Research Article

Correlates of Driving Under the Influence of Cannabis Among U.S. Adults in a State with Legalized Medical Cannabis

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ABSTRACT

Objective: Driving under the influence of cannabis (DUIC) is a modifiable risk factor for cannabis harm. To inform the development of effective measures to mitigate DUIC, this study assessed factors associated with DUIC risk. **Method:** Data were from a 6-wave cross-sectional survey (2020–2023) of N = 11,051 adult Oklahomans. The analytic sample consisted of 3,012 adults who reported past 30-day cannabis use. Participants self-reported sociodemographic characteristics (age, sex, race and ethnicity, education, family finances, rurality), substance use patterns (past 30-day alcohol use, medical cannabis license, daily cannabis use, modes of cannabis use, probability of cannabis use disorder [CUD], and cannabis harm perceptions), and exposure to cannabis marketing. Univariable and multivariable logistic regression models evaluated associations between individual factors (e.g., sociodemographic characteristics and substance use patterns), marketing exposure, and modes of cannabis use (e.g., vaped cannabis) with odds of past 30-day DUIC. **Results:** The multivariable logistic regression model adjusting for sociodemographic characteristics indicated that daily/near daily cannabis use (AOR = 2.54, 95% CI = 2.08-3.09), probable CUD (AOR = 1.63, 95% CI = 1.36-1.94), and exposure to cannabis marketing (AOR = 1.84, CI = 1.44-2.36) were each associated with increased odds of past 30-day DUIC (vs. no DUIC). The multivariable logistic regression model adjusting for modes of cannabis use showed that past 30-day (vs. not) vaping (AOR = 1.41, 95% CI = 1.20-1.67) and dabbing (AOR = 1.71, 95% CI = 1.43-2.05) were significantly associated with increased odds of past 30-day DUIC (vs. no DUIC). **Conclusions:** Daily/near daily cannabis use, probable CUD, and exposure to cannabis marketing were correlates of DUIC, as were vaping and dabbing modes of cannabis use.

Key words: = cannabis; driving under the influence of cannabis (DUIC); vaping; dabbing

Access to cannabis is legal in the majority of states in the United States (U.S.; Chapekis & Shah, 2024). Although cannabis has certain health benefits (National Academies of Sciences Engineering & Medicine, 2017), it carries risks for health harms. One harm is driving under the influence of cannabis (DUIC), which is associated with injury risks to both users and non-users (Aydelotte et al., 2019; Chihuri et al., 2017). The U.S. National Survey on Drug Use (NSDUH) found that 18.7% of Americans (aged 12 years or older) used cannabis at least once in the past year

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(Substance Abuse and Mental Health Services Administration, 2021), and NSDUH data from 2020 showed that 24.6% of adults (aged 18+) who used cannabis in the past year reported DUIC (Myers et al., 2023). Data from the National Cannabis Climate Survey (2016-2017) found that of U.S. adults (18+) reporting past 30-day cannabis use, 32.1% reported past 30-day DUIC (Dutra et al., 2022). A similar prevalence was found among college-aged adults in the National College Assessment Survey (2020-2021), with 29.9% reporting past-30-day DUIC (Tang et al., 2023). DUIC is a modifiable risk factor for cannabis harms (Fischer et al., 2017), and developing effective prevention measures to mitigate DUIC requires an understanding of the factors that correlate with DUIC.

Alcohol and cannabis are the most frequently detected drugs in the bloodwork of drivers involved in motor vehicle crashes (MVCs; Bondallaz et al., 2016; Brady & Li, 2013; NIDA, 2019). According to data from the Fatality Analyses Reporting System (FARS) in the U.S., from 2000 to 2018, alcohol was detected in approximately 40% of MVC fatalities, while MVCs involving any cannabis use (i.e., cannabis alone or with alcohol) increased from 9.0% in 2000 to 21.5% in 2018 (Lira et al., 2021). Data from the U.S. National Highway Traffic Safety Administration found that from 2019-2021, cannabis was more common than alcohol in toxicology reports of seriously injured or killed drivers involved in MVCs across multiple states (Thomas et al., 2022).

Laboratory studies with driving simulators demonstrated that acute cannabis intoxication (i.e., defined as within 3 hours of cannabis use) impaired psychomotor and cognitive function, indicating an increased risk of MVCs (Moskowitz, 1985; Ramaekers et al., 2009). Meta-analyses of observational epidemiological studies found that acute cannabis consumption (i.e., measured by toxicology of whole blood or by self-report) was associated with increased risk of MVC and fatal collisions (Asbridge et al., 2012; Rogeberg & Elvik, 2016). However, one large-scale case control study in the U.S. found that testing positive for cannabis (i.e., measured by blood or oral fluid) did not increase the risk of MVC when adjusting for demographics and alcohol use (Compton & Berning, 2015). While bloodwork can detect the presence of specific cannabinoids to identify acute vs. chronic cannabis use, such assessments typically require special laboratories and may not be assessed after MVCs (Loflin et al., 2020). Discrepancies between studies assessing the risk of DUIC and MVC are compounded by varied routes of administration for cannabis and related pharmacokinetic effects.

