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Oral health status among recreational cannabis (marijuana and hashish) users in the USA: A NHANES-based cross-sectional study



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ABSTRACT

Background: As of November 2023, twenty-four states, two territories, and DC have legalized marijuana for non-medical use, leading to concerns about its potential oral health effects. This study investigated the association between marijuana use and clinical dental outcomes among adults in the US.

Methods: We analyzed data from the National Health and Nutrition Examination Survey (NHANES) from 2015 to 2018 using a cross-sectional survey of non-institutionalized US civilians. Marijuana use was assessed among 18–59-year-old adults and categorized as never, former, or current frequent use. The dental outcomes included the prevalence of untreated coronal caries, root caries, and missing teeth. We employed logistic and negative binomial regressions to assess the crude and adjusted associations between marijuana use, dental caries, and tooth loss.

Results: Of the 6,424 participants, 13.85% of US adults aged 18–59 years were current frequent marijuana users (21.67 million), with the highest prevalence among 18–29-year-olds (21.31%), males (17.54%), and non-Hispanic Black individuals (21.31%). Frequent marijuana users showed the highest prevalence of untreated coronal caries (33.4%). Before adjusting for socioeconomic confounders, current frequent marijuana users had 1.76 times higher odds of having teeth with coronal caries, whereas former frequent users had 1.47 times higher odds. However, the associations between marijuana use and all dental outcomes were attenuated after adjusting for socioeconomic confounders, tobacco use, and access to dental care.

Conclusion: Although marijuana use was associated with worse dental health, socioeconomic factors, tobacco use, and access to dental care were more significant contributors to the prevalence of untreated dental caries and missing teeth than marijuana use alone.

1. Introduction

Cannabis preparations are derived from plant families, including hemp and *Cannabis sativa*. (Ashton, 2001) There are three types of recreational cannabis: marijuana, hashish, and hash oil. Of these, marijuana is the most commonly used; it has the lowest concentration (0.5–5%) of delta-9-tetrahydrocannabinol (THC), which is the primary active component of cannabis that produces the desired effect of being “high.” Hashish has a higher concentration of THC (2–20%), followed by hash oil, with the highest THC concentration (15–50%). (Iversen, 2003; Felder and Glass, 1998) Cannabis products can be consumed by inhaling or ingesting. The most efficient way to use marijuana is to smoke a hand-

rolled cigarette or pipe, because it is easy to prepare and has a rapid effect. (Cho et al., 2005; Hall et al., 2001; Iversen, 2001) Hashish and hash oil can also be smoked; hashish can also be cooked with cookies and cakes. (Hall et al., 2001; Iversen, 2001) More recently, vaping has become an increasingly popular mode of Cannabis intake, particularly among the youth and young adults. (Harrell et al., 2022; Boakye et al., 2022) In the US, the most common cannabis used is marijuana, and its use has become increasingly common owing to recreational legalization. (Richter and Levy, 2014; SAMHSA, 2014) Based on the latest update of the National Conference of State Legislatures as of November 8, 2023, 24 states, two territories, and the District of Columbia have legalized marijuana for non-medical adult (recreational) use, and as of April 24,

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Table 1

Prevalence and socio-demographic distribution of marijuana use status among adults between 18- and 59-year-old individuals who completed the dental examination and reported their marijuana use status in the National Health and Nutrition and Examination Survey (NHANES) 2015–2018.

