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Characteristics of adults with a medical cannabis license, reasons for use, and perceptions of benefit following medical cannabis legalization in Oklahoma

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ABSTRACT

Little is known about the risks and benefits associated with medical cannabis legalization. The current study was an online panel survey of adult Oklahomans recruited between September and October 2020 ($N = 1898$). Respondents with and without a medical cannabis license were compared on sociodemographic, substance use and health characteristics, and sub-analyses focused on the characteristics of licensed and unlicensed past 30-day cannabis users. Among all participants, 19.34% ($n = 367$) reported that they had a medical cannabis license, and 35.73% ($n = 676$) reported past 30-day cannabis use. Licensees were more likely to be younger (i.e., 18–35 years of age; $p = 0.001$), identify as a sexual minority ($p < 0.001$), and report past 30-day cannabis, cigarette, alcohol, and prescription opiate use (all p's ≤ 0.003). Licensed participants most commonly reported medically-recommended cannabis use for anxiety (42.51%), depression (33.24%), sleep problems (26.98%), chronic pain (24.25%), and arthritis (12.81%). The likelihood of medically-recommended cannabis use for anxiety, depression, and chronic pain differed by age group (all p's ≤ 0.028). Licensees were most likely to perceive that cannabis delivered "very much/extreme" relief from anxiety (78.57%), sleep problems (76.30%), nausea/vomiting (70.00%), and depression (67.05%). Compared to licensed past 30-day cannabis users ($n = 308$), unlicensed users ($n = 368$) were more likely to be non-White, to have $\leq$ high school education, to report an annual household income <\$30,000, and to report current smoking (all p's ≤ 0.027). Findings provide initial information about the personal characteristics associated with having a medical cannabis license in Oklahoma, the reasons for medical cannabis use, and the perceived medical benefits.

1. Introduction

Medical marijuana was legalized in Oklahoma in June 2018, and the first licenses were issued in August 2018. (AP, 2018) By January 2022, more than 400,000 medical marijuana licenses had been issued by the Oklahoma Medical Marijuana Authority (OMMA), (OMMA, 2022) indicating that nearly 10% of the state population had a license. (Census, 2021) Oklahoma has a unique regulatory environment, because it is the only state with no qualifying conditions required to obtain a medical cannabis license. Only the discretion of the recommending physician is needed. Oklahoma now has thousands of licensed cannabis dispensaries throughout the state, (OMMA, 2021) which has resulted in increased cannabis access for anyone willing to complete the required forms and pay the application fee.

Oklahoma has a distinctive health and sociodemographic profile that may influence cannabis perceptions as well as medical cannabis use.

Oklahomans are medically vulnerable with state rankings in the top five for heart disease, diabetes, chronic liver disease, and chronic respiratory disease mortality. (CDC, 2017) Likewise, the incidence of cancer is higher in Oklahoma than the U.S. overall. (NCI, 2020) In addition, Oklahoma has a large population of American Indian/Alaska Native residents (9.4%), (Census, 2021) one-third of residents live in rural areas (32.9%), (USDA, 2020) and 14.3% report household incomes below the poverty threshold. (Census, 2021) Yet, little is known about the relations between the personal characteristics of Oklahomans and medical cannabis use following legalization.

The findings of previous research have indicated that individuals use cannabis for a variety of medical reasons, with varying degrees of evidence of medical benefit. Chronic pain is the most common reason for medical cannabis use in the U.S. (Nasem, 2017; Boehnke et al., 2019; Park and Wu, 2017) Systematic reviews and *meta*-analyses, as well as a report from the National Academy of Sciences, Engineering, and Medicine (NASEM), have concluded that cannabis is an effective treatment for pain. (Nasem, 2017; Whiting et al., 2015; Aviram and Samuelly-Leichtag, 2017; Romero-Sandoval et al., 2018) Likewise, studies have shown that cannabis can help individuals reduce or discontinue their use of addictive opiate pain medications. (Reiman et al., 2017; Bachhuber et al., 2019; Boehnke et al., 2016; Bardford and Bradford, 2016; Flexon et al., 2019; Boehnke et al., 2019) Cannabis is also effective for the treatment of chemotherapy-induced nausea and vomiting, (Whiting et al., 2015; Smith et al., 2015; Sallan et al., 1980; Whitcomb et al., 2020) and there is moderate evidence that cannabinoids may improve outcomes for individuals with sleep disturbance due to certain medical conditions. (Babson et al., 2017) However, evidence for the efficacy of cannabis as a treatment for other medical or psychological conditions is limited or absent. (Nasem, 2017) For example, mental health problems are a common reason for medical cannabis use, though evidence of the efficacy of cannabis for the treatment of anxiety and mood disorders is limited and equivocal. (Walsh et al., 2017; Hoch et al., 2019; Black et al., 2019).

Altogether, neither the impact of medical cannabis legalization nor the medical utility of cannabis is well understood. Thus, the purpose of the current study was to: 1) compare the sociodemographic and personal characteristics of individuals with and without a medical cannabis license, 2) compare the sociodemographic and personal characteristics of licensed and unlicensed past 30-day cannabis users, and 3) describe the reasons for medical use and perceptions of medical benefit among medical cannabis users. Findings will provide insight about the correlates of medical cannabis use in Oklahoma, and offer a starting point for prospective investigations of the therapeutic benefits of cannabis.

