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Cannabis use patterns among people with HIV before and after legalization

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HIGHLIGHTS

- Prevalence of current and daily cannabis use did not change among people with HIV following legalization of recreational use.
- Severity of use mostly plateaued, but may decrease following legalization.
- Relaxation of cannabis policy does not appear to result in increases in use among people with HIV.

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ABSTRACT

Background: Cannabis use is highly prevalent and detrimental among people with HIV (PWH). Legislative changes in several states altered the legality and accessibility of cannabis. We examined pre-post legislative changes in current, daily, and severe use in PWH in clinical care.
Methods: PWH engaged in the Centers for AIDS Research Network of Integrated Clinical Systems (CNICS) cohort from 3 sites/states were asked about past 3-month cannabis use on a routine clinical assessment of health behavior before and after legalization. A fourth site in a state without legalization served as a comparator. We used linear regression to estimate changes in use prevalence from 1 year before to 1 year after legalization.
Results: Among PWH (n=7885), from 1 year before to 1 year after legalization, cannabis use prevalence increased slightly in Boston, MA (32–38 %), Birmingham, AL (26–27 %), and San Diego, CA (25–29 %); and decreased in Seattle, WA (44–41 %). Contemporaneously, daily cannabis use increased modestly (less than 5 %) at all sites. Severe use (cannabis-specific ASSIST score $\geq$27) decreased or plateaued at all sites. No site showed significant change in prevalence trends of current, daily, or severe use 1 year before and after legalization in linear regression ($p > 0.05$).
Conclusion: Few changes prevailed in cannabis use patterns around dates of legalization among PWH in care in the U.S. Relaxation of cannabis policy does not appear to result in an immediate increase in use among PWH.

1. Introduction

The prevalence of cannabis use among people with HIV (PWH) in the U.S. is much higher than the general population (Shiau et al., 2017). Studies have reported about a third of PWH using cannabis in the past year, compared to 11–23 % of persons without HIV (Center for Behavioral Health Statistics and Quality, 2016; Crane et al., 2021; Prentiss et al., 2004; "Results from the 2023 National Survey on Drug Use and Health: Detailed tables.," 2024; Shiau et al., 2017). Cannabis use among the general population has been associated with numerous adverse outcomes including addiction/dependence, chronic bronchitis, and more frequent motor vehicle accidents (Volkow et al., 2014). Conversely, there are also several potential benefits of cannabis use among PWH and the general population, including management of

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anxiety, insomnia, appetite, and pain (Campbell et al., 2020; Greenwald et al., 2023; Javanbakht et al., 2022; Laper et al., 2024). Such benefits have also been reported among sexual and gender minorities, a population with similarly high rates of cannabis use as PWH (Canada, 2023).

Cannabis use also has implications for HIV transmission through increased sexual risk behavior (Dirks et al., 2012; Mimiaga et al., 2013). Among men who have sex with men (MSM), cannabis use has been associated with increased odds of using two or more stimulants (Swartz and McCarty-Caplan, 2018), impulsive sexual decision-making/risk-taking (Zhang and Wu, 2017), and condomless anal sex outside main concordant partnerships (Kelly et al., 2016). Additional potential harms specific to PWH include decreased engagement in care and reduced adherence to antiretroviral therapy (ART) (Bahji et al., 2022; Dietz et al., 2010; Kipp et al., 2017; Kuhns et al., 2016; Montgomery et al., 2019; Newville et al., 2015). More frequent cannabis use (e.g., more than once a week or daily use) has been associated with poorer HIV-care appointment adherence (Dietz et al., 2010; Hartzler et al., 2018; Kipp et al., 2017). Findings have been mixed regarding associations between cannabis use and adherence to ART but are suggestive of a negative impact on adherence at higher frequency of use (Bonn-Miller et al., 2014; Kuhns et al., 2016; Newville et al., 2015; Sinha et al., 2017). Overall, the body of evidence supports the deleterious association between cannabis use and engagement with the HIV care continuum. However, elucidation of more nuanced impacts of cannabis use upon PWH has been hampered by smaller, often cross-sectional, studies and lack of comprehensive clinical data, which make causal inference difficult (Dietz et al., 2010; Kipp et al., 2017; Montgomery et al., 2019; Zhang et al., 2018).

