American Journal of Industrial Medicine

WILEY

AMERICAN JOURNAL OF INDUSTRIAL MEDICINE

RESEARCH ARTICLE

Self-Reported Cannabis Use and Intoxication at Work: Prevalence Across Industries and Occupations and Association With Workplace Injuries in the United States (US)

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Received: 15 December 2025 | **Revised:** 9 February 2026 | **Accepted:** 6 March 2026

Funding: Canadian Institutes of Health Research, Grant/Award Number: PJT-153342; Ontario Graduate Scholarship

Keywords: cannabis | industries | injuries | occupations | public health | substance use

ABSTRACT

Objective: To examine the prevalence of workplace cannabis use across industry and occupation categories, and potential associations between workplace use, intoxication, and work-related injuries.

Method: National survey data from Wave 7 (2024) of the International Cannabis Policy Study (ICPS) were used, including 30,123 workers aged 16–65 years from the United States. Separate logistic regression models examined past 30-day cannabis use at work across standard industry and occupation categories, and the association between past 30-day self-reported use, intoxication at work, and work-related injuries in the past 12 months.

Results: Approximately 1 in 10 workers reported using cannabis at work/within 2 h before work, of whom 2 in 5 reported feeling high at work "often" or "every time." The prevalence of workplace consumption was greatest among those working in the "Agriculture, forestry, fishing and hunting" (24.9%), "Construction" (14.4%), and "Accommodation and food services" (12.6%) industries. Similar results were observed by occupation. The odds of experiencing a work-related injury in the past 12 months were greater among workplace cannabis consumers who reported feeling high "sometimes," "often," or "every time" versus those who reported no past-year cannabis use (29.6% vs. 11.2%, adjusted OR = 1.66, $p < 0.001$).

Conclusions: Workplace cannabis use is common in some occupations and industries, including those with substantial occupational risks. Self-reported cannabis intoxication at work was associated with increased odds of experiencing a work-related injury. Workplaces could consider developing policies that minimize cannabis intoxication at work, specifically, rather than all cannabis use.

1 | Introduction

Drug use in occupational settings represents an important component of the health and economic burden of substance use [1]. Cannabis is one of the most commonly used substances among workers, with 1 in 10 working Americans reporting cannabis use in the last 30 days [2, 3], and its use has been associated with worker absenteeism and loss of productivity [4]. There is also evidence to suggest that American workers use cannabis at work: a recent cross-sectional study assessed the prevalence of workplace cannabis use in the United States (US) in 2023, and found that approximately one-fifth of workers who reported using cannabis also reported using cannabis at, or 2 h

before, work [5]. This is consistent with cross-sectional data from Canada that found approximately one-quarter of workers who reported consuming cannabis in the past 12 months also reported workplace use [6].

Patterns of cannabis use vary by industry and occupation [7–10]. A cross-sectional study using data from the National Survey on Drug Use and Health (NSDUH) found that the mining and construction industries had the highest prevalence of workers who use cannabis in 2013 and 2014 [9]. This is consistent with a repeat cross-sectional study also using data from NSDUH that found construction trade and extraction workers were significantly more likely to report past-month cannabis use compared to workers in other industries [8]. In contrast, a cross-sectional study using 2016−2020 data from the US Behavioral Risk Factor Surveillance System (BRFSS) found that the accommodation and food services industry had the highest prevalence of past-month cannabis use, with mining and extraction jobs having the lowest prevalence [3]. To date, there is insufficient literature to determine whether the discrepant findings reflect differences in the survey methodologies or differences over time when these studies were conducted. Further, these studies have only measured cannabis consumption overall and have not considered whether differences in workplace cannabis use exist across occupation and industry.

Some studies have examined workplace cannabis use across occupational hazards rather than standard occupation or industry categories [5, 6]. In these studies, high-risk occupations are typically defined as those in which workers perform hazardous occupational tasks at least weekly, such as driving a motor vehicle or working near hazardous substances. A Canadian cross-sectional study found that workers required to regularly perform hazardous occupational tasks were more likely to report using cannabis at work/within 2 h before work than workers in lower-risk occupations, which is consistent with cross-sectional findings among American workers [5, 6]. Such use could lead to an increased risk of work-related injuries, as Δ-9-tetrahydrocannabinol (THC) intoxication can impair psychomotor abilities necessary for driving and performing hazardous work tasks [11–13].

However, the literature assessing the association between cannabis consumption and work-related injuries is mixed. A systematic review found an association between general cannabis use and occupational injury in seven reviewed studies, while one reviewed study showed a negative association, and eight showed no evidence of a significant association [14]. The inconsistencies in the literature may in part be due to the fact that most research only examines overall cannabis use without consideration for when that use occurred or for intoxication at work [14]. A recent longitudinal study published since that review found that workplace cannabis use (use before and/or at work) was associated with increased risk of work-related injury, but not non-workplace use [15]. However, this study did not examine intoxication at work. The difference between workplace cannabis use and intoxication is an important distinction, as not all individuals who consume cannabis at or before work may be intoxicated, particularly medical consumers who may be using lower THC products or frequent consumers who have built up considerable tolerance [16]. Thus, further research is needed to examine the potential association between self-reported cannabis intoxication at work and work-related injuries [17].

