Health care utilization differences between First Nations and the general population with inflammatory bowel disease: a retrospective cohort study from Saskatchewan, Canada

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Abstract

Background: Indigenous peoples often face barriers to access specialized care, and no studies have evaluated inflammatory bowel disease (IBD) health care utilization among Indigenous peoples. This study aimed to compare health care utilization between First Nations (FNs) and the general population (GP) diagnosed with IBD in Saskatchewan.

Methods: A patient-oriented population-based retrospective cohort study was conducted by linking administrative health databases of Saskatchewan from 1998/1999 to 2017/2018 fiscal years. Following a patient-oriented approach, the study was designed and completed in partnership with Indigenous patients and family advocates. A validated algorithm was applied to identify incident IBD cases. The self-declared FN status variable was used to divide IBD cases. A 1:5 age and sex matching was applied. Cox-proportional models were used to assess associations and hazard ratios (HRs) and 95% confidence intervals (95%CI) were reported.

Results: A matched cohort with 696 IBD incident cases was created (FNs=116, GP=580). Adjusting by rural/urban residence and diagnosis type, differences between the groups were observed for IBD-specific hospitalizations (HR=1.33, 95%CI:1.01-1.75), IBD-related hospitalizations (HR=1.55, 95%CI:1.20-2.01), medication claims for IBD (HR=0.52, 95%CI:0.41-0.65), and 5-aminosalicylic acid claims (HR=0.56, 95%CI:0.45-0.71). There were no statistically significant differences in the hazard rate of outpatient gastroenterology visits (HR=1.13, 95%CI:0.90-1.41), colonoscopies (HR=1.14, 95%CI:0.92-1.41), and surgeries for IBD (HR=1.14, 95%CI:0.80-1.64).

Interpretation: We identified that FNs diagnosed with IBD had a higher rate of having hospitalizations due to IBD compared to individuals from the GP diagnosed with IBD. Also, an inverse association between FN status and having prescription medication claims for IBD was found.

Key words: Indigenous people, inflammatory bowel disease, ulcerative colitis, Crohn's disease, health services utilization, access to care

Plain language summary

Indigenous patients living with IBD have manifested concerns about access to IBD care. There are limited studies about IBD among Indigenous peoples. This study looked at health care utilization differences between First Nations (FNs) and the general population with the diagnosis of IBD. Indigenous patient and family advocates were engaged in the conception, design, and completion of this study. By looking back in time and using administrative health databases, we identified IBD cases in Saskatchewan from 1998 to 2018. IBD cases were divided by those with

and without FN status. We included 116 FNs and 580 IBD cases from the general population. We compared their health care utilization after the date of IBD diagnosis. Compared to the general population diagnosed with IBD, we found that FNs had higher rates of being hospitalized due to IBD and due to diagnoses associated with IBD (e.g., weight loss, nausea, vomiting, etc.). FNs also had fewer IBD medication claims compared to the general population diagnosed with IBD. We did not observe differences in outpatient gastroenterology visits, colonoscopies, and surgeries for IBD. Our results show that, compared to the general population with IBD, FNs with the diagnosis of IBD have fewer medication claims for IBD. We also identified higher hospitalizations due to IBD among FN compared to individuals with IBD from the general population. FNs with IBD may not be receiving appropriate treatment for their disease, causing them to be hospitalized more often.

Introduction

Oppression and racism are current problems faced by Indigenous peoples,[1] a population that continues to experience inequitably health outcomes compared to the Canadian general population (GP).[2] Indigenous peoples often access health care when they are experiencing more severe, complex health care challenges.[3] Health care disparities among Indigenous peoples is a problem previously studied.[4–7] However, little is known about access to care for inflammatory bowel disease (IBD) among Indigenous peoples. IBD, including Crohn's disease (CD) and ulcerative colitis (UC), is a chronic, idiopathic, and incurable disorder, causing inflammation of the gastrointestinal tract.[8] Canada has one of the highest prevalence and incidence rates of IBD in the world.[9,10] In 2018, 0.7% of Canadians lived with IBD.[11] By 2030, researchers estimate that 1% of the Canadian population will have IBD.[11] Our research group (IBD among Indigenous Peoples) reported that the prevalence of IBD among First Nations (FN), the largest Indigenous subgroup in Canada, doubled between 1999 and 2016 (from 64/100,000 to 142/100,000 population) in Saskatchewan and estimated an annual average increase of 4.2%.[12] Additionally, we observed stable IBD incidence rates among FNs, around 11 per 100,000 inhabitants.[12]

