The Intersection of Rurality, Unmet Treatment Need, and Cannabis Use for Adults with Chronic Pain

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ABSTRACT

Objective: Rates of chronic pain are higher among rural versus urban individuals and rural individuals experience higher levels of socioeconomic disadvantage, poor or no health insurance coverage, and unmet treatment need. Medical cannabis is legal in Oklahoma. With 40% of Oklahoma's population living in rural areas, and nearly 17% uninsured, the medical legalization of cannabis may present as an accessible and relatively low-cost alternative treatment, particularly for those with chronic pain. This study investigated differences in cannabis use by rural (vs. urban) status and unmet (vs. met) treatment need among adults with and without chronic pain living in Oklahoma. **Method**: To be eligible, participants had to be 18 years or older, reside in Oklahoma, and be able to read and write English-language surveys. **Results**: The sample (N= 3622) was primarily made up of non-Hispanic White (70.4%) females (53.8%) in their early middle age (M= 41.80, SD= 16.88), employed full-time or part-time (53.8%), with some college/technical school (37.2%) or a bachelor's degree (28.5%). Nearly one-fifth of the sample (18.2%) endorsed chronic pain, and individuals with chronic pain were eight times more likely to report past 30-day cannabis use. No difference was detected when only rurality (vs. urban residence) was examined. Among adults with chronic pain, those who were rural dwelling and who reported unmet treatment need were almost two times more likely to report past 30-day cannabis use, compared to urban dwelling chronic pain adults with unmet treatment need. **Conclusions**: In Oklahoma, adults in rural areas with unmet treatment need and chronic pain may benefit from increasing access to chronic pain treatment, as well as education on cannabis use and harm reduction strategies to inform healthcare decision-making.

Key words: = chronic pain; cannabis; rurality; treatment need

Chronic pain is one of the leading causes of disability and primary care visits among U.S. adults (Van Oostrom et al., 2014). Approximately 20% of U.S. adults experience chronic pain, defined as pain that lasts more than 3 months, which can fluctuate in severity and interference (Dydyk & Conermann, 2023; Katz et al., 2015). Chronic pain is associated with psychological, physical, and economic consequences, all of which can be exacerbated by inadequate pain treatment (Fine, 2011). Early pain management can mitigate these consequences and help people maintain or return to practical levels of daily functioning (Fine, 2011). Unfortunately, chronic pain remains poorly treated due to a variety of barriers (e.g., physical distance from healthcare

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facilities, lack of treatment providers, limited or no insurance coverage) (Darnall et al., 2016), leaving many adults to seek out their own pain management solutions. Individuals with chronic pain are more likely to experience social and economic vulnerabilities, such as poverty, rurality, and comorbid psychological or physical conditions (Albrecht et al., 2021; Day & Thorn, 2010; Keralis, 2021; Rios & Zautra, 2011; Tunks et al., 2008; Van Oostrom et al., 2014), all of which can augment pain management challenges.

Cannabis-based treatment options have increased in popularity for chronic pain management (Romero-Sandoval et al., 2018). As of 2023, medicinal cannabis is legal in 38 United States jurisdictions, and chronic pain (non-malignant) is the most commonly cited reason for medical cannabis use in the U.S. (Hameed et al., 2023). Estimates vary, but among a recent U.S. national sample of adults with chronic pain, 23.2% reported using cannabis within the past 30 days to manage their pain (Bicket et al., 2023).

Cross-sectional findings suggest that more than 35% of individuals using cannabis to treat pain report they have substituted cannabis for opioids, viewing it as an attractive harm reduction strategy (Corroon et al., 2017; Lim et al., 2023). With the widespread availability of cannabis and lower cost relative to traditional medical treatment, adults with chronic pain may be less likely to seek out efficacious non-pharmacological treatments for pain. For example, Bicket and colleagues (2023) found that the increased use of medical cannabis for chronic pain was associated with a decrease in use of effective non-pharmacological treatments including physical therapy and cognitive behavioral therapy. Increased use of cannabis as a replacement for other pharmacologic and non-pharmacologic treatment may be problematic because the evidence demonstrating the efficaciousness of cannabis for treating chronic pain is limited and mixed, with methodological issues such as short follow-up periods (<6 months), small sample sizes, industry funding (which can constitute significant bias), and inconsistent measurement practices (Wang et al., 2021). Moreover, the pharmacokinetics and pharmacodynamics of cannabinoids for chronic pain are unclear, leaving important prescribing questions, such as dosage and drug-drug interactions, unanswered (Sharon & Brill, 2019). Use of cannabis for chronic pain has also been associated with short-term adverse events including dizziness, nausea, dry mouth, and confusion, although there is a low evidence of cannabis use causing significant harm compared to controls (Nugent et al., 2017). The long-term consequences of medical cannabis use are yet to be clearly established (Zeraatkar et al., 2022).