The current study aims to examine the prevalence of self-reported workplace cannabis use across industries and occupations, and the potential association of workplace use and intoxication with work-related injuries among American workers. The present paper addresses three research questions: (1) Do patterns of workplace consumption (at work or 2 h before work) differ across industries and occupation groups? (2) What proportion of people who report using cannabis at work/within 2 h before work report feeling intoxicated at work? and (3) Is self-reported workplace cannabis use and intoxication associated with workplace injury?

2 | Methods

Data come from the International Cannabis Policy Study (ICPS), consisting of national population-based surveys conducted in six countries [18]. The current analysis is limited to US data from 2024 (Wave 7). ICPS respondents were recruited through Nielsen Global Panels, constructed using both probability and non-probability sampling methods. Individuals were eligible to participate if they were 16−65 years old, lived in a US state, and had access to the internet. The survey was self-administered online in September to October 2024. The median survey time was 22.3 min, including 35.4 min among past 12-month cannabis consumers and 17.3 min among those who had never consumed cannabis or not in the past 12 months [18]. The cooperation rate, which is the proportion of people asked to participate who actually did, for the Wave 7 US sample, was 45.9% [19]. All participants provided written informed consent. Upon completion, participants received remuneration in accordance with the panel's incentive structure. This study was reviewed by and received ethics clearance through the University of Waterloo Research Ethics Committee (ORE#31330).

2.1 | Measures

2.1.1 | *General Cannabis Consumption Measures*

Participants who reported consuming cannabis in the past 12 months were asked about their *frequency of use* in the past year, analyzed in the following categories: “Less than once per month,” “One or more times per month,” “One or more times per week,” “Every day or almost every day.”

2.1.2 | *Workplace Cannabis Consumption Measures*

Participants who reported using cannabis in the past 12 months were asked about their *past 30-day workplace cannabis consumption*: “In the past 30 days, have you used cannabis at work (including breaks) or within 2 h of starting work?” (Yes/No/Don't know/Refuse to answer).

Participants who reported consuming cannabis at or 2 h before work in the past 30 days were then asked about cannabis intoxication at work: “On the days you used cannabis at work, how often did you feel ‘high’ or stoned?” (Never/Sometimes/Often/Every time I used cannabis/Don't know/Refuse to answer). A new nominal variable was derived with the following four levels: “No past-year cannabis use,” “Past-year cannabis use,” “No 30-day workplace cannabis use,” “30-day

workplace cannabis use, never high," and "30-day workplace cannabis use, at least sometimes high."

2.1.3 | *Industry and Occupation Measures*

To assess *industry of work*, working participants were asked open-endedly, "What kind of business or industry do you work in? Or what does your employer make or do?" To assess the type of *occupation*, all participants were asked open-endedly, "What kind of work do you do? Or what is your job title?" Open-ended responses were recoded according to the North American Industry Classification System (NAICS) 2017 [20] for industry and the Standard Occupational Classification (SOC) 2018 [21] for occupation, using the National Institute for Occupational Safety and Health's (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS) [22]. Some responses auto-coded as having "insufficient information" were manually recoded. There were 1654 and 3390 insufficient responses for industry and occupation, respectively. In total, 298 insufficient information industry codes and 813 insufficient occupation codes were recoded into existing NAICS and SOC categories. The others remained in the 'insufficient information' category.

Occupational risk was assessed by asking all participants who worked in the past 12 months: "In your job, do you perform hazardous or safety-sensitive tasks at least once a week?" (Yes/No/Don't know), based on a previously validated measure [23]. Participants who reported 'Yes' were classified as having a high-risk job and those who reported 'No' were classified as having a low-risk job.

2.1.4 | *Past 12-month Work-Related Injuries*

To measure work-related injuries, all participants were asked "Have you sustained a physical injury due to your work that required you to take time off work or receive health care from a medical professional?" (Never/Yes, in the past 12 months/Yes, more than 12 months ago/Don't know/Refuse to answer). Participants who reported "Never" and "Yes, more than 12 months ago" were recoded as "No injury in the past 12 months."

2.1.5 | *Sociodemographic Variables*

Respondents reported demographic information, including state of residence, sex at birth, age, race, highest education level, and income adequacy (how difficult/easy it is for their family to make ends meet)—see Table 1. Participants who reported "Don't know" and "Refuse to answer" were recoded into a "Not reported" category for each sociodemographic variable.

2.1.6 | *State-Level Cannabis Laws*

Participants were categorized based on their state of residence into one of three state-level cannabis policy conditions: (1) "US legal-recreational," legal for both recreational and medical use, (2) "US legal-medical only," legal medical market, but illegal for recreational use; (3) "US-illegal market," illegal for recreational use and no legal medical market [24].

