Beyond Driving After Cannabis Use: Administration Method and Using Cannabis While Driving in Emerging Adults

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ABSTRACT

Objective: Cannabis-impaired driving is a growing public health concern, yet little is known about factors associated with cannabis use while driving (CUWD). No prior work has examined whether the method of cannabis administration used prior to driving is associated with CUWD; the present study addressed this gap. **Method:** Data were drawn from the baseline assessment of a randomized controlled trial. Participants were 149 emerging adults (18–29 years) who had driven after cannabis use at least three times in the past 3 months. Participants reported whether they had engaged in CUWD during that period and the method of cannabis administration (smoking, vaping, edibles, or multiple methods) used prior to driving on two cannabis-impaired driving occasions (most recent and heaviest). Two logistic regression models tested associations between administration method and CUWD. **Results:** Nearly two-thirds (61.7%) of participants reported CUWD in the past 3 months. Vaping prior to driving was associated with increased odds of CUWD on both the most recent ($OR = 4.33$, $p < .001$) and heaviest ($OR = 2.78$, $p = .025$) impaired driving occasions. Multiple-method use prior to driving on the heaviest impaired driving occasion was also associated with markedly higher odds ($OR = 7.06$, $p < .001$). Edible use was uncommon and not significantly associated with CUWD. **Conclusions:** Method of cannabis administration prior to driving is an important and underexamined correlate of CUWD. Vaping and multiple-method use may serve as behavioral markers of elevated risk and represent promising targets for screening, prevention, and method-specific harm reduction messaging.

Key words: cannabis use while driving; cannabis administration methods; emerging adults

Cannabis use continues to increase in the United States, particularly among emerging adults (18–29 years). As of 2025, 22.3% of U.S. adults and nearly 40% of emerging adults report past-year cannabis use, with daily or near-daily users concentrated in this age group (Caulkins, 2024; Substance Abuse and Mental Health Services Administration, 2025). As legalization expands, cannabis-involved traffic accidents have also increased, contributing to an estimated 6,800 excess roadway deaths annually (Pearlson et al., 2021). Studies have shown that cannabis use impairs lane maintenance, reaction time, attention, and decision making (Arkell et al., 2019; Brooks-Russell et al., 2024; Hartman et al., 2015; Meda et al., 2025). These effects directly compromise driving ability and safety, but the duration and intensity of impairment vary and are dependent upon quantity, method of administration, and potency (Arkell et al., 2019; Meda et al., 2025). Even though cannabis use objectively impairs the skills necessary to drive safely, many individuals underperceive the risk of cannabis on driving ability, with some even perceiving an improvement in driving ability after cannabis use (Greene, 2018; Mills & Freeman, 2023).

Driving after cannabis use (DACU), or driving under the influence of cannabis (DUIC), is commonly operationalized as driving within a few

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hours of cannabis use (e.g., 2–3 hours). Compared to DACU, cannabis use while driving (CUWD) is a unique and particularly high-risk behavior. The co-occurrence of intoxication and the physical act of using cannabis while driving represents a dual source of impairment (psychomotor plus physical distraction), along with the progressive escalation of THC levels and impairment throughout the duration of motor vehicle operation. To our knowledge, only one prior study has examined CUWD directly: Ortiz-Peregrina et al. (2020) found that 15% of occasional cannabis users (≥ 1 time per week but < 4 times per week in the past 3 months) reported smoking while driving. In a companion study drawn from the same parent trial as the present study (Teeters, Ramirez, et al., 2026), 61.7% of emerging adults reporting frequent DACU endorsed CUWD in the past 3 months. Together, these studies provide the most complete picture currently available of the prevalence of this behavior and suggest that CUWD may be especially common among individuals who frequently drive after cannabis use.