The types of cannabis products available on the market have different modes of delivery with implications for pharmacokinetic effects that could impact driving. Inhaling cannabis smoke or vaporized aerosols results in a more rapid onset of psychoactive effects and impairment (i.e., within minutes) than ingesting cannabis orally (i.e., within 30-90 minutes). However, both modes of delivery likely induce intoxication within the first hour of use (Grotenhermen, 2003; Ramaekers et al., 2016; Ramaekers et al., 2021). High-potency products have greater proportions of the psychoactive chemical tetrahydrocannabinol (THC) and may impair driving-related abilities (Bidwell et al., 2021; Pearlson et al., 2021). High-potency products are prevalent in legal markets in the U.S. and include dried flower and other alternative products, such as vaporizers, edibles, concentrates (i.e., wax), beverages, and lotions (ElSohly et al., 2021; Goodman et al., 2020). These products pose varied risks depending on the mode of delivery (e.g., smoke exposure from flower vs. delayed intoxication from edibles; Russell et al., 2018). Additionally, products that are not technically high potency could induce significant intoxication if taken more than directed, such as over-consuming edibles in one sitting. Assessments of DUIC prevalence typically evaluate cannabis use generally (i.e., collapsing across modes) and not associations between different modes and DUIC (Asbridge et al., 2012; Salas-Wright et al., 2021). Given the diversity of cannabis products, modes of use (smoked, vaporized, ingested, etc.), and related pharmacokinetic effects, more research is needed to assess associations between modes of cannabis use and DUIC.

Past research has identified sociodemographic factors associated with the risk of DUIC. Surveys showed that the risk of DUIC was higher among high-frequency cannabis users (e.g., using daily or near-daily) in legal cannabis jurisdictions (Bonar et al., 2019; Goodman et al., 2020). High-frequency cannabis use is a risk factor for other adverse effects, including developing dependence and cannabis use disorder (CUD; Compton et al., 2019; Fischer et al., 2017). Analysis of NSDUH data from 2017-2018, for instance, showed that frequency of cannabis use and number of CUD symptoms were associated with greater odds of DUIC (Salas-Wright et al., 2021). Results from the same NSDUH data showed that sociodemographic factors, including being male, having some college education (or higher), and household income <$20,000, were associated with higher odds of DUIC (Salas-Wright et al., 2021).

Finally, marketing influences may impact cannabis use and risk of DUIC. A survey of youth (aged 15-19) in U.S. states with legal recreational cannabis showed that exposure to cannabis marketing on social media was associated with greater odds of cannabis use (Whitehill et al., 2020). Another national survey of adults (aged 18-34) in legal and illegal states in the U.S. found that exposure to cannabis marketing was associated with higher rates of use (Krauss et al., 2017). Links between exposure to cannabis marketing and higher rates of cannabis use were reported in other studies (Cohn, Alexander, et al., 2023; Dai, 2017; Rup et al., 2020; Trangenstein et al., 2019). Although research found associations between marketing exposure and increased cannabis use, no studies have assessed whether cannabis marketing exposure may increase risk for DUIC.

Given the growing availability of cannabis and increased consumption, public health agencies have called for research monitoring cannabis use patterns to identify risk factors for adverse health outcomes, including DUIC (Centers for Disease Control and Prevention, 2024). To address this need, this study assessed individual factors (e.g., sociodemographic characteristics and substance use patterns) and marketing exposure associated with risk of DUIC in Oklahoma, where medical (but not adult use "recreational") cannabis has been legal since 2018. Oklahoma is a unique cannabis policy environment because it leads the nation in the number of dispensaries per capita (Chapekis & Shah, 2024), making it an ideal location to study correlates of DUIC among medical cannabis consumers.

METHODS

Participants and Procedure

This is a secondary analysis from a larger 6-wave repeated cross-sectional survey (September 2020-October 2023). Eligible survey participants were ≥18 years old and living in Oklahoma (verified by self-reported zip code). Individuals were recruited from a professionally maintained panel vendor by the research firm Cint (Cint, 2025). Panel vendors maintain membership pools of individuals who are invited to complete survey research based on eligibility criteria. Eligible individuals provided consent and then completed the online survey (~12 minutes long). Participants were compensated based on incentives provided by the panel to which they belong (e.g., cash, points to redeem prizes, or gift cards, equating to roughly $1). The analytic sample for this study consisted of 3,012 adults who endorsed past 30-day cannabis use (selected from the larger survey sample of 11,051 survey participants). Procedures were approved by the University of Oklahoma Health Sciences IRB (#11994). More details on the study methodology, data quality, and sample demographics are reported in previous publications (Cohn, Alexander, et al., 2023; Ehlke et al., 2022; Kendzor et al., 2022).

