



# Cannabis use among recently treated cancer patients: perceptions and experiences

Talya Salz<sup>1</sup> · Akriti Mishra Meza<sup>1</sup> · Fumiko Chino<sup>2</sup> · Jun J. Mao<sup>3</sup> · Nirupa J. Raghunathan<sup>3</sup> · Sankeerth Jinna<sup>1</sup> · Jessica Brens<sup>3</sup> · Helena Furberg<sup>1</sup> · Deborah Korenstein<sup>4</sup>

Received: 24 March 2023 / Accepted: 11 August 2023

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023

## Abstract

**Purpose** To characterize cannabis use among cancer patients, we aimed to describe 1) patterns of cannabis use across multiple cancer sites; 2) perceived goals, benefits, harms of cannabis; and 3) communication about cannabis.

**Methods** Patients with 9 different cancers treated at Memorial Sloan Kettering Cancer Center between March and August 2021 completed an online or phone survey eliciting cannabis use, attitudes, and communication about cannabis. Multivariable logistic regression estimated the association of cancer type and cannabis use, adjusting for sociodemographic characteristics and prior cannabis use.

**Results** Among 1258 respondents, 31% used cannabis after diagnosis, ranging from 25% for lung cancer to 59% for testicular cancer. Characteristics associated with cannabis use included younger age, lower education level, and cancer type. In multivariable analysis, compared to lung cancer patients, gastrointestinal cancer patients were more likely to use cannabis (odds ratio [OR] 2.64, 95% confidence interval [CI] 1.25–5.43). Cannabis use in the year prior to diagnosis was strongly associated with cannabis use after diagnosis (OR 19.13, 95% CI 11.92–30.72). Among users, reasons for use included difficulty sleeping (48%); stress, anxiety, or depression (46%); and pain (42%). Among respondents who used cannabis to improve symptoms, 70–90% reported improvement; < 5% reported that any symptom worsened. Only 25% discussed cannabis with healthcare providers.

**Conclusions** Almost a third of cancer patients use cannabis, largely for symptom management. Oncologists may not know about their patients' cannabis use. To improve decision making about cannabis use during cancer care, research is needed to determine benefits and harms of cannabis use.

**Keywords** Cannabis · Cancer · Palliative care · Health communication · Cross-sectional studies

## Introduction

Cannabis products are increasingly available for medical and non-medical use, and their use in the general population is rapidly expanding [1–5]. Surveys of cancer patients report that 12–21% of people with cancer used cannabis in the prior month, though this prevalence may have changed amidst rapidly shifting policies and attitudes toward cannabis [6–8]. Cancer patients may opt to use cannabis to reduce symptoms (e.g., pain, anxiety, depression, poor appetite) or extend survival, but may also feel discouraged from cannabis use, fearing side effects, interactions with treatment, or issues with legality [8–11].

Complicating patients' decision making about cannabis, few trials have evaluated the safety and efficacy of cannabis use in cancer; most evidence regarding cannabis

✉ Talya Salz  
salzt@mskcc.org

<sup>1</sup> Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, 1275 York Ave., New York, NY 10065, USA

<sup>2</sup> Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, NY, USA

<sup>3</sup> Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, NY, USA

<sup>4</sup> Department of Internal Medicine, Icahn School of Medicine at Mt. Sinai, New York, NY, USA

safety and efficacy in cancer comes from observational studies [12–15]. Cannabis is commonly used to treat cancer-related pain, and it may reduce nausea and anorexia [16–21]. There is also limited and conflicting evidence that cannabis has antitumor properties, carcinogenic properties, or both [20, 22–25]. Harms of cannabis include fatigue and cognitive changes, which are already common and debilitating symptoms in cancer patients [26, 27]. There is a risk of addiction and exacerbation of anxiety and depression with cannabis use, which are prevalent among cancer patients [24, 28]. Cannabis may also have harmful interactions with therapies; recent studies showed an association between cannabis use and reduced efficacy of immunotherapy in patients with advanced cancer [29–31]. A broad understanding of cancer patients' beliefs in the benefits and harms of cannabis use is lacking.

Despite unclear evidence regarding benefits and harms, patients and providers need to make informed decisions about cannabis use. Interventions to improve communication about cannabis use in the oncology setting require a stronger understanding of cancer patients' perceptions and experiences of cannabis use, as well as which patients are most likely to use cannabis. As part of the National Cancer Institute's efforts to characterize cannabis use among cancer patients [32], we conducted a survey study to describe: 1) the extent and characteristics of cannabis use across a range of cancer sites; 2) perceived goals, benefits, harms of cannabis use; and 3) communication about cannabis with healthcare providers.

## Methods

### Patients and setting

Using Memorial Sloan Kettering Cancer Center (MSK) billing and administrative data, we identified adults ( $\geq 18$  years old) who received treatment between March and August 2021 for any of nine cancer subtypes (brain, breast, head and neck, gynecological, gastrointestinal, lymphoma, prostate, testicular, and lung). These cancers were selected to represent populations with diverse characteristics. Among these are common and rare tumors, cancers diagnosed at various ages, cancers that affect both sexes or only one sex (assigned at birth), cancers with and without tobacco as a leading risk factor, and patients with a range of comorbidity rates, treatment types, treatment toxicity, and survival rates. We included patients who had an email address or phone number in the medical record and who resided in New York, New Jersey, or Connecticut, where medical and non-medical cannabis use is legal.

### Recruitment and survey administration

With a goal of including 1,500 patients in the final sample and accounting for an estimated 35% response rate, the sampling frame was stratified by cancer type, resulting in 486 patients randomly sampled from each cancer stratum. When there were fewer eligible patients in the cancer stratum (ie., brain and testicular cancers), all eligible patients were sampled. We contacted all sampled patients by email (or phone, if email was unavailable) to invite them to complete an online or phone survey regarding experiences with cannabis in which no identifying information (e.g., names, dates, medical record number, addresses) was collected. We followed our initial invitation with reminder emails, calls, and, for patients with cancer types with lower enrollment rates (brain, testicular, and head and neck cancer), mailed letters. We administered surveys from August 2021 to April 2022. Online surveys were anonymous, and phone surveys were confidential, with identifiers used for patient contact destroyed after study completion. Invitations and surveys were available in English and Spanish.

### Survey

The survey used harmonized measures developed by investigators from 12 NCI-designated cancer centers to elicit experiences regarding patient-reported cannabis use. (Appendix) Additional measures were developed by the MSK study team. Measures included cannabis use after diagnosis (yes/no), defined as any cannabis product, including whole plant and products containing only tetrahydrocannabinol (THC) or only cannabidiol (CBD). Patients reported their beliefs about cannabis harms and benefits; timing of cannabis use (after diagnosis, during treatment, and after treatment, as applicable); product type (whole-plant or products mostly composed of THC, products mostly composed of CBD, prescription cannabis), mode of ingestion, frequency of cannabis use; and preferred and actual sources of cannabis information. Patient factors evaluated in relation to cannabis use included self-reported sociodemographic characteristics (gender, age, race, ethnicity, income, insurance, marital status, education, and employment status), cannabis use prior to cancer diagnosis, and cancer site.