Increases in cannabis use over the past decade in the U.S. (Kerr et al., 2018) and increased social acceptability of nonmedical cannabis in post-legalization contexts (Clarke et al., 2018; Rusby et al., 2018), may contribute to evidence of small increases in prevalence of cannabis consumption following legalization, especially among younger adults (Farrelly et al., 2023). Early studies have primarily focused on college students, among whom post-legalization cannabis use increased only among those reporting heavy alcohol use in Oregon (Kerr et al., 2017), whereas among students in Washington, it increased overall (Miller et al., 2017). Another study identified small increases (2–5 %) in prevalence of past-month cannabis use among young adults (aged 18–23 years) (Kerr et al., 2023). A recent systematic review highlighted the increases observed among younger adults and reported more mixed findings among general population adults, then concluded that, overall, nonmedical cannabis legalization does not appear to have large magnitude impacts on cannabis use and related outcomes (Farrelly et al., 2023).

Cannabis consumption patterns pre- and post-legalization among PWH, particularly beyond college ages, remain poorly understood. A qualitative study among young men with HIV in Denver and Chicago who accessed cannabis through dispensaries reported perceived superiority of quality and safety of cannabis products (Alon et al., 2021). Another qualitative study among PWH in Seattle and Boston found that one-third increased cannabis use following legalization (Fredericksen et al., 2023). These qualitative studies have been limited to ~30 PWH each and did not assess overall trends in cannabis consumption (Alon et al., 2021; Fredericksen et al., 2023). One recent study among PWH in Florida assessing cannabis use patterns during the COVID-19 pandemic in the absence of legal status change, found that between 2020 and 2021, 13 % of respondent decreased cannabis use whereas 11 % increased and 76 % reported no change (Parisi et al., 2023). In a study comparing 397 PWH in Colorado with those in Ohio, participants in Colorado where more likely to identify benefits of use and less likely to identify risks however, the legal status of cannabis did not affect their frequency of cannabis use and the authors concluded that there may not be an impact of legalization on cannabis use patterns (Laper et al., 2024). Real-world data on patterns in use surrounding legalization changes among PWH remain scarce, limiting our ability to understand whether changes, particularly increases in use, occur following legalization. We sought to determine whether increases in prevalence of current, daily, or severe use of cannabis occurred following statewide legalization of cannabis policies among PWH.

2. Methods

2.1. Centers for AIDS Research Network of Integrated Clinical Systems (CNICS) cohort

CNICS is a longitudinal, observational study of PWH aged 18 years and older receiving primary care at ten geographically diverse HIV clinics across the United States from 1995 to the present (Kitahata et al., 2008). The CNICS data repository systematically captures comprehensive clinical data from all outpatient and inpatient encounters for PWH in CNICS including demographic, diagnosis, medication, and laboratory data from electronic health records (EHR) and other institutional data systems (Kitahata et al., 2008). CNICS was created to better define the relationship between patient and treatment factors and long-term clinical outcomes among PWH in the ART era. CNICS has been approved by Institutional Review Boards at each site.

2.2. Study participants and data

PWH completed the CNICS self-administered, tablet-based clinical assessment of patient reported measures and outcomes (PROs) including cannabis use items as part of routine clinical care visits every ~6 months. We reframed the continuous collection of PROs into quarterly periods by grouping all assessments within a given 3-month window for each quarter. We examined PRO data in the time periods during which there were legal status changes for nonmedical cannabis use at three CNICS sites: University of Washington (Seattle, WA), legalized on 12/06/2012; Fenway Health/Harvard University (Boston, MA), legalized on 12/15/2016; and University of California San Diego (San Diego, CA), legalized on 11/8/2016 (Supplemental Table 2). We also included University of Alabama at Birmingham (Birmingham, AL) which did not undergo legal status change for nonmedical use as a comparison site for the corresponding timeframe to each of the three sites with a legalization change. There were two Birmingham time periods: one denoted as "Birmingham (1)" for the corresponding legalization period in San Diego and Boston (which had overlapping legalization time periods), and a second denoted as "Birmingham (2)" for the legalization period in Seattle. Several legal status change dates occurred outside of the study period and/or focus (e.g., decriminalization) and were thus not analyzed (Supplemental Table 2). We utilized quarterly point prevalence data regarding cannabis use collected on PWH in the one year before and after changes in legal status.