Measures

Sociodemographic characterics. Participants provided information on age, biological sex, race and ethnicity, education, and annual household income. Residency in urban versus rural areas was determined by analyzing zip codes linked to the Rural-Urban Commuting Area (RUCA) codes (USDA, 2020). RUCA codes 1 to 3 were categorized as urban, while codes 4 to 10 were classified as rural.

Substance use patterns. Participants reported the number of days (0-30) they used alcohol in the past 30 days. Responses were dichotomized into no past 30-day alcohol use (0 days) versus any past 30-day alcohol use (≥ 1 day). Participants provided information on whether they had been issued a medical cannabis license from the Oklahoma Medical Marijuana Authority (OMMA) and the number of days they used cannabis in the past 30 days (0-30). Only those reporting ≥ 1 day were retained for analyses. Cannabis use was dichotomized into daily/near daily cannabis use (yes vs. no to using ≥ 20 of the past 30 days; Compton et al., 2019).

Driving under the influence of cannabis (DUIC) was assessed with an item adapted from previous work: "During the past 30 days, have you driven a vehicle approximately 3 hours after having used marijuana or cannabis?", with response options of yes or no (Dutra et al., 2022).

The 3-item Cannabis Use Disorder Identification Test-Short Form (Bonn-Miller et al., 2016) was used to assess probable cannabis use disorder (CUD). A summed total score was computed, where scores of ≥ 2 were indicative of probable CUD (scores range from 0-12).

Using items from the Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention, 2025), participants were asked to report the past 30-day use of seven different modes of cannabis use, including "smoked it," "ate it," "drank it," "vaporized it," "dabbed it," "dissolved it in my mouth," "applied to my skin," and "used some other way" (no, did not use = 0 vs. yes, did use = 1).

Cannabis harm perceptions were queried with the item: "How much do you think people harm themselves when they use cannabis?" with response options ranging from 1 = no harm to 4 = a lot of harm. Following previous research (Cohn, Alexander, et al., 2023; Compton & Berning, 2015; Kohlwes et al., 2023), responses were dichotomized so that higher scores indicated lower harm perceptions (no/little harm = 1 vs. some/lot of harm = 0).

Marketing exposure. A dichotomous variable was created to assess any past 30-day exposure to cannabis marketing (yes/no) from at least one of four sources: outdoor (billboards, signs), social media, print (magazines), and internet (Cohn, Alexander, et al., 2023).

Data Analyses

To assess individual factors (e.g., sociodemographic characteristics, substance use patterns, modes of cannabis use) and marketing exposure, we first computed descriptive statistics for the overall sample, including those who did and did not report past 30-day DUIC. Second, a multivariable logistic regression model was used to identify correlates of past 30-day DUIC, with all sociodemographic characteristics, substance use patterns, and marketing exposure entered simultaneously. Third, we conducted a multivariable logistic regression model to examine associations of past 30-day DUIC with all modes of cannabis use entered simultaneously. Fourth, as a sensitivity analysis, we ran a series of univariable logistic regression models with each sociodemographic variable, substance use measure, and cannabis marketing exposure as individual predictors of past 30-day DUIC. We also conducted a series of univariable logistic regression models with each mode of cannabis use as a predictor of past 30-day DUIC. Additional supplementary analyses examined associations of all sociodemographic characteristics with each mode of cannabis use. The pattern of results for modes of cannabis use and DUIC with and without socodemographic variables was the same, so we report the univariable and multivariable results for modes of use on past 30-day DUIC. All analyses were conducted using IBM SPSS Statistics (Version 29).

RESULTS

Participant Characteristics

Table 1 shows participant characteristics. Approximately one-third (30.9%) reported past 30-day DUIC. Higher proportions of those who reported past 30-day DUIC (vs. no past 30-day DUIC) were ages 25-34 (33.9% vs. 24.4%) or 35-44 (29.5% vs. 25.5%), reported male sex at birth (53.1% vs. 43.5%), earned an Associate's degree or higher education (31.8% vs. 28.7%), and resided in an urban area (66.9% vs. 61.9%). A higher proportion of participants with past 30-day DUIC (vs no DUIC) reported past 30-day alcohol use (65.4% vs. 60.7%), owning a medical cannabis license (62.5% vs. 54.9%), daily/near daily cannabis use (70.4% vs. 51.7%), probable CUD (62.9% vs. 44.1%), and past 30-day exposure to cannabis marketing (85.7% vs. 76.5%).