Indigenous patient and family advocates (IPFAs, Indigenous individuals living with IBD or family members of an Indigenous person with the disease) have manifested concerns about the access to IBD care,[13] and no studies have compared IBD health care utilization between FNs and the GP. Furthermore, half of FNs live on-reserve in Saskatchewan.[14] People with IBD in rural areas may not receive gastroenterologist care as often as those living with IBD in urban centres.[15] This issue may also impact the health of FNs living with IBD.[15,16] Therefore, we aimed to compare health care utilization (i.e., outpatient gastroenterologist visits, colonoscopies, IBD medication claims, and IBD-specific and -related hospitalizations, and surgeries for IBD) between FNs and individuals from the GP diagnosed with IBD in Saskatchewan.

Methods

Study population, setting, and design

A population-based retrospective cohort study was conducted in Saskatchewan between 1998/1999 and 2017/2018 fiscal years. This project was part of the *"Understanding and*

advocating for miyo-māhcihowin among Indigenous Peoples living with IBD" project, a patient-oriented research initiative of the IBD among Indigenous Peoples research group.[12]

Patient Engagement

IPFAs actively contributed to each stage of this project, from the study conception and design to the data analysis and knowledge sharing phases of our research. The opinions and perspectives of IPFAs had a considerable weight on the decision making towards the research process. For example, the study outcomes were chosen in close collaboration with IPFAs, and one of the IPFAs co-presented this work at three scientific conferences. The IPFAs received periodic reports and offered feedback on the results and interpretations. We also held research team meetings, had meals and coffee time together, and visited their communities.

Data sources

Administrative health databases from Saskatchewan were used, including the Person Health Registration System, hospital discharge abstracts, physician claims, and prescription medication claims. These databases capture all hospitalizations, outpatient physician visits (except those on reserve), and prescription medication claims in the province (regardless of the payer). Data were linked deterministically using the encrypted unique identifiers, extracted, and analyzed at the Saskatchewan Health Quality Council (HQC).

The algorithm developed by Bernstein et al[17] was applied to identify IBD cases using the International Classification of Diseases (ICD) codes (for CD, ICD-10-CA: K50 and ICD-9: 555; For UC, ICD-10-CA: K51 and ICD-9: 556). An IBD case had 1) ≥5 separate IBD contacts within 2 years of health care coverage, or 2) ≥3 IBD contacts when having <2 years of health care coverage. This algorithm has evidence of a good sensitivity (74.4-89.2%) and specificity (89.8-93.7%) to identify CD and UC cases.[17,18] In addition, we previously used this case definition to determine the epidemiology of IBD among FNs in Saskatchewan.[12] The cases were classified as CD or UC according to the most frequent IBD diagnosis. [12,19,20]

All individuals 18 years and older covered by the Saskatchewan Ministry of Health and meeting the IBD case definition were considered. Only incident IBD cases were included in the study which were distinguished from prevalent ones by using an eight-year washout period. This eight-year washout period was chosen based on previous IBD epidemiological studies using

administrative health data.[20,21] The self-declared FN status variable in the Person Health Registration System was used to classify individuals with IBD diagnosis in two groups, those with FN status and those from in GP.[22] Previous studies using Saskatchewan administrative databases have used such a method to include FN people.[12,23,24]

Our primary study outcome was IBD health care utilization assessed by measuring: 1) outpatient gastroenterologist visit, 2) colonoscopy, 3) prescription medication claims for IBD, 4) IBD-specific, 5) IBD-related hospitalizations, and 6) surgeries for IBD. These outcomes were measured after IBD diagnosis (i.e., first eligible health care contact of the case definition). We consider the codes of surgeries for IBD in the Canadian Classification of Diagnostic, Therapeutic, and Surgical Procedures and the Canadian Classification of Health Interventions,[15,25] as well the codes for colonoscopies. We used the drug identification numbers of the medications for IBD, including biologic (e.g., infliximab, adalimumab, golimumab, certolizumab, vedolizumab, and ustekinumab), immunomodulator (e.g., azathioprine, mercaptopurine, and methotrexate), and 5-ASA (e.g., mesalamine, sulfasalazine, and olsalazine sodium) in the prescription claims dataset. Furthermore, time from the date of IBD diagnosis to each of the study outcomes was measured. The list of used databases and codes can be found in Appendix 1.