### Statistical analysis

Weighting was assigned based on characteristics (age, sex assigned at birth, race, ethnicity, cancer) of the sampled population to account for potential nonresponse bias. We descriptively report patient characteristics, beliefs and

experiences with cannabis, cannabis use, and sources of cannabis information among participants who were asked and responded to each question; participants with missing responses were dropped from the denominator on a question-by-question basis. The primary endpoint was use of any cannabis product after cancer diagnosis (user vs. non-user). We used bivariate analyses to compare users' and non-users' beliefs that 1) cannabis has any benefits for cancer patients and 2) cannabis has any harms for cancer patients. We used unadjusted and weighted multivariable logistic regression to identify sociodemographic and clinical predictors of cannabis use after diagnosis, using 2-sided tests of significance (cutoff  $p < 0.05$ ).

This study was deemed exempt from human subjects review by MSK Institutional Review Board.

## Results

### Sample

Of 3,837 patients sampled and approached, 1,258 completed the survey (35% overall response rate; range: 25%–41% across cancers). The demographic characteristics of respondents were similar to those of the sampling frame, with a few exceptions. There were fewer female patients (52% vs. 58%) and Black patients (6% vs. 9%) among respondents compared to the sampling frame. Median age of the respondents was 63 years (interquartile range 53, 71), most were white, had at least a college education, and had an income  $> \$100,000$  (Table 1).

### Cannabis use

Details about cannabis use among all respondents are presented in Table 2. Thirty-one percent of respondents ( $N=385$ ) reported using cannabis since diagnosis, ranging from 25% among lung cancer patients to 59% among testicular cancer patients. Patients most commonly used whole-plant/mostly THC products (45%) or products including a mixture of approximately equal parts THC and CBD (30%). The most common mode of ingestion was eating (55%), followed by smoking (46%); 23% used pills (including prescribed cannabis), tinctures, or sublingual tablets. Cannabis products were mostly acquired through friends, family members, or members of the community (47%). Fifty-two percent of those using cannabis after diagnosis ( $N=197$ ) reported cannabis use in the past month. Eighteen percent of respondents ( $N=224$ ) had used cannabis in the year prior to diagnosis, 35% of whom ( $N=77$ ) used cannabis at least a few times a week.

**Table 1** Respondent characteristics ( $N=1258$ )

	<i>N</i>	(%)
Age		
≤ 45	174	(14)
46–64	525	(42)
≥ 65	559	(44)
Gender		
Male	599	(48)
Female	651	(52)
Non-binary	4	(0.3)
Missing	4	(0.3)
Race		
Asian, Asian American, Pacific Islander	82	(7)
Black	76	(6)
White	1014	(81)
Mixed or Other	82	(7)
Missing	4	(0.3)
Hispanic		
No	1146	(91)
Yes	102	(8)
Missing	7	(1)
Income		
< \$50,000	178	(14)
\$50,000–< \$100,000	311	(25)
≥ \$100,000	666	(53)
Missing	102	(8)
Insurance		
Private Insurance	657	(52)
Medicare	459	(36)
Uninsured	55	(4)
Medicaid or state program	56	(4)
Other	19	(2)
Missing	12	(1)
Marital Status		
Married or living as married	892	(71)
Divorced or separated	153	(12)
Single	131	(10)
Widowed	72	(6)
Missing	10	(1)
Employment status		
Retired or disabled	584	(46)
Employed	522	(41)
Other	144	(11)
Missing	8	(1)
Education		
Less than high school graduation	28	(2)
2 years or completed high school	153	(12)
Post HS training / some college	235	(19)
College graduate	420	(33)
Postgraduate	412	(33)
Missing	10	(1)

**Table 1** (continued)

	<i>N</i>	(%)
Cancer (self-report)		
Brain	70	(6)
Breast	188	(15)
Head and neck	142	(11)
Gynecological	146	(12)
Gastrointestinal	169	(13)
Lung	141	(11)
Lymphoma	133	(11)
Prostate	157	(12)
Testicular	32	(3)
Other	77	(6)
Missing	3	(0.2)

### Characteristics of patients using cannabis after diagnosis

Table 3 presents the prevalence of cannabis use by patient characteristics ( $n = 1120$ ). In unadjusted analyses, patients who were younger, had a diagnosis of gastrointestinal or testicular cancer, had a lower education level, and reported using cannabis in prior year were more likely than their counterparts to use cannabis after cancer diagnosis. Weighted multivariable models ( $N = 1120$ ) that adjusted for demographics and prior use of cannabis demonstrated that, compared to patients with lung cancer, patients with gastrointestinal cancer were more likely to use cannabis (odds ratio [OR] 2.64, 95% confidence interval [CI] 1.27–5.50). Independent associations of cannabis use with testicular cancer diagnosis, younger age, and lower education were not statistically significant, though trends remained. Use of cannabis at least once in the year prior to cancer diagnosis was strongly associated with cannabis use since diagnosis (multivariable OR 19.13, 95% CI 11.92–30.72). (Table 3).

### Reasons for non-use and use

Among the 865 respondents who did not use cannabis since diagnosis, 27% ( $N = 226$ ) considered using cannabis. The most frequently endorsed reasons for non-use were lack of recommendation from healthcare provider (47%), too many choices or unsure which products were safe or effective (35%), and not knowing how to get it (31%). Among the 385 patients who reported cannabis use after diagnosis, the top reasons for use were difficulty sleeping (48%); anxiety, depression, or stress (46%); and pain (42%), with 32% reporting recreational use. For each symptom endorsed, 70–90% of respondents indicated that cannabis improved the symptom. No more than 3% of

respondents indicated that cannabis worsened any symptom. (Figs. 1 and 2).

### Beliefs about cannabis

Eighty-two percent of respondents ( $N = 1032$ ) believed there were benefits associated with cannabis use for cancer patients, with those who used cannabis after diagnosis more likely to perceive benefits than non-users (98% vs. 80%, respectively,  $\chi^2(1, N = 1197) = 71.6, p < 0.05$ ). The top endorsed benefits related to symptom relief, including relief of stress, anxiety, and depression (71%), pain management (69%), and improved sleep (50%). Enjoyment or recreation was endorsed by 25% of patients, and 7% believed cannabis could contribute to treatment or cure. Fifty-three percent of respondents ( $N = 662$ ) reported that there were potential harms associated with cannabis use, with non-users more likely to perceive harms than users (62% vs. 41%, respectively,  $\chi^2(1, N = 1199) = 46.8, p < 0.05$ ). The most commonly reported harms included inability to drive (25%), difficulty concentrating (24%), and addiction (23%). Commonly endorsed perceived benefits and harms are shown in Figs. 3 and 4; Supplemental Figs. 1 and 2 show perceptions of each harm and benefit stratified by users and non-users.