	Total (%) ¹	Never frequent marijuana users		Former frequent marijuana users		Current frequent marijuana users		p-value
		Weighted US population N (in thousands)	Frequency (%)	Weighted US population N (in thousands)	Frequency (%)	Weighted US population N (in thousands)	Frequency (%)	
Total	6,424 (100)	112,587	71.96	22,199	14.19	21,671	13.85	
Age								
18–29	1,979 (29.46)	30,848	66.94	5,415	11.75	9,822	21.31	<0.01
30–39	1,474 (22.94)	26,210	73.02	4,492	12.51	5,190	14.64	
40–49	1,448 (22.63)	27,819	78.57	4,931	13.93	2,659	7.508	
50–59	1,523 (24.97)	27,800	70.92	7,361	18.84	4,000	10.24	
Gender								
Male	3,087 (49.78)	51,482	66.09	12,744	16.36	13,665	17.54	<0.01
Female	3,337 (50.22)	61,104	77.78	9,455	12.04	8,006	10.19	
Race/Ethnicity								
Non-Hispanic White	1,995 (59.6)	64,451	69.11	15,576	16.7	13,225	14.18	<0.01
Non-Hispanic Black	1,440 (12.03)	12,179	64.72	2,704	14.37	3,936	20.91	
Hispanic	1,798 (18.32)	23,522	82.05	2,373	8.276	2,774	9.676	
Non-Hispanic Asian	853 (5.46)	7,968	93.32	187	2.186	0,383	4.49	
Other, including multi-racial	338 (4.59)	4,467	62.22	1,360	18.94	1,353	18.84	
Education								
Less than high school	1,043 (11.35)	11,856	69.72	2,134	12.55	3,014	17.73	<0.01
High school	1,337 (23.22)	21,945	63.07	6,339	18.22	6,511	18.71	
More than high school	3,560 (65.43)	73,838	75.3	1,3419	13.69	10,795	11.01	
Family poverty level (FPL)²								
<100% FPL	1,244 (14.69)	13,627	64.5	3,255	15.41	4,244	20.09	<0.01
100–199% FPL	1,505 (20.1)	19,245	66.55	4,221	14.6	5,451	18.85	
200–399% FPL	1,576 (27.95)	28,937	71.98	6,013	14.96	5,253	13.07	
>400% FPL	1,457 (37.27)	41,364	77.16	7,732	14.42	4,511,	8.414	
Smoking status								
Never	4,083 (60.28)	82,154	87.12	5,662	6.00	6,488	6.88	<0.01
Former	1,003 (19.89)	16,145	51.89	9,349	30.05	5,620	18.06	
Current	1,306 (19.83)	14,263	45.99	7,189	23.18	9,563	30.83	
Time since the last dental visit								
Within a year	3,418 (56.47)	66,765	75.72	12,262	13.91	9,151	10.38	<0.01
>1 year, or never	2,990 (43.53)	45,594	67.07	9,874	14.53	12,506	18.4	

¹ The sample counts were unweighted, while percentages were weighted to account for complex survey design. The weighted population counts are rounded to the nearest 100.

²FPL: Family income ratio to the federal poverty level (<100%, 100–199%, 200–399%, >400).

Table 2

Prevalence of untreated coronal and root caries, state of teeth retention and utilization of routine dental care, by marijuana use status among adults between 18- and 59-year-old individuals who completed the dental examination and reported their marijuana use status in the National Health and Nutrition and Examination Survey (NHANES) 2015–2018.

Marijuana use status	Untreated dental caries			Teeth retention	
	Individuals with untreated dental coronal caries % ^{1,2} (95%CI) (N = 6,313)	The mean number of teeth with untreated coronal caries n ^{1,3} (95%CI) (N = 6,313)	Individuals with untreated root caries % ^{1,2} (95%CI) (N = 6,312)	Individuals with missing teeth % ^{1,2} (95%CI) (N = 6,313)	The mean number of missing teeth n ^{1,3} (95%CI) (N = 6,313)
Overall population	24.8 (21.9–27.7)	0.84 (0.72–0.95)	11.0 (9.3–12.7)	47.4 (45.4–49.5)	1.54 (1.37–1.71)
Never frequent marijuana users	22.2 (19.3–25.2)	0.71 (0.59–0.83)	9.1 (7.5–10.7)	46.9 (44.6–49.3)	1.42 (1.23–1.60)
Former frequent marijuana users	29.6 (24.8–34.4)	1.05 (0.80–1.30)	16.2 (12.6–19.9)	53.0 (47.0–59.0)	2.13 (1.68–2.57)
Current frequent marijuana users	33.4 (28.2–38.6)	1.29 (1.04–1.54)	15.0 (12.8–19.1)	44.4 (39.6–49.1)	1.62 (1.35–1.88)

¹ Among dentate individuals, excluding third molars.