Despite the known acute risks of cannabis use and the possibility of undetermined long-term risks, medical cannabis remains a desired and often accessible pain management option for many (Babalonis et al. 2021). This is particularly true for vulnerable populations, like individuals living in rural locations, with lower income, or with limited or no health insurance. In rural areas, 28.1% of adults report chronic pain compared to 16.4% in large urban areas (Wang et al., 2021, p. 20). Even after adjusting for age, chronic pain is still more prevalent in rural areas in comparison to large urban areas (25.4% vs. 16.8%) (Rikard et al., 2023). Rural dwelling individuals with chronic pain are more likely to be uninsured, younger, report higher levels of disability, and have historically faced challenges in accessing specialty treatment for pain (Goode et al., 2013; Spleen et al., 2014). The challenges of accessing healthcare in rural areas may lead to delays or avoidance of needed care (Spleen et al., 2014). This is supported by the finding that people with chronic pain in rural areas are more likely to use prescription opioids and less likely to use non-pharmacologic treatments or self-management strategies (Eaton et al., 2018). Increased cannabis use could amplify chronic disease and mental health disparities—which are elevated in rural areas (Coughlin et al., 2019; Morales et al., 2020). For example, recreational cannabis use has been associated with increased risk of cardiovascular disease and a decline in executive functioning abilities (Crean et al., 2011; Goyal et al., 2017). As such, cannabis use for chronic pain management may place vulnerable populations in a position to experience worse outcomes in a variety of domains.

It may be the case that the barriers preventing people from accessing evidence-based treatments for chronic pain management (e.g., financial constraints, physical distance, transportation barriers, lack of providers) are the same ones that might motivate people, particularly vulnerable groups, to seek medical relief via cannabis use. Thus, the current study investigated associations

of rurality, unmet treatment need, and cannabis use among adults with and without chronic pain living in Oklahoma, a legal medical cannabis state with a large rural and uninsured population (KFF, 2022). Oklahoma legalized medical cannabis in 2018, and 10% of adults in the state now possess a patient medical cannabis license (MCL; OMMA, 2022). Specifically, objectives of the current study were to: 1) compare adults with and without chronic pain on demographics (including rurality) and on factors related to cannabis use (e.g., licit and illicit substance use), medical comorbidities, and unmet treatment need; 2) assess the unique and combined associations of chronic pain and rurality on past 30-day cannabis use behavior; and 3) assess the unique and combined associations of rurality and unmet treatment need on past 30-day cannabis use behavior, separately across those with and without chronic pain. Findings will provide insight into possible group differences in cannabis use among adults with chronic pain. We hypothesized that rural-dwelling individuals with chronic pain would have a higher likelihood of past 30-day cannabis use when compared to those in urban areas with chronic pain. We also hypothesized that among those with chronic pain, those living in rural (vs. urban) areas and with unmet (vs. met) treatment need would be most likely to report past 30-day cannabis use.

METHODS

Participants and Procedures

Data were collected from English-speaking adults ages 18+ living in Oklahoma (verified by self-reported residential zip code) who completed one wave of a three-wave cross-sectional online survey. Three survey waves were fielded 6-months apart (September 2020-September 2021). Respondents were recruited from a professionally maintained panel vendor, Lucid, based on the demographics (state of residence, age, gender, race/ethnicity) of panel member profiles. Surveys took 10-12 minutes to complete. Sampling quotas for age, gender, and race/ethnicity were used to increase the likelihood that respondent demographics would be similar to the Oklahoma population (based on Oklahoma census data). Surveys remained active and accessible until the sampling quotas for each wave were filled. Participants were compensated based on incentives provided by the panel to which they belonged (e.g., cash, gift cards, points to redeem reward prizes, or gift cards, equating to roughly $1). More detail on the study methodology and data quality are published here (Cohn, Alexander, et al., 2023; Kendzor et al., 2022). Procedures were approved by the University of Oklahoma Health Sciences Center IRB.