Methods.

1.1. Procedure

Adult Oklahoma residents completed an online survey between September and October 2020 that was distributed by Lucid, (Lucid, 2019) a market research firm that has access to the over 250 panel suppliers. A panel supplier is a company that matches pre-recruited individuals (i.e., panel members) with research opportunities (e.g., marketing research). Panel suppliers invited potentially eligible individuals from their membership pool to complete the survey based on the panel member's previously provided demographic information. Informed consent was obtained from panel members prior to initiating the survey, and participants were compensated based on their panel agreements (i.e., the agreements that members had with panel suppliers at the time of panel enrollment), typically in the form of gift cards or redeemable points. The online survey took approximately 10–12 min to complete.

Data quality were monitored as part of the Lucid Quality Program (Lucid, 2022) to ensure high quality survey responses. Examples of standard quality checks included assessing random and illogical responding, and capturing and removing respondents who provided the same response for each survey question. In addition, the Lucid Quality

Program utilizes independent, third-party data specialists to evaluate their supply partners and their respondents. Coppock & McClellan (Coppock and McClellan, 2019) provide a detailed description of Lucid panel study procedures and evidence of validity. Quarterly reports of supply partner response quality, accepted completes, and consistency are available on the Lucid website. (Lucid, 2022) Study procedures were approved by the University of Oklahoma Health Sciences Center Institutional Review Board.

1.2. Participants

Individuals were eligible to participate if they were $\geq$ 18 years of age, an Oklahoma resident, and able to read and understand English language surveys. Potentially eligible individuals in the Lucid Marketplace were sent an invitation to the study, and those who passed the initial screening and provided consent were eligible to complete the survey. A total of 1919 individuals completed the study survey. However, 21 participants were removed from the analytic sample because they provided an ineligible or invalid zip code, leaving a final analytic sample of 1898 participants (0.0476% of the state population[3]). The sample was closely aligned with the racial and ethnic demographics of Oklahoma (i.e., 74% White, 7.8% Black, 9.4% American Indian/Alaska Native, 2.4% Asian 6.3% multi-race; 11.1% Hispanic). (Census, 2021) However, there was a higher proportion of female participants relative to the state population (i.e., 62.3% vs. 50.5% female[3]). The median annual household income of study participants was $30,000-$39,999, compared with a median income of $52,919 among Oklahomans, and 93.2% of participants reported completing high school/GED, compared with 88.0% among Oklahomans. (Census, 2021).

2. Measures

2.1. Sociodemographic characteristics

Participants self-reported their age (years), sex (male or female), race (White, Black/African American, Asian, Native Hawaiian/ Pacific Islander, American Indian/Alaska Native, or more than one race), and ethnicity (Hispanic or non-Hispanic). Response options for the following variables were collapsed into categories for analysis: age (18–35 years vs. $\geq$ 36 years [median = 36 years]; and age categories: 18–19 years, 20–29 years, 30–39 years, 40–49 years, 50–59 years, and $\geq$ 60 years), sexual orientation (heterosexual/straight vs. all others [i.e., lesbian/ gay/bisexual/questioning/queer/other/don't know/refuse to answer; LGBQ+]), education ($\leq$high school/GED vs. > high school/GED [assessed as years of education]), and income (<$30,000 vs. $\geq$$30,000 [assessed as increments of $\approx$$10,000 from $0-$9,999 to $100,000 or greater]). Rural/urban residence was derived based on the Rural-Urban Commuting Area (RUCA) (USDA, 2010) codes associated with participants' zip codes. RUCA codes 1–3 indicated urban residence and codes 4–10 indicated rural residence.

2.2. Cannabis use and dependence

Participants reported whether they had a medical marijuana/ cannabis card issued by the OMMA (yes = licensed or no = not licensed). They also reported the number of days in the past 30 days that they had used cannabis for medical reasons (e.g., use "to treat or decrease symptoms of a health condition") and non-medical reasons (e.g., use "for pleasure or satisfaction, to get high"). Those who reported cannabis use on $\geq$ 1 day for any reason were considered past 30-day users (i.e., responses recoded to "past 30-day users" vs. "non-users"). Cannabis use disorder (CUD) was assessed with the 3-item Cannabis Use Disorder Identification Test – Short form (CUDIT-SF). (Bonn-Miller et al., 2016) CUDIT-SF scores may range from 0 to 12, with scores of $\geq$ 2 indicating a positive screen for CUD and scores < 2 indicating a negative screen.

2.3. Alcohol, tobacco, and opiate use

Participants reported the number of days in the past 30 days that they had used alcohol, cigarettes, and opiates. Those who reported alcohol, cigarette, or opiate use on ≥ 1 day were considered past 30-day users of that substance (i.e., responses recoded to "past 30-day users" vs. "non-users").

