data for this variable were collected through unverified self-reports, and it is possible that some respondents who reported being high were not. Second, among respondents who were high when they took the survey, there is no way of assessing how high they were and how this might have influenced outcomes. It would be possible to better understand this through research conducted in an in-person setting, especially as methods of testing for cannabinoid impairment become more precise [11–13]. Third, we do not measure simultaneous use of marijuana and alcohol, or whether respondents were feeling the effects of alcohol when they took the survey, so this issue warrants additional research. Fourth, some key measures used here have not been validated or tested for reliability, reflecting the nascent state of research in this topic area.

This study has implications for public health research and for the development of public health campaigns to prevent driving under the influence of marijuana and alcohol. Studies with stronger research designs should be conducted to assess whether the observed relationship between being high and risk perceptions about driving high or drunk is causal and, if so, to clarify the influence of impairment on risk perceptions. If being high affects risk perceptions, the public health community would do well to address this in campaign planning and development. For example, campaigns to prevent drugged or drunk driving must be influential at a moment in which the audience is intoxicated. At the moment in which a decision is made to drive or not drive, an individual who is cognitively impaired must recall and be persuaded by campaign messaging. This study suggests that campaigns may benefit from understanding how messaging functions within the context of intoxication. A useful area for future research would be to assess whether some messages-including both content and message characteristics-are more memorable or more persuasive than others among those who are high. This study also strongly suggests that online public health surveys should routinely measure the proportion of the sample that completed the survey while under the influence of marijuana, alcohol or other intoxicants. Studies designed to test and validate survey items for measuring self-reported drug impairment would be useful for future survey research.

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#### Disclaimer

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