Demographic characteristics of the three-wave sample were within a 3-5% standard deviation of the Oklahoma census data. Participants who completed more than one wave (n = 145) of the three-wave study were identified and data from their most recent survey were retained. The final analytic sample for this analysis consisted of 3,622 adults in waves 2 and 3 who were asked about unmet medical treatment need (survey item not included in wave 1).

Measures

Sociodemographic Variables

Participants were asked to report age, race/ethnicity (categorized as non-Hispanic [NH] White, NH Black/African American, Hispanic, and NH Other), income (≤$19,999, $20,000–$39,999, $40,000–$59,999, $60,000–$79,999, $80,000–$99,999, ≥$100,000), employment (categorized as full- or part-time, unemployed and looking for work, unemployed and not looking for work, student, other), education (<12 years, high school diploma/GED, some college/technical school, associate's degree, bachelor's degree, or graduate school), and current health insurance (Medicare, Medicaid, private insurance, military insurance, no insurance). Health insurance was dichotomized for analyses as no insurance vs. any insurance (Medicare, Medicaid, private insurance, military insurance). Participants reported whether they had a medical cannabis license (MCL) issued by the Oklahoma Medical Marijuana Authority (OMMA) (yes/no).

Cannabis and Other Substance Use

Participants reported the number of days in the past 30 days they had used cannabis, alcohol, cigarettes, prescription painkillers (opiates, such as hydrocodone, buprenorphine, codeine, fentanyl) and other illicit drugs (cocaine, crack,

meth, heroin). Those who reported use on ≥1 day were coded as having used that substance in the past 30 days.

Rural/Urban

The Rural-Urban Commuting Area (RUCA) 30 codes associated with participants' self-reported zip code of residence were used to classify the participants as either rural or urban residents. RUCA codes 1-3 indicated urban residence and codes 4-10 indicated rural residence (USDA ERS - Rural-Urban Commuting Area Codes, n.d.).

Chronic Pain and Other Medical Conditions

Participants were asked to review a list of 14 medical conditions or symptoms and indicate the ones they had received a medical diagnosis for or self-diagnosed. Participants who responded "yes" to having been medically or self-diagnosed with "chronic pain" were categorized as such for the analysis. The list of medical conditions was summed and then categorized (None, 1-2 conditions, 3-4 conditions, 5 or more conditions).

Unmet Treatment Need

Using an item adapted from the National Survey of Drug Use and Health (SAMHSA, 2019; Walker et al., 2015) participants were asked: "In the past 12 months, was there a ever time when you needed to see a medical specialist about a health issue but did not get it?" Those who responded "Yes" were categorized as having an "unmet treatment need" (coded as 1), and those who responded "No" were categorized as having "met treatment need" (coded as 0).

Data Analysis

Frequencies were calculated for sociodemographic characteristics, unmet treatment need, substance use, and health-related behaviors in the full analytic sample. The demographic, substance use, and health-related correlates of those with and without chronic pain were assessed using cross-tabulations. Next, models assessed the main and interactive effects of chronic pain (yes/no) and rurality (rural vs. urban) on odds of reporting past 30-day cannabis use (yes/no). The sample was then stratified by whether they had chronic pain to investigate the main and interactive effects of rurality (rural vs. urban) and unmet treatment need (yes/no) on odds of reporting past 30-day cannabis use with binary adjusted logistic regression models. All models adjusted for age, race/ethnicity, and health insurance status, which were identified via a backward step selection to reduce the number of parameters in the models. We chose to exclude the number of medical conditions from the model because our categorization of chronic pain (vs. no chronic pain) was derived from the list of medical conditions, thus the two variables were highly collinear ($r = .67$, $p < .001$).