2.4. Pain and other health indicators

Two questions assessed pain severity. (USDHHS, 2015) The first item was "In the past 7 days, how much did pain interfere with your day to day activities?" ($1 =$ not at all to $5 =$ very much). This variable was recoded into two categories: "not at all/a little bit" and "somewhat/ quite a bit/very much." The second item was "In the past 7 days, how would you rate your pain intensity on average (0–10 scale)?" This variable was recoded into two categories: pain ratings of 0–3 (none/mild pain) and 4–10 (moderate to worst pain possible). Participants were also asked: "To what extent are you able to carry out every day physical activities, such as walking, climbing stairs, carrying groceries, or moving a chair?" ($1 =$ not at all to $5 =$ completely). (Hays et al., 2017) This variable was recoded into 2 categories: "not at all/a little/moderately" and "mostly/completely."

2.5. Reasons for medical cannabis use/perceptions of relief

Licensed cannabis users and unlicensed users who reported using cannabis for medical reasons during the past 30 days were asked to indicate whether they had any of 27 medical symptoms/conditions (see Table 3). For each symptom/condition endorsed, participants indicated whether cannabis use was medically-recommended, self-prescribed, or not used for this symptom/condition. Participants also indicated the extent to which cannabis relieved this symptom or condition. The 6 response options were combined into 3 categories: "don't know/not at all," "somewhat/moderately," and "very much/extremely".

2.6. Analytic plan

Frequencies were calculated for sociodemographic characteristics, substance use, and health-related variables, and chi-square analyses were conducted to compare participant characteristics of 1) adults with and without a cannabis license and 2) past 30-day cannabis users and non-users. Additional analyses were conducted with the sub-sample of past 30-day cannabis users to compare those with and without a license on sociodemographic, substance use, and health-related characteristics. Finally, the medical conditions for which participants used cannabis were described for licensed participants (medically-recommended and self-prescribed uses), and for past 30-day medical cannabis users without a license (self-prescribed uses only).

3. Results

3.1. Participant characteristics

Participants ($N = 1898$) were predominantly female (62.28%), and White (75.29%). In addition, 8.96% of participants reported American Indian/Alaska Native race, 8.54% reported Black/African American race, and 9.01% reported Hispanic ethnicity. The median age of participants was 36 years (range 18–83 years). A total of 19.34% of the sample reported having a medical cannabis license, and 35.73% reported cannabis use within the past 30-days. See Table 1. Among past 30-day cannabis users ($n = 676$), 30.03% ($n = 203$) reported medical use only, 14.50% ($n = 98$) reported non-medical use only, and 55.18% ($n = 373$) reported both medical and non-medical use (0.30% [$n = 2$] did not provide this information).

3.2. Differences between licensed and unlicensed participants

Chi-square tests indicated several differences between licensed ($n = 367$) and unlicensed participants ($n = 1531$). Compared to unlicensed participants, licensed participants were more likely to be younger (18–35 years) vs. older (≥ 36 years; $p = 0.001$). More participants aged 20–29 years ($p < 0.001$) and fewer participants aged ≥ 60 years ($p < 0.001$) were represented among licensed participants. Licensed participants were more like to identify as LGBQ+ ($p < 0.001$), and they were also more likely to report past 30-day cannabis use ($p < 0.001$), cigarette smoking ($p < 0.001$), alcohol use ($p = 0.001$), and prescription opiate use ($p = 0.003$). More licensed than unlicensed participants reported that pain had interfered with their day-to-day activities "somewhat/ quite a bit/very much" during the past 7 days ($p < 0.001$). More licensed than unlicensed participants reported pain intensity in the range of "moderate to worst possible pain" during the past 7 days ($p < 0.001$). See Table 1.

3.3. Differences between cannabis users and non-users

Because of the overlap between cannabis use and having a medical cannabis license, supplementary analyses were conducted to evaluate differences between past 30-day cannabis users ($n = 676$) and non-users ($n = 1216$). Differences in participant characteristics by license status and past-30 day cannabis use are presented for comparison in Table 1. Six participants were excluded from these analyses because past 30-day cannabis use could not be determined. Overall, comparisons by cannabis use status and license status produced similar results, with the following additional findings. More participants aged 30–39 years ($p < 0.001$) and fewer participants aged 50–59 years ($p = 0.002$) were represented among cannabis users than non-users. Cannabis users were more likely than non-users to report African American/Black race ($p = 0.048$) and less likely to report Asian race ($p = 0.028$). Cannabis users were more likely than non-users than to report an annual household income of <\$30,000 ($p < 0.001$). Notably, differences on education and sex approached significance with more individuals with $\leq$ high school education ($p = 0.055$) and fewer females ($p = 0.081$) represented among cannabis users than non-users. See Table 1.

3.4. Differences between licensed and unlicensed cannabis users

Among those who reported past 30-day cannabis use ($N = 676$), unlicensed participants were more likely than licensed participants to be non-White ($p = 0.027$), to have $\leq$ a high school education ($p = 0.018$), to report an annual household income of <\$30,000 ($p < 0.001$), and to report past 30-day cigarette smoking ($p = 0.002$). Licensed cannabis users were more likely to use cannabis for medical reasons on ≥ 12 days (i.e., the median days of medical cannabis use) over the past 30 days than unlicensed users ($p < 0.001$). Licensed and unlicensed participants did not differ in the proportion who screened positive for a CUD, nor on the percent who reported non-medical cannabis use on ≥ 4 days (the median days of non-medical cannabis use). See Table 2.

