


Impact of Cannabis Use on Inpatient Inflammatory Bowel Disease Outcomes in 2 States Legalizing Recreational Cannabis

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Background: We evaluated the impact of recreational cannabis legalization on use and inpatient outcomes of patients with inflammatory bowel disease (IBD).

Methods: Hospitalized adult patients in Colorado and Washington before (2011) and after (2015) recreational cannabis legalization were compared by chi-square tests for categorical variables and *t*-tests for continuous variables. Multivariable regression models adjusting for demographic data were fit to assess the association of cannabis use with hospital outcomes.

Results: Reported cannabis use increased after legalization (1.2% vs 4.2%, *P* < .001). On multivariable analysis, in 2011, cannabis users were less likely to need total parenteral nutrition (odds ratio 0.12, *P* = .038), and in 2015 had less hospital charges (\$–8418, *P* = .024).

Conclusions: The impact of cannabis legalization and use on IBD is difficult to analyze but may have implications on inpatient IBD outcomes as described in this retrospective analysis. Large, prospective studies are needed to evaluate other IBD outcomes based on cannabis legalization and use.

Lay Summary

Colorado and Washington inpatient databases were analyzed before (2011) and after (2015) recreational cannabis legalization assessing use and inflammatory bowel disease outcomes. Cannabis use increased after legalization. In 2011, cannabis users were less likely to need total parenteral nutrition, and in 2015 had less hospital charges.

Key Words: cannabis, inflammatory bowel disease, inpatient outcomes

Introduction

The role of cannabis legalization and use in inflammatory bowel disease (IBD) is of interest. First, patterns of use may be impacted by legalization of cannabis in certain states. While the physiologic mechanism of cannabis is not impacted by its legal status, legalization could allow patients with more severe disease to access and use cannabis for symptom control.¹ Retrospective studies of patients with IBD demonstrate ever-use of cannabis ranges from 30% to 70% in pediatric and 16% to 80% of adult patients, compared to active use of cannabis from 20% in pediatric to 10%–12% in adult patients, often for symptom control.^{2–8} Legalization could make cannabis more accessible and acceptable to use for older patients, as studies have shown younger age is a strong bivariate and multivariate predictor for cannabis use in patients with IBD.⁴

The impact of cannabis use on outpatient IBD outcomes has also been described with mixed results. A study of patients with IBD before and after cannabis use showed a reduction in symptoms, less frequent therapy adjustments, and decreased need for surgery.⁹ While observational studies have suggested

that cannabis use was associated with a lower quality of life and history of abdominal surgery,^{3,5} another demonstrated no difference in disease severity, quality of life, anxiety, or depression between cannabis users and nonusers.¹⁰

Few studies have explored the impact of cannabis use on inpatient IBD outcomes. Mbachi et al found that while only 1.4% of patients in the National Inpatient Sample (NIS) were coded as cannabis users, they were less likely to develop Crohn's disease (CD)-related complications.¹¹ Our study aim was to evaluate the impact of cannabis legalization and use on inpatient disease outcomes among adult patients with ulcerative colitis (UC) or CD, in 2 states before and after legalization of recreational cannabis.

Materials and Methods

Data were extracted from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases (SID, <https://www.hcup-us.ahrq.gov/sidoverview.jsp>), an administrative database which includes inpatient discharge records from

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community hospitals.¹² State inpatient databases for Colorado and Washington before (2011) and after (2015) recreational cannabis legalization were reviewed using International Classification of Diseases, Ninth and Tenth Revision Clinical Modification Codes (ICD-9-CM/ICD-10-CM, [Supplementary Table S1](#)). As explained on the SID website, for 2015, patients discharged between January 1, 2015 and September 30, 2015 were quarters 1–3 files and included ICD-9-CM data, and patients discharged between October 1, 2015 and December 31, 2015 were quarter 4 files and included ICD-10-CM data since ICD-10 debuted October 1, 2015.