### Communication and information about cannabis use

Among the 86% of respondents who believed there were potential benefits to cannabis use ( $N = 1032$ ), the sources they would likely go to for information included their oncologist (78%), nurse or physician assistant (PA) involved in their care (37%), and primary care provider (33%). Internet search was endorsed by 27% of respondents. Seventy-four percent reported they would be somewhat or extremely comfortable talking to a healthcare provider about cannabis, but only 25% had done so. (Table 4) Among these 25% ( $N = 311$ ), 75% ( $N = 233$ ) spoke to an oncologist and 36% ( $N = 113$ ) spoke to a nurse or PA involved in their care. Advice from providers about cannabis was uncommonly received; 12% of respondents ( $N = 153$ ) had a provider recommend cannabis to them, while 4% ( $N = 50$ ) had a provider recommend against using cannabis, and 8% ( $N = 98$ ) had a provider say they were unable to recommend for or against cannabis use, with oncology providers (oncologists, nurses, or PAs) responsible for most of this communication. (Fig. 5) Among people who reported using cannabis after diagnosis ( $N = 385$ ), 36% reported receiving no instructions regarding how to use cannabis and at what dose, and 24% received advice from a worker at dispensary or cannabis store; only 3% got this information from an oncologist. (Table 4).

**Table 2** Timing and patterns of cannabis use among all respondents ( $N=1258$ )

Cannabis use any time after diagnosis		
Used cannabis any time after diagnosis ( $N=1258$ )		
Missing: $N=8$		
Yes	385	(31)
No	865	(69)
Mode of ingestion (among users, multiple modalities could be selected, $N=385$ )		
Missing: $N=5$		
Eating in food such as brownies, cakes cookies, or candy	208	(55)
Smoking such as in a joint, bong, pipe, or blunt	173	(46)
Taking by mouth such as pills, tinctures, or sublingually	145	(38)
Vaping	111	(29)
Applying topically such as in a lotion, cream or patch	62	(16)
Drinking it in a liquid such as tea, cola, or alcohol	39	(10)
Dabbing such as using waxes or shatter	9	(2)
Other	10	(3)
Most frequent mode of ingestion (among users, $N=385$ )		
Missing: $N=4$		
Eating in food such as brownies, cakes cookies, or candy	115	(30)
Smoking such as in a joint, bong, pipe, or blunt	99	(26)
Pills/tinctures/sublingually	87	(23)
Vaping	45	(12)
Applying topically such as in a lotion, cream or patch	21	(6)
Drinking it in a liquid such as tea, cola, or alcohol	4	(1)
Other	10	(3)
Most frequent formulation (among users, $N=385$ )		
Missing: $N=3$		
Whole-plant cannabis (mostly THC)	170	(45)
CBD (mostly or only CBD)	61	(16)
Mixed (Approximately equal use of THC and CBD)	116	(30)
Prescribed cannabis medication	15	(4)
Don't know	20	(5)
How cannabis was acquired (among users, multiple sources could be selected, $N=385$ )		
Missing: $N=6$		
Friend, family member, or member of the community	176	(46)
Cannabis store or dispensary with a certification	165	(44)
Unlicensed cannabis dealer or seller	60	(16)
Cannabis store or dispensary without a certification	49	(13)
Retail store	26	(7)
Pharmacy with a prescription	13	(3)
Grown personally	12	(3)
Other	14	(4)
Cannabis use before cancer diagnosis		
Used cannabis prior to diagnosis ( $N=1258$ )		
Missing: $N=13$		
Yes	224	(18)
No	1021	(82)
Frequency of cannabis use prior to diagnosis (among users, $N=224$ )		
Missing: $N=2$		
More than once a day	11	(5)
Once a day or almost every day	29	(13)
A few times a week	37	(17)
A few times a month	35	(16)
Once a month or less	63	(28)
Only tried it once or twice	47	(21)
Used cannabis in the past month (among users, $N=385$ )		
Missing: $N=4$		
Yes	197	(52)
No	184	(48)

**Table 3** Distribution of cannabis use after diagnosis by patient characteristics (*N* = 1120)

	Used can- nabis		Did not use can- nabis		Unadjusted		Adjusted	
	N	(%)	N	(%)	OR	(95% CI)	OR	(95%CI)
All	356		764					
Age								
≤ 45	79	(22)	87	(11)	2.59	(1.63–4.09)	2.16	(0.91–5.10)
46–64	160	(45)	315	(41)	1.37	(0.99–1.90)	1.44	(0.72–2.89)
≥ 65	117	(33)	362	(47)	Ref	—	Ref	—
Gender								
Male	181	(51)	359	(47)	1.15	(0.85–1.54)	0.97	(0.58–1.60)
Female	173	(49)	404	(53)	Ref	—	Ref	—
Non-binary	2	(1)	1	(0)	—	—	—	—
Race								
White	291	(82)	621	(81)	Ref	—	Ref	—
Asian/Asian American Pacific Islander	17	(5)	60	(8)	0.70	(0.37–1.34)	0.78	(0.37–1.68)
Black	25	(7)	45	(6)	1.24	(0.70–2.20)	1.25	(0.65–2.41)
Mixed or other	23	(6)	38	(5)	1.36	(0.66–2.80)	0.72	(0.34–1.52)
Hispanic								
No	330	(93)	710	(93)	0.99	(0.54–1.79)	0.88	(0.41–1.88)
Yes	26	(7)	54	(7)	Ref	—	Ref	—
Income								
< \$50,000	49	(14)	123	(16)	0.85	(0.55–1.31)	1.31	(0.69–2.51)
\$50,000–\$99,000	100	(28)	202	(26)	0.92	(0.65–1.31)	1.07	(0.68–1.69)
≥ \$100,000	207	(58)	439	(57)	Ref	—	Ref	—
Insurance								
Private Insurance	215	(60)	399	(52)	Ref	—	Ref	—
Medicare	103	(29)	291	(38)	0.67	(0.49–0.93)	0.86	(0.45–1.66)
Uninsured	17	(5)	32	(4)	0.91	(0.43–1.93)	0.82	(0.38–1.76)
Medicaid or state program	14	(4)	33	(4)	0.83	(0.38–1.84)	0.97	(0.33–2.79)
Other	7	(2)	9	(1)	1.35	(0.44–4.10)	1.33	(0.16–10.8)
Marital Status								
Married/living as married	249	(70)	551	(72)	Ref	—	Ref	—
Divorced/separated	48	(13)	92	(12)	1.32	(0.84–2.05)	1.03	(0.60–1.77)
Single	49	(14)	67	(9)	1.51	(0.90–2.54)	0.69	(0.33–1.42)
Widowed	10	(3)	54	(7)	0.48	(0.22–1.04)	0.78	(0.32–1.92)
Employment status								
Retired or disabled	144	(40)	361	(47)	0.76	(0.55–1.04)	1.09	(0.62–1.90)
Employed	158	(44)	326	(43)	Ref	—	Ref	—
Other	54	(15)	77	(10)	1.38	(0.85–2.23)	2.03	(1.10–3.73)
Highest level of education								
< High school graduation	4	(1)	20	(3)	0.57	(0.16–2.06)	0.37	(0.09–1.52)
12 yrs or graduated high school	29	(8)	94	(12)	0.58	(0.33–1.00)	0.42	(0.17–1.04)
Post high school training / some college	52	(15)	162	(21)	0.66	(0.43–1.04)	0.55	(0.3–1.00)
College graduate	143	(40)	236	(31)	1.15	(0.81–1.64)	0.93	(0.61–1.41)
Postgraduate	128	(36)	252	(33)	Ref	—	Ref	—
Cancer site								
Brain	24	(7)	42	(5)	2.04	(0.89–4.49)	0.96	(0.38–2.42)
Breast	46	(13)	129	(17)	1.01	(0.62–1.94)	0.77	(0.35–1.70)
Head and neck	41	(12)	90	(12)	1.24	(0.69–2.24)	1.15	(0.53–2.53)
Gynecological	39	(11)	94	(12)	1.26	(0.69–2.29)	1.20	(0.53–2.70)