Statistical analysis

FN and the GP groups were matched 1:5 based on age and sex; the caliper for age was 5 years. Unadjusted and multivariable Cox proportional regression models were used to identify differences between these groups in outpatient gastroenterologist visits, colonoscopy, medication claims, IBD-specific and -related hospitalization, and surgeries for IBD. Time was measured in years from IBD diagnosis and terminated by either the time of the first event or censoring. Hazard ratios (HRs) and corresponding 95% confidence intervals (95%CI) were reported.

Models were adjusted by rural or urban status and diagnosis type. IBD cases with a residential postal code at the date of diagnosis within a Census Metropolitan Areas or Census Agglomeration of 15,000 or more inhabitants were labelled as having urban status.[20,26] Income quintile, region of residence (i.e., Regina/Saskatoon and surrounding areas, Northern, and Southern Saskatchewan), age at IBD diagnosis, and sex were tested as confounding variables. A set of health care utilization variables (i.e., number of visits to a general practitioner, outpatient

visits with specialists, and IBD medication claims),[19,27] corticosteroid dependency (CsDep),[19,28] and Charlson's Comorbidity index[29] were measured in the year before of IBD diagnosis and evaluated as potential confounding variables. CsDep was considered as proxy measure of disease severity[19,27] and defined as having two or more prescriptions of oral corticosteroids within six months.[19,28] A potential confounder was retained in the final model if its inclusion changed coefficients of other variables by >10%.[30,31] A stratified analysis was completed by type of disease (UC and CD).

As a sensitivity analysis, two different case definitions of IBD were used to evaluate variations in the identified associations. Two additional IBD incident cohorts were created using the case definitions of Rezaie et al.[32] and Benchmiol et al.[21], Appendix 2. After applying the matching procedure used in the main cohort, adjusted HRs were calculated for each study outcome in the different cohorts.

A two-sided p-value <0.05 was considered statistically significant. Data analyses was conducted using SAS 9.4 (SAS Institute, Cary, NC).

Ethics

Anonymized data of the Saskatchewan Ministry of Health and eHealth were accessed at a HQC secure location. Aggregated results were transferred. This project received approval from the Research Ethics Board of the University of Saskatchewan (Beh-REB 977).

Results

A matched cohort with 696 incident cases was created, 580 IBD cases from the GP and 116 from the FN group (Figure 1). Compared to the GP with the diagnosis of IBD, FN individuals tended to be in the lower income quintiles, live in rural and Northern Saskatchewan, and to be diagnosed with UC (Table 1). The number of events of each outcome are reported in Table 2.

The unadjusted models revealed differences between FN and the GP in having a prescription medication claims for biologic (HR=0.58, 95%CI:0.34-0.99) and 5-ASA (HR=0.68, 95%CI:0.54-0.85) therapies, and differences in having a colonoscopy (HR=0.58, 95%CI 0.47-0.73) and an IBD-related hospitalization (HR=1.45, 95%CI:1.12-1.87) (Table 3).

In the adjusted analyses by rural or urban residence at IBD diagnosis and diagnosis type, the hazard rate was 48% lower to first IBD medication claim (HR=0.52, 95%CI:0.41-0.65) and 44% lower to the first 5-ASA medication claims in the FN group (HR=0.56, 95%CI:0.45-0.71) compared to the GP. Additionally, FN had 33% higher hazard rates of having an IBD-specific hospitalization (HR=1.33, 95%CI:1.01-1.75) and 55% of having an IBD-related hospitalization (HR=1.55, 95%CI:1.20-2.01). None of the potential confounders changed regression estimates >10% and were not retained in the final model.[30,31]

In the stratified analysis by disease type (Table 3), FN with CD and UC had fewer medication claims for IBD (CD HR=0.51, 95%CI:0.34-0.76; UC HR=0.51, 95%CI: 0.39-0.68) and a 5-ASA claims (CD HR=0.56, 95%CI:0.36-0.86; UC HR=0.54, 95%CI:0.41-0.72) than individual with IBD from the GP. Also, differences were observed for IBD-related hospitalizations (HR=1.68, 95%CI:1.14-2.46) in the CD group.

