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Monograph

Cannabis use and patient-reported outcomes among patients at a comprehensive cancer center

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Abstract

Background: Patients with cancer report increasing rates of cannabis use, often to manage symptoms and toxicities. The efficacy and safety of cannabis, however, for some use cases remains unclear. To better understand characteristics of patients with cancer who report using cannabis, we examined data from a cannabis use survey of among patients with cancer seen at a National Cancer Institute–Designated Cancer Center.

Methods: In late 2021, patients with cancer (N = 1608) treated between July 2017 and December 2019 provided cannabis use data. Additional data were obtained from medical records data and routine patient-reported outcomes collected for clinical purposes. Univariable analyses and multivariable regression analyses were conducted to identify correlates of cannabis use at different stages in the cancer care trajectory.

Results: Rates of self-reported cannabis use by patients with cancer were 59% before cancer diagnosis and 47% after diagnosis. Longitudinal rates of cannabis use were 29% for no cannabis use, 23% before diagnosis, 12% after diagnosis, and 35% for both before and after diagnosis. Demographic factors associated with cannabis use included age, sex, race, and educational achievement. Tobacco use and binge drinking were associated with higher odds of cannabis use. Cannabis use was also associated with greater self-reported interference with physical functioning due to pain and interference with social functioning due to health problems.

Conclusions: We found high rates of cannabis use among patients with cancer, both before and after their cancer diagnosis. Future studies should further investigate psychosocial factors associated with cannabis use among patients with cancer as well as psychosocial outcomes among patients with cancer using cannabis.

Patients with cancer commonly use cannabis to control cancer-related symptoms and treatment toxicities. Recent studies report rates of cannabis use after cancer diagnosis between 8% and 24% (1-6). Use of cannabis in this population is reported to have increased (2), likely because of state-level legalization of cannabis use for medical and recreational purposes. Commonly reported reasons for cannabis use in patients with cancer include alleviating pain, increasing appetite, improving sleep, and reducing anxiety (7). Mixed empirical evidence suggests that cannabis may be helpful for alleviating these symptoms and toxicities (8), but cannabis use may have limited efficacy and raise clinically important risks (9-11). Little is known about the different patterns of cannabis use before and after cancer diagnosis and factors related to them. Clinicians would benefit from understanding which patients are most likely to use or seek cannabis after diagnosis so that these patients can be counseled on empirically supported benefits and risks associated with cannabis.

To address this gap in the literature, we asked patients seen at a National Cancer Institute–Designated Cancer Center to complete a survey on cannabis use. These data were integrated with clinical and patient-reported outcomes data to identify predictors and correlates of cannabis use among individuals with cancer. We hypothesized that greater pain and worse quality of life (QOL) would be predictive of subsequent cannabis use and that cannabis use would be associated with comorbidities commonly reported as reasons for using cannabis among individuals with cancer.

Methods

Participants and procedure

Eligible patients were those who were diagnosed with cancer, were seen at Moffitt Cancer Center, had consented to an institutional biobanking protocol, had completed cancer treatment between July 2017 and December 2019, were at least 18 years old, were alive as of last follow-up, had indicated a language preference of English or Spanish, and had an email address on file. Between August and November 2021, a Research Electronic Data Capture (12) project developed by the Participant Research, Interventions, & Measurements Core at Moffitt Cancer Center

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sent eligible patients with cancer an e-mail inviting them to the study and 2 reminder e-mails 1 and 3 weeks later. No participant incentive payment was offered for this study. Those who wished to participate in the study provided informed consent, and then completed the online survey developed to capture details of cannabis use. The Collaborative Data Services Core at Moffitt Cancer Center provisioned medical records data, patient-reported outcomes data, and health behaviors from surveys routinely administered for clinical purposes to consenting patients with cancer. The study protocol was reviewed by the Moffitt Cancer Center's Institutional Review Board (IRB) of record, Advarra IRB, and determined to be exempt from IRB oversight (Pro00014441).

Measures

Demographic and clinical characteristics

Demographic and clinical data from patients with cancer were collected from administrative datasets. Demographic characteristics included age, sex, race, ethnicity, marital status, education level, and employment. Clinical data included age at time of cancer diagnosis, primary cancer site, clinician-reported history of a sleep disorder, and clinician-reported history of pain.

Behavioral factors

Health behavior data for patients with cancer were collected from surveys routinely administered to all patients at their first visit to Moffitt Cancer Center. Self-reported health behavior data included history of using alcohol and tobacco. Alcohol use data were used to determine whether patients with cancer reported binge drinking, as defined by the National Institute on Alcohol Abuse and Alcoholism (13). Patient-reported binge drinking was defined as reporting drinking more than 4 drinks in 1 day for women or more than 5 drinks in 1 day for men within the past month. Tobacco use data were used to determine whether patients were current smokers (ie, within the past 30 days), former smokers, or never smokers; data were derived from smoking status variables from cancer registry data for combustible tobacco.

Quality of life

QOL at the patient's first visit (ie, near the time of diagnosis) was measured using items in the Medical Outcomes Study 12-item Short Form Health Survey (14). Self-reported overall health was assessed by a measure asking patients to rate their general health on a scale of "poor" to "excellent." Patients also rated how much pain interfered with their physical functioning on a scale of "not at all" to "extremely." Finally, patients reported how much any physical or emotional problems interfered with social activities on a scale of "none of the time" to "all of the time."