3.5. Medical reasons for cannabis use

The most common reasons for medically-recommended cannabis use were anxiety (42.51%), depression (33.24%), sleep problems (26.98%), chronic pain (24.25%), arthritis (12.81%), and migraine (11.72%). The most common reasons for self-prescribed use among licensed cannabis users were the same as medically-recommended reasons, although of a lower frequency. Among unlicensed adults who reported medical cannabis use in the past 30 days ($n = 274$), the most common self-prescribed reasons for use were similar to the reasons of licensed users, although of higher frequency. See Table 3. Of the 10 most frequently endorsed medically-recommended reasons for cannabis use, participants perceived the most symptom relief for anxiety, sleep

Table 1

Participant characteristics overall and by license and past 30-day cannabis use status.

	N	All Participants (N=1898)*	Licensed (n=367)*	Unlicensed (n=1531)*	p	Phi	N	Cannabis Users (n=676)*	Non-Users (n=1216)*	p	Phi
Proportion of Total Analytic Sample, % (n)	1898	100 (1898)	19.34 (367)	80.66 (1531)	-	-	1892	100 (1892)	35.73 (676)	64.27 (1216)	-	-
Sociodemographic Characteristics											
Age, ≥36 years, % (n)**	1898	50.37 (956)	**42.51 (156)**	**52.25 (800)**	**0.001**	-0.077	1892	**43.34 (293)**	**54.36 (661)**	**<0.001**	-0.106
Age, 18-19 years, % (n)		7.69 (146)	6.27 (23)	8.03 (123)	0.254	-0.026		7.40 (50)	7.73 (94)	0.793	-0.006
Age, 20-29 years, % (n)		27.19 (516)	**34.60 (127)**	**25.41 (389)**	**<0.001**	0.082		**30.47 (206)**	**25.49 (310)**	**0.020**	0.054
Age, 30-39 years, % (n)		23.71 (450)	26.16 (96)	23.12 (354)	0.219	0.028		**30.18 (204)**	**20.07 (244)**	**<0.001**	0.114
Age, 40-49 years, % (n)		18.23 (346)	18.26 (67)	18.22 (279)	0.988	0.000		19.53 (132)	17.52 (213)	0.278	0.025
Age, 50-59 years, % (n)		11.06 (210)	9.26 (34)	11.50 (176)	0.221	-0.028		**7.99 (54)**	**12.75 (155)**	**0.002**	-0.073
Age, ≥60 years, % (n)***		12.12 (230)	**5.45 (20)**	**13.72 (210)**	**<0.001**	-0.100		**4.44 (30)**	**16.45 (200)**	**<0.001**	-0.176
Sex, female, % (n)	1898	62.28 (1182)	58.58 (215)	63.16 (967)	0.104	-0.037	1892	59.76 (404)	63.82 (776)	0.081	-0.040
Race	1898						1892				
White, % (n)		75.29 (1429)	75.20 (276)	75.31 (1153)	0.966	-0.001		74.85 (506)	75.66 (920)	0.697	-0.009
American Indian/Alaska Native, % (n)		8.96 (170)	7.63 (28)	9.27 (142)	0.321	-0.023		8.88 (60)	8.96 (109)	0.949	-0.001
Black/African American, % (n)		8.54 (162)	10.63 (39)	8.03 (123)	0.110	0.037		**10.21 (69)**	**7.57 (92)**	**0.048**	0.045
Asian, % (n)		1.58 (30)	1.36 (5)	1.63 (25)	0.709	-0.009		**0.74 (5)**	**2.06 (25)**	**0.028**	-0.050
Native Hawaiian/Pacific Islander, % (n)		0.37 (7)	0.82 (3)	0.26 (4)	0.114	0.036		0.30 (2)	0.33 (4)	0.902	-0.003
Multi-Race, % (n)		5.27 (100)	4.36 (16)	5.49 (84)	0.385	-0.020		5.03 (34)	5.43 (66)	0.711	-0.009
Ethnicity, Hispanic, % (n)	1898	9.01 (171)	11.17 (41)	8.49 (130)	0.107	0.037	1892	9.47 (64)	8.80 (107)	0.627	0.011
Education, ≤ High School/GED, % (n)	1898	34.51 (655)	34.06 (125)	34.62 (530)	0.840	0.005	1892	37.28 (252)	32.89 (400)	0.055	-0.044
Annual Income, <$30,000, % (n)	1807	44.38 (802)	43.79 (155)	44.53 (647)	0.801	0.006	1801	**53.28 (349)**	**39.35 (451)**	**<0.001**	-0.135
Sexual orientation, LGBQ+, % (n)****	1898	16.75 (318)	**25.89 (95)**	**14.57 (223)**	**<0.001**	-0.120	1892	**24.85 (168)**	**12.34 (150)**	**<0.001**	-0.160
Rural Residence, % (n)	1898	36.83 (699)	34.60 (127)	37.36 (572)	0.326	-0.023	1892	36.98 (250)	36.68 (446)	0.895	0.003
Substance Use (Past 30 Days)											
Cannabis use, % (n)	1892	35.73 (676)	**84.38 (308)**	**24.10 (368)**	**<0.001**	0.496	-	**-**	**-**	**-**	-
Cigarette smoking, % (n)	1893	34.23 (648)	**46.58 (170)**	**31.28 (478)**	**<0.001**	0.127	1890	**56.82 (383)**	**21.71 (264)**	**<0.001**	0.354
Alcohol use, % (n)	1892	50.21 (950)	**57.69 (210)**	**48.43 (740)**	**0.001**	0.073	1891	**63.41 (428)**	**42.85 (521)**	**<0.001**	0.197
Opiate painkiller use, % (n)	1890	16.30 (308)	**21.43 (78)**	**15.07 (230)**	**0.003**	0.068	1887	**22.96 (155)**	**12.54 (152)**	**<0.001**	0.135
Health/Quality of life											
Ability to carry out every day physical activities, Not at all/A Little/Moderately, % (n)	1898	29.72 (564)	31.61 (116)	29.26 (448)	0.377	0.020	1892	29.44 (199)	29.85 (363)	0.850	-0.004
Pain interfered with day-to-day activities (past 7 days), Somewhat/Quite a Bit/Very Much, % (n)	1898	39.62 (752)	**52.59 (193)**	**36.51 (559)**	**<0.001**	0.130	1892	**52.81 (357)**	**31.99 (389)**	**<0.001**	0.204
Average Pain Intensity (past 7 days), Pain Rating ≥ 4 (moderate to worst pain possible), % (n)	1893	47.70 (903)	**59.84 (219)**	**44.79 (684)**	**<0.001**	0.119	1887	**62.17 (419)**	**39.41 (478)**	**<0.001**	0.218