Data on cannabis use were collected using a modification of the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST). We considered three measures of cannabis use as outcomes: (1) current use, within the past 3 months; (2) daily use; and (3) severe use, defined by an ASSIST score $\geq$27 (Humeniuk et al., 2008; Humeniuk et al., 2010; Newcombe et al., 2005). We also considered an alternative cut point for severe use at ASSIST score $\geq$10, which has been identified as a level corresponding to abuse/dependence (Humeniuk et al., 2008). Approximately 2 % of PWH had incomplete data for the ASSIST substance use measure on the CNICS PROs and thus were not included.

2.3. Statistical analyses

Proportion of PWH reporting cannabis use, daily cannabis use, and severe use were calculated for each three-month quarterly period of time based on responses in the CNICS PROs completed during the time period of interest. PWH contributed to any and all quarters in which they completed a PRO assessment. Changes in prevalence trends for each of the three outcomes (current use, daily use, and severe use at $\geq$27 and

≥10) before and after legalization date at each site were modeled using linear regression adjusted for time with an interaction term between time and duration of time after legalization. We calculated the difference in slope before and after legalization change to assess whether the legalization of cannabis impacted use trends. In summary, we evaluated cannabis use trends from 1 year prior to the legalization change to 1 year following the change at each site, so slope comparisons were based on before legalization vs. after. For each site, we conducted pre-post models, where the pre-legalization period acts as the 'control' period in comparison to post-legalization. We also included a fourth site (Birmingham, AL) during the corresponding time frame as an example of the level of variability in cannabis use that could occur naturally in the absence of legalization. Analyses were conducted using Stata version 18 (StataCorp, College Station, Texas, USA).

3. Results

Overall, 7885 unique PWH completed the cannabis questions during the two-year time period of interest for each site, with 18,595 responses overall. Demographic characteristics before and after legislative change date for each site are presented in Table 1. Age, sex, and race/ethnicity composition was similar before and after legislative change dates at each site. The number of respondents and total PROs are summarized by site in Supplemental Table 1. Current (past 3 month) cannabis use prevalence increased slightly at Boston (32–38 %), San Diego (25–29 %), and at Birmingham (1) (26–27 %) during the comparison timeframe and decreased at Seattle (44–41 %) with no change at Birmingham (2) (24–24 %) during the comparison timeframe. Daily cannabis use increased with an absolute change less than 5 % at all sites. Severe use (cannabis-specific ASSIST score ≥27 and ≥10) decreased at Boston, San Diego, and Birmingham (1), and increased by 1 % at Seattle and Birmingham (2) for the cut-point at 27 and by 4–6 % for the cut-point at 10 (Table 1).

None of the sites showed a significant change in the slope of point prevalence of current use from 1 year before to after legal changes (p-values: 0.9 [Seattle], 0.8 [Boston], 0.4 [San Diego]; Table 2, Fig. 1). Similarly, no site demonstrated a significant change in the slope of point prevalence of daily cannabis use from 1 year prior to 1 year after legal changes (p-values: 0.3 [Seattle], 0.1 [Boston], 0.4 [San Diego]; Table 3, Fig. 2). For cannabis-specific severity, we also found no significant changes in slope using the ASSIST ≥27 cut-point (p-values: 0.054 [Seattle], 0.1 [Boston], 1.0 [San Diego]), and a marginally significant decrease (-19.8; 95 % Confidence Interval: −37.2, −2.4, p-value: 0.03) at the Seattle site only when using the ASSIST ≥10 cut-point (p-values: 0.2 [Boston], 0.2 [San Diego]; Tables 4–5, Figs. 3–4).