2.2 | Statistical Analyses

Overall, 44,795 participants completed the 2024 US ICPS survey. Participants who did not report working a job in the past 12 months ($n = 13{,}382$) and participants who did not report whether they consumed cannabis at or before work in the past 30 days ($n = 1252$) were excluded from all analyses. The NIOCC system flags unexpected industry and occupation pairs; 38 were dropped from the analytic sample. The final analytic sample was $N = 30{,}123$. Unless otherwise stated, participants who reported "Don't know" or refused to answer the measures mentioned above were excluded from analysis using case-wise deletion. In total, $n = 537$ were excluded from analyses, including the work-related injury and work risk measures.

Post-stratification weights were constructed based on age, sex, education, ethnicity, and state, using a raking algorithm, as reported in the ICPS technical reports [18]. Descriptive statistics were used to characterize the sample and the overall prevalence of workplace cannabis consumption across industry and occupation groups.

To assess differences across industry and occupation groups, two binary logistic regression models were fitted among all workers, regardless of their cannabis consumption in the past 12 months, with industry (Model 1) and occupation (Model 2) as the main independent variables and past 30-day workplace cannabis consumption (yes/no) as the main outcome. In Model 1, participants in the industry category "Management and companies and enterprises" had event counts below 5 and were therefore excluded from this model ($n = 21$) [25]. In Model 2, participants in the "Military services" ($n = 51$) occupation category were excluded for the same reason [25]. Sensitivity analyses were conducted, and the exclusion of these groups did not materially impact the findings. All models were run unadjusted and adjusted, including the following covariates: sex at birth, age, race, education, income adequacy, and state-level cannabis laws.

A binary logistic regression model (Model 3) was fitted with past-year work-related injuries as the main outcome and past 30-day workplace cannabis use and intoxication as the independent variable. The model was run unadjusted and adjusted, including the following variables: state-level cannabis laws, sex at birth, age, race, income adequacy, education, and occupational risk. A sensitivity analysis was conducted with the multinomial past 12-month workplace injury variable, which yielded similar results to the binary model. Only the results of the binary model are reported. Unadjusted (ORs) and adjusted odds ratios (AORs), exact p-levels to 3 decimal places, and 95% confidence intervals are reported. Analyses were conducted using survey procedures in SAS (SAS version 9.4, SAS Institute Inc., Cary, NC, USA).

The statistical analysis plan for this study was pre-registered on Open Science Framework (DOI:10.17605/OSF.IO/7DM3E).

3 | Results

3.1 | Sample Characteristics

Table 1 shows the unweighted and weighted prevalences of sociodemographic characteristics of the analytic sample. Table 2 shows the unweighted and weighted prevalences of occupation and industry categories.

In weighted analyses, two thirds of respondents did not consume cannabis in the past 12 months (62.8%); 29.1% reported

TABLE 1 | Sample characteristics among all participants who report working in the past 12 months ($n = 30,123$).

	Unweighted. % (*n*) *N* = 30,123	Weighted. % (*n*) *N* = 30,123
Sex at birth		
Female	62.9% (18,958)	47.1% (14,196)
Male	37.1% (11,165)	52.9% (15,927)
Age		
16–18 years	2.6% (780)	6.2% (1880)
19–24 years	6.0% (1815)	10.1% (3042)
25–30 years	8.6% (2601)	12.2% (3674)
31–50 years	48.5% (14,607)	46.0% (13,848)
51–65 years	34.3% (10,320)	25.5% (7678)
Education		
Less than high school	2.7% (812)	4.1% (1232)
High school diploma or equivalent	19.5% (5877)	24.0% (7244)
Some college or university	33.7% (10,142)	31.5% (9480)
Bachelor's degree or higher	43.8% (13,205)	40.0% (12,062)
Not reported	0.3% (87)	0.4% (106)
Race		
White non-Hispanic	66.5% (20,023)	63.9% (19,244)
White Hispanic	8.1% (2455)	11.2% (3370)
American Indian or Alaskan Native	1.6% (494)	1.4% (420)
Asian	4.3% (1291)	4.2% (1260)
Black or African American	13.2% (3980)	14.2% (4274)
Native Hawaiian or Pacific Islander	0.6% (190)	0.5% (148)
Other[a]	4.2% (1257)	3.3% (981)
Not reported	1.4% (433)	1.4% (425)
Income Adequacy		
Very difficult	12.1% (3635)	11.8% (3565)
Difficult	23.1% (6949)	21.6% (6519)
Neither easy nor difficult	30.5% (9183)	30.0% (9042)
Easy	19.8% (5974)	20.0% (6036)
Very easy	13.0% (3921)	14.7% (4441)
Not reported	1.5% (461)	1.7% (520)
State Cannabis Laws		
Legal recreational, and medical	81.5% (24,538)	55.2% (16,636)
Legal medical only	8.8% (2645)	18.3% (5521)
Illegal market	9.8% (2940)	26.4% (7966)
Occupational Risk		
High-risk occupation	28.8% (8663)	32.7% (9843)
Low-risk occupation	70.0% (21,098)	65.8% (19,829)
Not reported	1.2% (362)	1.5% (450)
Work-Related Injury		
Never	72.6% (21,878)	71.0% (21,379)
Yes, in the past 12 months	9.6% (2899)	12.7% (3837)
Yes, more than 12 months ago	16.0% (4830)	14.4% (4326)
Not reported	1.7% (516)	1.9% (580)
Past 12-Month Cannabis Use		
Yes	39.2% (11,814)	40.6% (11,211)