RESULTS

Participant Characteristics

Table 1 shows sociodemographic characteristics of the full analytic sample (N = 3622) and compares those with (18.2%, n = 659) and without chronic pain (81.8%, n = 659). In the full sample, slightly over half were female (53.8%), early middle-aged (M = 41.80, SD = 16.88), employed full-time or part-time (53.8%), received either some college/technical school (37.2%) or a bachelor's degree (28.5%), and the majority identified as non-Hispanic White (70.4%). Just over one-third (37.3%) resided in a rural area, 20% did not have health insurance, close to a quarter (27.8%) reported unmet treatment need and reported having a medical cannabis license (23.5%). Just over half of participants (55.4%) endorsed not having any medical conditions. In terms of substance use, 33.5% reported past 30-day cannabis use, 34.5% reported past 30-day cigarette use, 48.5% reported past 30-day alcohol use, 18.1% reported past 30-day prescription pain medication use (opioids, such as hydrocodone, buprenorphine, codeine, fentanyl), and 22.5% reported past 30-day illicit drug use (cocaine, crack, meth, heroin).

Table 1. *Sample Descriptives*

	Overall (N = 3,622)	No chronic pain (n = 2,963) 81.8%	Chronic pain (n = 659) 18.2%	p
	(n) %	(n) %	(n) %	
Sex				
Male	(1673) 46.2	(1402) 47.3	(271) 41.1	.004
Female	(1949) 53.8	(1561) 52.7	(388) 58.9	
Race/ethnicity				
Non-Hispanic (NH) White	(2546) 70.4	(2086) 70.5	(460) 69.8	.07
NH Black	(285) 7.9	(238) 8.0	(47) 7.1	
NH Other	(440) 12.2	(342) 11.6	(98) 14.9	
Hispanic	(346) 9.6	(292) 9.9	(54) 8.2	
Age				
18-24	(682) 18.8	(604) 20.4	(78) 11.8	<.001
25-34	(758) 20.9	(604) 20.4	(154) 23.4	
35-44	(728) 20.1	(586) 19.8	(142) 21.5	
45-54	(522) 14.4	(399) 13.5	(123) 18.7	
55-64	(479) 13.2	(376) 12.7	(103) 15.6	
65+	(453) 12.5	(394) 13.3	(59) 9.0	
Education				
Less than 12 years	(274) 7.6	(218) 7.4	(56) 8.5	<.001
Highschool diploma/GED	(964) 26.6	(801) 27.1	(163) 24.7	
Some college/technical school	(1348) 37.2	(1035) 35.0	(313) 47.5	
Bachelor's degree or higher	(1033) 28.5	(906) 30.6	(127) 19.3	
Household income				
< $20,000	(897) 26.2	(703) 25.3	(194) 30.2	<.001
$20,000 – $39,999	(819) 23.9	(634) 22.8	(185) 28.8	
$40,000 – $59,999	(589) 17.2	(477) 17.1	(112) 17.4	
$60,000 – $79,999	(419) 12.2	(350) 12.6	(69) 10.7	
$80,000 – $99,999	(274) 8.0	(239) 8.6	(35) 5.4	
$100,000 or more	(428) 12.5	(380) 13.7	(48) 7.5	
Employment				
Employed (Full- or part-time)	(1947) 53.8	(1646) 55.6	(301) 45.7	<.001
Unemployed, not seeking	(1068) 29.5	(804) 27.1	(264) 40.1	
Unemployed, looking	(357) 9.9	(294) 9.9	(63) 17.6	
Student	(149) 4.1	(130) 4.4	(19) 2.9	
Other	(101) 2.8	(89) 3.0	(12) 1.8	
No. of Medical Conditions				
None reported	(2005) 55.4	(2005) 67.7	(0) 0.0	<.001
1-2	(460) 12.7	(412) 13.9	(48) 7.3	
3-4	(516) 14.2	(367) 12.4	(149) 22.6	
5 or more	(641) 17.7	(179) 6.0	(462) 70.1	
Health insurance				
Yes	(2903) 80.2	(2353) 79.5	(550) 83.5	.02
No	(715) 19.8	(606) 20.5	(109) 16.5	
Rural/Urban				
Rural	(1350) 37.3	(1092) 36.2	(258) 39.2	0.27
Urban	(2272) 62.7	(1871) 63.1	(401) 60.8	
Unmet treatment need				
Yes	(1006) 27.8	(715) 24.2	(291) 44.2	<.001
No	(2611) 72.2	(2243) 75.8	(368) 55.8	
Medical cannabis license				
Yes	(852) 23.5	(499) 16.9	(353) 53.6	<.001
No	(2766) 76.5	(2460) 83.1	(306) 46.4	