The sensitivity analysis with the matched cohort using Rezaie et al.[32] case definition (matched cohort #2) included 990 IBD incident cases whose 165 belonged to the FN group, and 825 were from the GP. The HRs from matched cohort #2 demonstrated similar strengths and directions of associations compared to those in the main analysis (Appendix 3). The matched cohort using Benchimol et al.[21] case definition (matched cohort #3) obtained 708 IBD incident cases, with 118 from the FN group and 590 from the GP. The analysis using this case definition also attested to the robustness of the study findings (Appendix 4).

Interpretation

FN had a higher hazard rate of having an IBD-specific and IBD-related hospitalization than the GP. Additionally, FN had fewer prescription claims for any IBD medication and 5-ASA compared to the GP.

In agreement with the evidence of increased hospitalization risks for FN with other chronic conditions (myocardial infarction and congestive heart failure,[6] and chronic kidney disease[7]), we identified higher hospitalization hazard rates due to IBD.

FNs had lower IBD prescription claims compared to the GP. Some hypotheses to explain this finding could be: 1) a shorter follow-up time in the FN group could result in lower medication claims, 2) an association confounded by disease severity, 3) a preference to use traditional medicines; 4) barriers due to differences in access/coverage criteria for prescription

medications; and 5) experiences related to systematic racism. Given that we also identified higher IBD-specific and IBD-related hospitalization hazard rates among FNs, these results may suggest that FNs with IBD are not receiving appropriate treatments for their disease resulting in increased rates of hospitalizations. These results call for a change in the context of the social determinants of health, the inequities that exist within the health care system and "who" has and "who" does not have access to a more streamlined, optimal, health care.[33,34] A potential explanation for FN not having prescription medication claims for IBD involves systemic challenges that are embedded in racist protocols and processes in health care. For example, FN may have faced lack of coverage by Non-Insured Health Benefits (NIHB), lack of understanding about the NIHB coverage and claim process, or simply NIHB rejection of coverage,[35] which is in general more limited and restrictive than provincial coverage for the general population.

These results speak to more action in the light of the Truth and Reconciliation Commission (TRC) Calls to Action, anti-racist practices in the health care system, and proper addressing of the root causes of the health care inequities for FN with IBD. Further studies should continue evaluating access to IBD care (including navigation and cultural safety in health care systems), medication use, and disease severity among FN with IBD. Despite the Royal Commission on Aboriginal Peoples and the TRC that aimed to improve the health of Indigenous peoples, there is still a long way to go in order to promote cultural safety in health care.[36–38] Patient navigation could also help FN to obtain early access to health care services and help reduce health care disparities.[39,40]

Based on the study results, IPFAs in the research team highlighted the need to improve access to specialized care for FN living with IBD. The IPFA considered that FN communities are more exposed to westernized diet and need more traditional and spiritual care along with westernized medicine. IPFAs also suggested that poor housing and water/food insecurity on reserves should be considered when studying IBD among FN. IPFA stressed that racism and poor living conditions leading to poorer mental health (e.g., stress, anxiety, depression) might also place FN living with IBD at a greater disadvantage. FNs with IBD could advocate for themselves with more awareness and education about this disease.

Lessons learned from working with IPFAs

Promoting reconciliation and healing was evidenced through bonding with the IPFAs, appreciation, and learning about Indigenous cultures and the prioritization of IPFAs' perspectives and recommendations. We also ensured an inclusive and collaborative research environment. The research team also learned that there are different ways forward in advocating for the health of FN and that the study results have application in the light of systematic racism and oppression. The Covid-19 pandemic restrictions limited in-person interactions; although, research team members have communicated regularly via videoconference, telephone calls, and text messages.

Limitations

Misclassification bias can be a potential issue when using health administrative data to study chronic diseases such as IBD.[20,41] Mistakes can be originated from data entry.[41] A validated case definition that required multiple health care contacts with the diagnosis of IBD diagnosis was applied to address this potential issue.[17] A sensitivity analysis was also completed using two additional validated IBD case definitions.[21,32] Moreover, the used FN status variable could account for those self-declared FN in the administrative health databases. Another limitation comes from using Indigenous-specific health information in health systems. This data may not have been collected in a culturally appropriate way and may be compromised due to factors such as misclassification errors and non-response bias, leading to an underestimation of Indigenous health issues.[42] Finally, disease severity and disease management data are not available in administrative health data and may confound IBD health care utilization and medication claims. We considered multiple health care utilization variables in the year before IBD diagnosis as proxy measures of disease severity;[19,27] although, these variables did not have an impact on the observed associations.