(Continues)

TABLE 1 | (Continued)

	Unweighted. % (*n*) *N* = 30,123	Weighted. % (*n*) *N* = 30,123
No, never or not in the past 12 months	60.8% (18,309)	59.4% (17,506)
Frequency of Past-Year Cannabis Consumption		
Less than once per month	22.4% (2650)	20.5% (2295)
One or more times per month	19.4% (2291)	20.4% (2281)
One or more times per week	17.4% (2057)	18.2% (2036)
Every day or almost everyday	40.8% (4816)	40.9% (4582)
Workplace Cannabis Use and Intoxication		
No past-year cannabis use	60.8% (18,309)	62.8% (18,929)
Cannabis use, no workplace use	31.5% (9496)	29.1% (8766)
Workplace use, never high	1.2% (350)	1.2% (351)
Workplace use, sometimes high	6.5% (1968)	6.9% (2076)

[a]Includes individuals who reported their race as "other" and individuals who reported being of more than one race.

consuming cannabis in the past 12 months but no past 30-day workplace cannabis use; 1.1% reported consuming cannabis at work or 2 h before work in the past 30 days but reported never feeling high at work; and 6.8% reported consuming cannabis at work or 2 h before work in the past 30 days and felt high at least sometimes.

3.2 | Past 30-Day Cannabis Use at Work

Overall, 8.1% of all workers and 21.7% of past year cannabis consumers reported consuming cannabis at work or within 2 h of starting work in the past 30 days.

3.2.1 | *Across Industries*

Table 3 shows the weighted prevalence, counts, and unadjusted and adjusted ORs for cannabis use at work or 2 h before work across all industries. The prevalence of workplace cannabis use varied across industry groups. Workers in the "Agriculture, forestry, fishing and hunting" (20.4%), "Construction" (14.4%) and "Accommodation and food services" (12.7%) industries had the highest prevalence of workplace cannabis use and the greatest odds of consuming cannabis at work or 2 h before work when compared to workers in "Professional, scientific and technical services," although in adjusted models, the results for "Construction" and "Accommodation and food services" were no longer statistically significant. Comparatively, workers in "Educational services" (3.2%), "Mining, quarrying, and oil and gas extraction" (2.7%), "Utilities" (1.5%), and "Public administration" (1.4%) industries had the lowest prevalence estimates of workplace use and the lowest odds of workplace consumption in the past 30 days.

3.2.2 | *Across Occupations*

Table 4 shows the weighted prevalence, counts, unadjusted and adjusted ORs for past 30-day workplace cannabis use across all occupation groups. The prevalence of cannabis use at work or 2 h before work also varied across occupational groups. Workers in "Farming, fishing and forestry" (15.9%), "Construction and extraction" (15.8%) and "Food preparation and serving related" (13.3%) occupations had the highest prevalence estimates of workplace cannabis use and greatest odds of consuming cannabis at work or 2 h before work, although estimates for "Farming, fishing and forestry" were not statistically significant. On the other hand, workers in "Legal" (3.6%), "Education, training and library" (2.4%) and "Community and social services" (2.3%) occupations had the lowest prevalence estimates and odds of consuming cannabis at work or 2 h before work, although results were not statistically significant for "Legal" occupations.

3.3 | Past 12-month Work-Related Injuries

Among those who reported consuming cannabis at work or 2 h before work in the past 30 days, 21.6% and 22.6% reported feeling high at work "often" and "every time" they consumed cannabis at work or before work, respectively, while 39.7% reported feeling high at work "sometimes," and 14.6% of workplace consumers reported "never" feeling high at work. Overall, 29.6% of workplace consumers who reported at least sometimes feeling high at work in the past 30 days, and 22.8% of those who reported never feeling high at work, also reported a work-related injury in the past 12 months. Table 5 shows the unadjusted and adjusted OR estimates for work-related injuries across workplace cannabis use and intoxication.

In the adjusted models, participants who reported no workplace cannabis use were no more likely to experience a workplace injury than those who reported no past-year use (12.5% vs. 11.2%, AOR = 0.97, 95% CI = 0.82−1.50). On the other hand, participants who reported workplace cannabis use and at least sometimes feeling high at work (29.6%) had about two times greater odds of a workplace injury than participants who reported no cannabis use in the past 12 months (11.2%; AOR = 2.06, 95% CI 1.66−2.60). The same group had greater odds of a workplace injury than those who used cannabis but not at work (12.5%) in both the unadjusted (OR = 2.95, 95% CI = 2.37−3.69) and adjusted models (AOR = 2.12, 95% CI = 1.68−2.69) (data not shown).