Understanding factors associated with increased risk for CUWD is critical for prevention efforts. Although no prior study has directly examined whether administration method is associated with CUWD, related evidence suggests that method of use is relevant to cannabis-impaired driving more broadly; for example, among U.S. young adults, past-year vaping has been associated with an increased likelihood of DUIC (Lee & Parker, 2023). One potentially important but underexamined factor is the method of cannabis administration prior to driving. Different administration methods (e.g., smoking, vaping, edibles, multiple methods) vary considerably in their pharmacokinetics, portability, and discreteness. These are all characteristics that may influence the likelihood of continuing cannabis use while operating a motor vehicle. For example, consuming cannabis via smoking (combustion of plant material) results in rapid THC absorption via the lungs, with onset occurring within minutes, psychotropic effects peaking within 15–30 minutes, and tapering off within 2–3 hours (Grotenhermen, 2003). Vaping, while similar to smoking in onset and duration, is much more portable, discreet, and relatively odorless compared to smoking (Ramamurthi et al., 2019; Spindle et al., 2018). Edibles, on the other hand, have much longer onset times (peaking within 1–2 hours; Huestis, 2007), but also much longer impairment duration (4–12 hours; Grotenhermen, 2003; Lafaye et al., 2017). Finally, individuals may use a combination of any two or more methods, which represents a complex pattern marked by increased severity of use (Swan et al., 2021). Regarding potency, determining levels of THC by product is difficult, but according to current averages, smoked cannabis ranges from 16–31% THC (Jikomes & Zoorob, 2018; Smart et al., 2017), vaping products range from 50–90% THC depending on the type of product (distillates vs. live resin; MacCallum et al., 2021), and edibles are typically measured in milligrams per serving rather than percentage, with serving sizes ranging from 5–10 mg THC (Steigerwald et al., 2018). This gap is notable given the high potency of many vaping products and their discreet, portable design, which may facilitate continued cannabis use across contexts such as driving. Additionally, use of multiple cannabis administration methods has been associated with heavier or more persistent use patterns, which may further increase risk for CUWD (Swan et al., 2021). These factors may reduce barriers to continued cannabis use while driving.

The current study addresses this gap by using baseline data from a recently completed longitudinal randomized controlled trial of a mobile-based cannabis-impaired driving intervention. Specifically, we examined whether an individual's cannabis use method prior to driving on the most recent and heaviest impaired driving occasions was associated with CUWD among emerging adults reporting cannabis-impaired driving in the past 3 months. Because the method of cannabis use during driving was not assessed, administration method prior to driving was conceptualized as a potential behavioral risk marker for CUWD rather than as a direct measure of the method used while driving. Given the lack of prior research on this specific impaired driving behavior and the absence of empirical evidence linking specific consumption methods to CUWD, the current study is exploratory. However, the distinct pharmacokinetic and practical profiles of different consumption methods suggest that method of use prior to driving may differentiate risk for CUWD.

METHODS

Participants

The sample consisted of 149 emerging adults (18–29) from the southeastern United States, drawn from a randomized controlled trial (RCT) investigating a mobile-based cannabis-impaired driving intervention. Data were collected in Kentucky, where recreational cannabis use is illegal; although legislation legalizing medical cannabis was signed in 2023, it did not take effect until January 2025, and no dispensaries had opened during the data collection period. Medical cannabis card status was not assessed. Inclusion criteria required a valid driver's license, regular vehicle access, reported at least three instances of driving after cannabis use within the past 3 months, owned a smartphone, were willing to engage with intervention materials, and consented to post-intervention text message exchanges with research personnel via an encrypted mobile application. Individuals currently receiving substance use treatment were ineligible to participate. The sample was predominantly female (74.1%; 25.9% male) and White (79.2%), with 9.4% identifying as Black or African American, 1.3% as Asian, 0.7% as another race, and 4.7% as multiracial; 4.7% of the sample identified as Hispanic or Latino. The mean age was 20.70 years (SD = 2.78).

Measures

Cannabis use while driving. A single item assessed the number of times participants had consumed cannabis while actively operating a vehicle in the past 3 months: "In the past 3 months, how many times have you used marijuana WHILE driving (using marijuana while operating a motor vehicle)." Responses were dichotomized for analysis (0 = no CUWD, 1 = any CUWD).

Cannabis use method prior to driving. Consumption method was assessed separately for two driving occasions (most recent and heaviest impaired driving episode) using an identical check-all-that-apply item ("How were you using [smoking, vaping, edibles, etc.]?") with response options of smoking marijuana, vaping marijuana, and eating marijuana. Specific items included:

1. Most recent occasion: "What method did you use on the most recent time you drove after cannabis use?"
2. Heaviest occasion: "What method did you use on your heaviest impaired driving occasion?"