Cannabis use

The study team administered a survey to assess cannabis use, defined as all products that contain ingredients from the cannabis plant, including "any marijuana, cannabis concentrates, edibles, lotions, ointments, tinctures containing cannabis, [cannabidiol] CBD-only products, pharmaceutical or prescription cannabinoids (eg, dronabinol, nabilone, Marinol, Syndros, Cesamet), and other products made with cannabis" and excluding hemp seed oil. This survey asked patients with cancer to self-report whether cannabis was used before their cancer diagnosis ("Prior to your cancer diagnosis, did you ever, even once, use cannabis for any reason?") and after their cancer diagnosis ("Have you used cannabis at any time since your cancer diagnosis?"). Patients were also asked to self-report whether they used cannabis currently, which was defined as use in the prior 30 days. These questions were asked regardless of replies to previous questions so that patients with cancer had an opportunity to report cannabis use after diagnosis and currently, even if they did not report prediagnosis use of cannabis.

Patients with cancer were allocated to cannabis use groups in 2 ways. First, patients were categorized as those who did vs did not report using cannabis before their cancer diagnosis, after their cancer diagnosis, and currently (ie, at the time of the study survey). These groups were not mutually exclusive. The goal of analyses using these groupings was to examine associations with self-reported cannabis use at distinct periods in the cancer care trajectory.

The second grouping categorized patients into groups based on patterns of cannabis use. Patients were grouped as those who reported never using cannabis, only using cannabis before diagnosis, only using cannabis after diagnosis, and using cannabis before and after diagnosis. These groupings were mutually exclusive. The goal of analyses using these groupings was to examine associations with patients' self-reported longitudinal pattern of cannabis use.

This survey also asked patients who used cannabis after diagnosis about their forms of cannabis use by the question, "Which one of the following ways do you, or did you, use cannabis most often since your cancer diagnosis?" with mutually exclusive options such as "Smoking such as in a joint, bong, pipe, or blunt" or "Eating it in food such as brownies, cakes, cookies, or candy."

Reasons for use

Patients who used cannabis after diagnosis were asked about their reasons for use with the question, "What were your reasons for using cannabis after your cancer diagnosis?" with select-all-that-apply options such as "Pain" or "Difficulty sleeping."

Statistical analyses

Statistical analyses were performed using SAS, version 9.4, statistical software (SAS Institute Inc, Cary, NC) and R (R Foundation for Statistical Computing, Vienna, Austria). Descriptive statistics (ie, means [SD], ranges, frequencies, percentages) were used to characterize patients' demographic and clinical characteristics. *T* tests and χ^2 tests were used to determine associations between cannabis use and demographic, clinical, behavioral, and QOL characteristics. Variables associated with cannabis use were considered for inclusion in subsequent multivariable analyses to identify factors associated with cannabis use while controlling for other factors. Variables with extremely small groups (<5%) were either dichotomized or excluded from additional analysis to maintain statistical power. Logistic regression analyses were used to identify factors associated with cannabis use at distinct periods in the cancer care trajectory (ie, before diagnosis, after diagnosis, currently). Three multinomial logistic regression analyses were used to compare patients with cancer who reported never using cannabis with those who reported using cannabis only before cancer diagnosis, only after cancer diagnosis, and before and after cancer diagnosis.

Results

Patient characteristics

Overall, 9043 eligible cancer patients were invited to participate in the study. Of these, 1592 completed the survey, and an additional 16 provided usable cannabis use data and were included in this study, yielding a total sample size 1608. Demographic and clinical characteristics of the overall sample are shown in Table 1. The sample was approximately balanced between

Table 1. Demographic, clinical, behavioral, and quality-of-life characteristics and associations with cannabis use among patients with cancer throughout the cancer care trajectory[a]