² Weighted percentages.

³ Weighted mean.

⁴ Among all participants who completed the dental examination.

95% CI: 95% confidence interval.

2023, 38 states, three territories, and the District of Columbia have allowed the medical use of marijuana and cannabis products. (NCSL, 2023)

Although the acceptance of cannabis use is expected to increase, few national-level studies have examined the side effects of cannabis use on oral and dental health. Cannabis stomatitis, which includes hyperkeratosis, is a change in the oral epithelium caused by cannabis chewing and smoking. Moreover, painful gingivitis and white patches have been reported in the gingivae of cannabis smokers. (Darling and Arendorf, 1992) Darling et al. reported that the prevalence of xerostomia in cannabis users is significantly greater than in cigarette smokers. Most cannabis users commonly experience dry mouths immediately after consumption. (Darling and Arendorf, 1993)

Limited data are available on the potential clinical link between cannabis use and dental caries and tooth loss, and more often, the available findings can be confusing to interpret without careful consideration. (Chaffee, 2021) Despite the nuanced and complex findings regarding the effects of cannabis use on dental caries and tooth loss, available data on its effects on gingival and periodontal health suggest a consistent and clear association. In a local Chilean survey, Lopez et al. concluded that no significant association existed between cannabis use and destructive periodontal diseases among adolescents. (López and Baelum, 2009) However, Shariff et al. reported an association between frequent recreational cannabis use and severe periodontitis among adults from a US national survey. (Shariff et al., 2017) Several other small-scale studies indicated a link between Cannabis use and worsened periodontal health. (Bellocchio et al., 2021; Keboa et al., 2020) However, despite previous reviews suggesting that cannabis and other drug users have worse overall oral health than non-users, with higher DMFT scores, plaque indices, and poorer gingival health, the conclusions were more focused on the lifestyle impact of marijuana and other drug use and how worsening oral health conditions may be a result of these lifestyle effects, rather than a direct cause-and-effect relationship between cannabis use and dental caries and tooth loss. (Pallasch and Joseph, 1987; Rees, 1992; Silverstein et al., 1978) Apart from periodontal diseases, there has not been any study that investigates the association between cannabis use and clinically assessed dental conditions (dental caries and tooth loss) using national-level data. This study aimed to investigate the association between cannabis use and dental health conditions, including teeth with untreated coronal caries, untreated root caries, missing teeth, and number of missing teeth due to dental diseases, among US adults aged 18–59 years using the 2015–2018 National Health and Nutrition Examination Survey (NHANES).

2. Materials and Methods

2.1. Data source

Pooled NHANES data from 2015 to 2018 were used in this study. The National Center for Health Statistics at the Center of Disease Control and Prevention conducts NHANES, a comprehensive cross-sectional survey of health and nutrition among non-institutionalized individuals in the US. The protocols used in these surveys include multiple data collection tools, including self-reported questionnaires, laboratory assessments, and clinical examinations. This study was approved by the ethical review boards of the National Center for Health Statistics (approval protocol numbers: 2011-17 and 2018-0) and College of Medicine Institutional Review Board of King Saud University (No. 22/0098/IRB).

2.2. Recreational cannabis

Adults aged 18–59 were queried about their recreational cannabis use. We categorized cannabis users based on their frequency of recreational marijuana, hashish, or hash oil use as follows: 1) never frequent marijuana users (never used marijuana or hashish at least once a month for more than 1 year), 2) former frequent marijuana users (not used marijuana or hashish at least once a month for more than 1 year within the last 12 months), and 3) current frequent marijuana users (used marijuana or hashish at least once a month for more than 1 year within the last 12 months).

2.3. Clinical assessment of dental outcomes

Trained and calibrated dentists conducted the dental examinations to ensure consistent measurements among the examiners and between cycles. To report the prevalence of dental outcomes, we created the following indicators: 1) untreated coronal caries (untreated cavity in the crown of the tooth, exclusive of third molars), 2) untreated root caries (untreated cavity between the cemento-enamel junction and gingival margin of teeth with recession, exclusive of third molars), 3) number of teeth with dental caries, and 4) missing teeth (tooth loss owing to dental caries or periodontal disease among those with at least one natural tooth, exclusive of third molars). We also counted the number of teeth with untreated dental caries and those missing because of dental caries or periodontal disease.