Individual Factors and Driving Under the Influence of Cannabis

Univariable and multivariable logistic regression results are also shown in Table 1. Regarding sociodemographic differences in past 30-day DUIC, compared to the 55+ age group, those who were 18-24 (AOR = 2.11, 95% CI = 1.45-3.07), 25-34 (AOR = 2.99, 95% CI = 2.13-4.20), 35-44 (AOR = 2.53, 95% CI=1.80-3.55), and 45-54

(AOR = 1.73, 95% CI = 1.19-2.51) had significantly higher odds of past 30-day DUIC. Female participants had lower odds (AOR = 0.77, 95% CI = 0.65-0.92) of past 30-day DUIC (vs. males). Those with an Associate's degree or higher (AOR = 1.36, 95% CI = 1.07-1.73) had greater odds of reporting past 30-day DUIC (vs. high school or GED or less education). Those reporting incomes of \$20,000 - \$39,000 (AOR =1.33, 95% CI = 1.06-1.66) or \$40,000 - \$79,000 (AOR = 1.26, 95% CI = 0.99-1.62) had higher odds of past 30-day DUIC (vs. \$20,000 or less). Regarding substance use patterns, daily/near daily cannabis use (AOR = 2.54, 95% CI = 2.08-3.09) and probable CUD (AOR = 1.63, 95% CI = 1.36-1.94) were each associated with increased odds of past 30-day DUIC, whereas lower cannabis risk perceptions correlated with lower odds (AOR = 0.71, 95% CI = 0.53-0.96). Finally, exposure to cannabis marketing was associated with greater odds of past 30-day DUIC (AOR = 1.84, CI = 1.44-2.36).

Cannabis Use Modes and Driving Under the Influence of Cannabis

Figure 1 displays proportions of participants reporting past 30-day use of each mode by past 30-day cannabis DUIC. Higher proportions of those reporting past 30-day DUIC (vs. no 30-day DUIC) also reported past 30-day use of the following modes: smoked (83.7% vs. 78.7%), vaped (50.5% vs. 36.6%), edible (44.1% vs. 37.7%), dabbed (42.3% vs. 25.8%), drank (17.1% vs. 11.4%), applied (16.6% vs. 12.4%), and dissolved (14.3% vs. 9.6%; all p's < .05). Table 2 shows univariable and multivariable logistic regression results. In the multivariable logistic regression model controlling for all modes, vaping (AOR = 1.41, 95% CI = 1.20-1.67) and dabbing (AOR = 1.71, 95% CI = 1.43-2.05) were the only significant correlates of greater odds of past 30-day DUIC.

DISCUSSION

Study findings identified risk factors for DUIC to inform public health agencies trying to assess the impacts of legalized cannabis use. In our sample of past 30-day cannabis consumers, rates of past 30-day DUIC were 30.9%, similar to national surveys of U.S. adults reporting past 30-day cannabis use, where 32.1% reported past 30-day DUIC (Dutra et al., 2022). Those at risk for DUIC reported being younger, male, and having higher education levels and incomes ≥\$20,000. Most were daily/near daily cannabis users (70.4%), and most met the threshold for probable CUD (62.9%). In multivariable models, both cannabis-use factors were associated with higher odds of past 30-day DUIC. Previous studies identified daily/near-daily cannabis use and CUD symptoms (Bonar et al., 2019; Salas-Wright et al., 2021) as correlates of DUIC. Participants reporting past 30-day DUIC (vs. not) had higher proportions for every mode of cannabis use. When controlling for all modes of use, vaping and dabbing were the only modes uniquely associated with past 30-day DUIC.

The probable CUD rate of 49% in our overall sample exceeded previous estimates. A review of NSDUH surveys showed that the rate of CUD among adult cannabis consumers in the U.S. decreased from 33.4% in 2002 to 19.5% in 2017 among daily/near daily cannabis consumers, as the prevalence of daily/near daily use more than doubled (1.9% to 4.2%) during the same period (Compton et al., 2019). However, a meta-analysis of research in the U.S. and other countries estimated CUD prevalence up to 33% among young people who used cannabis weekly or daily (Leung et al., 2020). Estimates for CUD prevalence among cannabis users can vary based on the diagnostic criteria used (Compton et al., 2019), and it is possible our measure (Bonn-Miller et al., 2016) was sensitive to CUD symptoms. However, 2023-2024 NSDUH surveys showed that an estimated 22% of adults (18+) in Oklahoma reported past-30-day cannabis use, exceeding the estimate of 16% of adults in the U.S. (Substance Abuse and Mental Health Services Administration, 2024). Notably, Oklahoma has more dispensaries per capita than any U.S. state (Chapekis & Shah, 2024). Dispensary proximity has been linked to higher rates of daily/near daily cannabis use (Trangenstein et al., 2025), and daily/near-daily use is a risk factor for CUD (Fischer et al., 2017). Thus, higher CUD rates in our sample could reflect higher overall use rates in Oklahoma. Although nearly half of the dispensaries in Oklahoma are located in rural areas (Cohn, Sedani, et al., 2023), dispensaries are often clustered in urban areas (Trangenstein et al., 2025), which may also explain, in part, why urbanicity (vs. rurality) correlated with past 30-day DUIC in our sample. While this study did not assess dispensary proximity, associations between dispensary proximity, cannabis use, and CUD symptoms highlight areas for future research.