Past 30-day cannabis use				
Yes	(1157) 33.5	(703) 25.0	(454) 72.1	<.001
No	(2289) 66.4	(2113) 75.0	(176) 27.9	
Past 30-day cigarette use				
Yes	(1235) 34.5	(894) 30.5	(341) 52.1	<.001
No	(2349) 65.5	(2035) 69.5	(314) 47.9	
Past 30-day alcohol use				
Yes	(1737) 48.5	(1377) 47.1	(360) 54.8	<.001
No	(1846) 51.5	(1549) 52.9	(297) 45.2	
Past 30-day Rx painkillers				
Yes	(656) 18.1	(431) 14.5	(225) 34.1	<.001
No	(2966) 81.9	(2532) 85.5	(434) 65.9	
Past 30-day illicit drug use				
Yes	(809) 22.5	(554) 18.9	(255) 38.7	<.001
No	(2784) 77.5	(2380) 81.1	(404) 61.3	
Wave				
2	(1826) 50.4	(1512) 51.0	(314) 47.6	.12
3	(1796) 49.6	(1451) 49.0	(345) 52.4	

Note. Health insurance was dichotomized for analyses as no insurance vs any insurance (Medicare, Medicaid, private insurance, military insurance). Prescription painkillers included opioids, such as hydrocodone, buprenorphine, codeine, fentanyl, and illicit drugs included cocaine, crack, meth, heroin.

Differences Between Participants With and Without Chronic Pain

Compared to participants without chronic pain, a higher proportion of participants with chronic pain were female (58.9% vs. 52.7%), unemployed (40.1% vs. 27.1%), and reported having some college or technical school education (47.5% vs. 35.0%). A larger proportion of adults with chronic pain also reported unmet treatment need (44.2% vs. 24.2%), endorsed 5 or more medical conditions (70.1% vs. 6.0%), and had a medical cannabis license (53.6% vs. 16.9%). Similarly, concerning substance use, a higher proportion of those with chronic pain reported past 30-day cannabis use (72.1% vs. 27.9%), past 30-day prescription pain medication use (34.1% vs. 14.5%), past 30-day alcohol use (54.8% vs. 47.1%), past 30-day cigarette use (52.1% vs. 30.5%), and past 30-day illicit drug use (38.7% vs. 18.9%). The proportion of participants with chronic pain (vs. those without chronic pain) did not significantly differ across study waves (47.6% vs. 52.4%).

Associations of Rurality and Chronic Pain with Past 30-day Cannabis Use

Table 2 shows results of the adjusted binary logistic regression of the main and interactive effects of rurality and chronic pain on the odds of past 30-day cannabis use. Results showed a main effect of chronic pain, but no significant interaction of chronic pain with rurality emerged. Specifically, having chronic pain (vs. no chronic pain) was associated with increased odds of reporting past 30-day cannabis use (*aOR* = 8.90, 95% CI = [6.83-11.61]), after adjusting for covariates, yet there was no main effect of rurality on increased odds of reporting past 30-day cannabis use (*aOR* = 0.91, 95% CI = [0.76-1.09]).

Table 2. *Adjusted Logistic Regression Model of of the Main and Interactive Effects of Chronic Pain and Rurality with Past 30-day Cannabis Use*

	Any past 30-day cannabis use (vs no past 30-day use)	
	AOR (95% CI)	*p*
Chronic Pain		
No	Ref	
Yes	8.90 (6.83, 11.61)	<.001
Rural vs. Urban		
Urban	Ref	
Rural	0.91 (0.76, 1.09)	.31
Chronic pain x rurality	1.11 (0.73, 1.68)	.62

Note. Models control for age, race/ethnicity, and health insurance status (none vs any). Ref=Reference group.