In unadjusted models, those who reported consuming cannabis at work but never feeling high (22.8%) had over two times greater odds of reporting a work-related injury than workers with no past-year cannabis use (11.2%; OR = 2.35, 95% CI =

TABLE 2 | Weighted and unweighted prevalence of industry and occupations among all workers.

	Unweighted. % (*n*) *N* = 30,123	Weighted. % (*n*) *N* = 30,123
Industry groups		
Health care and social assistance	14.9% (4474)	11.6% (3490)
Retail trade	12.1% (3634)	12.4% (3740)
Professional, scientific, and technical services	10.4% (3125)	10.5% (3159)
Educational services	8.8% (2663)	7.5% (2272)
Accommodation and food services	7.6% (2299)	9.0% (2717)
Manufacturing	6.5% (1964)	7.0% (2099)
Insufficient Information	5.5% (1653)	7.2% (2156)
Finance and insurance	5.1% (1547)	5.1% (1538)
Construction	4.7% (1415)	5.6% (1700)
Other services (except public admin)	4.5% (1355)	4.2% (1276)
Transportation and warehousing	3.9% (1167)	4.1% (1244)
Public Administration	3.8% (1147)	3.2% (960)
Administrative and support	3.5% (1040)	3.7% (1103)
Arts, entertainment, and recreation	2.2% (672)	2.5% (745)
Information and cultural industries	1.9% (568)	1.8% (550)
Real estate and rental and leasing	1.7% (512)	1.3% (404)
Wholesale trade	1.0% (299)	1.0% (312)
Unpaid workers	0.6% (191)	0.8% (231)
Utilities	0.6% (168)	0.6% (181)
Agriculture, forestry, fishing, and hunting	0.5% (161)	0.5% (152)
Mining, quarrying, and oil and gas extraction	0.2% (48)	0.2% (61)
Management and companies and enterprises	0.1% (21)	0.1% (33)
Occupation Groups		
Management	12.0% (3619)	11.2% (3368)
Sales and related	11.6% (3483)	9.3% (2810)
Office and Administrative Support	11.1% (3349)	11.5% (3463)
Insufficient Information	8.5% (2555)	10.3% (3098)
Business and Financial Operations	6.7% (2019)	5.8% (1741)
Education, Training, and Library	6.2% (1868)	5.4% (1634)
Food Preparation and Serving Related	4.8% (1437)	5.8% (1748)
Healthcare Practitioners and Technical	4.6% (1378)	3.9% (1175)
Computer and Mathematical	4.5% (1346)	4.9% (1462)
Transportation and Material Moving	4.3% (1281)	4.9% (1480)
Healthcare Support	3.9% (1179)	3.2% (951)
Construction and Extraction	3.2% (968)	4.3% (1284)
Building and Grounds Maintenance	2.9% (873)	3.3% (993)
Personal Care and Service	2.5% (766)	2.5% (746)
Arts, Design, Entertainment, Sports, and Media	2.5% (757)	2.7% (818)
Production	2.4% (724)	2.6% (783)
Community and Social Service	1.7% (501)	1.1% (340)
Protective Services	1.5% (442)	1.6% (494)
Installation, Maintenance, and Repair	1.1% (335)	1.5% (444)
Architecture and Engineering	1.1% (332)	1.2% (358)
Legal	1.1% (331)	1.0% (308)
Life, Physical, and Social Science	0.9% (264)	0.8% (232)

(Continues)

TABLE 2 | (Continued)

	Unweighted. % (*n*) *N* = 30,123	Weighted. % (*n*) *N* = 30,123
Unpaid Workers	0.7% (208)	0.8% (247)
Farming, Fishing, and Forestry	0.2% (57)	0.2% (64)
Military Services	0.2% (51)	0.3% (82)

TABLE 3 | Weighted prevalence, unadjusted and adjusted odds ratios for past-30-day workplace cannabis use by industry group[a] ($n_{\text{unweighted}} = 30{,}102$).