Note: Bolded values indicate statistically significant differences.

*Maximum sample size for the column. Sub-analyses may have included a smaller sample due to missing data. See "*N*" column in the table.

** The median age of participants overall was 36 years (mode=20 years), and the median ages of licensed and unlicensed participants were 33 years (modes=29 and 40 years) and 36 years (mode=18 years), respectively. The median ages of past 30-day cannabis users and non-users were 33 years (mode=18 years) and 38 years (mode=20 years), respectively.

***Ages ranged from 60-83 years (60-69 years [n=164], 70-79 years [n=62], 80-83 years [n=4]).

****Includes lesbian or gay (*n*=54), bisexual (*n*=176), queer (*n*=12), questioning (*n*=12), other (*n*=31), don't know/not sure (*n*=11), refuse to answer (*n*=22).

Table 2
Cannabis use characteristics among past 30-day users with and without a medical cannabis license (n=676).

	N	All Cannabis Users (n=676)*	Licensed (n=308)*	Unlicensed (n=368)*	p	Phi
Proportion of Total Analytic Sample, % (n)	676	100 (676)	45.56 (308)	54.44 (368)	-	-
Sociodemographic Characteristics						
Age, ≥36 years, % (n)**	676	43.34 (293)	42.86 (132)	43.75 (161)	0.816	-0.009
Sex, female, % (n)	676	59.76 (404)	59.09 (182)	60.33 (222)	0.744	-0.013
Race, Non-White, % (n)***	676	25.15 (170)	**21.10 (65)**	**28.53 (105)**	**0.027**	0.085
Ethnicity, Hispanic, % (n)	676	9.47 (64)	9.42 (29)	9.51 (35)	0.966	-0.002
Education, ≤ High School/GED, % (n)	676	37.28 (252)	**32.47 (100)**	**41.30 (152)**	**0.018**	0.091
Income, <$30,000, % (n)	655	53.28 (349)	**43.19 (130)**	**61.86 (219)**	**<0.001**	0.187
Sexual orientation, LGBQ+, % (n)	676	24.85 (168)	25.65 (79)	24.18 (89)	0.661	-0.017
Rural Residence, % (n)	676	36.98 (250)	34.74 (107)	38.86 (143)	0.269	-0.042
Cannabis Dependence/Use Frequency						
CUDIT-SF, positive (score ≥2), % (n)****	676	46.60 (315)	49.03 (151)	44.57 (164)	0.247	0.045
Days of medical use, past 30 days, ≥12 days (median), % (n)	675	50.81 (343)	**67.10 (206)**	**37.23 (137)**	**<0.001**	0.298
Days of non-medical use, past 30 days, ≥4 days (median), % (n)	674	51.34 (346)	48.37 (148)	53.80 (198)	0.160	-0.054
Other substance use (past 30 days)						
Cigarette smoking, % (n)	674	56.82 (383)	**50.49 (155)**	**62.13 (228)**	**0.002**	-0.117
Alcohol use, % (n)	675	63.41 (428)	60.91 (187)	65.49 (241)	0.219	-0.047
Opiate painkiller use, % (n)	675	22.96 (155)	21.17 (65)	24.46 (90)	0.312	-0.039
Health/Quality Of Life						
Ability to carry out every day physical activities, Not at all/A Little/Moderately, % (n)	676	29.44 (199)	30.52 (94)	28.53 (105)	0.572	0.022
Pain interfered with day-to-day activities (past 7 days), % (n) Somewhat/Quite a Bit/Very Much	676	52.81 (357)	53.57 (165)	52.17 (192)	0.717	0.014
Average Pain Intensity (past 7 days), Pain Rating ≥4 (moderate to worst pain possible), % (n)	674	62.17 (419)	61.56 (189)	62.67 (230)	0.768	-0.011

Note: Bolded values indicate statistically significant differences (p<0.05).