**Table 3** (continued)

	Used cannabis		Did not use cannabis		Unadjusted		Adjusted	
	N	(%)	N	(%)	OR	(95% CI)	OR	(95% CI)
Gastrointestinal	53	(15)	92	(12)	1.84	(1.04–3.25)	2.64	(1.27–5.50)
Lung	30	(8)	90	(12)	Ref	—	Ref	—
Lymphoma	44	(12)	74	(10)	1.71	(0.94–3.11)	1.55	(0.74–3.26)
Prostate	42	(12)	94	(12)	1.32	(0.73–2.37)	1.36	(0.64–2.86)
Testicular	17	(5)	12	(2)	4.34	(1.77–10.6)	2.28	(0.64–8.15)
Other	20	(6)	47	(6)	1.22	(0.57–2.61)	1.20	(0.50–2.89)
Cannabis use prior to diagnosis								
Yes	172	(48)	39	(5)	16.5	(10.5–25.9)	19.1	(11.9–20.7)
No	184	(52)	725	(95)	Ref	—	Ref	—

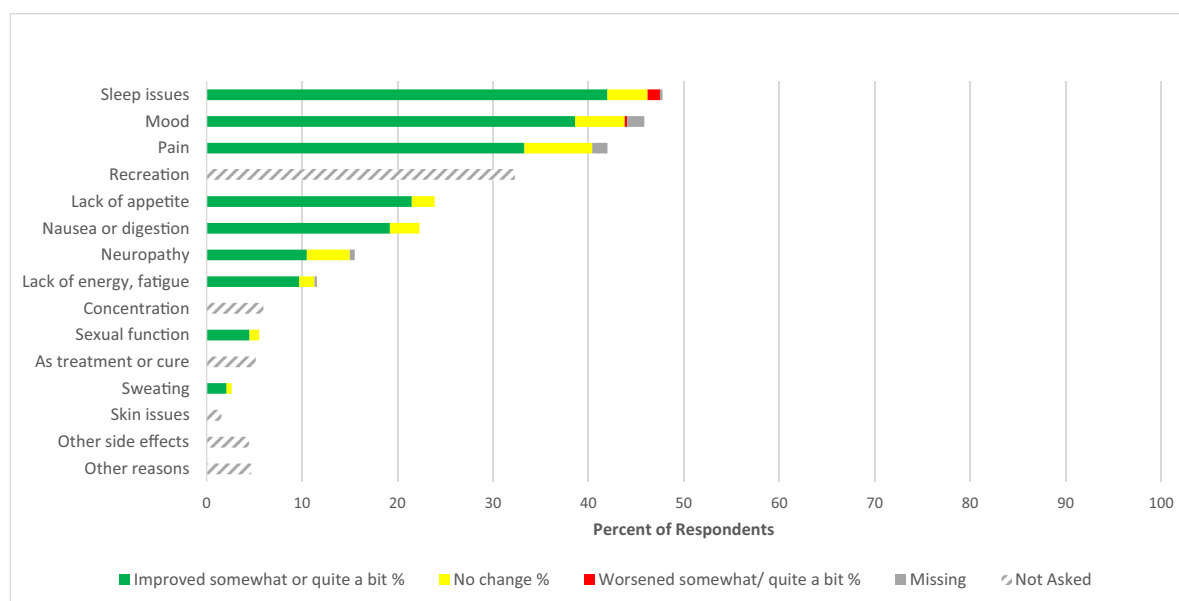
Percentages shown among respondents included in the multivariable complete case analysis ( $N=1120$ )

Analyses were not performed for non-binary patients due to small sample size ( $N=3$ )

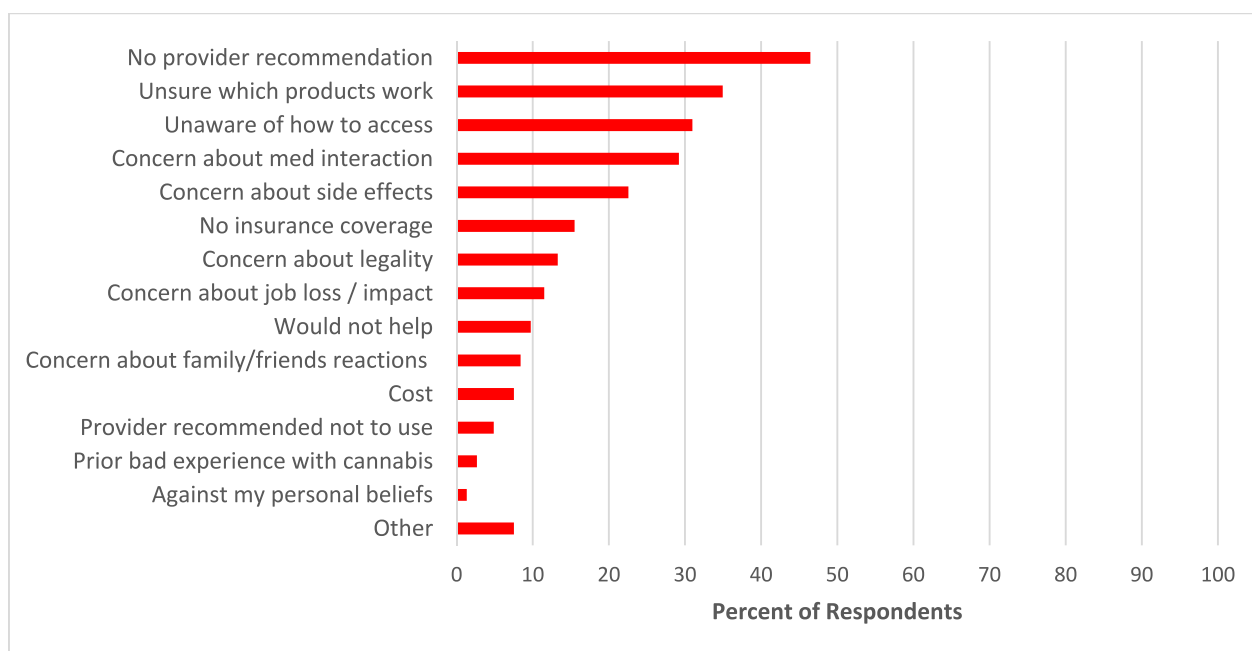
## Discussion

In a large sample of recently or currently treated patients with a range of cancers and living in states where cannabis use is legal for adults, almost a third of patients reported using cannabis after their cancer diagnosis. Patients who used cannabis largely did so for symptom relief rather than