Conclusions

This study identified that FN diagnosed with IBD have higher hazard rates of IBD-specific and -related hospitalization compared to the GP diagnosed with IBD. Additionally, an inverse association between FN status and having prescription medication claims for IBD and 5-ASA was found. These associations might reflect a barrier to access IBD medications, contributing to a higher hazard rate for IBD-specific or -related hospitalizations in the FN group.

Further studies should continue evaluating access to IBD care among FN and other Indigenous peoples living with IBD to improve care and address health disparities.

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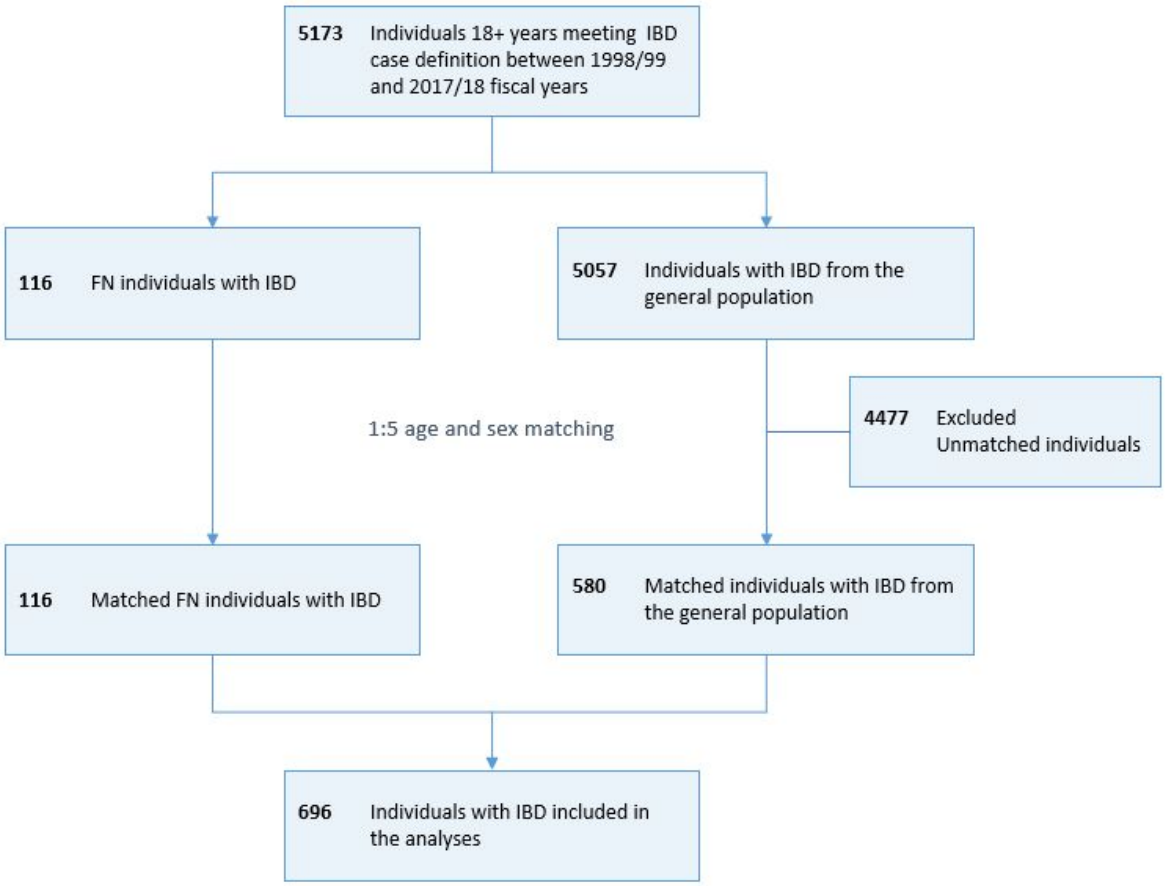

Figure 1. Flow diagram of the study cohort. The caliper used for age was 5 years.