For each occasion, responses were recoded into a single four-category variable: participants who endorsed only one method were coded into the respective category (smoking, vaping, or edibles), whereas participants who endorsed two or more methods were coded as multiple methods. Although other product types (e.g., concentrates, beverages) were not listed as separate response options, these products align with the listed methods by route of administration (e.g., vaporized concentrates with vaping; orally consumed products with eating). Accordingly, the multiple methods category reflects endorsement of two or more of the three assessed methods.

Occasion characteristics. For each occasion, participants reported the time elapsed between cannabis use and driving ("How much time passed from when you stopped using marijuana until beginning to drive?", measured in hours) and their subjective intoxication ("Estimate how high you were on a scale of 1 to 10"). These variables were not used to define impaired driving occasions or included in the analytic models; they are reported descriptively to contextualize the sample (see Supplemental Table S2).

Procedures

This manuscript reports baseline data from a longitudinal randomized controlled trial (ClinicalTrials.gov: NCT05537116). The Western Kentucky University Institutional Review Board approved all study protocols, and participants received assurances regarding data confidentiality. Recruitment occurred through a campus-wide email distribution, the university's research participant pool, and community-posted flyers.

Trained research personnel contacted individuals who met eligibility criteria (determined via an initial screening survey) by phone and extended invitations to participate in the clinical trial. Those who agreed to enroll received a text message link to a 30-minute baseline survey, which they completed independently on their personal mobile devices via a secure web-based platform. Compensation consisted of either a $25 Amazon gift card or 4 research participation credits. The clinical trial

included additional assessments at 3- and 6-month intervals and concluded data collection in fall 2025. Complete trial findings are reported elsewhere (Teeters, Moskal, et al., 2026).

Data Analysis Plan

All analyses were conducted in SPSS. Two separate logistic regression analyses were conducted to examine the relationship between method of cannabis administration prior to driving and self-reported CUWD in the past 3 months. The first model examined method of use on participants' most recent occasion of impaired driving as a predictor of CUWD, and the second model examined method of use on participants' heaviest occasion of impaired driving as a predictor of CUWD. Because the four method categories were mutually exclusive and exhaustive, administration method was entered as a single categorical predictor with smoking as the reference group in both models. Smoking was selected as the referent because it was the most prevalent method in the current sample and remains the most common method of cannabis administration among U.S. adults (Diaby et al., 2025), providing the most stable and interpretable comparison group. Three participants had missing data on the heaviest impaired driving occasion method variable, resulting in a valid sample of N = 146 for the second logistic regression model.

RESULTS

In the three months prior to assessment, 61.7% of participants reported CUWD, occurring a mean of 10.27 times (SD = 20.17) during the same period. Across both cannabis-impaired driving occasions, smoking emerged as the most common consumption method, with vaping and edibles reported less frequently. On the most recent cannabis-impaired driving occasion, over half of the participants (55.0%) endorsed smoking, while 32.2% indicated vaping, 10.1% used multiple methods, and 2.7% consumed edibles. A similar pattern emerged for the heaviest impaired driving episode: smoking was most prevalent (52.7%), followed by multiple methods (24.7%), vaping (21.2%), and edibles only (1.4%). Time elapsed between cannabis use and driving further contextualized these occasions. On the most recent impaired driving occasion, the median time between use and driving was 1.0 hour (M = 1.60, SD = 2.81), with 83.6% of participants driving within 2 hours of use and 91.8% within 3 hours. On the heaviest impaired driving occasion, the median time was also 1.0 hour (M = 1.55, SD = 3.06), with 88.4% driving within 2 hours of use and 93.9% within 3 hours. Additionally, participants reported greater subjective intoxication on the heaviest occasion (Mdn = 7.00) than the most recent occasion (Mdn = 5.00; see Supplemental Table S2 for full occasion characteristics).

Among participants classified within the multiple methods category on the most recent impaired driving occasion (n = 15), the majority of participants endorsed smoke + vape use (66.7%), followed by edible + smoke (13.3%), smoke + vape + edible (13.3%), and edible + vape (6.7%). A similar breakdown was observed for the heaviest impaired driving occasion (see Supplemental Table S1).

The overall model for the most recent impaired driving occasion was significant, $\chi^2(3) = 13.61$, p = .004, Nagelkerke R^2 = .087 (see Table 1). Participants who reported vaping as their method of use on their most recent impaired driving occasion were over four times more likely than participants who smoked to report CUWD in the past 3 months (OR = 4.33, 95% CI [1.86, 10.08], p < .001). In contrast, edibles and multiple methods of use on the most recent occasion did not significantly differ from smoking in their association with CUWD in the past 3 months (all ps > .05).