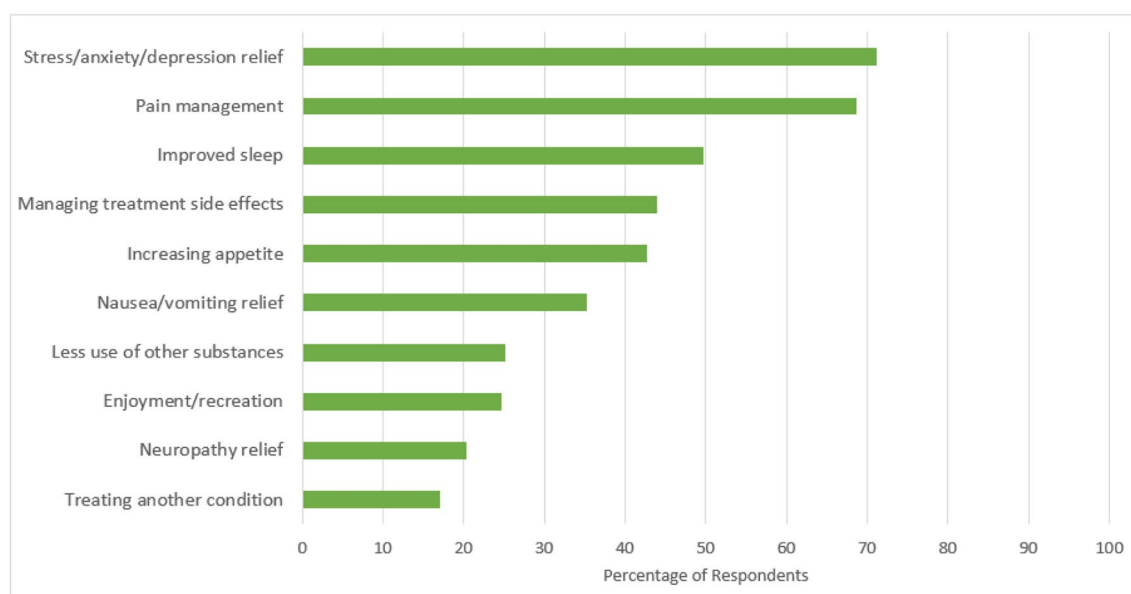
with the goal of treating or curing their cancer. Those who used cannabis for symptom relief overwhelmingly reported improvement in symptoms; very few reported that cannabis made their symptoms worse. Although almost half of patients either used or considered using cannabis after diagnosis, only one fifth of patients discussed cannabis use with their oncologist.

**Fig. 1** Reasons for use of cannabis ( $N=381$ )





**Fig. 2** Reasons for not using cannabis among those who considered cannabis use after diagnosis ( $N=226$ )

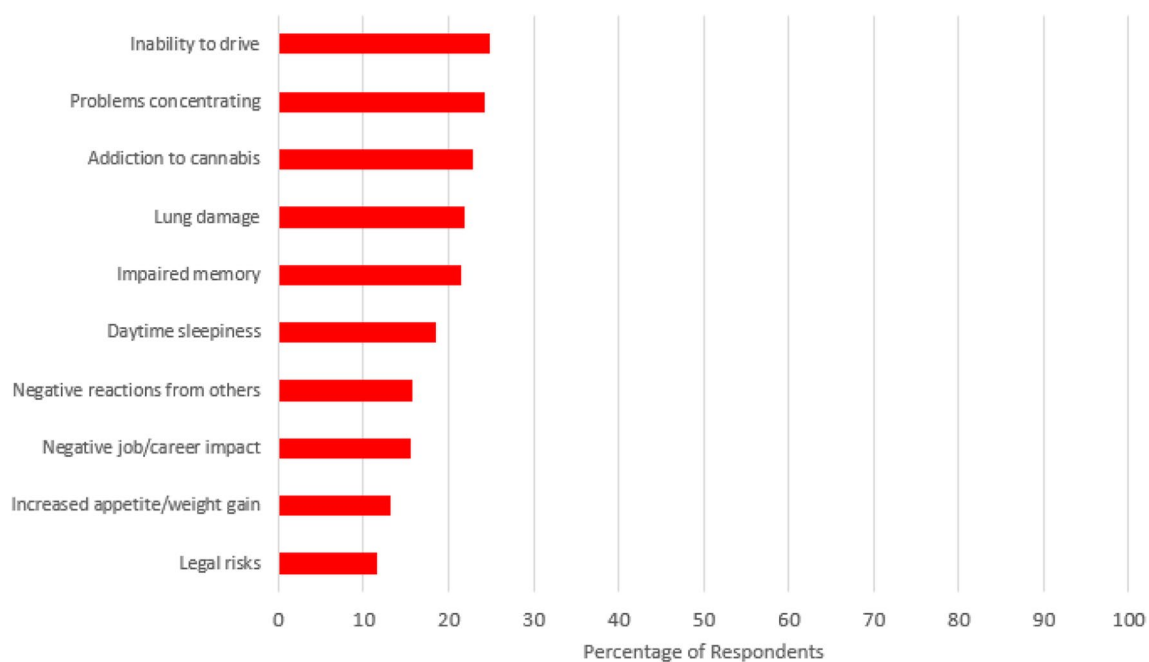


**Fig. 3** Most common perceived benefits of Cannabis ( $N=1205$ )

Among the 31% of patients who used cannabis after their cancer diagnosis, half used cannabis in the past month (16% of the total sample). This is consistent with findings from earlier studies reporting rates of 12–21% of cancer patients using cannabis in the past month [6–8]. We noted differences in prevalence of cannabis use by sociodemographic and clinical characteristics in unadjusted analysis, in which younger

patients, those with high school education, and those with testicular or gastrointestinal cancer were more likely to use cannabis. In adjusted analyses, only the comparison of cannabis use between patients with gastrointestinal cancer and those with lung cancer remained statistically significant, although risk estimates in use by age and education remained elevated. Our findings align with a recent national





**Fig. 4** Most common perceived harms of Cannabis ( $N=1206$ )

survey study which found greater cannabis use among younger cancer survivors, as well as with a survey study of cancer patients in multiple western states that found greater cannabis use in younger patients and those with lower levels of education [6, 33]. Neither of these studies evaluated differences in cannabis use by cancer site. Ultimately, cannabis was relatively widely adopted across multiple patient groups. In our study, the strongest predictor of cannabis use after diagnosis was cannabis use in the year prior to diagnosis. This finding suggests that cannabis is not a novel product for many cancer patients, who continue to use cannabis in the context of cancer for medical or non-medical reasons. Use patterns in cancer may simply reflect trends in the general population.

Few patients reported using cannabis use with the goal of curing or treating their cancer. This contrasts with a recent study of advanced cancer patients in outpatient palliative care practices, in which 59% of patients using medical cannabis reported that cannabis was important for cancer cure [10]. This difference may be driven by study population differences. Our study was not comprised of patients primarily receiving palliative care, suggesting that use of cannabis with curative intent is more limited among a wider range of cancer patients.

The vast majority (82%) of patients in our study believed that cannabis benefits people with cancer, and indeed 70–90% of patients who used cannabis to address issues with sleep, mood, pain, and other symptoms reported that cannabis use improved their symptoms. A smaller study of

cancer patients using cannabis found similar self-reported benefit in sleep, pain, and anxiety symptoms, and a survey study of patients seeking cannabis through a medical cannabis clinic also found reasons for cannabis use included sleep, pain, anxiety, and appetite [34, 35]. A recent review of cannabis effectiveness for symptom management among patients with terminal illnesses found that although benefits have been reported, the quality of evidence is low [36]. The evidence for cancer patients is of similarly poor quality but suggests improvement in nausea, pain, and other symptoms [37]. Clinical practice guidelines for cancer pain state that evidence for herbal remedies, including cannabis, is insufficient to recommend these approaches [38].