Included among the potential confounders were factors known to be risks for both cannabis use and for dental health, such as age in years (18–29, 30–39, 40–49, or 50–59 years), sex (men or women), race/

Table 3

Logistic regression models of associations between marijuana use status and presence of untreated coronal and root caries, and missing teeth among adults between 18 and 59-year-old individuals who completed the dental examination and reported their marijuana use status in the National Health and Nutrition and Examination Survey (NHANES) 2015–2018.

	Dental caries ¹				Any missing teeth ¹	
	Coronal Caries ¹		Root Caries ¹		Crude OR	Adjusted OR
	Crude OR	Adjusted OR	Crude OR	Adjusted OR		
	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)	(95% CI)
	(N = 6,313)	(N = 5,250)	(N = 6,312)	(N = 5,249)	(N = 6,313)	(N = 5,250)
Marijuana use status						
Never frequent marijuana users	Ref	Ref	Ref	Ref	Ref	Ref
Former frequent marijuana users	1.47 (1.16–1.86)*	1.03 (0.76–1.39)	1.95 (1.52–2.48)*	1.13 (0.71–1.80)	1.27 (0.97–1.67)	1.11 (0.84–1.46)
Current frequent marijuana users	1.76 (1.42–2.18)*	0.97 (0.74–1.26)	1.9 (1.51–2.40)*	1.04 (0.81–1.34)	0.9 (0.74–1.10)	1 (0.79–1.27)
Age categories						
18–29	Ref	Ref	Ref	Ref	Ref	Ref
30–39	1.18 (0.93, 1.48)	1.32 (1.03, 1.69)*	1.67 (1.19, 2.34)*	1.65 (1.14, 2.39)*	2.26 (1.82, 2.81)*	2.47 (1.96, 3.13)*
40–49	1.2 (0.95, 1.52)	1.61 (1.19, 2.18)*	1.92 (1.38, 2.68)*	2.31 (1.58, 3.38)*	4.58 (3.62, 5.79)*	5.82 (4.67, 7.25)*
50–59	1.09 (0.86, 1.40)	1.52 (1.14, 2.02)*	2.51 (1.76, 3.59)*	3.06 (2.05, 4.58)*	8.41 (6.73, 10.5)*	11.41* (8.76, 14.87)*
Gender						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female	0.77 (0.64, 0.92)	0.84 (0.70, 1.00)	0.82 (0.70, 0.97)*	0.86 (0.69, 1.08)	1.25 (1.11, 1.42)*	1.29 (1.10, 1.51)*
Race/Ethnicity						
Non-Hispanic White	Ref	Ref	Ref	Ref	Ref	Ref
Non-Hispanic Black	2.27 (1.82, 2.83)*	1.91 (1.49, 2.45)*	1.56 (1.21, 2.01)*	1.22 (0.85, 1.75)	1.57 (1.33, 1.87)*	1.61 (1.31, 1.99)*
Hispanic	1.32 (1.00, 1.75)	0.86 (0.65, 1.13)	0.72 (0.55, 0.96)*	0.5 (0.37, 0.66)*	1.36 (1.1, 1.69)*	1.25 (0.95, 1.64)
Non-Hispanic Asian	0.55 (0.39, 0.76)*	0.64 (0.43, 0.97)*	0.33 (0.21, 0.51)*	0.46 (0.30, 0.71)*	1.05 (0.88, 1.25)	1.39 (1.16, 1.66)*
Other, including multi-racial	1.38 (1.03, 1.86)*	1.09 (0.75, 1.57)	1.63 (1.08, 2.46)*	1.25 (0.77, 2.04)	1.09 (0.77, 1.54)	0.94 (0.60, 1.47)
Family poverty level (FPL)²						
<100% FPL	Ref	Ref	Ref	Ref	Ref	Ref
100–199% FPL	0.74 (0.59, 0.94)*	0.75 (0.60, 0.93)*	0.82 (0.59, 1.13)	0.82 (0.60, 1.12)	0.86 (0.67, 1.11)	0.85 (0.66, 1.09)
200–399% FPL	0.52 (0.4, 0.66)*	0.63 (0.50, 0.79)*	0.5 (0.37, 0.68)*	0.56 (0.42, 0.75)*	0.75 (0.59, 0.96)*	0.7 (0.56, 0.87)*
>400% FPL	0.18 (0.13, 0.25)*	0.28 (0.21, 0.38)*	0.17 (0.10, 0.29)*	0.23 (0.14, 0.37)*	0.54 (0.41, 0.71)*	0.4 (0.31, 0.52)*
Education						
Less than high school	Ref	Ref	Ref	Ref	Ref	Ref
High school	0.78 (0.63, 0.97)*	0.91 (0.75, 1.12)	0.74 (0.57, 0.96)*	0.72 (0.52, 0.98)*	0.68 (0.55, 0.84)*	0.83 (0.65, 1.04)
More than high school	0.29 (0.23, 0.36)*	0.53 (0.42, 0.67)*	0.28 (0.20, 0.39)*	0.45 (0.34, 0.60)*	0.4 (0.33, 0.50)*	0.5 (0.39, 0.64)*
Smoking						
Never	Ref	Ref	Ref	Ref	Ref	Ref
Former	1.34 (1.06, 1.69)*	1.12 (0.87, 1.44)	1.98 (1.57, 2.52)*	1.32 (1.03, 1.68)*	1.36 (1.15, 1.61)*	1.1 (0.88, 1.37)
Current	3.18 (2.6, 3.89)*	1.97 (1.53, 2.55)*	4.82 (3.67, 6.34)*	2.47 (1.72, 3.56)*	2 (1.69, 2.36)*	1.68 (1.32, 2.16)*
Time since the last dental visit						
Within a year	Ref	Ref	Ref	Ref	Ref	Ref
>1 year, or never	3.42 (2.89, 4.05)*	2.48 (2.00, 3.07)*	3.05 (2.42, 3.84)*	2.02 (1.51, 2.69)*	1.03 (0.86, 1.23)	0.86 (0.68, 1.08)