This is one of the first studies to assess modes of cannabis use in relation to DUIC risk. Our results identified vaping and dabbing as correlates of DUIC when controlling for all other modes. Vaping includes vaporizing cannabis flower or concentrates (e.g., THC oils) with electronic devices, some of which may be designed for tobacco use (i.e., e-cigarettes). Dabbing involves flash-heating wax concentrates with a blowtorch to vaporize the "dabs" and inhale the vapors, which can create an intense high (Loflin & Earleywine, 2014). Vaping liquids and dabbing waxes have THC concentrates ranging from 20% to 90%, often much higher than flower products, averaging 16% to 19% THC concentrations (Loflin & Earleywine, 2014; Russell et al., 2018). Thus, vaping and dabbing present risks for driving-related impairment, although the rapid onset of effects may have dissipated in the 3-hour window specified in our DUIC item. Alternatively, using cannabis products with potent THC concentrations—such as vapes and dabs—may contribute to greater intoxication within a 3-hour window. We did not include survey items that would allow us to assess the acute effects of intoxication on driving impairment levels by different modes of administration. However, evaluating how modes of use relate to discrete DUIC events is a promising area for future research, and this paper highlights specific modes for such investigations.

The results inform prevention and messaging outreach to reduce adverse cannabis-use outcomes. It is important to effectively communicate the risks of cannabis use, including DUIC, to consumers and the public. This includes clear labeling on packages to indicate high potency (Hammond, 2021) and using "comprehensive" health warnings (Massey et al., 2024). Such warnings should use attention-grabbing designs to describe cannabis risks, including risks of daily/near-daily use for CUD and DUIC. As researchers develop effective health warnings, the messages can be adapted to campaigns across legalized and non-legalized states and shared in a variety of settings, such as school programs and via social media, reaching youth who have not yet aged up to purchase cannabis legally. Results identified sociodemographic and cannabis-use-related correlates of DUIC, such as younger age, male sex at birth, greater education, and moderate income, all factors that could inform tailored health messaging. Promoting accurate risk perceptions through multiple channels is especially relevant for mitigating problematic cannabis use due to a lack of effective policy enforcement in preventing marketing violations and the spread of spurious claims about cannabis use (Carlini et al., 2022; Lau et al., 2021; Orenstein & Glantz, 2018). This allows retailers to promote products with unsubstantiated health claims (Cavazos-Rehg et al., 2019; Hoeper et al., 2022; Luc et al., 2020), likely contributing to consumer misunderstanding about the risks of cannabis use.

To our knowledge, no studies have assessed cannabis marketing exposure as a risk factor for DUIC. While cannabis marketing is prohibited at the federal level under the Controlled Substances Act (USFDA, 2022), many states allow for cannabis marketing (Allard et al., 2022), including Oklahoma, where cannabis marketing has proliferated following the medical cannabis legalization in 2018 (Cohn, Alexander, et al., 2023). Research has shown associations between exposure to tobacco and alcohol advertising and tobacco (Villanti et al., 2015) and alcohol use (Anderson et al., 2009), including progression to problematic use (Jernigan et al., 2017). Similarly, research has demonstrated associations between exposure to cannabis marketing and cannabis use (Cohn, Alexander, et al., 2023; Rup et al., 2020; Trangenstein et al., 2019). Our results contribute to the literature by identifying cannabis marketing as a correlate of DUIC. Established measures to restrict marketing established in alcohol and tobacco control research may inform cannabis control systems in the U.S. (Barry & Glantz, 2017) and could potentially reduce the risk and prevalence of DUIC in legalized states.

Unexpectedly, lower harm perceptions were associated with lower odds of DUIC, meaning those who perceived cannabis as having greater health harm were more likely to report past 30-day DUIC. One interpretation of these results is that those who engaged in past 30-day DUIC had realistic assessments of the higher risks associated with impaired driving based on their experience. This interpretation aligns with previous studies of cannabis intoxication and driving, indicating that cannabis consumers (vs. alcohol consumers) tend to be aware of their intoxication (Pearlson et al., 2021) while compensating with certain driving behaviors (e.g., slower driving to account for intoxication), which may still contribute to dangerous driving (Sewell et al., 2009). Another interpretation is that probable CUD includes the inability to reduce or stop using cannabis, even when use has negative impacts on one's life. Since lower risk perceptions and probable CUD correlated with odds of past 30-day DUIC, it is possible that some participants—including the approximately 50% of our sample with CUD symptoms—were aware of the impacts of cannabis but continued to use it or were unable to reduce use to reduce risk. However, these interpretations are based on a single item measuring cannabis harm perceptions. How people perceive cannabis health risks is multifaceted and differs by user profile and mode of use. Our measure captured general harm perceptions and not perceptions about specific cannabis use behaviors or different modes of use. Thus, our findings provide insight into general cannabis harm perceptions and highlight areas of future research to determine how specific perceptions relate to adverse cannabis use, including the differentiation of general harm perceptions versus those possibly arising from problematic use or specific product types.