Table 2
Change in the proportion of PWH who reported cannabis use from 1 year before to 1 year after state legal change.

Seattle (12/6/2012)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Seattle	1.3 (−13.9, 16.5) 0.8	2.6 (−13.9, 19.2) 0.7	1.3 (−28.7, 31.3) 0.9
Birmingham (2)	1.2 (−4.5, 6.8) 0.6	0.1 (−6.1, 6.2) 1.0	−1.1 (−12.3, 10.0) 0.8
Boston (12/15/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Boston	1.2 (−26.5, 28.8) 0.9	−3.6 (−35.5, 28.2) 0.8	−4.8 (−61.2, 51.6) 0.8
Birmingham (1)	0.1 (−8.3, 8.4), 1.0	−0.9 (−10.5, 8.8) 0.8	−0.9 (−18.0, 16.1) 0.9
San Diego (11/8/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
San Diego	0.1 (−7.2, 7.4) 1.0	5.0 (−1.7, 11.6) 0.1	4.9 (−8.2, 17.9) 0.4
Birmingham (1)	0.5 (−8.3, 9.4) 0.9	−1.1 (−9.2, 6.9) 0.7	−1.7 (−17.6, 14.3) 0.8

4. Discussion

In this study we explored trends in point prevalence of cannabis use, daily use, and severe use with respect to legalization among PWH in care across the US in the current treatment era and found no significant changes in use following legalization, with the exception of a decline in severe use in Seattle for the ASSIST measure that indicates abuse/dependence (Humeniuk et al., 2008). Prevalence of cannabis use among PWH is higher than the general population (34 % vs. 23 % past-year use) and concerns regarding potential increases in use following legalization are particularly poignant among PWH due to the adverse relationship between cannabis use and the HIV care continuum (Alon et al., 2021; Fredericksen et al., 2023; Kerr et al., 2017; Miller et al., 2017; Montgomery et al., 2019; "Results from the 2023 National Survey on Drug Use and Health: Detailed tables.," 2024; Shiau et al., 2017). This study highlights the high prevalence of cannabis use reported among PWH (ranging from 24 % to 44 % by site), including high prevalence of daily use (6 %-18 % by site) and severe use, via cannabis ASSIST scores ≥27 (5 %-68 % by site) and scores ≥10 (35 %-76 % by site) among PWH reporting current use (Table 1). Several sites showed small, transient increases or decreases in point prevalence of cannabis use around dates of legal status changes (Figs. 1–4) that are unlikely to be clinically meaningful. Most importantly, there were no large or durable increases in reported prevalence, frequency, or severity of use during the study period, which is encouraging given the known adverse impacts of

Table 1
Populations at each site at the visit 1 year before and 1 year following state legal change.

	Boston		**San Diego**		**Birmingham (1)**		**Seattle**		**Birmingham (2)**	
	Before	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
N	81	143	602	454	697	558	194	238	536	674
Age, mean (SD)	47 (10)	48 (12)	47 (11)	49 (12)	46 (11)	46 (11)	45 (9)	46 (11)	45 (10)	45 (11)
Female	1 %	3 %	9 %	11 %	25 %	22 %	15 %	11 %	19 %	24 %
Race/ethnicity										
White	65 %	69 %	44 %	42 %	37 %	37 %	62 %	58 %	46 %	41 %
Black	9 %	8 %	14 %	11 %	61 %	61 %	20 %	23 %	52 %	57 %
Hispanic	17 %	17 %	35 %	39 %	0 %	0.4 %	11 %	12 %	1 %	1 %
Other	9 %	6 %	7 %	8 %	1 %	2 %	6 %	7 %	1 %	1 %
Current cannabis use	32 %	38 %	25 %	29 %	26 %	27 %	44 %	41 %	24 %	24 %
Daily cannabis use	6 %	8 %	8 %	9 %	8 %	9 %	14 %	18 %	6 %	6 %
ASSIST score ≥27 among current users	35 %	31 %	38 %	37 %	68 %	41 %	7 %	8 %	5 %	6 %
ASSIST score ≥10 among current users	50 %	45 %	61 %	55 %	76 %	55 %	36 %	42 %	35 %	39 %