Adjusted for age, sex, race/ethnicity, education, income, cigarette smoking, and time since their last dental visit.

¹Among dentate individuals.

95% CI: 95% confidence interval.

* P-value < 0.05.

ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, or other), family income to federal poverty level (FPL) ratio (<100% FPL, 100%–199% FPL, 200%–399% FPL, or ≥ 400% FPL), education level (lower than high school, completed high school/GED, or beyond high school), smoking status (never, former, or current smoker), and time since their last dental visit (within a year, and more than a year or never).

2.4. Statistical analysis

Descriptive statistics were reported, including sample means, standard deviations, counts, frequencies, and percentages. We reported the prevalence of teeth with untreated coronal caries, teeth with root caries, and missing teeth owing to dental diseases with 95% confidence intervals (CIs). We also calculated the average number of missing teeth and teeth with untreated caries. To adjust the sample weights of the pooled data from the two NHANES cycles, we divided the sample weights by two to recalibrate them for nationally representative estimates. For standard error estimations, we employed a survey analysis approach based on Taylor linearization, utilizing masked variance units to account for the complex design of the survey.

Simple and multivariable logistic regressions and negative binomial regressions were applied separately to estimate the crude and adjusted estimates. We reported the odds ratios (ORs) for binary outcomes and mean ratios for the number of teeth with untreated dental caries and missing teeth among marijuana users (former and current) compared with adults who never used marijuana frequently. Statistical significance was set at $p < 0.05$, and all analyses were performed using Stata/MP V.17.0 (STATAcorp, College Station, TX, USA).

3. Results

Out of 6424 participants, 893 were identified as current frequent marijuana users, representing 13.85% (21.67 million) of US adults aged between 18 and 59 years (Table 1). The 18–29 age group had the highest prevalence of 21.31%, followed by non-Hispanic Black individuals (20.91%), high school graduates (18.71%), and those living below 100% FPL (20.09%). Furthermore, former frequent marijuana users comprised 14.19% of the US population and had a demographic distribution similar to that of current users, except that former users were mostly non-Hispanic Caucasians (16.7%) and aged 50–59 years (18.84%).