Harms of cannabis use include risks of fatigue, cannabis use disorder, and neurological harm [26, 27, 39–41]. Preliminary data from cancer patients also suggests a possible reduction in the efficacy of immunotherapy [29–31]. About half of respondents in our study acknowledged that cannabis could be harmful to cancer patients, with less acknowledgment of harms among users than non-users. This suggests many patients are using cannabis without a full understanding of potential side effects and associated problems, which could meaningfully impact their clinical outcomes.

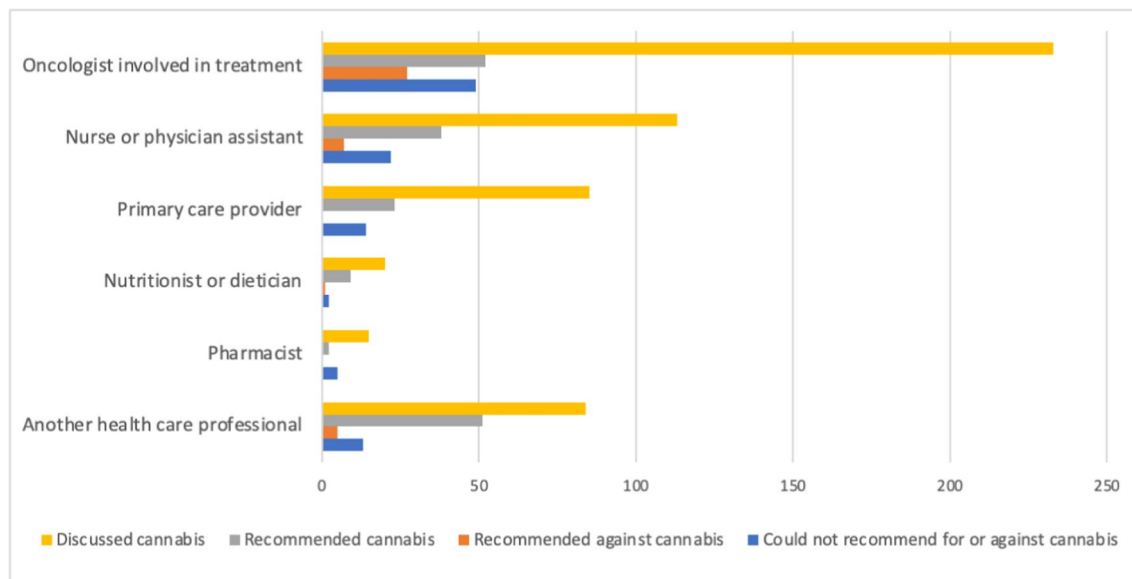
Given the limited evidence of the impact of cannabis use in cancer care, it is difficult for patients and providers to make an informed decision, and the responsibility of advising on this topic may fall to oncology providers. However, oncologists are often unsure about what to recommend; 70% of oncologists do not feel comfortable

**Table 4** Communication and information about cannabis use

	<i>N</i>	(%)
Among those who think there are benefits of cannabis ( <i>N</i> = 1032), most likely information source(s) to learn about cannabis and cancer		
Missing: <i>N</i> = 10		
Oncologist involved with your cancer treatment	799	(78)
Nurse or physician assistant involved with your cancer treatment	373	(37)
Primary care provider	332	(33)
Internet search engine (e.g. Google)	278	(27)
Another cancer patient	234	(23)
Cannabis store or dispensary	202	(20)
Friend of family member	149	(15)
Hospital website	128	(13)
Official federal, state, or local government website	114	(11)
News or magazine articles	112	(11)
Nutritionist	93	(9)
Pamphlet or handout	85	(8)
Social media or blogs (Facebook, Twitter, etc.)	37	(4)
Other	41	(4)
Comfort talking to healthcare provider ( <i>N</i> = 1258)		
Missing: <i>N</i> = 3		
Extremely comfortable	589	(47)
Somewhat comfortable	330	(26)
Somewhat uncomfortable	168	(13)
Extremely uncomfortable	153	(12)
Discussed cannabis for cancer symptoms with a healthcare provider ( <i>N</i> = 1258)		
Missing: <i>N</i> = 3		
Yes	311	(25)
No	944	(75)
Among those who use cannabis ( <i>N</i> = 385), main person that provides instructions on cannabis use		
Missing: <i>N</i> = 1		
No one gives me instructions	138	(36)
Cannabis store or dispensary worker	91	(24)
Family or family member	82	(21)
Oncologist involved with your cancer treatment	12	(3)
Nurse or physician assistant involved with your cancer treatment	10	(3)
Primary care provider	9	(2)
Pharmacist	9	(2)
Another cancer patient	7	(2)
Unlicensed cannabis dealer or seller	5	(1)
Nutritionist or dietitian	4	(1)
Other	17	(4)

advising on the clinical benefits and harms of cannabis [42], with only a quarter of oncology fellows receiving education about cannabis use and 13% reporting insufficient knowledge to make a recommendation to their patients [43]. Similarly, a Canadian survey of healthcare providers found that 56% of providers felt uncomfortable with their level of knowledge regarding medical cannabis [44]. We found that among patients who spoke to a provider about cannabis use, 24% had a provider report that

they did not know enough to recommend for or against cannabis use. To some extent, providers' discomfort with recommendations aligns with the lack of evidence and is unavoidable; high quality studies are critically needed to evaluate the efficacy and safety of cannabis for symptom relief, which will inform clinical practice guidelines regarding cannabis. Until that occurs, providers need to be educated about cannabis use in cancer to help patients make informed decisions in the context of uncertainty.



**Fig. 5** Healthcare provider and their advice about cannabis use ( $N=311$ )

Patients may not get adequate information about cannabis outside of the oncology setting either. A study of cannabis dispensary workers found limited training and knowledge about therapeutic cannabis use, with workers often relying on discussions with colleagues and sampling products [45]. In one study of glioma patients, more than half of cannabis users procured cannabis from friends or family [46]. Many cannabis users in our study acquired cannabis through non-medical sources (e.g. friends, family, or unlicensed cannabis dealers), suggesting that oncologists should be aware that many patients use cannabis without clinician involvement. Indeed, oncologists likely do not know if their patients are using cannabis; we found that although three quarters of patients report that they are comfortable talking to providers about cannabis, only one fifth of patients talk to their oncologists.