Table 1. *Logistic Regression Results: Cannabis Administration Method (Most Recent Impaired Driving Occasion) Predicting Using Cannabis While Driving (N = 149)*

Predictor Variable	*B*	*SE*	*Wald* χ^2	*p*	*OR*	95% CI for *OR*
Vaping	1.47	0.43	11.59	< .001	4.33	[1.86, 10.08]

Multiple Methods	0.69	0.59	1.38	.241	2.00	[0.63, 6.36]
Edibles	0.00	1.02	0.00	1.00	1.00	[0.13, 7.44]

Note. Smoking was the reference category. OR = odds ratio; CI = confidence interval. Overall model: $\chi^2(3) = 13.61$, p = .004; −2 log likelihood = 184.64; Nagelkerke $R^2 = .087$.

The overall model for the heaviest impaired driving occasion was also significant, $\chi^2(3) = 18.85$, $p < .001$, Nagelkerke $R^2 = .121$ (see Table 2). Participants who endorsed vaping prior to their heaviest impaired driving occasion were approximately three times more likely than those who endorsed smoking to report CUWD in the past 3 months ($OR = 2.78$, 95% CI [1.14, 6.82], $p = .025$). Those who reported using multiple methods of use demonstrated the strongest association, with over seven times the odds of reporting CUWD compared to those who smoked ($OR = 7.06$, 95% CI [2.48, 20.08], $p < .001$). Edibles were not significantly associated with CUWD in the past 3 months on the heaviest occasion ($p > .05$).

Table 2. *Logistic Regression Results: Cannabis Administration Method (Heaviest Impaired Driving Occasion) Predicting Using Cannabis While Driving (N = 146)*

Predictor Variable	*B*	*SE*	*Wald* χ^2	*p*	*OR*	95% CI for *OR*
Vaping	1.02	0.46	5.02	.025	2.78	[1.14, 6.82]
Multiple Methods	1.96	0.53	13.43	< .001	7.06	[2.48, 20.08]
Edibles	0.13	1.43	0.01	.928	1.14	[0.07, 18.87]

Note. Smoking was the reference category. OR = odds ratio; CI = confidence interval. Overall model: $\chi^2(3) = 18.85$, $p < .001$; −2 log likelihood = 175.56; Nagelkerke $R^2 = .121$. $N = 146$ due to 3 missing values on the heaviest impaired driving occasion.

DISCUSSION

Given the elevated rates of cannabis-impaired driving and the additional risks associated with CUWD, the current study sought to better understand factors surrounding this behavior across both typical (most recent) and high-risk (heaviest impaired) driving occasions in a sample of emerging adult cannabis users reporting recent DACU. To our knowledge, this is the first study to examine whether method of cannabis administration prior to driving is associated with CUWD among emerging adults. Across both recent and heaviest impaired driving occasions, vaping was consistently associated with a greater likelihood of CUWD, and on the heaviest occasion, multiple-method use was associated with more than sevenfold increased odds, compared to smoking. Edible-only use was uncommon in this sample and was not significantly associated with CUWD, though these findings should be interpreted cautiously given the low prevalence of edible-only use in the sample.

Rates of CUWD were notably high, with over 60% of the sample reporting this behavior in the past 3 months. Although this behavior remains underexamined, Ortiz-Peregrina et al. (2020) found that 15% of occasional (≥ 1 time per week but < 4 times per week in the past 3 months) cannabis users ages 19–36 reported smoking while driving. The substantially higher rate observed in the current study likely reflects the inclusion of individuals reporting multiple recent instances of DACU, in contrast to prior work focused on occasional users. Importantly, impairment is greatest in the period closely following cannabis use, including the point at which driving behaviors like lane-keeping and reaction time are most impacted (Marcotte et al., 2022). Consistent with this concern, the large majority of participants in the present sample reported driving within 2 hours of use on both impaired driving occasions, squarely within this window of peak impairment, while also reporting moderate to high subjective intoxication (see Supplemental Table S2). CUWD may result in not just progressive impairment while driving, but

physical distraction due to use of product, increasing risk for roadway accidents.