Variable	Overall sample (N = 1608)	Cannabis use before diagnosis			Cannabis use after diagnosis			Current cannabis use		
		No (n = 659)	Yes (n = 942)	P	No (n = 846)	Yes (n = 762)	P	No (n = 1115)	Yes (n = 487)	P
Age at cancer diagnosis, mean (SD), y	60 (13)	62 (13)	59 (12)	<.001	63 (12)	57 (13)	<.001	62 (13)	57 (13)	<.001
Sex, No. (%)				<.01			.09			.21
Female	843 (52)	373 (57)	465 (49)		426 (50)	417 (55)		596 (54)	243 (50)	
Male	765 (48)	286 (43)	477 (51)		420 (50)	345 (45)		519 (46)	244 (50)	
Race, No. (%)				<.01			.55			.36
Asian	10 (1)	9 (1)	1 (0)		5 (1)	5 (1)		9 (1)	1 (0)	
Black/African American	65 (4)	34 (5)	31 (3)		33 (4)	32 (4)		45 (4)	20 (4)	
White	1499 (93)	604 (92)	888 (94)		795 (94)	704 (92)		1042 (93)	452 (93)	
American Indian, Alaska Native, Native Hawaiian, Pacific Islander, more than one race, or prefer not to answer	31 (2)	11 (2)	20 (2)		12 (1)	19 (2)		17 (2)	13 (3)	
Missing	3 (0)	1 (0)	2 (0)		1 (0)	2 (0)		2 (0)	1 (0)	
Race (dichotomized), No. (%)				.10			.40			.90
Non-White	106 (7)	54 (8)	52 (6)		50 (6)	56 (7)		71 (6)	34 (7)	
White	1499 (93)	604 (92)	888 (94)		795 (94)	704 (92)		1042 (93)	452 (93)	
Missing	3 (0)	1 (0)	2 (0)		1 (0)	2 (0)		2 (0)	1 (0)	
Ethnicity, No. (%)				.11			.25			.38
Non-Hispanic/non-Latino	1504 (94)	609 (92)	889 (94)		796 (94)	708 (93)		1050 (94)	450 (92)	
Hispanic/Latino	102 (6)	50 (8)	51 (5)		50 (6)	52 (7)		64 (6)	36 (7)	
Missing	2 (0)	0 (0)	2 (0)		0 (0)	2 (0)		1 (0)	1 (0)	
Marital status, No. (%)				.04			<.01			<.01
Not married	450 (28)	171 (26)	273 (29)		212 (25)	238 (31)		294 (26)	154 (32)	
Married	1134 (71)	483 (73)	650 (69)		625 (74)	509 (67)		809 (73)	321 (66)	
Missing	24 (1)	5 (1)	19 (2)		9 (1)	15 (2)		12 (1)	12 (2)	
Living alone, No. (%)				.91			.10			.12
Live with other people	1165 (72)	481 (73)	679 (72)		621 (73)	544 (71)		817 (73)	343 (70)	
Live alone	156 (10)	63 (10)	91 (10)		89 (11)	67 (9)		113 (10)	43 (9)	
Missing	287 (18)	115 (17)	172 (18)		136 (16)	151 (20)		185 (17)	101 (21)	
Education, No. (%)				.49			<.01			<.01
≤High school	403 (25)	157 (24)	244 (26)		194 (23)	209 (27)		261 (23)	139 (29)	
≥Some college	920 (57)	388 (59)	527 (56)		517 (61)	403 (53)		671 (60)	247 (51)	
Missing	285 (18)	114 (17)	171 (18)		135 (16)	150 (20)		183 (16)	101 (21)	
Employment, No. (%)				.18			.11			.11
Not employed	735 (46)	318 (48)	411 (44)		402 (48)	333 (44)		516 (46)	217 (45)	
Employed	588 (37)	227 (34)	360 (38)		309 (37)	279 (37)		416 (37)	169 (35)	
Missing	285 (18)	114 (17)	171 (18)		135 (16)	150 (20)		183 (16)	101 (21)	
Sleep disorder, No. (%)				.80			.22			.33
Past 30 d	25 (2)	9 (1)	16 (2)		12 (1)	13 (2)		17 (2)	8 (2)	
Former	384 (24)	154 (23)	228 (24)		188 (22)	196 (26)		255 (23)	128 (26)	
Never	1199 (75)	496 (75)	698 (74)		646 (76)	553 (73)		843 (76)	351 (72)	
Pain, No. (%)				.56			<.01			.04
Past 30 d	96 (6)	35 (5)	61 (6)		45 (5)	51 (7)		62 (6)	33 (7)	
Former	837 (52)	350 (53)	483 (51)		416 (49)	421 (55)		562 (50)	272 (56)	
Never	675 (42)	274 (42)	398 (42)		385 (46)	290 (38)		491 (44)	182 (37)	
Binge drinking,[b] No. (%)	225 (14)	56 (8)	169 (18)	<.001	95 (11)	130 (17)	<.001	128 (11)	96 (20)	<.001
Combustible tobacco use, No. (%)				<.001			<.001			<.001
Past 30 d	155 (10)	33 (5)	120 (13)		50 (6)	105 (14)		78 (7)	77 (16)	
Former	717 (45)	224 (34)	492 (52)		361 (43)	356 (47)		477 (43)	236 (48)	
Never	733 (46)	400 (61)	329 (35)		433 (51)	300 (39)		557 (50)	174 (36)	
Missing	3 (0)	2 (0)	1 (0)		2 (0)	1 (0)		3 (0)	0 (0)	
Cancer region, No. (%)				.70			.13			.22
Breast	242 (15)	110 (17)	131 (14)		124 (15)	118 (15)		172 (15)	69 (14)	
Central nervous system	22 (1)	10 (2)	11 (1)		10 (1)	12 (2)		15 (1)	7 (1)	
Connective/soft tissue	44 (3)	21 (3)	23 (2)		21 (2)	23 (3)		28 (3)	16 (3)	
Digestive	197 (12)	72 (11)	125 (13)		99 (12)	98 (13)		130 (12)	66 (14)	
Female genital	87 (5)	38 (6)	47 (5)		50 (6)	37 (5)		67 (6)	20 (4)	
Head and neck	82 (5)	30 (5)	52 (6)		48 (6)	34 (4)		61 (5)	21 (4)	
Hematologic	236 (15)	95 (14)	140 (15)		116 (14)	120 (16)		166 (15)	70 (14)	
Lymphoma	91 (6)	31 (5)	60 (6)		45 (5)	46 (6)		65 (6)	24 (5)	
Male genital	134 (8)	51 (8)	83 (9)		78 (9)	56 (7)		99 (9)	35 (7)	
Musculoskeletal	13 (1)	7 (1)	6 (1)		5 (1)	8 (1)		7 (1)	6 (1)	
Skin	146 (9)	62 (9)	83 (9)		92 (11)	54 (7)		105 (9)	40 (8)	
Thoracic	168 (10)	71 (11)	97 (10)		79 (9)	89 (12)		107 (10)	60 (12)	
Thyroid and other endocrine	44 (3)	20 (3)	24 (3)		29 (3)	15 (2)		33 (3)	11 (2)	
Urinary system	95 (6)	37 (6)	57 (6)		46 (5)	49 (6)		56 (5)	39 (8)	