	Weighted % (*n*) of workplace use	Unadjusted OR (95%CI), P-level	Adjusted[b] OR (95% CI) P-level
Industry groups			
Professional, scientific, and technical services	8.3% (263)	Reference	Reference
Agriculture, forestry, fishing, and hunting	20.4% (31)	2.82 (1.37, 5.83), $p = 0.005$	2.47 (1.10, 5.52), $p = 0.028$
Construction	14.4% (245)	1.86 (1.33, 2.60), $p = 0.000$	1.26 (0.89, 1.77), $p = 0.193$
Accommodation and food services	12.7% (344)	1.60 (1.19, 2.15), $p = 0.002$	1.29 (0.93, 1.79), $p = 0.135$
Real estate and rental and leasing	12.5% (270)	1.58 (1.11, 2.25), $p = 0.011$	1.13 (0.79, 1.62), $p = 0.516$
Administrative and support	10.3% (42)	1.26 (0.65, 2.46), $p = 0.490$	1.28 (0.66, 2.50), $p = 0.469$
Manufacturing	9.8% (108)	1.19 (0.77, 1.85), $p = 0.434$	0.91 (0.56, 1.46), $p = 0.688$
Transportation and warehousing	9.4% (198)	1.14 (0.80, 1.65), $p = 0.467$	0.99 (0.68, 1.45), $p = 0.950$
Retail trade	8.5% (106)	1.03 (0.67, 1.59), $p = 0.903$	0.82 (0.53, 1.27), $p = 0.365$
Other services (except public admin)	7.5% (281)	0.89 (0.65, 1.22), $p = 0.478$	0.74 (0.54, 1.03), $p = 0.071$
Information and cultural industries	6.9% (87)	0.81 (0.51, 1.28), $p = 0.366$	0.82 (0.52, 1.31), $p = 0.414$
Wholesale trade	6.2% (34)	0.72 (0.37, 1.43), $p = 0.352$	0.77 (0.39, 1.52), $p = 0.457$
Finance and insurance	5.8% (18)	0.67 (0.30, 1.51), $p = 0.337$	0.50 (0.22, 1.15), $p = 0.104$
Arts, entertainment, and recreation	5.7% (88)	0.67 (0.44, 1.01), $p = 0.054$	0.68 (0.44, 1.03), $p = 0.068$
Health care and social assistance	5.7% (43)	0.67 (0.40, 1.11), $p = 0.122$	0.60 (0.35, 1.02), $p = 0.058$
Educational services	4.8% (168)	0.56 (0.40, 0.77), $p = 0.001$	0.60 (0.42, 0.84), $p = 0.003$
Mining, quarrying, and oil and gas extraction	4.8% (11)	0.55 (0.18, 1.74), $p = 0.313$	0.53 (0.17, 1.67), $p = 0.277$
Utilities	3.2% (73)	0.36 (0.23, 0.58), $p < 0.0001$	0.46 (0.29, 0.73), $p = 0.001$
Public Administration	2.7% (2)	0.30 (0.09, 1.03), $p = 0.056$	0.26 (0.08, 0.91), $p = 0.034$

Abbreviations: CI, confidence interval; OR, odds ratio.
[a]North American Industry Classification System, 2-level coding;
[b]Adjusted for age, sex-at-birth, income adequacy, education, state-level cannabis laws, and race.

TABLE 4 | Weighted prevalence, unadjusted and adjusted odds ratios for past-30-day workplace cannabis use by occupation[a] among all workers ($n_{\text{unweighted}} = 30{,}072$).

	Weighted % (n) of workplace use	Unadjusted OR (95% CI), P-level	Adjusted[b] OR (95% CI), P-level
Occupation groups			
Office and Administrative Support	8.4% (292)	Reference	Reference
Farming, Fishing, and Forestry	15.9% (10)	2.05 (0.57, 7.38), $p = 0.270$	1.94 (0.44, 8.55), $p = 0.384$
Construction and Extraction	15.8% (202)	2.03 (1.44, 2.88), <0.0001	1.50 (1.05, 2.15), $p = 0.025$
Food Preparation and Serving Related	13.3% (233)	1.67 (1.23, 2.27), $p = 0.001$	1.46 (1.06, 2.02), $p = 0.022$
Installation, Maintenance, and Repair	11.4% (51)	1.40 (0.76, 2.57), $p = 0.285$	1.12 (0.59, 2.12), $p = 0.725$
Insufficient Information	10.3% (320)	1.25 (0.91, 1.72), $p = 0.167$	1.07 (0.78, 1.46), $p = 0.678$
Building and Grounds Maintenance	10.0% (100)	1.21 (0.80, 1.83), $p = 0.363$	1.01 (0.65, 1.55), $p = 0.979$
Production	9.6% (76)	1.16 (0.74, 1.81), $p = 0.513$	1.06 (0.67, 1.66), $p = 0.813$
Transportation and Material Moving	9.5% (140)	1.14 (0.78, 1.67), $p = 0.514$	0.90 (0.61, 1.34), $p = 0.602$
Computer and Mathematical	9.4% (137)	1.13 (0.76, 1.66), $p = 0.551$	1.27 (0.84, 1.92), $p = 0.254$
Management	8.9% (300)	1.06 (0.80, 1.41), $p = 0.687$	1.21 (0.89, 1.64), $p = 0.222$
Arts, Design, Entertainment, Sports and Media	7.0% (57)	0.82 (0.47, 1.42), $p = 0.476$	0.97 (0.55, 1.72), $p = 0.915$
Healthcare Support	7.0% (67)	0.82 (0.52, 1.30), $p = 0.392$	0.90 (0.56, 1.44), $p = 0.659$
Architecture and Engineering	5.6% (20)	0.64 (0.35, 1.19), $p = 0.158$	0.85 (0.46, 1.60), $p = 0.624$
Personal Care and Service	5.4% (40)	0.62 (0.36, 1.04), $p = 0.072$	0.69 (0.40, 1.19), $p = 0.178$
Healthcare Practitioners and Technical	5.3% (62)	0.61 (0.33, 1.11), $p = 0.107$	0.76 (0.42, 1.38), $p = 0.371$
Protective Services	5.3% (26)	0.61 (0.22, 1.67), $p = 0.334$	0.55 (0.19, 1.60), $p = 0.274$
Sales and Related	4.9% (137)	0.56 (0.40, 0.78), $p = 0.001$	0.68 (0.48, 0.95), $p = 0.024$
Business and Financial Operations	4.6% (81)	0.53 (0.35, 0.80), $p = 0.002$	0.68 (0.45, 1.05), $p = 0.081$
Life, Physical, and Social Science	4.6% (11)	0.53 (0.18, 1.57), $p = 0.252$	0.78 (0.26, 2.30), $p = 0.648$
Legal	3.6% (11)	0.40 (0.12, 1.33), $p = 0.137$	0.69 (0.20, 2.34), $p = 0.547$
Education, Training, and Library	2.4% (39)	0.27 (0.17, 0.43), $p < 0.0001$	0.41 (0.25, 0.67), $p = 0.000$