Our study has limitations. As anticipated for a survey study among cancer patients on a potentially sensitive topic, the response rate was low (35%), raising concerns about non-response bias. Patients who used cannabis may have been less likely to participate due to concerns about confidentiality, legal risks, or stigma. However, it is also possible that patients who did not use cannabis were uninterested in a survey about cannabis. Patients who were sick from treatment might have been less likely to respond. We aimed to mitigate these concerns by ensuring anonymity, offering a brief survey (in English and Spanish) through multiple modalities with a modest financial incentive, providing extra recruitment efforts for patients with cancers that had a lower response rate, and explicitly noting in recruitment materials that we sought feedback from patients who do and do not use cannabis. We also statistically accounted for non-response

using sampling weights. Ultimately, the prevalence of cannabis use among cancer patients in our study is within the range found in similar studies, which lends credibility to our findings [6–8]. Self-reported cannabis use may be inaccurate as patients may underreport cannabis use because of stigma. They also may not accurately recall their cannabis use, particularly because there are multiple available products with varying constituents and modes of ingestion. Rates of cannabis use after diagnosis may vary by stage and prognosis, which we did not assess. Our findings that patients report relief across multiple symptoms must be tempered by the fact benefits and harms has not yet been determined in a randomized clinical trial.

Strengths of this study include a large population of recently (or currently) treated cancer patients living where cannabis is legal. Stratifying recruitment by cancer enabled the analyses of cannabis use in relation to cancer site. Our study found frequent cannabis use among users, a range of cannabis products consumed, a widespread perceived improvement in symptoms, a potential underestimation of cannabis harms, and limited conversations with healthcare providers about harms and benefits. Furthermore, our study found that cannabis use among cancer patients is common across sociodemographic and clinical populations, with cannabis often obtained without oncologist involvement. Oncologists and other members of the oncology team are uniquely positioned to provide education about the harms and benefits of cannabis use specifically for cancer patients, which is especially important in the context of inconclusive and often conflicting evidence. Interventions to improve cannabis education and communication

need not target oncologists who treat specific cancers, as cannabis use appears consistent across multiple patient characteristics.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s00520-023-07994-y>.

**Author contributions** Conceptualization: All authors. Data Curation: SJ and AM. Formal Analysis: SJ and AM. Methodology: All authors. Supervision: TS. Writing—original draft: TS. Writing- reviewing & editing: All authors.

**Funding** This work was supported by Memorial Sloan Kettering Cancer Center Support Grant from the National Institutes of Health (P30 CA008748) and a Covid administrative supplement from the National Cancer Institute (P30 CA008748-54S2).

**Data availability** To protect patient privacy, data are not publicly available.

## Declarations

**Ethics approval** This study was reviewed and deemed exempt by our Memorial Sloan Kettering Institutional Review Board. The study was performed in accordance with the ethical standards of the MSK Institution.

**Consent** This anonymous study was deemed exempt from human subject review by MSK's Institutional Review Board.

**Competing interests** Dr. Korenstein's spouse does consulting for Takeda and sits on the scientific advisory board of Vedanta Biosciences. No connection to this work. All other authors have no relevant financial or non-financial interest to disclose.

## References

1. State Medical Marijuana Laws. National Conference of State Legislatures, United States. Washington, D.C. <http://www.ncsl.org/research/health/state-medical-marijuana-laws.aspx>. Accessed 23 Aug 2023
2. Marijuana Overview. National Conference of State Legislatures, United States. Washington, D.C. <http://www.ncsl.org/research/civil-and-criminal-justice/marijuana-overview.aspx>. Accessed 23 Aug 2023
3. Key substance use and mental health indicators in the United States: results from the 2018 National Survey on Drug Use and Health (HHS Publication No. PEP19-5068, NSDUH Series H-54). 2019.
4. Prevalence of Marijuana Use Among U.S. Adults Doubles Over Past Decade. The National Institute of Health. 2019. <https://www.nih.gov/news-events/news-releases/prevalence-marijuana-use-among-us-adults-doubles-over-past-decade>. Accessed 23 Aug 2023
5. Hasin DS, Saha TD, Kerridge BT et al (2015) Prevalence of Marijuana use disorders in the United States between 2001–2002 and 2012–2013. *JAMA Psychiat* 72(12):1235–1242. <https://doi.org/10.1001/jamapsychiatry.2015.1858>
6. Pergam SA, Woodfield MC, Lee CM et al (2017) Cannabis use among patients at a comprehensive cancer center in a state with legalized medicinal and recreational use. *Cancer* 123(22):4488–4497. <https://doi.org/10.1002/cncr.30879>
7. Tringale KR, Huynh-Le MP, Salans M, Marshall DC, Shi Y, Hattangadi-Gluth JA (2019) The role of cancer in marijuana and prescription opioid use in the United States: A population-based analysis from 2005 to 2014. *Cancer*. <https://doi.org/10.1002/cncr.32059>
8. Tanco K, Dumlao D, Kreis R et al (2019) Attitudes and beliefs about medical usefulness and legalization of Marijuana among cancer patients in a legalized and a nonlegalized state. *J Palliat Med* 22(10):1213–1220. <https://doi.org/10.1089/jpm.2019.0218>
9. Lockett T, Phillips J, Lintzeris N et al (2016) Clinical trials of medicinal cannabis for appetite-related symptoms from advanced cancer: a survey of preferences, attitudes and beliefs among patients willing to consider participation. *Intern Med J* 46(11):1269–1275. <https://doi.org/10.1111/imj.13224>
10. Zarrabi AJ, Welsh JW, Sniecinski R et al (2020) Perception of benefits and harms of medical cannabis among seriously ill patients in an outpatient palliative care practice. *J Palliat Med* 23(4):558–562. <https://doi.org/10.1089/jpm.2019.0211>
11. Hawley P, Gobbo M (2019) Cannabis use in cancer: a survey of the current state at BC Cancer before recreational legalization in Canada. *Current oncology (Toronto, Ont)* 26(4):e425–e432. <https://doi.org/10.3747/co.26.4743>
12. Steele G, Arneson T, Zylla D (2019) A comprehensive review of cannabis in patients with cancer: Availability in the USA, general efficacy, and safety. *Curr Oncol Rep*. 21(1):10. <https://doi.org/10.1007/s11912-019-0757-7>
13. Anderson SP, Zylla DM, McGriff DM, Arneson TJ (2019) Impact of medical cannabis on patient-reported symptoms for patients with cancer enrolled in Minnesota's medical cannabis program. *J Oncol Pract / Am Soc Clin Oncol* 15(4):e338–e345. <https://doi.org/10.1200/JOP.18.00562>
14. Schleider LB-L, Mechoulam R, Lederman V et al (2018) Prospective analysis of safety and efficacy of medical cannabis in large unselected population of patients with cancer. *Eur J Intern Med* 49:37–43
15. Abrams DI (2018) The therapeutic effects of cannabis and cannabinoids: An update from the national academies of sciences, engineering and medicine report. *Eur J Intern Med* 49:7–11. <https://doi.org/10.1016/j.ejim.2018.01.003>
16. Tateo S (2017) State of the evidence: Cannabinoids and cancer pain-A systematic review. *J Am Assoc Nurse Pract* 29(2):94–103. <https://doi.org/10.1002/2327-6924.12422>
17. VanDolah HJ, Bauer BA, Mauck KF (2019) Clinicians' guide to cannabidiol and hemp oils. *Mayo Clin Proc* 94(9):1840–1851. <https://doi.org/10.1016/j.mayocp.2019.01.003>
18. Sanders L (2019) The CBD Boom is way ahead of the Science. *Sci News*. <https://www.sciencenews.org/article/cbd-product-boom-science-research-hemp-marijuana>. Accessed 23 Aug 2023
19. Meng H, Dai T, Hanlon JG, Downar J, Alibhai SMH, Clarke H (2020) Cannabis and cannabinoids in cancer pain management. *Curr Opin Support Palliat Care* 14(2):87–93. <https://doi.org/10.1097/spc.0000000000000493>
20. Wilkie G, Sakr B, Rizack T (2016) Medical marijuana use in oncology: A review. *JAMA Oncol* 2(5):670–675. <https://doi.org/10.1001/jamaoncol.2016.0155>
21. Boland EG, Bennett MI, Allgar V, Boland JW (2020) Cannabinoids for adult cancer-related pain: systematic review and meta-analysis. *BMJ Support Palliat Care* 10(1):14–24. <https://doi.org/10.1136/bmjspcare-2019-002032>
22. Nikan M, Nabavi SM, Manayi A (2016) Ligands for cannabinoid receptors, promising anticancer agents. *Life Sci* 146:124–130. <https://doi.org/10.1016/j.lfs.2015.12.053>
23. Deng L, Ng L, Ozawa T, Stella N (2017) Quantitative analyses of synergistic responses between cannabidiol and DNA-damaging agents on the proliferation and viability of glioblastoma and neural