Associations of Rurality and Unmet Treatment Need with Past 30-day Cannabis Use, Stratified by Chronic Pain Status

Table 3 presents results of adjusted binary logistic regression models of the main and interactive effects of rurality and unmet treatment need among those with and without chronic pain. Among those with chronic pain, a significant interaction of rurality and unmet treatment need emerged on past 30-day cannabis use (*aOR* = 2.39, 95% CI = [1.11, 5.14]). In explicating the interaction, among those with chronic pain, the odds of reporting past 30-day cannabis were nearly two times greater for rural residents who experienced unmet treatment need compared to urban residents with unmet treatment need (*aOR* = 1.97, 95% CI = [1.05-3.69]); while there was no association between rurality and increased odds of past 30-day cannabis among those who did not report unmet treatment need (*aOR* = 0.74, 95% CI = [0.46-1.19]). See Figure 1 for proportions of respondents with chronic pain who reported past 30-day cannabis use, stratified by rural and unmet treatment need status.

No main effects of either rurality (*aOR* = 0.74, 95% CI = [0.46, 1.19]) or unmet treatment need (*aOR* = 1.21, 95% CI = [1.53-2.48]) emerged.

Among those without chronic pain, no significant interaction emerged, but a main effect of unmet treatment need did. Specifically, those with unmet treatment need (vs. met treatment need) had higher odds of reporting past 30-day cannabis use (*aOR* = 1.95, 95% CI = [1.53-2.48]). There was no main effect of rurality on increased odds of past 30-day cannabis use (*aOR* = .93, 95% CI = [0.74-1.16]).

Table 3. *Adjusted Logistic Regression Model of the Main and Interactive Effects of Rurality and Unmet Treatment Need with Past 30-day Cannabis Use, Stratified by Chronic Pain Status (yes/no)*

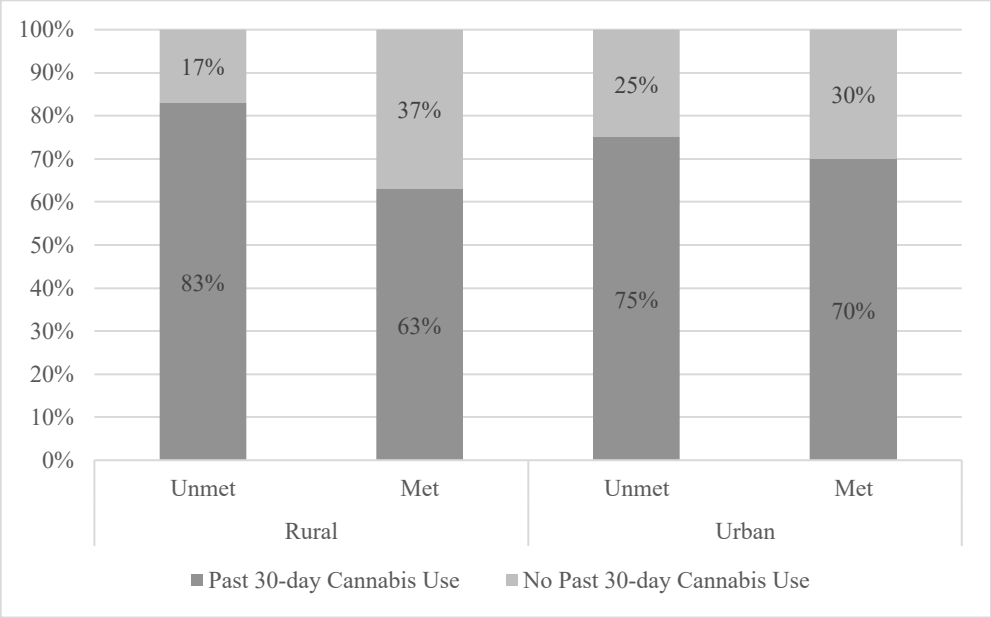
	Any past 30-day cannabis use (vs. no past 30-day use)	
	AOR (95% CI)	*p*
Participants with chronic pain (*N*=630)		
Rural vs. Urban		
Urban	Ref	
Rural	0.74 (0.46, 1.19)	.22
Unmet treatment need		
No	Ref	
Yes	1.21 (0.75, 1.94)	.44
Rural x unmet treatment need	2.39 (1.11, 5.14)	.03
Participants without chronic pain (*N*= 2809)		
Rural vs. Urban		
Urban	Ref	
Rural	0.93 (0.74, 1.16)	.51
Unmet treatment need		
No	Ref	
Yes	1.95 (1.53, 2.48)	<.001
Rural x unmet treatment need	0.95 (0.63, 1.43)	.79

Note. Models control for age, race/ethnicity, and health insurance status (none vs any). Ref = Reference group.