Abbreviations: CI, confidence interval; OR, odds ratio.
[a]Standard Occupation Classification, 2-level coding;
[b]Adjusted for age, sex at birth, income adequacy, education, state-level cannabis laws, and race.

TABLE 5 | Weighted prevalence, counts, unadjusted, and adjusted odds ratios for past 12-month work-related injury across cannabis use and intoxication ($n_{unweighted} = 29{,}586$).

	Past 12-month workplace injury % (*n*)	Unadjusted OR (95% CI) P-level	Adjusted[a] OR (95% CI) P-level
Workplace Cannabis Use and Intoxication[b]			
No past-year cannabis use	11.2% (2074)	Reference	Reference
Cannabis use, no workplace use	12.5% (1,078)	1.13 (0.97, 1.32), $p = 0.118$	0.97 (0.82, 1.50), $p = 0.705$
Workplace use, never high	22.8% (79)	2.35 (1.33, 4.15), $p < 0.003$	1.42 (0.83, 2.44), $p = 0.197$
Workplace use, at least sometimes high	29.6% (605)	3.33 (2.73, 4.09), $p < 0.001$	2.06 (1.66, 2.60), $p < 0.001$

Abbreviations: CI, confidence interval; OR, odds ratio.
[a]Adjusted for age, sex at birth, income adequacy, occupational risk, frequency of cannabis use, state-level cannabis laws, education, and race;
[b]Among all workers ($n = 30{,}123$).

1.33−4.15) and past 12-month consumers with no workplace use (12.5%; OR = 2.08, 95% CI = 1.17−3.70; data not shown). However, these results were no longer statistically significant in the adjusted model.

4 | Discussion

Overall, just under 1 in 10 workers and 1 in 5 cannabis consumers reported consuming cannabis at work or shortly before work, with variation seen across industry and occupation. Among workers who reported workplace cannabis consumption, over half reported feeling high at work at least "sometimes," which was associated with experiencing a work-related injury in the past 12 months.

The association between self-reported intoxication and work-related injuries is plausible due to the cognitive and physical impairment associated with cannabis intoxication [11–14]. Cannabis intoxication has been associated with impairment of psychomotor abilities, executive function, and critical tracking tasks, which could be necessary for performing work-related duties [11, 12]. However, virtually no research examines its association with occupational injuries, due to the absence of a universally accepted cannabis-impairment measure [14]. Behavioural testing and biological samples are often used to determine substance-related impairment; however, THC levels are not necessarily indicative of impairment [14, 26]. A strength of this study is that it is one of the first to measure self-reported intoxication at work and its association with work-related injuries, rather than simply overall cannabis use.

Given the cross-sectional design of the current study, however, we cannot discount the bidirectional nature of this association, as workers may use cannabis at work to cope with the negative consequences of physical labour [1]. Indeed, occupations that involve physical labour and fast-paced work environments, namely natural resource, construction, and extraction occupations, had the greatest odds of workplace cannabis use in the present study. A cross-sectional study in Ontario, Canada, found that over 1 in 10 injured workers reported using cannabis to cope with work-related injuries, and medical cannabis use has been associated with workplace consumption [5, 27]. In the present study, past 12-month work-related injuries were also more frequent among participants who reported using cannabis at or shortly before work with no self-reported intoxication compared to non-consumers. This finding may in part be due to workers' inaccurate self-assessment of their own intoxication. However, this association may also be a result of the medical use of low THC, high cannabidiol products for therapeutic purposes [16, 26]. Future research should investigate why employees consume cannabis at work and the relationship between product type and injury risk. Additionally, future work should measure trends in use at work longitudinally and across states with varying jurisdictions. Regardless, findings of this study support those of other research [15], suggesting workplace policies should focus on deterring cannabis use that results in intoxication at work, rather than all cannabis use.

