Drug and Alcohol Dependence 176 (2017) 44–47

Contents lists available at ScienceDirect

Drug and Alcohol Dependence

journal homepage: www.elsevier.com/locate/drugalcdep

Short communication

New product trial, use of edibles, and unexpected highs among marijuana and hashish users in Colorado

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ARTICLE INFO

Keywords:
Marijuana
Hashish
Edible
Packaging
Communication
Policy

ABSTRACT

Objective: This study examines the relationships between trial of new marijuana or hashish products and unexpected highs, and use of edible products and unexpected highs.
Methods: We conducted an online survey of 634 adult, past-year marijuana users in Colorado. We used logistic regression models to examine the relationship between new product trial or edible use and unexpected highs.
Results: In the first year that recreational marijuana was legal in Colorado, 71.4% of respondents tried a new marijuana or hashish product, and 53.6% used an edible product. Trial of new products was associated with greater odds of experiencing an unexpected high after controlling for age, gender, education, mental health status, current marijuana or hashish use, and mean amount of marijuana or hashish consumed in the past month (OR = 2.13, $p < 0.001$). Individuals who reported having used edibles had greater odds of experiencing an unexpected high, after controlling for the same set of variables (OR = 1.56, $p < 0.05$).
Conclusion: People who try new marijuana or hashish products, or use edible marijuana or hashish products, are at greater risk for an unexpected high. It is possible that some negative outcomes associated with marijuana use and unexpected highs may be averted through a better understanding of how to use product packaging to communicate with consumers.

1. Introduction

In the United States, changing attitudes toward marijuana are giving rise to greater legalization of marijuana for adult recreational use. Since Colorado legalized marijuana for adult recreational use in 2012, seven states have followed its lead. It is unclear how legalization will affect state economies, legal systems, health and social service systems, and public health. Legalization likely will lead to both public health benefits and harms. Potential benefits stemming from legalization include reduced reliance on opioids and other pain medications (Bradford and Bradford, 2016, 2017; Kral et al., 2015), greater product and source regulation (Pacula et al., 2014), and reductions in marijuana-related arrests and incarcerations (Maxwell and Mendelson, 2016; Oregon Public Health Division, 2016). Potential harms stemming from legalization include increased use among youth (Committee on Substance Abuse and Committee on Adolescence, 2015), increased incidence of impaired driving (Allen et al., 2016; Rogeberg and Elvik, 2016; Compton and Berning, 2015), precipitation of a psychotic event among susceptible individuals (Degenhardt and Hall, 2002), accidental consumption by adults and children (Bui et al., 2015; Wang et al., 2013), and unexpected highs (Kosa et al., 2017).

Delta-9-tetrahydrocannabinol (THC) is the primary psychoactive constituent in marijuana (National Institute on Drug Abuse, 2016; Gaoni and Mechoulam, 1964). Unexpected highs occur when an individual consumes more THC than intended. Reasons this might occur include unintended use of marijuana; use of marijuana by novices; use of new marijuana products by experienced users; weaknesses in product labeling; and product inconsistency, such as the uneven distribution of THC throughout a product, or a different amount of THC in the same product consumed at different points in time.

The emergence of the retail marijuana economy has led to numerous new products, including products less commonly used before legalization, such as edibles (Weise, 2015). These products are sold to consumers who may have little or no experience with them, in packages with labels and warnings that are still being tested for comprehension (Kosa et al., 2017; Malouff and Rooke, 2013). Edibles have been linked to unexpected highs in part because of the delayed onset of the high they produce. The effect of an edible marijuana product may not be felt for 1 or 2 h after consumption. For this reason, users, and especially new users, have trouble predicting what kind of effect they will achieve

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http://dx.doi.org/10.1016/j.drugalcdep.2017.03.006
Received 19 January 2017; Received in revised form 22 March 2017; Accepted 23 March 2017
Available online 09 May 2017
0376-8716/

from the amount of product consumed, and they may overconsume, thinking in the first hour or so after initial consumption that they have not ingested enough product to feel an effect (Barrus et al., 2016).

Policy makers are beginning to explore ways in which lessons from tobacco and alcohol can be applied to marijuana to reduce unintended negative consequences of legalization (Anderson and Rees, 2014; Barry et al., 2014; Pacula et al., 2014). States that have legalized marijuana for recreational use, including Colorado, are working very quickly to develop and adapt product, packaging and labeling standards designed to prevent unexpected highs (Ghosh et al., 2016). However, at this time, limited research is available to guide policy development. This study is the first, to our knowledge, to examine the relationships between (1) trial of new marijuana or hashish products and unexpected highs and (2) use of edible marijuana or hashish products and unexpected highs.