For the most recent impaired driving occasion, participants who vaped were over four ($OR = 4.33$) times more likely than participants who smoked to report CUWD. On the heaviest impaired driving occasion, those who vaped and those who used multiple methods were over two ($OR = 2.78$) and seven ($OR = 7.06$) times more likely than those who smoked, respectively, to report CUWD. Several hypothetical mechanisms may explain these associations, although additional research is needed to establish causality. First, cannabis administration methods differ in pharmacokinetic and practical characteristics that shape use patterns. Vaping is characterized by rapid onset, shorter duration of effects, and high portability and discreteness (Grotenhermen, 2003; Spindle et al., 2018), features commonly associated with more frequent or repeated dosing. Repeated dosing across extended activities (like driving) may increase the likelihood of continued cannabis use while driving, although this mechanism was not directly examined in the present study. Importantly, administration method is not the sole determinant of intoxication severity: the THC concentration of the product and the time window between consumption and driving also shape impairment (Marcotte et al., 2022), and not all vaping products are high in potency (MacCallum et al., 2021). Because neither product potency nor the timing of use relative to driving was assessed, the present associations should be interpreted as reflecting differential risk for CUWD rather than differential impairment per se. Similarly, multiple-method use may reflect heavier or more persistent patterns of cannabis involvement or higher tolerance. Prior research suggests that multiple-method use is associated with greater dependence severity, higher frequency of use, increased cannabis-related harms, broader substance involvement, and a greater proportion of cannabis use days relative to vape-only patterns (Baggio et al., 2014; Cloutier et al., 2022; Gunn et al., 2020; Swan et al., 2021), indicating that it may serve as a marker of more intensive cannabis use patterns.

Perceptual and contextual factors may further contribute to CUWD. Vaping devices are often perceived as discreet and socially acceptable (Aston et al., 2019; Budney et al., 2015), potentially lowering perceived barriers to use in everyday contexts, including while driving. Qualitative research has documented that individuals report ease of vaping "during and after driving" due to its discreet nature (Knapp et al., 2019). Taken together, pharmacokinetic, behavioral, and contextual factors may create conditions that facilitate cannabis use while operating a motor vehicle.

Findings should be interpreted in light of several limitations that also highlight directions for future research. First, the sample was predominantly White and female and recruited from a single state where recreational cannabis use remains illegal; because product source, potency, and composition were not assessed, findings may differ in states with regulated retail markets. Future work should prioritize more diverse samples, as well as varying legalization contexts. Second, the study relied on self-report data, which may introduce recall or social desirability bias. Incorporating objective or real-time assessment methods (e.g., ecological momentary assessment) may improve measurement precision. Relatedly, although time elapsed between cannabis use and driving was assessed and indicated that the large majority of participants drove within the 2–3-hour window commonly used to operationalize DUIC, no time-based threshold was applied to define impaired driving occasions, and occasion characteristics (timing, subjective intoxication) were not incorporated into the analytic models. Given known differences in the onset and duration of effects across administration methods, the precise degree of impairment at the time of driving cannot be determined, and future studies should model the timing of use relative to driving alongside administration method. Third, CUWD was assessed as a binary outcome, precluding examination of frequency, quantity, or specific methods used during driving episodes. Future studies should assess method, frequency, and quantity of cannabis use while driving to better characterize this high-risk behavior. Although method of cannabis administration prior to driving was assessed, method used during driving was not, and assuming concordance between the two would be inappropriate; accordingly, findings are best interpreted as identifying pre-driving administration method as a behavioral marker of risk for CUWD rather than as characterizing cannabis use during driving itself. Finally,

although data were drawn from a longitudinal study, analyses were limited to baseline data, precluding causal inference. Therefore, longitudinal designs are needed to determine whether administration method prospectively predicts CUWD and to clarify potential mechanisms.

In conclusion, method of cannabis administration prior to driving appears to differentiate risk for CUWD. Emerging adults who vape or use multiple methods show significantly elevated odds of engaging in this high-risk behavior, particularly during heaviest impaired driving occasions. These findings suggest that prevention and harm reduction efforts may benefit from moving beyond broad discussions of cannabis use to instead consider how individuals consume cannabis. Assessing the method of administration may improve identification of individuals at elevated risk, and intervention messaging may benefit from clarifying that all forms of cannabis use impair driving and that using cannabis while driving introduces progressive intoxication and physical distraction. Incorporating method-specific considerations into screening and prevention efforts may therefore strengthen strategies aimed at reducing cannabis-related roadway risk.

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