Workplace cannabis consumption varied across industries, with the greatest odds among those in the "Agriculture, forestry, fishing and hunting," "Construction" and "Accommodation and food services" industries. "Utilities," "Public administration," and "Educational services" had the lowest odds of workplace consumption. These results are fairly consistent with NSDUH data from 2008 to 2012, which found that "Accommodation and food services" workers had the highest rates of substance use disorder, while "Educational services" workers had the lowest [28]. Similarly, this is generally consistent with cross-sectional studies using NSDUH data that found "Construction, Trade and Extraction" workers had greater odds of reporting past-month cannabis use [8, 9]. However, the present study examined "Mining, quarrying, and oil and gas extraction" workers separately from "Construction" workers and found no significant differences in the odds of workplace cannabis for this group.

The current findings also generally align with recent cross-sectional research among American workers using BRFSS data that examined past 30-day cannabis use across industries, with some notable differences [3]. The authors found that "Accommodation and food services" and "Construction" workers had some of the highest odds of reporting past 30-day cannabis use, which was also true for the current study. However, the current results for both groups were no longer statistically significant after adjusting for sociodemographic characteristics, possibly due to the associated odds of consuming cannabis broadly across these groups [29]. In contrast, "Agriculture, forestry, fishing, and hunting" workers in the current study had higher odds of consuming cannabis at work than the reference group, whereas "Agriculture, forestry, fishing, and hunting" workers in the

BRFSS study had significantly lower odds of past 30-day cannabis use [3]. This difference may suggest that Agricultural workers are less likely to use cannabis generally, but may be more likely to use at work when they do consume cannabis. Results by occupation were generally consistent with those by industry.

In addition to physical labour, differences in cannabis use at work across industries and occupations may be a result of work environment factors, such as workplace social norms and psychosocial stressors [30]. A cross-sectional study among American workers found that social norms of permissive workplace substance use were associated with overall alcohol and illicit drug use before and at work [31]. Additionally, a cross-sectional study among Canadian workers before the legalization of "recreational" cannabis found that 40% of workers who consumed cannabis had work-related motives for their general cannabis consumption, including coping with stress and to relax [30]. Employers in industries with high prevalence of cannabis use at work could attempt to reduce permissive substance use social norms and psychosocial stressors in the workplace through the development of comprehensive substance use policies that include Employee Assistant programs [32, 33]. The lack of substance use policies in some industries may contribute to the high prevalence and odds of workplace use in the present paper. For instance, an analysis of NSDUH data among US workers found that over half of respondents in "Agriculture, forestry, fishing, and hunting" sectors reported not having a workplace substance use policy [34]. Ultimately, more research is needed investigating factors that contribute to cannabis use at work within industries that have a high prevalence, such as the "Agriculture, forestry, fishing and hunting," "Construction" and "Accommodation and Food Services" industries.

The findings of the present study highlight the need to address cannabis impairment in the workplace, especially in safety-sensitive industries and occupations with high prevalences of workplace cannabis use. Many US employers employ mandatory drug testing to deter substance use among their employees [8, 35]. Drug testing alone may not be suitable for accurately detecting cannabis-related impairment or use on the job, as THC metabolites can remain detectable in the body for months after consumption [35]. Additionally, evidence supporting the effectiveness of drug testing alone on reducing all and workplace drug use among employees is scant, and more comprehensive policies may be better suited for addressing potential cannabis impairment at work [32, 36]. Employers with drug testing policies may consider conducting fitness-for-duty tests of their employees in combination with drug testing to more accurately determine potential impairment on the job.

5 | Limitations

As this study used self-reported data, social desirability bias is a potential limitation. As a result, cannabis consumption, workplace use, and intoxication, and frequency of use may be underestimated. However, responses were anonymized and self-administered online, and respondents were asked whether they were able to answer questions honestly. Participants who reported that they were unable to answer honestly were excluded from the sample. The use of nonprobability-based sampling could lead to sampling bias. To mitigate this to the extent possible, data were weighted to match the age, sex, region, and education profile of the population. Finally, the sample excluded individuals over the age of 65; although the median retirement age in the US is 62, some individuals work beyond 65 and are not represented in the current analysis.

6 | Conclusion

Workplace cannabis consumption varied across industries and occupations. Self-reported intoxication at work was associated with workplace injury, with just under one-third of workplace cannabis consumers reporting a work-related injury in the past 12-months. Results of this study reaffirm the occupational health and safety implications of workplace cannabis use.

Author Contributions

D.H., A.K., N.C., and A.M. are responsible for the design, conceptualization, and interpretation of the work. D.H. is responsible for the research and acquisition of data. A.K. is responsible for the data analysis. A.K. and D.H. drafted the written work. All authors are responsible for reading and critically revising the work. D.H. is the guarantor for this study. All authors read and approved the final manuscript.

Acknowledgments

Funding for this study was provided by a Canadian Institutes of Health Research Project Bridge grant (PJT-153342) and an Ontario Graduate Scholarship.

Ethics Statement

This study was reviewed by and received ethics approval from the University of Waterloo Research Ethics Committee (ORE#31330). Participants provided written informed consent before completing the study.

Conflicts of Interest

D.H. has provided paid expert testimony on behalf of public health authorities in response to legal claims from the tobacco, vaping, and cannabis industries. The other authors declare no conflicts of interest.

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