*Maximum sample size for the column. Sub-analyses may have included a smaller sample due to missing data. See "N" column in the table for the analytic sample size.

** The median age of past 30-day cannabis users overall was 33 years (mode=18 years), and the median ages of licensed and unlicensed cannabis users were 33 years (mode=40 years) and 33.5 years (modes=18 and 22 years) respectively. The proportion of individuals within each age category (see age categories in Table 1) did not differ by cannabis license status. However, the difference in the proportions of licensed and unlicensed participants aged 30-39 (26.95% vs. 32.88%, p=0.094) and 50-59 years (10.06% vs. 6.25%, p=0.068) approached significance.

***The proportion of individuals within each individual racial group did not differ by cannabis license status. The racial makeup of the subsample of past 30-day cannabis users was: 74.9% White (n=506), 10.2% Black (n=69), 8.9% American Indian (n=60), 5.0% multi-race (n=34), 0.7% Asian (n=5), and 0.3% Native Hawaiian/Pacific Islander (n=2).

**** The Cannabis Use Disorder Identification Test – Short form (CUDIT-SF)[31] assessed likely Cannabis Use Disorder (CUD). CUDIT-SF scores ranged from 0-12, with scores ≥2 indicating a positive screen for CUD.

Table 3

Frequency of medically-recommended and self-prescribed reasons for medical cannabis use among licensed and unlicensed medical cannabis users.

	Licensed (*n*=367)		Unlicensed (*n*=274)
	Medically-Recommended,% (*n*)	Self-Prescribed, % (*n*)	Self-Prescribed, % (*n*)
Symptoms/Conditions			
Anxiety	42.51 (156)*	14.17 (52)	64.23 (176)
Depression	33.24 (122)*	13.90 (51)	54.01 (148)
Sleep Problems	26.98 (99)	9.54 (35)	34.31 (94)
Chronic Pain	24.25 (89)**	8.17 (30)	24.45 (67)
Arthritis	12.81 (47)	6.81 (25)	20.44 (56)
Migraine	11.72 (43)	6.27 (23)	19.71 (54)
Bipolar Disorder	9.54 (35)	5.45 (20)	20.07 (55)
Nausea/Vomiting	7.08 (26)	3.81 (14)	13.50 (37)
Muscle Spasms	7.08 (26)	3.27 (12)	11.31 (31)
Diabetes	3.00 (11)	3.00 (11)	2.92 (8)
Seizures/Epilepsy	2.72 (10)	1.36 (5)	1.82 (5)
Hypertension	2.45 (9)	3.00 (11)	6.20 (17)
Fibromyalgia	2.45 (9)	1.63 (6)	4.01 (11)
Inflammatory Bowel Disease/Crohn's Disease	2.45 (9)	1.09 (4)	4.01 (11)
Obesity	1.91 (7)	1.09 (4)	4.74 (13)
Chronic Fatigue Syndrome	1.63 (6)	1.91 (7)	5.11 (14)
Neurological Disorder	1.63 (6)	1.09 (4)	2.92 (8)
Opioid Addiction	1.36 (5)	1.91 (7)	2.92 (8)
Cancer	1.36 (5)	1.36 (5)	0.73 (2)
High Cholesterol	1.36 (5)	0.82 (3)	0.73 (2)
Spinal Cord Injury	0.82 (3)	0.82 (3)	2.19 (6)
Glaucoma	0.82 (3)	0.27 (1)	1.09 (3)
Traumatic Brain Injury	0.27 (1)	0.54 (2)	1.82 (5)
Kidney Disease	-	0.27 (1)	1.09 (3)

*Participants 18-35 years of age were significantly more likely than those aged ≥36 years to report that cannabis was medically- recommended for this reason (*p*'s<0.05).

**Participants ≥36 years of age were significantly more likely than those aged 18-35 years to report that cannabis was medically- recommended for chronic pain (*p*=0.001).

Note: Licensed and unlicensed medical users (i.e., those who indicated that they had used cannabis for medical reasons in the past 30 days) were asked to report on whether they had any of 27 medical symptoms/conditions. For each symptom/condition endorsed, participants indicated whether cannabis use was medically-recommended, self-prescribed, or not used to gain relief from this particular symptom/condition. Within each column, less than 1% of the sample endorsed the use of medical cannabis for HIV/AIDS, multiple sclerosis, and Parkinson's disease; thus, these conditions were omitted from the table.

problems, nausea/vomiting, and depression. See Fig. 1.