(continued)

Table 1. (continued)

Variable	Overall sample (N = 1608)	Cannabis use before diagnosis			Cannabis use after diagnosis			Current cannabis use		
		No (n = 659)	Yes (n = 942)	P	No (n = 846)	Yes (n = 762)	P	No (n = 1115)	Yes (n = 487)	P
Other	7 (0)	4 (1)	3 (0)		4 (0)	3 (0)		4 (0)	3 (1)	
Time since diagnosis, mean (SD), y	2.9 (0.8)	2.9 (0.8)	2.8 (0.8)	.23	2.9 (0.8)	2.9 (0.8)	.71	2.9 (0.8)	2.8 (0.8)	.25
Physical interference due to pain,[c] mean (SD)	2.1 (1.2)	2.1 (1.2)	2.1 (1.2)	.86	1.9 (1.1)	2.3 (1.3)	<.001	2.0 (1.2)	2.4 (1.3)	<.001
General health,[d] mean (SD)	3.6 (1.0)	3.6 (1.0)	3.6 (1.0)	.29	3.7 (.9)	3.5 (1.0)	<.001	3.6 (1.0)	3.4 (1.1)	<.01
Social interference due to health,[e] mean (SD)	2.1 (1.4)	2.0 (1.4)	2.2 (1.5)	<.01	1.9 (1.3)	2.4 (1.5)	<.001	2.0 (1.3)	2.5 (1.6)	<.001

[a] Percentages may not sum to 100 because of rounding. *T* tests and χ^2 tests were used to assess whether demographic, clinical, behavioral, and quality-of-life characteristics differed based on cannabis use groups.
[b] Binge drinking was defined as drinking ≥4 drinks with alcohol in 1 day for women and ≥5 drinks with alcohol in 1 day for men [13].
[c] For pain interference, higher scores greater interference from pain.
[d] For general health, higher scores indicate better health.
[e] For social interference due to health, higher scores indicate greater interference due to health.

female (52%) and male (48%) patients. Most patients were White (76%) and non-Hispanic (78%). Most were married (59%) and did not live alone (73%). The average (SD) age at diagnosis was 60 (13) years (range = 18-89 years), and the average (SD) year from survey time to diagnosis was 3 (0.8) years. The most common cancer types were hematologic (15%) and breast (15%).

Cannabis use

Most (59%) patients with cancer reported using cannabis before their cancer diagnosis. Fewer than half (47%) reported using cannabis after their diagnosis. Current cannabis use was reported in less than one-third of the sample (30%). When grouped based on patients' longitudinal patterns of cannabis use, fewer than one-third (29%) reported never using cannabis, fewer than one-quarter of the sample (23%) reported only using cannabis before their cancer diagnosis, 12% reported only using cannabis after their diagnosis, and more than one-third (35%) reported using cannabis before and after their diagnosis.

Univariable correlates of cannabis use

Table 1 presents demographic, clinical, behavioral, and QOL factors associated with cannabis use at periods in the cancer care trajectory. Patients who reported using cannabis at each period were younger (mean age range = 59-62) compared to patients who reported never using cannabis (mean age = 64; $P < .001$). Men were more likely than women to report using cannabis before diagnosis ($P < .01$), but no sex differences were observed at other periods ($P \geq .09$). Patients with cancer who were married and had some college education reported lower rates of cannabis use after cancer diagnosis and at the study survey than patients who were not married and who had less educational attainment, respectively ($P < .01$). Race, cancer type, and clinician-reported sleep disorders were not associated with cannabis use. Patients with current or previous clinician-reported pain as a comorbidity were more likely than patients who never had a pain comorbidity to use cannabis after diagnosis ($P < .01$) and at the time of the study survey ($P = .04$). Patients who self-reported binge drinking within the past month and patients who were former or current smokers were more likely to report cannabis use before diagnosis, after diagnosis, and at the time of the study survey than patients who did not report binge drinking or tobacco use, respectively ($P < .001$). Greater interference with physical functioning due to pain and worse general health were positively associated with cannabis use after diagnosis and at the time of the study survey ($P < .01$). Greater interference with social functioning due to health problems was positively associated with cannabis use before cancer diagnosis, after diagnosis, and at the time of the study survey ($P < .01$).

Table 2 presents correlates among timing patterns of cannabis use. Similar patterns of cannabis use were observed as described earlier, but 2 notable patterns of cannabis use indicated that sex and race may be associated with the timing of cannabis use among patients with cancer. Men were more likely to use cannabis only before their cancer diagnosis, and women were more likely to use cannabis only after their diagnosis ($P \leq .001$). Also, White patients were more likely to use cannabis only before their cancer diagnosis than patients of other races ($P = .03$).