Birmingham (1) corresponds to the control time period for Boston and San Diego
Birmingham (2) corresponds to the control time period for Seattle

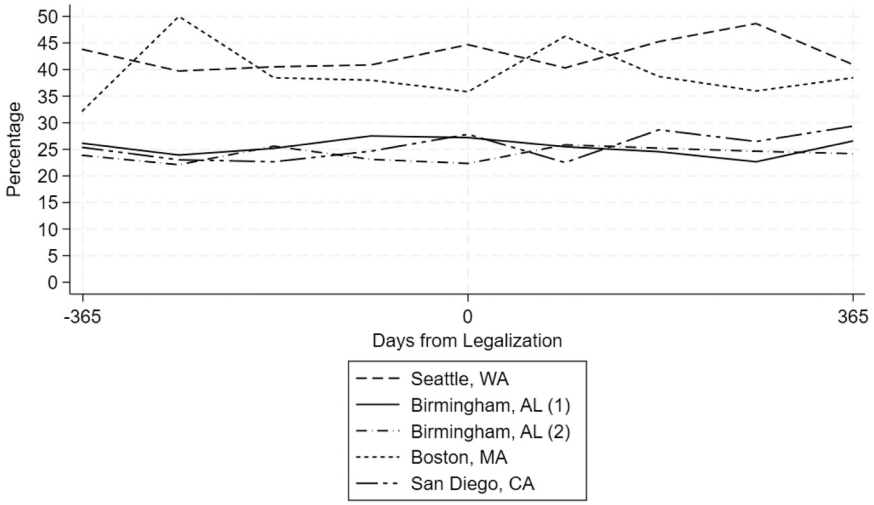

Fig. 1. Prevalence of current Cannabis use by site within 1 year (before and after) of legalization among people with HIV (PWH).

Table 3
Change in the proportion of PWH who reported daily cannabis use from 1 year before to 1 year after state legal change.

Seattle (12/6/2012)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Seattle	5.2 (−0.1, 10.5) 0.052	0.5 (−5.3, 6.2) 0.8	−4.8 (−15.2, 5.7) 0.3
Birmingham (2)	1.6 (0.00, 3.2) 0.050	−1.1 (−2.9, 0.6) 0.1	−2.8 (−6.0, 0.4) 0.1
Boston (12/15/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Boston	10.1 (0.1, 20.1) 0.049	−9.3 (−19.9, 3.2) 0.1	−18.5 (−38.9, 1.9) 0.1
Birmingham (1)	−0.9 (−3.7, 2.0) 0.4	2.5 (−0.8, 5.8) 0.1	3.3 (−2.5, 9.2) 0.2
San Diego (11/8/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
San Diego	−0.4 (−4.0, 3.2) 0.8	1.7 (−1.6, 5.0) 0.2	2.1 (−4.4, 8.5) 0.4
Birmingham (1)	−0.8 (−4.4,2.5) 0.5	2.0 (−1.0, 5.0) 0.1	2.8 (−3.1, 8.6) 0.3

Table 4
Change in the proportion of PWH who currently use cannabis reporting ASSIST score ≥27 from 1 year before to 1 year after state legal change.