The top 10 most commonly reported medically-recommended reasons for cannabis use were compared between younger (18–35 years) and older participants (≥36 years). Chi-square analyses revealed that younger participants were more likely than older participants to report medically-recommended cannabis use for anxiety (47.39% vs. 35.90%, *p* = 0.028) and depression (37.91% vs. 26.92%, *p* = 0.027). Whereas, older participants were more likely than younger participants to report medically-recommended cannabis use for chronic pain (32.69% vs.

18.01%; *p* = 0.001). Age differences in medically-recommended cannabis use for arthritis approached significance (*p* = 0.057), with older participants more likely to report medically-recommended use for this condition than younger participants (16.67% vs. 9.95%).

4. Discussion

In summary, nearly 20% of survey participants reported having a medical cannabis license, and more than 35% reported past 30-day
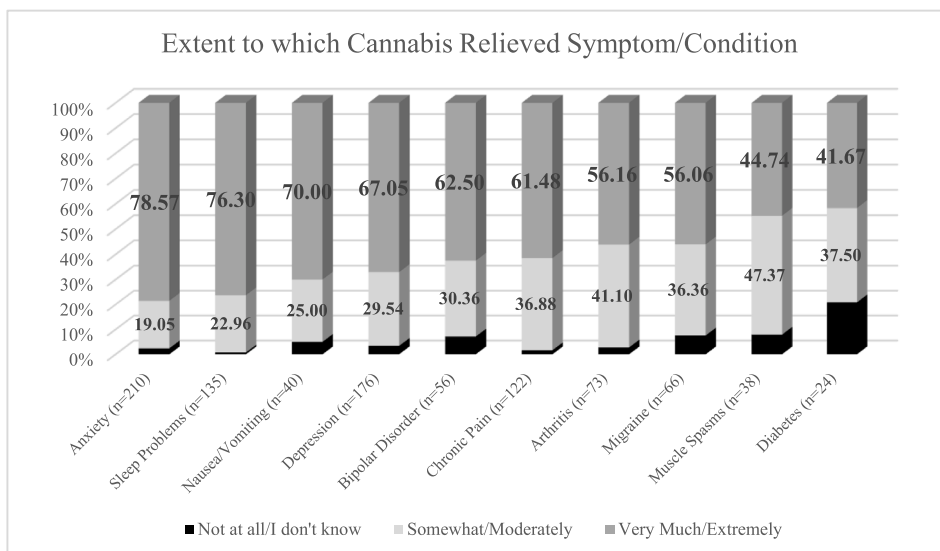

Fig. 1. Perceptions of cannabis-related relief for the most common medically-recommended reasons for cannabis use.

cannabis use. Licensees were younger, and more likely to report a minority sexual orientation as well as past 30-day use of substances including cigarettes, alcohol, and opiates. Licensees were also more likely to report higher pain intensity, and that pain had interfered with day-to-day activities. Comparisons of cannabis users and non-users produced similar results, with the additional findings that Black/African American and socioeconomically disadvantaged participants were more likely and Asians less likely to report cannabis use in the past 30 days. In the subset of past 30-day cannabis users, those without a cannabis license were more likely to be non-White, socioeconomically disadvantaged, and to report current cigarette smoking than licensed users. The most common reasons for medically-recommended cannabis use were anxiety, depression, and sleep problems, and most individuals perceived that cannabis offered relief for these conditions.

Notably, the prevalence of past 30-day cannabis use was more than 3 times higher than estimates of adult cannabis use nationally and within Oklahoma (2018–2019). (SAMSHA., 2019) Perhaps this was due, in part, to differences in the way that past 30-day cannabis use was assessed in the current study relative to other studies (i.e., days of recreational and medical use over the past 30 days were separately assessed). People who used cannabis may also have been more likely to complete the study survey. It is also possible that cannabis use may have increased in Oklahoma since medical cannabis legalization, a pattern which has been observed in other states. (Everson et al., 2019; Cerdá et al., 2020; Yu et al., 2020; Wen et al., 2015) Plausibly, increases in cannabis use could occur as a result of the decriminalization of cannabis use, reduced penalties for non-legal use, and changing attitudes about cannabis, (Yu et al., 2020) along with greater access via the increasing number of cannabis retailers, (Everson et al., 2019) and the ease of obtaining a cannabis license in Oklahoma. Data collection occurred during the COVID-19 pandemic, and research suggests that cannabis users may have increased their use during the pandemic. (van Laar et al., 2020; Imtiaz et al., 2021; Boehnke et al., 2021; Vidot et al., 2021) However, the available evidence does not clearly support the hypothesis that non-users initiated cannabis use during the pandemic. (Imtiaz et al., 2021; Vanderbruggen et al., 2020; Schepis et al., 2021) Further study is warranted to determine whether cannabis use patterns are changing in Oklahoma.