2. Methods

2.1. Sample and data collection

The study sample consisted of adult residents of Colorado aged 18 or older who were past-year users of marijuana or hashish. Respondents were members of an established online panel of U.S. adult consumers managed by Global Market Insite. The study was approved by RTI International's federally sanctioned Institutional Review Board. Data collection took place in the last week of September 2014, nine months after the January 1, 2014, start of retail sales in Colorado. The total study sample consisted of 634 respondents.

2.2. Measures

Respondents were screened into the study using measures from the 2012 National Survey on Drug Use and Health. Those who responded affirmatively to the question, "Have you ever, even once, used marijuana or hashish?" were asked, "How long has it been since you last used marijuana or hashish?" Past-year users were included in the study; all others, including those who responded don't know/prefer not to answer were screened out.

2.2.1. Dependent variable

The outcome of interest was unexpected highs, measured using two items: "Thinking about the past year, when you used marijuana or hashish, did you ever get (more high/a high that lasted longer) than you expected?" Response options were yes, no, and don't know/prefer not to answer. Those who responded don't know/prefer not to answer were dropped from the analysis.

2.2.2. Independent variables

New product trial was measured by asking, "Thinking about the past year, did you try new marijuana or hashish products? That is, marijuana or hashish products that you had never tried before?" Response options were yes, no, and don't know/prefer not to answer. The method of consuming marijuana was measured as follows: "Now we are going to list some ways marijuana, pot, or grass can be used. This question is about marijuana, pot, and grass only (not about hashish, hash, or wax). Please check all of the ways you have used marijuana in the past year." Response options were smoked a joint; smoked using a vaporizer or e-joint; smoked marijuana in a pipe; smoked a blunt (marijuana added to a cigar); ate it; drank it; applied it under the tongue as a liquid or oil; and applied it to the skin as a cream, liquid, or oil. The method of consuming hashish was measured similarly: "Now we are going to list some ways hashish, hash, or wax can be used. This question is about hashish, hash, or wax only (not about marijuana). Please check all of the ways you have used hashish in the past year. Response options were smoked in a pipe; ate it; drank it; applied it under the tongue as a liquid or oil; and applied it to the skin as a cream, liquid, or oil. Both measures also included the response options some other way; I have not used marijuana/hashish in the past year; and don't know/prefer not to answer.

2.2.3. Control variables

Models controlled for age, gender, education, mental health status, current marijuana or hashish use, and mean amount of marijuana or hashish consumed in the past month. Mean amount of marijuana or hashish consumed in the past month was measured by showing respondents images of different amounts of marijuana or hashish and asking them to check the box next to the image that best represents how much they used the last time they consumed the product. From these data, we developed three usage levels that represent roughly equal tertiles.

2.2.4. Additional variables

We provide descriptive data on several additional variables that assess respondents' recall of engaging in certain behaviors or having certain experiences as a result of experiencing an unexpected high. Behaviors and experiences related to unexpected highs were measured using the question stem, "Thinking about the past year, how frequently have you done these things because the high or effect you got from marijuana or hashish was greater or lasted longer than you expected?" Response options were called a friend for help; changed or cancelled plans; decided not to drive a car or other motor vehicle; decided not to go to work; felt paranoid; had a hallucination; had a panic attack; had sex with someone you didn't intend to have sex with; went to a hospital, clinic, or emergency room for treatment; and, went to sleep.

2.3. Analysis

Regression models were used to examine the effects of a new product trial and use of edibles on unexpected highs. Both models controlled for age, gender, education, mental health status, current marijuana or hashish use, and mean amount of marijuana or hashish consumed in the past month. Analyses were conducted using Stata software, version 13.1.

3. Results

3.1. Sample characteristics

All respondents were past-year marijuana or hashish users. More than half (62.9%) reported having used marijuana within the past 30 days (Table 1). We classified 41.1% of the sample as having "low usage," 22.5% as having "medium usage," and 36.5% as having "high usage" of marijuana or hashish in the past 30 days. The sample was predominantly white (83.3%). Females composed 64.7% of the sample. The majority of the sample (67.1%) was aged 35 or older, and more than half (59.5%) had a college degree or more education. In terms of mental health status, 40.6% reported having zero days in the past 30 during which their mental health was "not good," and 38.9% reported having 1–7 days of mental health that were not good.

3.2. Findings

3.2.1. Descriptive analyses

Most respondents (71.4%) reported trying new marijuana and hashish products over the past year. More than half of respondents (53.6%) reported consuming marijuana or hashish in the form of an edible.

More than half of respondents (55.4%) experienced an unexpected high. When respondents were asked whether they engaged in certain behaviors or had certain experiences as a result of an unexpected high, the most common response was going to sleep (87.9%). Other behaviors and experiences respondents reported were deciding not to drive a car (59.9%); feeling paranoid (44.3%); changing or cancelling plans