Adult patients with a principal diagnosis of UC or CD were included. Exclusion criteria included pregnancy and age less than 18 years. Demographic data collected included gender, age, race, income quartile (as defined here https://www.hcup-us.ahrq.gov/db/vars/zipinc_qrtl/nisnote.jsp), insurance

type, AHRQ-Elixhauser Comorbidity Index,¹³ and cannabis use. Hospital admission outcomes included steroid use, need for inpatient colonoscopy, need for surgery (ileocectomy, colectomy), total parenteral nutrition (TPN), abscess incision and drainage (I&D), mortality, length of stay (LOS), and total hospital charges. Hospitalized adult patients in Colorado and Washington before (2011) and after (2015) recreational cannabis legalization were compared by chi-square tests for categorical variables and *t*-tests for continuous variables. Multivariable regression models adjusting for demographic data were fit to assess the association of cannabis use with hospital admission outcomes. The models adjust for IBD type, age, gender, race, income, insurance, and Elixhauser comorbidity. Time period (before and after legalization) and cannabis use were included in the models in addition to their interaction, with the exception of colonoscopy, ileocectomy,

Table 1. Comparison of hospitalized adult patients in Colorado and Washington, states which legalized the use of cannabis, before (2011) and after (2015) legalization.

	2011 (<i>n</i> = 8735)		2015 (<i>n</i> = 9810)		<i>P</i> *
	<i>n</i>	%	<i>n</i>	%	
Cannabis use	107	1.22	413	4.21	<.001
Female sex	4744	54.31	5202	53.03	.082
Age (mean, SD)	53.02	19.00	53.82	18.70	.004
Race					.005
White	7254	90.18	8396	89.38	
Black	249	3.10	371	3.95	
Hispanic	244	3.03	317	3.37	
Other	297	3.69	310	3.30	
Income quartile					.028
First	1255	14.70	1273	13.27	
Second	1793	21.01	2113	22.03	
Third	2980	34.91	3394	35.38	
Fourth	2508	29.38	2813	29.32	
Type of insurance					<.001
Medicare	3184	36.46	3733	38.07	
Medicaid	759	8.69	1639	16.71	
Private	3904	44.70	4041	41.21	
Other	887	10.16	393	4.01	
AHRQ-Elixhauser Comorbidity ≥3	3772	43.18	4795	48.88	<.001
IBD type					.098
Crohn's disease	5352	61.64	6132	62.82	
Ulcerative colitis	3331	38.36	3629	37.18	
Steroid use	857	9.81	855	8.72	.010
Colonoscopy	145	1.66	164	1.67	.950
Ileocectomy	76	0.87	62	0.63	.060
Colectomy	174	1.99	169	1.72	.174
TPN	554	6.34	448	4.57	<.001
I&D	47	0.54	45	0.46	.443
Mortality	144	1.65	170	1.73	.655
Length of stay (mean, SD)	5.30	6.24	5.42	6.99	.201
Total charges (mean, SD)	44 241	62 570	57 059	78 505	<.001

Abbreviations: IBD, inflammatory bowel disease; I&D, incision and drainage; TPN, total parenteral nutrition. **P* values are from chi-square tests for categorical variables and *t*-tests for continuous variables.

and I&D where the interaction could not be included due to the fact no patients who had those procedures also reported use of cannabis.

Ethical Considerations

This study was approved by The Ohio State University Wexner Medical Center Institutional Review Board.

Results

A total of 18 545 hospitalized adult IBD patients were included in the analysis, including 8735 patients before (2011) and 9810 after (2015) recreational cannabis legalization. Of these, 107 (1.22%) were cannabis users in 2011 and 413 (4.21%) in 2015 ($P < .001$). After legalization, hospitalized IBD patients were more likely to be older, Black or Hispanic, in second or third quartile of income, insured by Medicare or Medicaid and have more comorbidities (Table 1).

On univariate analysis, there were significant decreases in steroid use (9.8% vs 8.7%, $P = .010$) and need for TPN support (6.3% vs 4.6%, $P < .001$) from 2011 to 2015 after cannabis legalization. Total hospital charges after cannabis legalization increased from \$44 241 to \$57 059 ($P < .001$, Table 1).