Consistent with previous research, (Pergam et al., 2017; Parekh et al., 2020) cannabis licensees and users in the current study were younger than unlicensed individuals and non-users. Studies have shown that younger people have increasingly permissive views about cannabis, which has coincided with the increasing frequency of cannabis legalization in the U.S. (Schmidt et al., 2016) Conversely, older adults may have negative attitudes about cannabis use, (Arora et al., 2020) which may prevent them from seeking cannabis for medical conditions. Similar to other research, (Gonzales, 2020) those who reported a minority sexual orientation were more likely to use cannabis and to have a license. Sexual minority stress theory (Meyer, 2003; Parent et al., 2018) posits that substance use among individuals with minority sexual orientation may occur as a means to cope with the unique and often chronic stressors associated with their sexual orientation (e.g., discrimination). In the context of cannabis legalization, efforts may be needed to protect these and other at-risk groups from the potential consequences of increased cannabis availability. On the other hand, it is also possible that cannabis may provide some relief from mental health problems which may occur as a result of minority stressors. Further study of the risks and benefits of medical cannabis use specifically among SGM individuals is warranted.

Licensed adults and cannabis users were far more likely to report current tobacco, alcohol, and opiate use than non-licensed adults and non-users. The co-use of cannabis with other substance is common, and has been associated with variety of adverse health and mental health outcomes. (Hindocha et al., 2020; Smith et al., 2020; Correa et al., 2020; Yurasek et al., 2017; Rogers et al., 2019) Although more research is needed to understand the pathways linking cannabis use with the use of

other substances and mental health problems, polysubstance use appears to be associated with cannabis use and having a cannabis license. In addition, smoking rates were exceptionally high (57%) among cannabis users, highlighting an opportunity to advise those seeking a license about the importance of smoking cessation and to offer referrals to treatment, such as through the state tobacco helpline. Efforts to mitigate problematic health behaviors associated with medical cannabis use in Oklahoma should be considered, including public health campaigns that provide information about the addiction potential of cannabis and the link between cannabis and other substance use.

Importantly, the most common conditions and symptoms for which participants reported medically-recommended cannabis use included: anxiety, depression, sleep problems, chronic pain, arthritis, migraine, bipolar disorder, nausea/vomiting, muscle spasms, and diabetes. Evidence indicates that cannabis is an effective treatment for pain, (Nasem, 2017; Whiting et al., 2015; Aviram and Samuelly-Leichtag, 2017; Romero-Sandoval et al., 2018) though little is known about the efficacy of cannabis as a treatment for other conditions. (Nasem, 2017) Nevertheless, cannabis use for anxiety and depression are common, and individuals perceive benefits of cannabis use for these conditions. (Kosiba et al., 2019) In contrast with Oklahoma, the most common conditions for which people sought medical cannabis licenses in other medicalized states were chronic pain, multiple sclerosis, cancer, irritable bowel disease, and epilepsy. (Boehnke et al., 2019) Differences may be a reflection of the different qualifying conditions required to obtain a medical cannabis license in Oklahoma versus other states (e.g., few states include anxiety, depression, and sleep problems as qualifying conditions). Cannabis was widely perceived by participants to provide relief for anxiety, sleep problems, depression, and nausea/vomiting, while participants perceived less cannabis-related relief from diabetes, muscle spasms, migraine, and arthritis. Interestingly, younger people were more likely to report medically-recommended cannabis use for mental health conditions, whereas older participants were more likely to report medically-recommended use for chronic pain.

Limitations of the study include the cross-sectional design and the non-probability sample. It is both a strength and a weakness that this study focused on Oklahomans specifically, with findings more generalizable to the state and potentially less applicable to the U.S. overall. While the racial demographics of the study sample matched the racial demographics of the state, the sample was predominantly female and participants had a lower median household income than Oklahomans more broadly. (Census, 2021) In addition, about 17% of participants identified as LGBQ+, compared with 5.6% of U.S. adults who identified as a sexual and/or gender minority person. (Jones, 2021) Ultimately, randomized trials are needed to understand the therapeutic benefits of cannabis for specific medical and psychological conditions, though perceptions of therapeutic benefits among users offer a starting point for investigation.

5. Conclusion

Medical cannabis legalization may offer benefits for some, while also increasing cannabis access among at-risk individuals. Medical cannabis legalization in Oklahoma was widely supported among residents, and the taxation of medical cannabis sales has provided additional funding for Oklahoma communities. Nevertheless, findings indicate that having a medical cannabis license and cannabis use are associated with behavioral health risk factors, and there are disparities between licensed and unlicensed cannabis users which may have legal, social, and health implications. For example, socioeconomically disadvantaged cannabis users may not be able to afford the cost of obtaining a license, and thus, their cannabis use may place them at legal risk. It is important to understand which groups may benefit from medical cannabis availability and which groups incur greater risk, so that public health campaigns and interventions can be appropriately targeted. Finally, increasing our understanding of the risks and benefits associated with legalized medical

cannabis use can inform cannabis-related policies.

CRediT authorship contribution statement

Darla E. Kendzor: Conceptualization, Writing – original draft, Formal analysis. **Sarah J. Ehlke:** Conceptualization, Writing – review & editing. **Laili Kharazi Boozary:** Writing – review & editing. **Michael A. Smith:** Project administration, Writing – review & editing. **Amy M. Cohn:** Conceptualization, Writing – review & editing, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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