Seattle (12/6/2012)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Seattle	8.3 (−2.1, 18.8) 0.1	−11.7 (−23.0, −0.3) 0.046	−20.0 (−40.6, 0.6) 0.054
Birmingham (2)	0.3 (−10.2, 10.9) 0.9	−2.9 (−14.4, 8.6) 0.5	−3.3 (−24.1, 17.6) 0.7
Boston (12/15/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Boston	−14.8 (−41.7, 12.1) 0.2	22.2 (−8.8, 53.2) 0.1	37.0 (−17.8, 91.8) 0.1
Birmingham (1)	−24.1 (−62.0, 13.8) 0.2	14.9 (−28.7, 58.6) 0.4	39.0 (−38.2, 116.2) 0.2
San Diego (11/8/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
San Diego	0.0 (−12.7, 12.7) 1.0	0.4 (−11.3, 12.0) 0.9	0.4 (−22.6, 23.3) 1.0
Birmingham (1)	−27.7 (−65.6, 10.1) 0.1	13.4 (−21.1, 48.0) 0.3	41.2 (−26.9, 109.3) 0.2

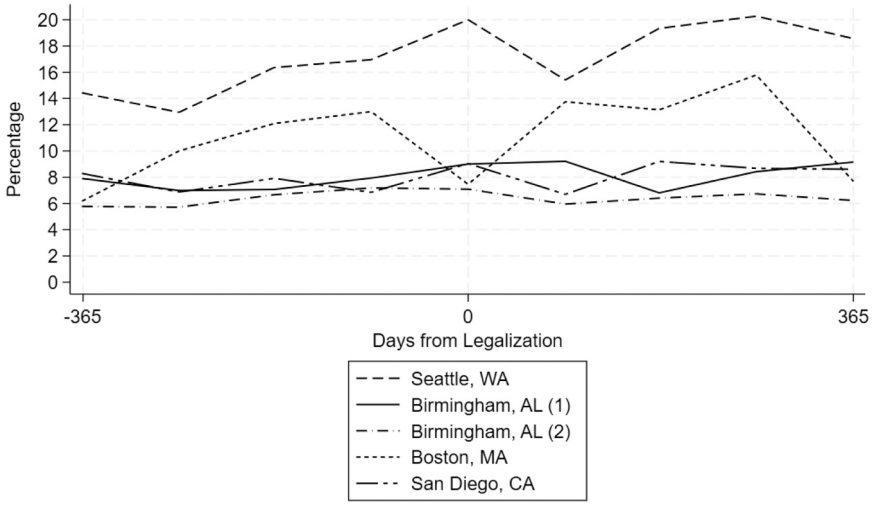

Fig. 2. Prevalence of daily Cannabis use by site within 1 year (before and after) of legalization among people with HIV (PWH).

Table 5
Change in the proportion of PWH who currently use cannabis reporting ASSIST score ≥10 from 1 year before to 1 year after state legal change.

Seattle (12/6/2012)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Seattle	11.0 (2.2, 19.8) 0.03	−8.8 (−18.4, 0.8) 0.06	−19.8 (−37.2, −2.4) 0.03
Birmingham (2)	0.4 (−20.9, 21.7) 1.0	−0.0 (−23.1, 23.1) 1.0	−0.4 (−42.4, 41.6) 1.0
Boston (12/15/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
Boston	−10.3 (−35.5, 14.9) 0.3	15.2 (−13.8, 44.2) 0.2	25.5 (−25.8, 76.8) 0.2
Birmingham (1)	−11.3 (−46.2, 23.6) 0.4	6.1 (−34.1, 46.2) 0.7	17.4 (−53.7, 88.5) 0.5
San Diego (11/8/2016)	**Slope before** β (95 % CI) p-value	**Slope after** β (95 % CI) p-value	**Slope change** β (95 % CI) p-value
San Diego	−9.0 (−26.2, 8.2) 0.2	7.9 (−7.8, 23.7) 0.2	17.0 (−14.0, 48.0) 0.2
Birmingham (1)	−13.5 (−50.0, 22.8) 0.4	5.9 (−27.3, 39.0) 0.6	19.4 (−46.0, 84.8) 0.5

cannabis use on engagement in care and ART adherence among PWH (Bahji et al., 2022; Hartzler et al., 2018; Kipp et al., 2017; Montgomery et al., 2019). Our findings align with another study that concluded legalization changes may not impact cannabis use patterns among PWH (Laper et al., 2024).