The prevalence of at least one tooth with untreated dental caries was 25.64% (95%CI = 21.9%, 27.7%) among adults aged 18–59 years, and 11% had at least one tooth with untreated root caries (95%CI [9.3%, 12.7%]; Table 2). The prevalence of having at least one missing tooth was 47.4% (95%CI [45.4%, 49.5%]). The average number of teeth with an untreated carious lesion was 0.84 (95% CI [0.72, 0.95]), and the average number of missing teeth was 1.54 (95% CI [1.37, 1.71]). Moreover, current frequent marijuana users had the highest prevalence of teeth with untreated coronal caries (33.4%; 95% CI [28.2%, 38.6%]), whereas the prevalence of missing teeth in former frequent marijuana users was the highest (53%; 95 CI [47%, 59%]). The prevalence of root caries was similar between current and former frequent marijuana users.

Compared to never frequent users, before adjusting for the confounders, current frequent marijuana users had 1.76-times the odds of having teeth with coronal caries (95%CI = 1.42, 2.18) and 1.90 times the odds of having root caries (95%CI [1.51, 2.40]) (Table 3). Similarly, former frequent marijuana users had 1.47-times the odds of having untreated coronal caries (95%CI [1.16, 1.86]) and 1.95-times the odds of root caries (95%CI [1.52, 2.48]). Nonetheless, after adjusting for socioeconomic factors, tobacco smoking status, and time since last dental visit, the association between marijuana use and the presence of dental diseases was nullified.

Before adjusting for confounding variables, current frequent marijuana users had a 1.82 times average number of teeth with untreated caries than that of never frequent users (95%CI [1.59, 2.09]) (Table 4). Additionally, former frequent marijuana users had 1.48 times the average number of untreated caries (95%CI [1.11, 1.98]) and 1.50 times the average number of missing teeth (95%CI [1.19, 1.88]). Similar to disease presence, the severity of dental diseases and marijuana use were attenuated after adjusting for socioeconomic confounders and smoking status.

4. Discussion

Our study addressed the current gaps in the literature by conducting a secondary data analysis of nationally representative NHANES data to explore the associations between the use of marijuana and clinical dental outcomes, including untreated caries and missing teeth. Approximately 28% reported using cannabis at some point in their lifetime (former and current), whereas 13.85% reported using cannabis at least once a month over the preceding 12-month period (current). Current frequent marijuana users had the highest prevalence of teeth with untreated caries, and the prevalence of missing teeth in former frequent marijuana users was the highest. However, no association between marijuana use and dental diseases was found after adjusting for confounding factors, suggesting a relationship between crude marijuana use and dental diseases related to participants underlying socioeconomic factors (including age, sex, race/ethnicity, education, and family poverty level), smoking status, and access to dental care.

In a retrospective cohort study published by Ditmyer et al., the data included 66,941 dental school-based examinations of adolescents (13–18 years old) in Nevada, USA. The authors concluded that marijuana use increases the prevalence and severity of caries among adolescents. However, the authors did not adjust for socioeconomic confounders, which may explain the differences in our results. (Ditmyer et al., 2013) Furthermore, the participants' age differs from that in our study. In a recent NHANES analysis assessing the association between cocaine use and oral health, Bahdila et al. found that cocaine and marijuana co-users exhibited no statistical significant association compared to those exclusively using cocaine. (Bahdila et al., 2020)

In another study conducted in Switzerland, Katterbach et al. compared cigarette smokers with cannabis users. They reported that cannabis users exhibited significantly higher decayed surface values. Similarly, the results were not adjusted for socioeconomic confounding factors. Additionally, the control group in that study consisted of tobacco smokers, which differed from our study (no smokers). (Schulz-Katterbach et al., 2009) On the other hand, many studies have focused on the relationship between marijuana use and periodontitis. Shariff et al., using the NHANES 2011–2012 cycle, concluded that recreational cannabis use was associated with more severe periodontitis. (Shariff et al., 2017) Furthermore, Chaffee reported in 2021 that Cannabis use is associated with self-rated fair or poor overall oral health and multiple periodontal disease sequelae; we, however, did not assess periodontal diseases association with Cannabis use and relied only on clinically examined dental conditions. (Chaffee, 2021)

Owing to the increased legalization of marijuana use by many states and the possible increase in marijuana users among young adults, dental schools should become more familiar with topics that cover the important aspects of marijuana use. Dental professionals should also be more aware of the related oral disorders and harmful effects associated with marijuana use, particularly periodontitis, and should facilitate and provide an appropriate approach for effective clinical management.