Table 1 - Sample characteristics

		Group	
	Matched cohort [n=696]	**General population [n= 580]**	**First Nations [n= 116]**
Age at diagnosis of IBD, mean [SD], years	41.44 [14.8]	41.48 [14.7]	41.21 [15.1]
Age groups, No. [%]			
≤30	157 [22.6]	130 [22.4]	27 [23.3]
31-49	346 [49.7]	287 [49.5]	59 [50.9]
≥50	193 [27.7]	163 [28.1]	30 [25.9]
Sex, n[%]			
Female	414 [59.5]	345 [59.5]	69 [59.5]
Male	282 [40.5]	235 [40.5]	47 [40.5]
Income quintiles,* No. [%]			
1 (Lowest)	101 [15.4]	62 [11.3]	39 [36.1]
2	150 [22.8]	130 [22.6]	20 [18.5]
3	130 [19.8]	113 [20.6]	17 [15.7]
4	156 [23.7]	137 [24.9]	19 [17.6]
5 (Highest)	121 [18.4]	108 [19.6]	13 [12.0]
Residence, ** **No. [%]**			
Rural	239 [34.6]	190 [33.0]	49 [42.2]
Urban	452 [65.4]	385 [67.0]	67 [57.8]
Region of residence,* **No. [%]**			
Regina, Saskatoon, and surrounding	353 [50.8]	305 [52.7]	48 [41.4]
Northern Saskatchewan	146 [21.0]	97 [16.8]	49 [42.2]
Southern Saskatchewan	196 [28.2]	177 [30.6]	19 [16.4]
Diagnosis type, No. [%]			
Crohn's Disease	342 [49.1]	300 [51.7]	42 [36.2]
Ulcerative Colitis	354[50.9]	280 [48.3]	74 [63.8]
Length of follow-up, mean [SD], years	10.74 [5.51]	11.13 [5.44]	8.78 [5.43]

IBD: inflammatory bowel disease, SD: standard deviation

* Data of income quintile not available for all subjects [missing values=38]. ** Data of rural or urban residence not available for all subjects [missing values=5]. *** Data of region of residence not available for all subjects [missing values=1].

Table 2 - Number of study outcomes observed in the general population and First Nation groups after the date of IBD diagnosis.

	Matched cohort [n=696]	**General population [n=580]**	**First Nations [n=116]**
Outpatient gastroenterologist visit	579	485	94
Colonoscopy	610	504	106
Prescription claim for IBD	610	518	92
Prescription claim of a Biologic	160	145	15
Prescription claim of an IM	264	232	32
Prescription claim of a 5-ASA	560	472	88
IBD-specific hospitalization	349	286	63
IBD-related hospitalization	380	306	74
Surgery for IBD	230	194	36

IBD: inflammatory bowel disease, IM: immune modulator, 5-ASA: 5-aminosalicylic acid,

Table 3 Measures of association between First Nation status (reference general population) and each of the study outcomes

Outcomes	Full-group analysis (n=696)		Stratified analysis			
			Crohn's Disease (n=342)		Ulcerative Colitis (n=354)	
	Unadjusted HR (95%CI)	Adjusted HR (95%CI)*	Unadjusted HR (95%CI)	Adjusted HR (95%CI)**	Unadjusted HR (95%CI)	Adjusted HR (95%CI)***
Outpatient gastroenterologist visit	1.10 (0.88-1.37)	1.13 (0.90-1.41)	0.95 (0.65-1.39)	0.99 (0.67-1.45)	1.22 (0.92-1.61)	1.20 (0.91-1.59)
Colonoscopy	**1.25 (1.01-1.54)**	1.14 (0.92-1.41)	1.19 (0.83-1.72)	1.20 (0.83-1.73)	1.11 (0.86-1.45)	1.11 (0.85-1.44)
Prescription claim for IBD	**0.58 (0.47-0.73)**	**0.52 (0.41-0.65)**	**0.53 (0.35-0.78)**	**0.51 (0.34-0.76)**	**0.52 (0.39-0.68)**	**0.51 (0.39-0.68)**
Prescription claim of a Biologic	**0.58 (0.34-0.99)**	0.65 (0.38-1.11)	0.67 (0.33-1.38)	0.67 (0.32-1.37)	0.61 (0.28-1.35)	0.62 (0.28-1.36)
Prescription claim of an IM	0.70 (0.48-1.01)	0.79 (0.55-1.15)	0.68 (0.40-1.15)	0.69 (0.40-1.17)	0.93 (0.55-1.57)	0.93 (0.55-1.58)
Prescription claim of a 5-ASA	**0.68 (0.54-0.85)**	**0.56 (0.45-0.71)**	**0.60 (0.39-0.92)**	**0.56 (0.36-0.86)**	**0.54 (0.41-0.72)**	**0.54 (0.41-0.72)**
IBD-specific hospitalization	1.24 (0.94-1.63)	**1.33 (1.01-1.75)**	**1.55 (1.04-2.30)**	1.50 (1.00-2.23)	1.18 (0.80-1.72)	1.17 (0.80-1.71)
IBD-related hospitalization	**1.45 (1.12-1.87)**	**1.55 (1.20-2.01)**	**1.74 (1.19-2.54)**	**1.68 (1.14-2.46)**	1.42 (1.00-2.01)	1.41 (1.00-2.00)
Surgery for IBD	1.13 (0.79-1.62)	1.14 (0.80-1.64)	0.95 (0.52-1.72)	0.93 (0.51-1.70)	1.32 (0.84-2.07)	1.30 (0.83-2.05)