Table 3 presents the distributions of most frequently used cannabis forms and reasons for use among patients with cancer who reported cannabis use after diagnosis. By comparison, those who used cannabis only after diagnosis were more likely to take the drug by mouth, such as pills, tinctures, or under the tongue, and apply it topically, such as in a lotion, cream or patch; those who used cannabis both before and after diagnosis were more likely to smoke the drug, such as in a joint, bong, pipe, blunt, vape, or vaporize; use cannabis for mood changes, stress, anxiety, or depression; and use for digestive problems or for recreation or enjoyment ($P < .001$).

Multivariable correlates of cannabis use

Table 4 presents the results of multivariable logistic regression models identifying correlates of cannabis use at specific time periods in the cancer care trajectory. Higher odds of reporting cannabis use before diagnosis were associated with younger age (odds ratio [OR] = 0.97, 95% confidence interval [CI] = 0.95 to 0.98), male sex (OR = 1.44, 95% CI = 1.13 to 1.84), White race (OR = 2.29, 95% CI = 1.41 to 3.74), self-reported binge drinking (OR = 1.93, 95% CI = 1.37 to 2.74), current smoking (OR = 3.55, 95% CI = 2.24 to 5.78), former smoking (OR = 3.11, 95% CI = 2.41 to 4.03), and greater social interference due to health problems (OR = 1.15, 95% CI = 1.04 to 1.28). Higher odds of reporting cannabis use after diagnosis were associated with younger age (OR = 0.97, 95% CI = 0.96 to 0.98), self-reported binge drinking (OR = 1.42, 95% CI = 1.04 to 1.94), current smoking (OR = 2.54, 95% CI = 1.66 to 3.92), former smoking (OR = 1.76, 95% CI = 1.37 to 2.26), greater physical interference due to pain (OR = 1.19, 95%

Table 2. Demographic, clinical, behavioral, and quality-of-life characteristics among patients with cancer, by patterns of cannabis use[a]

Characteristic	Never used cannabis (n = 469)	Cannabis only before diagnosis (n = 374)	Cannabis only after diagnosis (n = 190)	Cannabis before and after diagnosis (n = 568)	P
Age at cancer diagnosis, mean (SD), y	64 (13)	62 (11)	59 (14)	59 (13)	<.001
Sex, No. (%)					<.001
Female	250 (53)	175 (47)	123 (65)	290 (51)	
Male	219 (47)	199 (53)	67 (35)	278 (49)	
Race, No. (%)					.03
Asian	5 (1)	0 (0)	4 (2)	1 (0)	
Black/African American	25 (5)	8 (2)	9 (5)	23 (4)	
White	432 (92)	360 (96)	172 (91)	528 (93)	
American Indian, Alaska Native, Native Hawaiian, Pacific Islander, more than one race, or prefer not to answer	7 (1)	5 (1)	4 (2)	15 (3)	
Missing	0 (0)	1 (0)	1 (1)	1 (0)	
Race (dichotomized), No. (%)					.09
Non-White	37 (8)	13 (3)	17 (9)	39 (7)	
White	432 (92)	360 (96)	172 (91)	528 (93)	
Missing	0 (0)	1 (0)	1 (1)	1 (0)	
Ethnicity, No. (%)					.06
Non-Hispanic/non-Latino	440 (94)	353 (94)	169 (89)	536 (94)	
Hispanic/Latino	29 (6)	21 (6)	21 (11)	30 (5)	
Missing	0 (0)	0 (0)	0 (0)	2 (0)	
Marital status, No. (%)					.02
Not married	120 (26)	90 (24)	51 (27)	183 (32)	
Married	347 (74)	277 (74)	136 (72)	373 (66)	
Missing	2 (0)	7 (2)	3 (2)	12 (2)	
Living alone, No. (%)					.50
Live with other people	348 (74)	271 (72)	133 (70)	408 (72)	
Live alone	46 (10)	42 (11)	17 (9)	49 (9)	
Missing	75 (16)	61 (16)	40 (21)	111 (20)	
Education, No. (%)					.07
≤High school	104 (22)	89 (24)	53 (28)	155 (27)	
≥Some college	290 (62)	225 (60)	98 (52)	302 (53)	
Missing	75 (16)	60 (16)	39 (21)	111 (20)	
Employment, No. (%)					.13
Not employed	237 (51)	162 (43)	81 (43)	249 (44)	
Employed	157 (33)	152 (41)	70 (37)	208 (37)	
Missing	75 (16)	60 (16)	39 (21)	111 (20)	
Sleep disorder, No. (%)					.36
Past 30 d	5 (1)	7 (2)	4 (2)	9 (2)	
Former	99 (21)	88 (24)	55 (29)	140 (25)	
Never	365 (78)	279 (75)	131 (69)	419 (74)	
Pain, No. (%)					.04
Past 30 d	24 (5)	21 (6)	11 (6)	40 (7)	
Former	235 (50)	179 (48)	115 (61)	304 (54)	
Never	210 (45)	174 (47)	64 (34)	224 (39)	
Binge drinking,[b] No. (%)	43 (9)	52 (14)	13 (7)	117 (21)	<.001
Combustible tobacco use, No. (%)					<.001
Past 30 d	21 (4)	28 (7)	12 (6)	92 (16)	
Former	155 (33)	206 (55)	69 (36)	286 (50)	
Never	291 (62)	140 (37)	109 (57)	189 (33)	
Missing	2 (0)	0 (0)	0 (0)	1 (0)	
Cancer region, No. (%)					.04
Breast	77 (16)	46 (12)	33 (17)	85 (15)	
Central nervous system	5 (1)	5 (1)	5 (3)	6 (1)	
Connective/soft tissue	14 (3)	7 (2)	7 (4)	16 (3)	
Digestive	52 (11)	47 (13)	20 (11)	78 (14)	
Female genital	29 (6)	21 (6)	9 (5)	26 (5)	
Head and neck	26 (6)	22 (6)	4 (2)	30 (5)	
Hematologic	60 (13)	56 (15)	35 (18)	84 (15)	
Lymphoma	16 (3)	29 (8)	15 (8)	31 (5)	
Male genital	39 (8)	39 (10)	12 (6)	44 (8)	
Musculoskeletal	4 (1)	1 (0)	3 (2)	5 (1)	
Skin	54 (12)	37 (10)	8 (4)	46 (8)	
Thoracic	43 (9)	36 (10)	28 (15)	61 (11)	
Thyroid and other endocrine	19 (4)	10 (3)	1 (1)	14 (2)	
Urinary system	27 (6)	18 (5)	10 (5)	39 (7)	
Other	4 (1)	0 (0)	0 (0)	3 (1)	