It is important to note that this study had several limitations to be acknowledged. As the NHANES is a cross-sectional survey, we could not define the temporality of marijuana use preceding the development of

Table 4

Negative binomial regression analysis of the associations of marijuana use status with a mean number of teeth with untreated coronal caries and missing teeth among adults 18–59-year-old individuals who completed the dental examination and reported their marijuana use status in the National Health and Nutrition and Examination Survey (NHANES) 2015–2018.

	The mean number of teeth with untreated coronal caries ¹		The mean number of missing teeth ¹	
	Crude mean ratio (95% CI) (n = 6,313)	Adjusted mean ratio (95% CI) (n = 5,250)	Crude mean ratio (95% CI) (n = 6,417)	Adjusted mean ratio (95% CI) (n = 5,343)
Marijuana use status				
Never frequent marijuana users	Ref	Ref	Ref	Ref
Former frequent marijuana users	1.48 (1.11 – 1.98)*	1.04 (0.76 – 1.42)	1.5 (1.19 – 1.88)*	1.12 (0.82 – 1.53)*
Current frequent marijuana users	1.82 (1.59–2.09)*	1.01 (0.81–1.25)	1.14 (0.93–1.41)	1.01 (0.77–1.32)
Age categories				
18–29	Ref	Ref	Ref	Ref
30–39	1.2 (0.93, 1.55)	1.16 (0.91, 1.47)	3.03 (2.39, 3.85)*	2.98 (2.20, 4.03)*
40–49	1.06 (0.85, 1.32)	1.20 (0.90, 1.60)	5.86 (4.70, 7.32)*	6.48 (5.22, 8.03)*
50–59	0.99 (0.71, 1.38)	1.12 (0.84, 1.51)	11.14 (8.87, 13.99)*	13.94 (10.72, 18.11)*
Gender				
Male	Ref	Ref	Ref	Ref
Female	0.82 (0.70, 0.97)*	0.90 (0.74, 1.09)	1.17 (0.99, 1.37)	1.13 (0.96, 1.34)
Race/Ethnicity				
Non-Hispanic White	Ref	Ref	Ref	Ref
Non-Hispanic Black	1.52 (1.29, 1.79)*	1.66 (1.35, 2.05)*	1.6 (1.32, 1.95)*	1.86 (1.54, 2.24)*
Hispanic	0.92 (0.71, 1.18)	0.70 (0.54, 0.91)*	1.03 (0.86, 1.24)	1.07 (0.90, 1.27)
Non-Hispanic Asian	0.41 (0.29, 0.59)*	0.71 (0.46, 1.10)	0.8 (0.64, 1.00)*	1.42 (1.13, 1.78)*
Other, including multi-racial	1.4 (1.00, 1.96)	1.27 (0.87, 1.84)	1.22 (0.89, 1.67)	1.06 (0.78, 1.44)
Family poverty level (FPL)²				
<100% FPL	Ref	Ref	Ref	Ref
100–199% FPL	0.88 (0.69, 1.11)	0.88 (0.68, 1.15)	0.84 (0.68, 1.04)	0.87 (0.71, 1.06)
200–399% FPL	0.49 (0.38, 0.63)*	0.58 (0.44, 0.76)*	0.73 (0.57, 0.94)*	0.66 (0.55, 0.80)*
>400% FPL	0.15 (0.11, 0.21)*	0.24 (0.17, 0.34)*	0.4 (0.29, 0.54)*	0.37 (0.29, 0.49)*
Education				
Less than high school	Ref	Ref	Ref	Ref
High school	0.84 (0.7, 1.00)*	0.92 (0.73, 1.15)	0.78 (0.63, 0.96)*	0.91 (0.76, 1.10)
More than high school	0.3 (0.25, 0.38)*	0.49 (0.38, 0.62)*	0.37 (0.30, 0.45)*	0.48 (0.40, 0.57)*
Smoking				