4.1. Behavioral response to legal status of cannabis

The public health concern of rampant, high-level use after relaxation of cannabis laws was not supported by our data, which notably was among PWH where rates were already high (Shiau et al., 2017). No site showed clinically meaningful changes in the prevalence of current or daily cannabis use. The Seattle site demonstrated a marginally significant trend towards *decreasing* prevalence of severe use for the cut-point for abuse/dependence (ASSIST ≥10) while other sites showed no significant trend. Overall, our two cut points for severe use showed very similar results. Given that the ASSIST measure combines internal (desire/urge) and external (health, social, legal, or financial problems) factors, we suspect that this may reflect a changing legal and social environment and a possible decline in perceptions of societal concerns about cannabis use following legalization. This theory is consistent with qualitative findings on the topic, though these findings should be further evaluated in additional settings (Fredericksen et al., 2023). We conclude that relaxation of laws proscribing cannabis use did not correlate with clinically meaningful or durable increases in cannabis use among PWH, consistent with similar work in other settings (Laper et al., 2024). Given that PWH already have high prevalence and frequency of cannabis use and that cannabis use behavior is likely impacted by numerous factors (e.g. HIV symptoms, social acceptability, and cost/availability), these findings suggest that statewide cannabis policy has relatively small impact upon cannabis use behavior among PWH in care.

4.2. Future studies

This study captured prevalence, frequency, and severity of use of cannabis during a period of changing legal status, yet far less is known about changes in accessibility, changes in delivery (edibles, vaping, smoking, topicals), and changes in other substance use behaviors: for example, cannabis leading to use of other substances, or co-use of cannabis with other substances. Additionally, we focused on the immediate (1 year) pre- and post-legalization period to target short-term changes in nonmedical cannabis use during this timeframe and did not assess cannabis use in the context of commercialization due to the nuanced and complex process of market evolution, involving several external factors (e.g., state laws and taxes, advertisement)(Hall et al., 2019). Further, we suspect that participants within different demographic groups experience unequal degrees of law enforcement pressure based on demographic and other characteristics. It would therefore be possible that initial variations of perceived legal/social risk of cannabis use may lead to unequal effects on cannabis use behavior after legalization. This may be at play between regions and for different demographic groups. These issues would be best clarified via a combination of qualitative methodology and quantitative questionnaires.

The present study was not able determine which PWH used medical cannabis prior to or after the legalization of nonmedical cannabis. Our data, as reported by participants, combines medical and nonmedical use as it has been previously documented that the use patterns highly overlap, with many people using medical cannabis for nonmedical purposes or people using nonmedical products to address various symptoms with or without clinical guidance (Esposito-Smythers et al., 2014; Montgomery et al., 2019). It is possible that little lasting change is seen in patterns of cannabis use among PWH because most people who were interested in using cannabis did so via medical licensure or due to widespread extra-legal access and thus did not experience a major change following statewide legalization for nonmedical use. Future