(continued)

Table 2. (continued)

Characteristic	Never used cannabis (n = 469)	Cannabis only before diagnosis (n = 374)	Cannabis only after diagnosis (n = 190)	Cannabis before and after diagnosis (n = 568)	P
Time since diagnosis, mean (SD), y	2.8 (0.8)	2.9 (0.8)	3.0 (0.8)	2.8 (0.8)	.06
Physical interference due to pain,[c] mean (SD)	2.0 (1.2)	1.9 (1.1)	2.5 (1.3)	2.3 (1.3)	<.001
General health,[d] mean (SD)	3.7 (0.9)	3.7 (0.9)	3.4 (1.1)	3.5 (1.0)	<.01
Social interference due to health,[e] mean (SD)	1.9 (1.3)	1.9 (1.3)	2.3 (1.4)	2.4 (1.5)	<.001

[a] Percentages may not sum to 100 due to rounding. T tests and χ^2 tests were used to assess whether demographic, clinical, behavioral, and quality-of-life characteristics differed based on patterns of cannabis use.
[b] Binge drinking was defined as drinking ≥4 drinks with alcohol in 1 day for women and ≥5 drinks with alcohol in 1 day for men [13].
[c] For pain interference, higher scores mean greater interference from pain.
[d] For general health, higher scores indicate better health.
[e] For social interference due to health, higher scores indicate greater interference due to health.

Table 3. Most common forms of cannabis and reasons for cannabis use among patients with cancer, by patterns of use after diagnosis[a]

	Cannabis use after diagnosis (n = 762)	Cannabis only after diagnosis (n = 190)	Cannabis before and after diagnosis (n = 568)	P
Most common forms of cannabis, No. (%)				<.001
Smoking, such as in a joint, bong, pipe, or blunt	204 (27)	19 (10)	183 (32)	
Eating it in food such as brownies, cakes, cookies, or candy	154 (20)	40 (21)	113 (20)	
Drinking it in a liquid such as tea, cola, or alcohol	9 (1)	5 (3)	4 (1)	
Taking by mouth, such as pills, tinctures, or under the tongue	188 (25)	76 (40)	112 (20)	
Vaping or vaporizing	108 (14)	16 (8)	92 (16)	
Dabbing, such as using waxes or shatter	10 (1)	1 (1)	9 (2)	
Applying topically, such as in a lotion, cream, or patch	53 (7)	23 (12)	29 (5)	
Other	20 (3)	6 (3)	14 (2)	
Missing	16 (2)	4 (2)	12 (2)	
Reasons for use, No. (%)				
Pain	414 (54)	111 (58)	301 (53)	.22
Mood changes, stress, anxiety, or depression	394 (52)	69 (36)	321 (57)	<.001
Neuropathy (numbness or tingling)	149 (20)	41 (22)	107 (19)	.47
Difficulty sleeping	461 (60)	105 (55)	353 (62)	.11
Difficulty concentrating	73 (10)	15 (8)	56 (10)	.51
Skin problems	22 (3)	5 (3)	17 (3)	.99
Sweating symptoms (eg, hot flashes, night sweats)	43 (6)	8 (4)	35 (6)	.41
Digestive problems (eg, nausea, vomiting, diarrhea, constipation)	222 (29)	37 (19)	184 (32)	<.001
Lack of appetite	224 (29)	42 (22)	180 (32)	.02
Lack of energy or fatigue	140 (18)	37 (19)	102 (18)	.72
Lack of sexual interest of activity	60 (8)	11 (6)	48 (8)	.30
Used as a treatment or cure for cancer	80 (10)	22 (12)	56 (10)	.59
Used recreationally or enjoyment	171 (22)	3 (2)	166 (29)	<.001
Used for other cancer symptom or cancer treatment side effects	50 (7)	12 (6)	38 (7)	.99
Other reason	31 (4)	11 (6)	20 (4)	.25

[a] χ^2 tests were used to assess whether forms of use and reasons for use differed by patterns of cannabis use.