- progenitor cells in culture. *J Pharmacol Exp Ther* 360(1):215–224. <https://doi.org/10.1124/jpet.116.236968>
24. Kramer JL (2015) Medical marijuana for cancer. *CA: Cancer J Clin* 65(2):109–22. <https://doi.org/10.3322/caac.21260>
  25. Ghasemiesfe M, Barrow B, Leonard S, Keyhani S, Korenstein D (2019) Association between marijuana use and risk of cancer: A systematic review and meta-analysis. *JAMA Netw Open* 2(11):e1916318. <https://doi.org/10.1001/jamanetworkopen.2019.16318>
  26. Whiting PF, Wolff RF, Deshpande S et al (2015) Cannabinoids for medical use: A systematic review and meta-analysis. *Jama* 313(24):2456–73. <https://doi.org/10.1001/jama.2015.6358>
  27. Scarborough BM, Smith CB (2018) Optimal pain management for patients with cancer in the modern era. *CA: Cancer J Clin* 68(3):182–196. <https://doi.org/10.3322/caac.21453>
  28. Hill KP (2015) Medical marijuana for treatment of chronic pain and other medical and psychiatric problems: A clinical review. *Jama* 313(24):2474–83. <https://doi.org/10.1001/jama.2015.6199>
  29. Taha T, Meiri D, Talhamy S, Wollner M, Peer A, Bar-Sela G (2019) Cannabis impacts tumor response rate to nivolumab in patients with advanced malignancies. *Oncologist* 24(4):549–554. <https://doi.org/10.1634/theoncologist.2018-0383>
  30. Bar-Sela G, Cohen I, Campisi-Pinto S, et al (2022) Correction: Bar-Sela et al. Cannabis consumption used by cancer patients during immunotherapy correlates with poor clinical outcome. *Cancers* 2020, 12, 2447. *Cancers* (Basel). 14(8). <https://doi.org/10.3390/cancers14081957>
  31. Bar-Sela G, Cohen I, Campisi-Pinto S, et al (2020) Cannabis consumption used by cancer patients during immunotherapy correlates with poor clinical outcome. *Cancers* (Basel). 12(9). <https://doi.org/10.3390/cancers12092447>
  32. Ellison GL, Alejandro Salicrup L, Freedman AN et al (2021) the national cancer institute and cannabis and cannabinoids research. *J Natl Cancer Inst Monogr* 2021(58):35–38. <https://doi.org/10.1093/jncimonographs/lgab014>
  33. Lee M, Salloum RG, Jenkins W, Hales DB, Sharma A (2022) Marijuana use among US adults with cancer: findings from the 2018–2019 behavioral risk factor surveillance system. *J Cancer Surviv: Res Pract*. <https://doi.org/10.1007/s11764-021-01138-z>
  34. Tofthagen C, Perlman A, Advani P et al (2022) Medical marijuana use for cancer-related symptoms among floridians: A descriptive study. *J Palliat Med* 25(10):1563–1570. <https://doi.org/10.1089/jpm.2022.0100>
  35. Raghunathan NJ, Brens J, Vemuri S, Li QS, Mao JJ, Korenstein D (2022) In the weeds: a retrospective study of patient interest in and experience with cannabis at a cancer center. *Support Care Cancer* 30(9):7491–7497. <https://doi.org/10.1007/s00520-022-07170-8>
  36. Doppen M, Kung S, Majers I, et al (2022) Cannabis in palliative care: A systematic review of current evidence. *J Pain Symptom Manage*. <https://doi.org/10.1016/j.jpainsymman.2022.06.002>
  37. Abu-Amna M, Salti T, Khoury M, Cohen I, Bar-Sela G (2021) Medical cannabis in oncology: A valuable unappreciated remedy or an undesirable risk? *Curr Treat Options Oncol* 22(2):16. <https://doi.org/10.1007/s11864-020-00811-2>
  38. Mao JJ, Ismaila N, Bao T, et al (2022) Integrative medicine for pain management in oncology: Society for integrative oncology–ASCO guideline. *J Clin Oncol* 0(0):JCO.22.01357. <https://doi.org/10.1200/jco.22.01357>
  39. Filbey FM, Aslan S, Calhoun VD et al (2014) Long-term effects of marijuana use on the brain. *Proc Natl Acad Sci U S A* 111(47):16913–16918. <https://doi.org/10.1073/pnas.1415297111>
  40. Meier MH, Caspi A, Ambler A et al (2012) Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proc Natl Acad Sci U S A* 109(40):E2657–E2664. <https://doi.org/10.1073/pnas.1206820109>
  41. Barkus E (2016) High-potency cannabis increases the risk of psychosis. *Evid Based Ment Health* 19(2):54. <https://doi.org/10.1136/eb-2015-102105>
  42. Braun IM, Wright A, Peteet J et al (2018) Medical oncologists' beliefs, practices, and knowledge regarding marijuana used therapeutically: A nationally representative survey study. *J Clin Oncol* 36(19):1957–1962. <https://doi.org/10.1200/jco.2017.76.1221>
  43. Patell R, Bindal P, Dodge L, et al (2022) Oncology fellows' clinical discussions, perceived knowledge, and formal training regarding medical cannabis use: A national survey study. *JCO Oncol Pract*. Op2100714. <https://doi.org/10.1200/op.21.00714>
  44. Hachem Y, Abdallah SJ, Rueda S et al (2022) Healthcare practitioner perceptions on barriers impacting cannabis prescribing practices. *BMC Complement Med Ther* 22(1):237. <https://doi.org/10.1186/s12906-022-03716-9>
  45. Braun IM, Nayak MM, Roberts JE, et al (2022) Backgrounds and trainings in cannabis therapeutics of dispensary personnel. *JCO Oncol Pract Op*2200129. <https://doi.org/10.1200/op.22.00129>
  46. Reblin M, Sahebjam S, Peeri NC, Martinez YC, Thompson Z, Egan KM (2019) Medical cannabis use in glioma patients treated at a comprehensive cancer center in Florida. *J Palliat Med* 22(10):1202–1207. <https://doi.org/10.1089/jpm.2018.0528>

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.