Strengths and Limitations

The study's strengths include a large sample collected over multiple waves within a legal cannabis jurisdiction using established measures. Limitations included the cross-sectional nature of the data, which limited our ability to determine a causal association between the factors of interest and past 30-day DUIC. Future research should examine longitudinal associations between modes of cannabis use and subsequent DUIC in legal and non-legal states. We measured past 30-day DUIC with an item adapted from the Behavioral Risk Factor Surveillance System annual survey. As with many self-report measures, the item relies on participants' recall of past behavior and their interpretation of the item wording. Future research should continue to evaluate the correspondence between self-reports of DUIC and laboratory-based assessments. Data were collected in Oklahoma and may not generalize to other states, especially those with no legal cannabis available. We did not collect data on alcohol and cannabis retail outlet density, both of which may influence the propensity to engage in intoxicated driving. The co-use of alcohol with cannabis is also common, and alcohol intoxication may also influence one's decision-making to consume cannabis and to drive while intoxicated. However, cannabis (and not alcohol) use was a correlate of DUIC in our study. Still, the co-use of both substances should be examined further in future research on impaired driving.

Conclusion

A growing body of evidence indicates DUIC is a risk to public safety. Developing effective strategies for reducing DUIC requires awareness of factors associated with this behavior. This research examined the individual and cannabis-use factors associated with the likelihood of DUIC within a medical cannabis state. Our results found that being younger, male, with higher education levels, and incomes ≥ $20,000 were risk factors for past 30-day DUIC. Daily/near daily cannabis use, probable CUD, and exposure to cannabis marketing were associated with past 30-day DUIC. Those reporting past 30-day DUIC had higher proportions of every mode of cannabis use than those reporting no past 30-day DUIC. Vaping and dabbing were the two modes associated with past 30-day DUIC controlling for other modes. Results identify sociodemographic and cannabis-use factors informing prevention and messaging outreach to reduce adverse cannabis-use outcomes. Research should continue to assess the unique role that the mode of cannabis use and harm perceptions play in the risk of DUIC.

Table 1. *Characteristics of Adult Oklahomans Who Reported Past 30-Day Cannabis Use (2020-2023)*

	Overall *N* = 3,012 *N* (%)	Past 30-day DUIC *n* = 931 (30.9%)[a] *n* (%)	No past 30-day DUIC *n* = 2,081 (69.1%) *n* (%)	OR (95% CI)[b]	AOR (95% CI)[b]
Age					
18-24	535 (17.8)	156 (16.8)	379 (18.2)	**2.12 (1.52-2.96)**	**2.11 (1.45-3.07)**
25-34	824 (27.4)	316 (33.9)	508 (24.4)	**3.20 (2.35-4.37)**	**2.99 (2.13-4.20)**
35-44	806 (26.8)	275 (29.5)	531 (25.5)	**2.67 (1.95-3.65)**	**2.53 (1.80-3.55)**
45-54	478 (15.9)	124 (13.3)	354 (17.0)	**1.80 (1.28-2.54)**	**1.73 (1.19-2.51)**
55+	369 (12.3)	60 (6.4)	309 (14.8)	Ref	Ref
Sex					
Female	1612 (53.5)	437 (46.9)	1175 (56.5)	**0.68 (0.58-0.80)**	**0.77 (0.65-0.92)**
Male	1400 (46.5)	494 (53.1)	906 (43.5)	Ref	Ref
Race					
NH Black	248 (8.2)	81 (8.7)	167 (8.0)	1.14 (0.86-1.51)	1.02 (0.75-1.40)
NH Other	441 (14.6)	148 (15.9)	293 (14.1)	1.19 (0.95-1.48)	1.18 (0.93-1.51)
Hispanic	269 (8.9)	88 (9.5)	181 (8.7)	1.14 (0.87-1.50)	1.08 (0.80-1.46)
Non-Hispanic (NH) White	2054 (68.2)	614 (66.0)	1440 (69.2)	Ref	Ref
Education					
High School or GED or less	1160 (38.5)	341 (36.6)	819 (39.4)	Ref	Ref
Some college/technical school	958 (31.8)	294 (31.6)	664 (31.9)	1.06 (0.88-1.28)	1.14 (0.92-1.41)
Associate's degree or higher	894 (29.7)	296 (31.8)	598 (28.7)	1.19 (0.99-1.44)	**1.36 (1.07-1.73)**
Income					
$20,000 or less	862 (28.6)	230 (24.7)	632 (30.4)	Ref	Ref
$20,000 - $39,000	897 (29.8)	288 (30.9)	609 (29.3)	**1.30 (1.06-1.60)**	**1.33 (1.06-1.66)**
$40,000 - $79,000	794 (26.4)	263 (28.2)	531 (25.5)	**1.36 (1.10-1.68)**	**1.26 (0.99-1.62)**
$80,000 or more	401 (13.3)	140 (15.0)	261 (12.5)	**1.47 (1.14-1.90)**	1.32 (0.96-1.83)
Urban or Rural Residence					
Urban	1912 (63.5)	623 (66.9)	1289 (61.9)	Ref	Ref
Rural	1092 (36.3)	304 (32.7)	788 (37.9)	**0.80 (0.68-0.94)**	0.86 (0.72-1.03)
Past 30-day alcohol use					
Yes	1873 (62.2)	609 (65.4)	1264 (60.7)	**1.22 (1.04-1.44)**	1.10 (0.92-1.32)
No	1139 (37.8)	322 (34.6)	817 (39.3)	Ref	Ref
Medical Cannabis License					
Yes	1724 (57.2)	582 (62.5)	1142 (54.9)	**1.37 (1.17-1.61)**	1.12 (0.93-1.34)
No	1287 (42.7)	349 (37.5)	938 (45.1)	Ref	Ref
Daily/near daily cannabis use					
Yes	1730 (57.4)	655 (70.4)	1075 (51.7)	**2.22 (1.88-2.62)**	**2.54 (2.08-3.09)**
No	1282 (42.6)	276 (29.6)	1006 (48.3)	Ref	Ref