Table 4. Results from 3 logistic regression models examining factors associated with cannabis use status

	Cannabis used before diagnosis Odds ratio (95% confidence interval)	Cannabis used after diagnosis Odds ratio (95% confidence interval)	Cannabis used currently Odds ratio (95% confidence interval)
Age at diagnosis	0.97 (0.95 to 0.98)***	0.97 (0.96 to 0.98)***	0.98 (0.97 to 0.99)***
Male vs female	1.44 (1.13 to 1.84)**	0.90 (0.71 to 1.13)	1.21 (0.94 to 1.56)
White vs other racial groups	2.29 (1.41 to 3.74)**	1.22 (0.76 to 1.98)	1.25 (0.74 to 2.15)
≥Some college vs <some college	1.15 (0.88 to 1.49)	0.94 (0.73 to 1.22)	0.88 (0.67 to 1.16)
Current pain vs no pain	0.92 (0.54 to 1.58)	0.77 (0.46 to 1.29)	0.87 (0.49 to 1.49)
Former pain vs no pain	0.94 (0.73 to 1.20)	0.98 (0.77 to 1.25)	0.96 (0.73 to 1.25)
Binge drinking vs no binge drinking	1.93 (1.37 to 2.74)***	1.42 (1.04 to 1.94)*	1.75 (1.27 to 2.41)**
Current vs never tobacco use	3.55 (2.24 to 5.78)***	2.54 (1.66 to 3.92)***	2.31 (1.51 to 3.53)***
Former vs never tobacco use	3.11 (2.41 to 4.03)***	1.76 (1.37 to 2.26)***	1.82 (1.38 to 2.40)***
Physical interference due to pain	0.91 (0.80 to 1.02)	1.19 (1.06 to 1.34)**	1.22 (1.08 to 1.39)**
General health	1.03 (0.89 to 1.19)	1.02 (0.89 to 1.17)	1.09 (0.94 to 1.26)
Social interference due to health	1.15 (1.04 to 1.28)**	1.15 (1.04 to 1.26)**	1.17 (1.06 to 1.30)**

* $P < .05$, ** $P < .01$, *** $P < .001$.

CI = 1.06 to 1.34), and greater social interference due to health problems (OR = 1.15, 95% CI = 1.04 to 1.26). Finally, higher odds of reporting cannabis use at the time of the study survey were associated with younger age (OR = 0.98, 95% CI = 0.97 to 0.99), self-reported binge drinking (OR = 1.75, 95% CI = 1.27 to 2.41), current smoking (OR = 2.31, 95% CI = 1.51 to 3.53), former

Table 5. Results from multinomial logistic regression models examining factors associated with patterns of cannabis use

	Cannabis only before diagnosis vs never Odds ratio (95% confidence interval)	Cannabis only after diagnosis vs never Odds ratio (95% confidence interval)	Cannabis before and after diagnosis vs never Odds ratio (95% confidence interval)
Age at diagnosis	0.97 (0.96 to 0.99)***	0.97 (0.95 to 0.99)**	0.95 (0.93 to 0.96)***
Male vs female	1.34 (0.98 to 1.84)	0.65 (0.43 to 0.98)*	1.24 (0.91 to 1.67)
White vs other racial groups	3.14 (1.48 to 6.66)**	1.31 (0.65 to 2.64)	2.22 (1.22 to 4.01)**
≥Some college vs <some college	1.09 (0.76 to 1.54)	0.79 (0.52 to 1.21)	1.06 (0.76 to 1.47)
Current pain vs no pain	0.96 (0.48 to 1.92)	0.74 (0.31 to 1.78)	0.75 (0.39 to 1.46)
Former pain vs no pain	0.94 (0.68 to 1.31)	1.01 (0.67 to 1.53)	0.93 (0.68 to 1.28)
Binge drinking vs no binge drinking	1.36 (0.87 to 2.14)	0.69 (0.35 to 1.34)	2.04 (1.35 to 3.08)***
Current vs never tobacco use	2.80 (1.44 to 5.47)**	1.81 (0.79 to 4.12)	5.50 (3.03 to 10.00)***
Former vs never tobacco use	3.02 (2.16 to 4.21)***	1.44 (0.95 to 2.21)	3.86 (2.79 to 5.34)***
Physical interference due to pain	0.90 (0.76 to 1.06)	1.32 (1.09 to 1.60)**	1.06 (0.91 to 1.24)
General health	1.04 (0.86 to 1.26)	1.01 (0.80 to 1.27)	1.03 (0.86 to 1.23)
Social interference due to health	1.10 (0.96 to 1.27)	1.09 (0.92 to 1.28)	1.24 (1.09 to 1.41)**

* $P < .05$, ** $P < .01$, *** $P < .001$.

smoking (OR = 1.82, 95% CI = 1.38 to 2.40), greater physical interference due to pain (OR = 1.22, 95% CI = 1.08 to 1.39), and greater social interference due to health problems (OR = 1.17, 95% CI = 1.06 to 1.30).