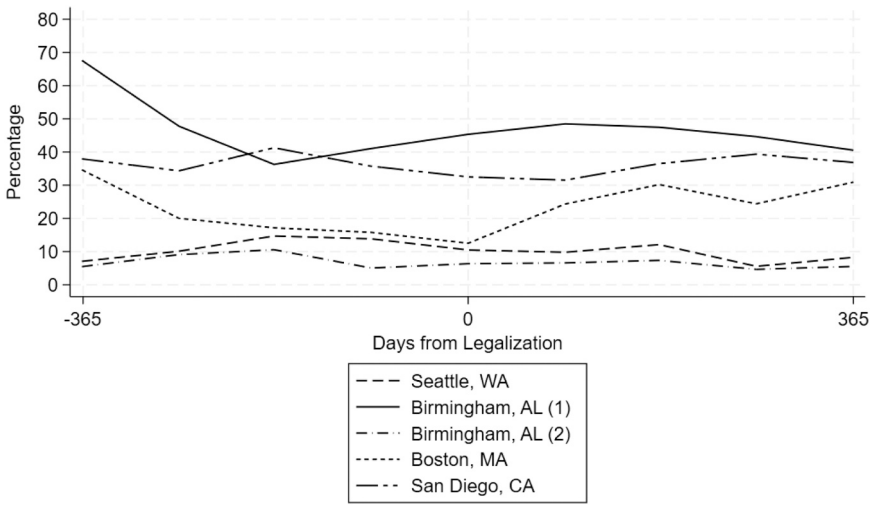

Fig. 3. Prevalence of severe use (ASSIST score ≥27) among current cannabis users by site within 1 year (before and after) of legalization among people with HIV (PWH).

Fig. 4. Prevalence of severe use (ASSIST score ≥10) among current cannabis users by site within 1 year (before and after) of legalization among people with HIV (PWH).

studies differentiating participants with and without access to medical cannabis prior to legalization would help elucidate this phenomenon.

4.3. Strengths

A strength of this study is the large, geographically diverse cohort of PWH in treatment provided by the CNICS collaboration. The cohort represents the changing epidemiology of HIV in multiple regions across the U.S. with substantial numbers of women, racial and ethnic diversity, and an aging population. These aspects make findings from this group reasonably generalizable to PWH in care in the U.S. Additionally, the granularity of our data allowed for assessment of three different measures of use, including two versions for severe use. The inclusion of comprehensive measurements of use frequency and use of ASSIST, a robust, validated tool for measurement of severity of substance use, allows assessment of important and nuanced factors related to use.

4.4. Limitations

Several limitations are important to note. One limitation of our observational cohort-based approach is that testing of associations fails to yield underlying reasons for consistent or heavy use of cannabis among PWH following legislation changes. Qualitative studies exploring motivations for use and how PWH experienced legalization would help clarify the reasons. Additionally, modelling legislative change as single dates is an inherent limitation of our study. We focused on nonmedical legalization as our timepoint of interest, rather than decriminalization or medicinal cannabis legalization, which could restrict our ability to observe discrete changes from illegal to legal status. It has been established that cannabis legislative change is gradual and multifaceted starting with increased public discourse and lessened stigma, proceeding with debate among policymakers, culminating in statutory changes which are subsequently manifested as alterations of enforcement patterns. Social acceptance, concerns about legal risk, and/or willingness to disclose use could have changed progressively during this transitional period, resulting in failure to observe a change in use patterns based on a single point in time. CNICS is limited to academic clinical sites, so these findings may not generalize to PWH who attend other HIV clinics for their primary care or are in different regions or states than included in this analysis, which could experience different external factors that impact cannabis use patterns. Finally, cannabis use was self-reported, which could be subject to underreporting related to social desirability bias, though CNICS PRO assessments are conducted on touch-screen tablets, which have been shown to yield more disclosure of sensitive behaviors (Dolezal et al., 2012; Fredericksen et al., 2021; Kurth et al., 2004; Newman et al., 2002; Perlis et al., 2004).

5. Conclusion

We describe patterns of cannabis use by PWH in clinical care within several regions across the U.S. before and after changes in cannabis policy, and, contrary to our hypothesis, we did not identify significant increases in use related to changes in legalization. There was consistently high frequency of cannabis use among PWH at all sites, and at those which experienced legal status change there were no significant changes in prevalence of current use or prevalence of daily use, and minimal changes in severity of use. The sole exception was Seattle, where the slope of severe use decreased a small, but statistically significant amount after legal status changes. These findings suggest that state-level legal status is not a major contributor to the prevalence, frequency, or severity of cannabis use among PWH in care in the U.S. The lower-than-expected impact of policy change on these behaviors among a population with high use emphasizes the importance of understanding patients' reasons for cannabis use in order to inform future, patient-focused approaches to reducing potential harmful effects related to heavy use.

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Declaration of Competing Interest

The authors declare that they have no known competing financial

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.dadr.2024.100291.

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