On multivariate analysis, there were no differences between cannabis users and nonusers in 2011 versus 2015 regarding mortality, steroid use, colectomy, or LOS (Supplementary Tables S1, S2, S6, and S8). Comparison between years could not be performed for colonoscopy, ileocectomy, or I&D, as no patients who had those procedures in 2011 also reported use of cannabis. Therefore, the interaction between year and cannabis use was not included in the model. Nonetheless, there was no difference in these variables between cannabis users and nonusers (Supplementary Tables S4, S6, and S7). In 2011 before legalization, there were significantly fewer cannabis users on TPN compared to noncannabis users (odds ratio 0.12, 95% confidence interval 0.02, 0.89, $P = .038$, Table 2). In 2015 after legalization, total hospital charges were significantly less in cannabis users compared to noncannabis users ($-\$8418$, 95% confidence interval $-\$15 717$, $-\$1119$, $P = .024$, Table 3).

Regardless of year, an Elixhauser comorbidity index of 3 or greater than 3 was associated with increased need for TPN and total charges (Tables 2 and 3), as well as mortality, steroid use, ileocectomy, and LOS ($P < .001$, Supplementary Tables S2, S3, S5, and S8), but not for colonoscopy, colectomy, or I&D (Supplementary Tables S4, S6, and S7).

Table 2. Multivariable logistic regression model for TPN.

	OR	95% CI	P
2011 (before legalization)			.038
Noncannabis user	Reference		
Cannabis user	0.12	(0.02, 0.89)	
2015 (after legalization)			.768
Noncannabis user	Reference		
Cannabis user	0.94	(0.61, 1.44)	
IBD type			.005
Crohn's disease	Reference		
Ulcerative colitis	0.81	(0.70, 0.94)	
Age (1-year increase)	0.98	(0.98, 0.99)	<.001
Male sex	1.10	(0.96, 1.27)	.159
Race			.001
White	Reference		
Black	0.88	(0.61, 1.27)	
Hispanic	0.46	(0.27, 0.79)	
Other	1.57	(1.16, 2.14)	
Income quartile			.718
First	0.88	(0.70, 1.10)	
Second	0.96	(0.79, 1.16)	
Third	0.96	(0.81, 1.14)	
Fourth	Reference		
Type of insurance			.009
Private	Reference		
Medicare	0.85	(0.71, 1.02)	
Medicaid	1.09	(0.89, 1.34)	
Other	0.66	(0.48, 0.90)	
AHRQ-Elixhauser Comorbidity ≥ 3	2.83	(2.43, 3.29)	<.001

The interaction between state and time period was significant, $P = .049$. Abbreviations: CI, confidence interval; IBD, inflammatory bowel disease; OR, odds ratio; TPN, total parenteral nutrition.

Table 3. Multivariable linear regression model for total charge.

	Days	95% CI	P
2011 (before legalization)			.188
Noncannabis user	Reference		
Cannabis user	-9967	(-24 813, 4878)	
2015 (after legalization)			.024
Noncannabis user	Reference		
Cannabis user	-8418	(-15 717, -1119)	
IBD type			<.001
Crohn's disease	Reference		
Ulcerative colitis	5446	(3234, 7658)	
Age (1-year increase)	12	(-61, 85)	.745
Male sex	4855	(2714, 6996)	<.001
Race			<.001
White	Reference		
Black	4354	(-1473, 10 181)	
Hispanic	3071	(-3003, 9146)	
Other	12 303	(6457, 18 148)	
Income quartile			<.001
First	-7008	(-10 484, -3533)	
Second	-3776	(-6831, -721)	
Third	-5780	(-8447, -3113)	
Fourth	Reference		
Type of insurance			<.001
Private	Reference		
Medicare	-2872	(-5700, -44)	
Medicaid	-1542	(-5051, 1967)	
Other	-9404	(-13 849, -4959)	
AHRQ-Elixhauser Comorbidity ≥ 3	22 975	(20 680, 25 271)	<.001

The interaction between state and time period was not significant, $P = .854$. Abbreviations: CI, confidence interval; IBD, inflammatory bowel disease.

Discussion

Our analysis of adult IBD patients hospitalized in Colorado and Washington before (2011) and after (2015) legalization of recreational cannabis demonstrates an increased use after legalization. Further, there were no significant differences noted in IBD hospital outcomes between cannabis users and nonusers except for less TPN need among cannabis users in 2011, as well as less total hospital charges in 2015.