Post-hoc Analyses

Given the overlap between chronic pain and possession of a MCL (e.g., 53.4% of those with chronic pain reported having an MCL), we re-analyzed the model that included individuals with chronic pain and included MCL as a covariate. Results showed that the interaction between unmet treatment need and rurality inclusion among those with chronic pain was no longer significant once possession of an MCL was included as a covariate in the model. The odds of past 30-day cannabis use was 11 times greater among those with chronic pain with an MCL (*aOR* = 11.08, 95% CI = [7.01, 17.50], p <.001). The interactive effect of rurality and chronic pain on the odds of past 30-day cannabis use was not significant (*aOR* = 1.71, 95% CI = 0.72, 4.07, p = 0.22). There were no significant main effects of rurality (*aOR* = 0.90, 95% CI = 0.52, 1.55, p = 0.71), nor unmet treatment need (*aOR* = 1.61, 95% CI = [0.94, 2.77], p = 0.08).

Figure 1. *Association of Rurality and Unmet Treatment Need with Proportion of Past 30-day Cannabis Use Among Those with Chronic Pain*



DISCUSSION

In this sample of adults in Oklahoma, about 20% reported chronic pain, which is consistent with previously published U.S. population-based studies (Dydyk & Conermann, 2023; Yong et al., 2022). Overall, those with chronic pain reported worse overall physical health and more substance use than those without chronic pain. Consistent with other published work (Martel et al., 2018), adults with chronic pain in our sample were more likely to be female, have lower income and education, and to be unemployed; all of which are factors that could exacerbate chronic pain symptoms and/or treatment utilization (Huffman et al., 2019). People with chronic pain frequently experience co-occurring medical conditions and often have difficulty accessing treatment (Foley et al., 2021), as shown by our findings that 70.2% of participants with chronic pain reported having at least 5 medical conditions or more and 44.2% reported having unmet treatment need in the past year. Unmet treatment need may exacerbate pain intensity and interference, both of which are associated with high-frequency cannabis use (Boehnke et al., 2020; John & Wu, 2020). In our sample, 70% of those with chronic pain reported past 30-day cannabis use, which is much higher than recent national estimates showing that in medically legal cannabis states, 25% of those with chronic pain reported ever using cannabis (Leung et al., 2022). Further, 54% of those with chronic pain (compared to 17% of those without chronic pain) reported having an MCL issued by the

Oklahoma Medical Marijuana Authority. This may be a by-product of Oklahoma's permissive policy environment, easy access to an MCL, and the wide availability of cannabis dispensaries in Oklahoma (Cohn, Sedani, et al., 2023). Notably, in Oklahoma, approximately 10% of all adults have an MCL (Marijuana Policy Project, 2023).

We also evaluated associations among rurality, chronic pain, and unmet treatment need on past 30-day cannabis use, while controlling for age, race, and health insurance. Previous studies have typically found that cannabis use tends to be higher among those with chronic pain versus those without, but findings have been mixed regarding rurality (Day & Thorn, 2010; Eaton et al., 2018). We identified that individuals with chronic pain were eight times more likely to report past 30-day cannabis use, but no difference was found between those who were rural dwelling versus those urban dwelling on propensity to engage in past 30-day cannabis use. When we evaluated the relationship further between rurality and unmet treatment need on past 30-day cannabis, separately across adults with and without chronic pain, we found that adults with chronic pain who were rural dwelling and who reported unmet treatment need were almost two times more likely to report past 30-day cannabis use compared to urban dwelling adults with chronic pain and unmet treatment need. In contrast, those individuals without chronic pain who had unmet treatment need were also two times more likely to report cannabis use; however, in this case, rural or urban dwelling status did not seem to play a role in their cannabis use. These findings highlight the importance of individuals' unmet treatment need when considering their propensity to engage in cannabis use. This may be especially true for adults with chronic pain who are living in rural areas.