Probable Cannabis Use Disorder					
Yes	1503 (49.9)	586 (62.9)	917 (44.1)	**2.10 (1.79-2.46)**	**1.63 (1.36-1.94)**
No	1478 (49.1)	345 (37.1)	1133 (54.4)	Ref	Ref
Exposure to cannabis marketing					
Yes	2391 (79.4)	798 (85.7)	1593 (76.5)	**2.07 (1.64-2.61)**	**1.84 (1.44-2.36)**
No	529 (17.6)	103 (11.1)	426 (20.5)	Ref	Ref
Cannabis harm perceptions[d]					
No harm / a little harm	2720 (90.3)	817 (87.8)	1903 (91.4)	**0.67 (0.52-0.86)**	**0.71 (0.53-0.96)**
Some harm / A lot of harm	291 (9.7)	114 (12.2)	177 (8.5)	Ref	Ref
Wave[i]					
1	546 (18.1)	156 (16.8)	390 (18.7)	0.87 (0.67-1.13)	0.91 (0.67-1.23)
2	409 (13.6)	127 (13.6)	282 (13.6)	0.98 (0.74-1.30)	1.06 (0.77-1.45)
3	461 (15.3)	127 (13.6)	334 (16.0)	0.83 (0.63-1.09)	0.79 (0.58-1.07)
4	542 (18.0)	177 (19.0)	365 (17.5)	1.06 (0.81-1.37)	1.11 (0.83-1.49)
5	546 (18.1)	184 (19.8)	362 (17.4)	1.11 (0.85-1.43)	1.10 (0.83-1.48)
6	508 (16.9)	160 (17.2)	348 (16.7)	Ref	Ref

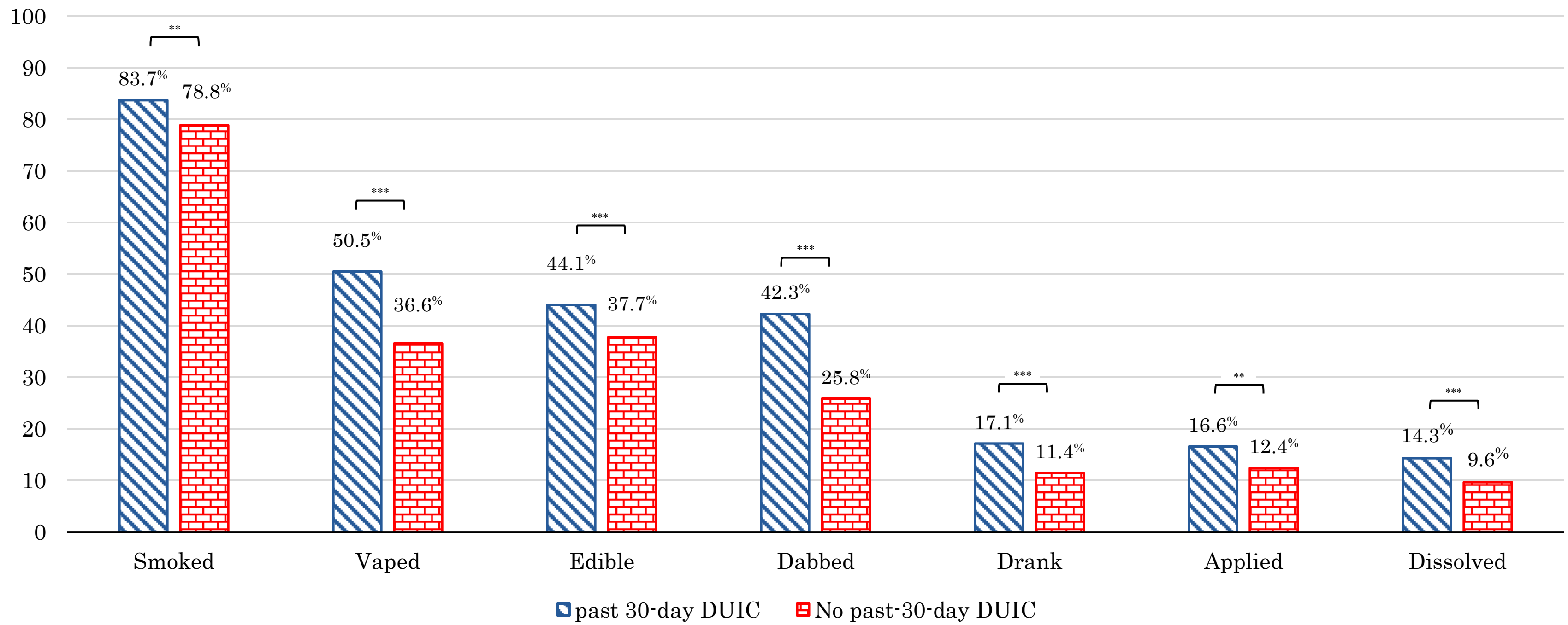
Note. [a]The analytical sample reported using cannabis in the past 30 days. Past 30-day DUIC was scored as 0 = "No, have not driven a vehicle approximately 3 hours after having used cannabis" (referent) vs. 1 = "Yes, have driven a vehicle approximately 3 hours after having used cannabis." [b]OR = odds ratio, AOR = adjusted odds ratio, 95% CI = 95% confidence interval. Bold indicates statistical significance at $p < .05$. [c]Some columns may not add up to 100% due to missingness: 58 participants did not provide income; 8 participants did not provide urban/rural information; 1 participant did not provide medical cannabis card information; 31 participants did not provide CUD information; 92 participants did not provide marketing exposure information; 1 participant did not provide cannabis harm perceptions. [d]Survey waves were 2020 (Wave 1; September), 2021 (Wave 2; March), 2021 (Wave 3; September), 2022 (Wave 4; September), 2023 (Wave 5; March), 2023 (Wave 6; September).