Table 5 presents results of multivariable multinomial logistic regression models identifying correlates of cannabis use only before diagnosis, only after diagnosis, and before and after diagnosis. Compared with patients with cancer who never used cannabis, those who only used cannabis before diagnosis were more likely to be younger (OR = 0.97, 95% CI = 0.96 to 0.99), White (OR = 3.14, 95% CI = 1.48 to 6.66), a current smoker (OR = 2.80, 95% CI = 1.44 to 5.47), or a former smoker (OR = 3.02, 95% CI = 2.16 to 4.21). Compared with never users, patients with cancer who used cannabis only after diagnosis were more likely to be younger (OR = 0.97, 95% CI = 0.95 to 0.99), female (OR = 1.54, 95% CI = 1.02 to 2.31), and reporting interference with physical functioning due to pain (OR = 1.32, 95% CI = 1.09 to 1.60). Compared with never users, patients who used cannabis before and after cancer diagnosis were more likely to be younger (OR = 0.95, 95% CI = 0.93 to 0.96), White (OR = 2.22, 95% CI = 1.22 to 4.01), binge drinkers (OR = 2.04, 95% CI = 1.35 to 3.08), current smokers (OR = 5.50, 95% CI = 3.03 to 10.00), former smokers (OR = 3.86, 95% CI = 2.79 to 5.34), and report interference with social functioning due to health problems (OR = 1.24, 95% CI = 1.09 to 1.41).

Discussion

Self-reported rates of cannabis use among patients with cancer were 59% before diagnosis and 47% after diagnosis. Fewer than one-third of patients with cancer (30%) reported being current cannabis users. Consistent patterns emerged showing that cannabis use was more common among younger patients with cancer, those with greater interference with physical functioning due to pain, those with a history of tobacco use, and those who reported binge drinking in the prior month.

The rates of cannabis use we report are statistically significantly higher than published rates for patients with cancer in the range of 8% to 24% (1-6). Current use of cannabis (ie, within the prior month) in our study was 30%. Some of this difference can be attributed to further legalization of marijuana, both for recreational and medicinal purposes, throughout the United States and in the state of Florida. As of 2023, 38 states allowed medical use of cannabis, and 23 states allowed use of cannabis for nonmedical purposes (15). Use of cannabis for medical purposes has increased dramatically in Florida in the previous 6 years, with the number of patients registered to use medical marijuana expanding from 54 251 in 2017 (16) to 848 942 in 2023 (17). This explanation for the high rates of cannabis use we observed is underscored by more recent research examining current cannabis use among patients with cancer, such as 1 study reporting 31% of patients reporting ever using cannabis after their cancer diagnosis (18). This finding is similar to our reported rate of current cannabis use (30%); however, a higher rate (47%) reported using cannabis at any point after diagnosis. Thus, the potential for significant recent increases in the rates of cannabis use among patients with cancer should be further explored in future research.

Little research has examined correlates of cannabis use among patients with cancer. One recent study of patients in Denmark found that cannabis use was more common among patients with cancer using tobacco and reporting worse QOL (19). Another study in the United States found that younger patients and those with lower educational achievement were more likely to use cannabis (18). This finding is in line with our findings of higher rates of cannabis use among patients reporting worse physical and social functioning and using other substances (eg, tobacco, alcohol). Future studies in this area should examine whether cannabis use among patients with cancer is associated with changes in QOL or psychosocial outcomes.

Strengths of this study include a large sample of patients with cancer seen at an National Cancer Institute–Designated Cancer Center, the availability of QOL data from around the time of diagnosis, and the ability to identify patterns of cannabis use beyond current users vs nonusers. Limitations of this study include the potential for selection bias resulting from the requirement that patients have an e-mail address on file and limited racial and ethnic heterogeneity of the sample, although the sample demographics were approximately similar to that of the patients treated at this institution (20). Also, patients with cancer who used cannabis may have been more likely to participate in this survey study, and we only have limited data on nonresponders; thus, there is some risk for self-selection bias that may have influenced our results. The use of self-reported data regarding substance use may have introduced some social desirability bias, and the lack of formal validation of the cannabis survey measure limits the potential for comparisons across studies. Future investigators should consider objective measurement of current or recent cannabis use through biospecimen testing and use of validated self-report measures.

Our study suggests that rates of cannabis use among patients with cancer may be elevated compared with reports in the past few years. This study elucidates correlates of cannabis use, which may help clinicians identify patients likely to consider using cannabis and for whom such counseling may be warranted.

Data availability

To protect the privacy of individuals who participate in this study, individual-level data underlying this article, including protected health information, cannot be shared. Summary-level data may be requested by contacting the corresponding author Brian D. Gonzalez (Brian.Gonzalez@Moffitt.org).

Author contributions

Brian D. Gonzalez, PhD (Conceptualization; Data curation; Formal analysis; Writing—original draft; Writing—review & editing), Xiaoyin Li, PhD (Data curation; Formal analysis; Writing—original draft; Writing—review & editing), Yessica C. Martinez, MPH (Investigation; Project administration), Heather S. L. Jim, PhD (Writing—original draft; Writing—review & editing), Laura B. Oswald, PhD (Writing—review & editing), Jessica Y. Islam, PhD (Writing—review & editing), Kea Turner, PhD (Writing—review & editing), Kathleen M. Egan, ScD (Conceptualization; Data curation; Funding acquisition; Investigation; Methodology; Project administration; Supervision; Writing—review & editing).

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