Historically, rural individuals with chronic pain have been less likely to have access to specialty pain management care and more likely to use prescription opioids for pain management (Eaton et al., 2018). As more states legalize cannabis for medical (and/or recreational) use, it may be that rural residents are using cannabis to self-medicate their pain symptoms. While our study did not investigate the specific medical conditions for which participants were using cannabis, Kendzor et al. (2022) found that chronic pain ranked among the primary reasons for medical cannabis use within Wave 1 of this sample. Once possession of a MCL was included in the analytic model, the interaction of rurality and unmet treatment need, among adults with chronic pain, was no longer significant. This suggests that legalized use, via possession of a legal medical license, may serve as a more direct proxy of the associations between rurality and unmet treatment and cannabis use than each factor separately. Three times as many adults with chronic pain (vs. no chronic pain) reported having an MCL (54% vs. 16%), even though adults with chronic pain were overall more likely to have unmet treatment need.

The legalization of medical cannabis may influence use among chronic pain patients as an alternative therapy option. More research is needed to understand what factors motivate chronic pain patients to seek out alternative therapies such as cannabis. Future research should investigate whether patients are using cannabis to replace evidence-based, pharmacological and non-pharmacological chronic pain treatments. Examining if and why substitution is occurring will provide greater insight into how the legalization of medical cannabis could be impacting those with chronic pain and their healthcare decisions. For example, in Oklahoma, license application fees are significantly lower for adults enrolled in Medicaid or Medicare ($20) compared to those without such coverage ($100), which may encourage individuals facing barriers to accessing traditional medical care to pursue medical cannabis as a potential treatment option (OMMA, 2024).

This study extends previous work by clarifying the conditional effects of chronic pain, rural residence, and unmet treatment need on risk for cannabis use (Eaton et al., 2018; Park & Wu, 2017). The use of medical cannabis for chronic pain treatment often fails to align with actual medical guidelines or be administered by medical healthcare professionals, resulting in unintended overdose or poisoning, higher risk consumption modalities (e.g., smoking, vaping), higher rates of co-use with prescription opioids (34% in this sample), and greater negative adverse events (e.g., car accidents, falls) (Azizoddin et al., 2023; Busse et al., 2021). Additionally, in Oklahoma, a recent assessment found that 55% of patients with an MCL still obtain at least some of their cannabis from illicit sources (Mudd et al., 2023), which can

place them at a higher risk for using contaminated supply (e.g., contains pesticides or microorganisms), using more than intended due to mislabeling, or legal issues (Boehnke et al., 2020; MacCallum et al., 2023). Future research should examine access to cannabis (both licit and illicit) and sources of cannabis purchasing specifically among rural dwelling adults living with chronic pain.

This study had several limitations. First, while we assessed unmet treatment need, we did not measure factors impacting unmet treatment need, including distance to treatment provider(s), perceptions of trust/distrust of the medical care system, and knowledge about how to find a chronic pain treatment provider (among others). Additionally, our measure of unmet treatment need was selected as it aligns with the NSDUH and provides greater generalizability; however, it does not allow us to discern whether the unmet treatment need stemmed from chronic pain issues specifically or other medical conditions. Similarly, while the measurement of past 30-day cannabis use aligns with national surveys, it lacks granularity, such as frequency and modality of use. Future work can extend these findings by examining unmet treatment need specifically related to chronic pain symptoms and while using a more detailed assessment of cannabis use to evaluate patient outcomes. Another limitation is that our data are cross-sectional, restricting the ability to conclude whether unmet treatment need and rurality lead to cannabis use, or whether cannabis use leads to greater pain and unmet treatment need. Future work should examine the longitudinal linkages between cannabis use and treatment need among rural/urban adults with chronic pain to further illuminate the impact of cannabis use on pain outcomes and the potential interaction with treatment availability. Lastly, data collection occurred in Oklahoma, a legal medical cannabis state, with high rates of both uninsured and rural residents. Findings may not generalize to states without legal medical cannabis, or states with a higher proportion of urban dwelling and insured residents.

Conclusion

In this large sample of adults from Oklahoma, rural dwelling individuals with unmet treatment need and chronic pain appear to be uniquely at risk of cannabis use and could benefit from targeted community efforts for chronic pain treatment, as well as education on cannabis use and harm reduction strategies to inform healthcare decision-making. The consequences resulting from the lack of treatment providers and increased use of cannabis for self-management of chronic pain suggest that some of the most vulnerable populations may offset traditional medical treatment for an unsupported but widely available alternative—cannabis.

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