Table 4 (continued)

	The mean number of teeth with untreated coronal caries ¹		The mean number of missing teeth ¹	
	Crude mean ratio (95% CI) (n = 6,313)	Adjusted mean ratio (95% CI) (n = 5,250)	Crude mean ratio (95% CI) (n = 6,417)	Adjusted mean ratio (95% CI) (n = 5,343)
Never	Ref	Ref	Ref	Ref
Former	1.4 (1.12, 1.74)*	1.18 (0.93, 1.51)	1.78 (1.41, 2.23)*	1.37 (1.09, 1.72)*
Current	3.33 (2.55, 4.33)*	2.07 (1.62, 2.64)*	2.92 (2.44, 3.49)*	2.14 (1.60, 2.85)*
Time since the last dental visit				
Within a year	Ref	Ref	Ref	Ref
>1 year, or never	3.03 (2.59, 3.55)*	2.23 (1.83, 2.71)*	1.26 (1.07, 1.49)*	0.96 (0.81, 1.14)

Adjusted for age, sex, race/ethnicity, education, income, cigarette smoking, and time since their last dental visit.

¹Among dentate individuals.

95% CI: 95% confidence interval.

* P-value < 0.05.

caries or missing teeth. Conducting a repeated-measures cohort study in future research would evaluate this relationship more accurately. In addition, we did not have information on the duration or intensity of marijuana consumption. Inquiries regarding marijuana use specifically focused on smoked marijuana were asked to adults aged 18–59 years. Therefore, we could not examine the impact of oral health on the older population or other methods of cannabis consumption, such as cooked marijuana or vaping. Furthermore, the survey did not collect data on reasons for consumption, whether for medical or recreational purposes. We were unable to investigate periodontal health because related data were not collected during the 2013–2014 cycle. Such information, if present, might have provided a more comprehensive assessment of this association. However, the main strength of this study was the use of two cycles (2015–2018) from the NHANES survey cycles, providing a nationally representative estimate, and the oral health of the participants was assessed clinically by calibrated dental examiners.

5. Conclusion

Integrating oral healthcare into drug treatment settings, considering socioeconomic factors, tobacco use, and access, can quickly identify and treat issues, connecting patients to crucial dental services. Our data suggest that the frequent use of cannabis alone was not directly associated with missing teeth or untreated dental caries. It is crucial to emphasize that this is not an endorsement for cannabis, as we acknowledge its negative effects on periodontal health. This study assessed the effects of cannabis use on the clinical outcomes of specific dental conditions. Given that healthcare providers frequently encounter cannabis users, it is imperative to be prepared to discuss marijuana's effects on oral and general health, including lifestyle impacts. Healthcare professionals can offer or refer individuals to comprehensive support programs addressing socioeconomic factors, tobacco use, and access to dental care.

Ethics approval and consent to participate

The study was approved by the ethical review board of the National Center for Health Statistics (approval protocol numbers: 2011–17 and 2018–0) and the College of Medicine Institutional Review Board of King Saud University (No. 22/0098/IRB).

Consent for publication

Not applicable.

Availability of data and materials

The data is unidentified and coded; it is not encrypted nor password-

protected; it is stored and available at the CDC website “<https://wwwn.cdc.gov/nchs/nhanes/nhefs/default.aspx/>” for public use.

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CRediT authorship contribution statement

Mohammad Helmi: Conceptualization, Methodology, Writing – review & editing, Supervision. **Abdulmalik Aldawood:** Writing – original draft, Methodology. **Mohammed AlOtaibi:** Writing – original draft. **Essam Alnasser:** Writing – original draft. **Abdulrahman AlSubaie:** Writing – original draft. **Muath Aldosari:** Data curation, Formal analysis, Writing – review & editing.

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