A similar study described a reduced prevalence of TPN as well as active fistulizing disease, intra-abdominal abscess, blood product transfusion, and partial or total colectomy among cannabis users with CD.¹¹ It is unclear whether reduced need for TPN support is secondary to a direct pathophysiologic influence or related to tetrahydrocannabinol impact on appetite stimulation. In our study, the lack of difference in TPN use among cannabis users and nonusers after 2015 may be related to improved diagnostics, treatment strategies, and early appropriate medical therapies such as biologic agents, which unfortunately are not reported on in the SID.

Notably, we describe less total hospital charges among cannabis users compared to nonusers in 2015, despite no IBD-related differences in procedures, surgeries, mortality, or LOS. We did not adjust for inflation or increased hospital charges over time. One plausible explanation is the growing use of biologics from 2011 to 2015,^{14,15} often used for severe fistulizing disease which previously required steroids, surgery, and possible TPN, which contributes to higher healthcare costs. Furthermore, other medical comorbidities were associated with increased total hospital charges.

We note limitations of our study. First regarding capturing cannabis use, due to reliance on ICD codes from the SID, lower reported rates of cannabis use were described compared to prior retrospective studies. There is risk for underreporting, possibly due to perceived stigma. It is also not clear if routine intake of complementary and alternative medicines or recreational drugs is performed by the admitting provider when discussing medication reconciliation, let alone accounted for in a codable way. This would also lead to underreporting of cannabis use. Cannabis use in terms of medical or recreational, route of administration, dosage, frequency, or disease indication was not available. Future studies should elucidate these variables to control for the effects of cannabis on IBD.

Secondly, our study is underpowered with only 107 patients in the 2011 and 413 in the 2015 cohort. To explore our findings, future studies could compare IBD outcomes in cannabis users versus nonusers in states which did not legalize cannabis versus legalized states. This study was limited in scope to hospitalized patients, and the retrospective nature does not allow for us to analyze the rate of hospitalization in patients with IBD who used cannabis.

Thirdly, due to the nature of the SID, we were unable to collect further data on IBD disease history or severity. We did describe the impact of cannabis use on inpatient IBD outcomes such as need for inpatient colonoscopy, surgery, I&D, steroid use, and TPN support, which may indirectly provide a better understanding of disease behavior. Future studies should aim to prospectively correlate IBD severity with quantifiable cannabis use to assess the impact of cannabis on IBD outcomes.

Conclusion

Cannabis users had less TPN use than nonusers before legalization, and total hospital costs were significantly less among cannabis users after legalization. Otherwise, no significant differences on IBD hospital admission outcomes were seen among users and nonusers of cannabis. Future studies can use this study as a hypothesis driver to investigate IBD-related hospitalization rates among users and nonusers of cannabis before and after legalization. Prospective studies can capture more precise quantification of cannabis use and more detailed IBD history, severity, and medical therapies to fully understand the impact of cannabis on IBD outcomes.

Supplementary Data

Supplementary data is available at *Crohn's and Colitis* 360 online.

Authors' Contribution

A.P.: interpreting data, drafting manuscript; she approved the final submitted version of this manuscript. A.An.: planning the study; he approved the final submitted version of this manuscript. L.N.: planning the study, editing manuscript; she approved the final submitted version of this manuscript. A.H.: statistically analyzing data, editing manuscript; she approved the final submitted version of this manuscript. L.L.: planning the study, editing manuscript; he approved the final submitted version of this manuscript. A.Af.: planning the study, editing manuscript; she approved the final submitted version of this manuscript.

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Conflicts of Interest

Dr. Anita Afzali serves as a consultant, speaker, and/or advisory board for AbbVie, Pfizer, Takeda, Janssen, and Celgene/Bristol Myers Squibb. Dr. Luis Lara serves as a speaker for Abbvie and Allergan and a consultant for Medtronic. Dr. Antoinette Pusateri, Dr. Laura Nemer, Dr. Ahmad Anaizi, and Dr. Alice Hinton have no conflicts of interest to declare.

Data Availability

Data available on the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases, <https://www.hcup-us.ahrq.gov/sidoverview>.

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