Table 2. *Results From Univariable and Multivariable Logistic Regression Models Examining Associations of Modes of Cannabis Use With Past 30-day Driving Under the Influence of Cannabis (DUIC)*

	Overall *N* = 3,012 *N* (%)	Past 30-day DUIC *n* = 931 (30.9%)[a] *n* (%)	No past 30-day DUIC *n* = 2,081 (69.1%) *n* (%)	OR (95% CI)[b]	AOR (95% CI)
Yes, did use [mode] at least once in past 30 days[c]					
Smoked	2,418 (80.3)	799 (83.7)	1,639 (78.8)	**1.38 (1.23-1.69)**	1.23 (1.00-1.52)
Vaped	1,232 (40.9)	470 (50.5)	762 (36.6)	**1.77 (1.51-2.06)**	**1.41 (1.20-1.67)**
Edible	1,196 (39.7)	411 (44.1)	785 (37.7)	**1.31 (1.12-1.53)**	1.09 (0.99-1.29)
Dabbed	931 (30.9)	394 (42.3)	537 (25.8)	**2.11 (1.79-2.48)**	**1.71 (1.43-2.05)**
Drank	397 (13.2)	159 (17.1)	238 (11.4)	**1.60 (1.28-1.98)**	1.21 (0.95-1.56)
Applied	414 (13.7)	155 (16.6)	259 (12.4)	**1.41 (1.13-1.74)**	1.16 (0.91-1.48)
Dissolved	333 (11.1)	133 (14.3)	200 (9.6)	**1.57 (1.24-1.98)**	1.18 (0.90-1.54)
Some other way	205 (6.8)	66 (7.1)	139 (6.7)	1.07 (0.79-1.44)	0.85 (0.61-1.18)

Note. [a]The sample reported using cannabis in the past 30 days. Past 30-day DUIC was scored as 0 = "No, have not driven a vehicle approximately 3 hours after having used cannabis" (referent) vs. 1 = "Yes, have driven a vehicle approximately 3 hours after having used cannabis." [b]OR = odds ratio, AOR= adjusted odds ratio, 95% CI = 95% confidence interval. Bold indicates statistical significance at $p < .05$. [c]Each mode of cannabis use ranged from 0 (did not use in the past 30 days) to 30 (used every day in the past 30 days) and was dichotomized as 0 = "No, did not use [mode] in the last 30 days" (referent) vs. 1 "yes, did use [mode] at least once in the past 30 days." Participants could report multiple modes of cannabis use.

Figure 1. *Differences in Proportions of Participants Reporting Past 30-Day Modes of Cannabis Use by Driving Under the Influence of Cannabis (DUIC) in the Past 30 Days*



Note. Y-axis is the proportion of participants reporting modes of cannabis use in the past 30 days by categories of past 30-day driving under the influence of cannabis (DUIC). The x-axis shows the different modes of cannabis use, as participants could identify multiple modes of use. Bivariate analyses compared proportions of participants reporting each mode of cannabis use by DUIC status; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

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