HR: hazard ratio, 95%CI: 95% confidence interval
* Models adjusted by rural or urban status, and diagnosis type (n=691).
** Crohn's Disease group, models adjusted by rural/urban status (n=339).
*** Ulcerative colitis group, models adjusted by rural/urban status (n=352).

Appendices

Appendix 1–List of codes used to identify the study outcomes.

Table A: List of codes used to identify IBD-specific and IBD-related hospitalizations in the hospital discharge abstracts database. IBD-related diagnoses refer to all diagnostic codes, including the IBD-specific codes. This code list was developed by Benchimol et al., 2018.*

CONDITION	ICD-9	ICD-10
IBD-SPECIFIC:		
Crohn's	555.x	K50.x
UC	556.x	K51.x
IBD SIGNS/SYMPTOMS:		
Anorexia	783.0	R63.0
Abnormal Weight Gain	783.1	R63.5
Abnormal Weight Loss	783.2	R63.4
Underweight	783.22	R62.8
Failure to thrive, child	783.4	R62.8 R62.9
Failure to thrive, adult	783.7	R62.8 R62.9
Symptoms involving digestive system, including: (787.0) Nausea and vomiting (787.01) Nausea w/vomiting (787.02) Nausea, alone (787.03) Vomiting, alone (787.1) Heartburn (787.2) Dysphagia (787.3) Gas/bloating (787.6) Encopresis, fecal incontinence (787.9) Other symptoms involving digestive system (787.91) Diarrhea, NOS	787.x	R11.x R12.x R13.x R14.x R15.x R19.x
Abdominal pain	789.0	R10.x
Dyspepsia	536.8	K30.x
Cachexia	799.4	R64.x
Esophagitis	530.1	K20.x K21.x
Esophagial ulcer	530.2	K22.1
Gastric ulcer	531.x	K25.x
Duodenal ulcer	532.x	K26.x
Peptic ulcer	533.x	K27.x
GJ ulcer	534.x	K28.x
Gastritis/duodenitis	535.x	K29.x

* Benchimol EI et al. Rural and urban disparities in the care of Canadian patients with inflammatory bowel disease: a population-based study. Clin Epidemiol. 2018;10:1613–26. https://doi.org/10.2147/CLEP.S178056

Intestinal obstruction	560.8 560.9	K31.5 K56.6
Rectal/anal haemorrhage	569.3	K62.5
Other disorder of rectum/anus, including: (569.41) Ulcer	569.4	K62.6 K62.8
(569.42) Pain (569.43) Sphincter tear (healed) (569.44) Dysplasia (569.45) Other specified, including proctitis, inflammation		
Abscess of the intestine	569.5	K63.0
Other disorders of intestine, including: (569.81) Fistula (excl rectum) (569.82) Ulcer of intestine (569.83) Perforation (569.84) Angiodysplasia, no haemorrhage (569.85) Angiodysplasia, with haemorrhage (569.86) Dieulafoy (569.89) Other, including: - Enteroptosis - Granuloma of intestine - Prolapse of intestine - Pericolitis - Perisigmoiditis - Visceroptosis	569.8	K63.2 K63.3 K63.1 K55.2 K63.8
Malabsorption	262.x 263.0 263.1 263.2 263.9 579.8 579.9	E43.x E44.0 E44.1 E45.x E46.x K90.8 K90.9
EXTRA-INTESTINAL MANIFESTATIONS:		
Anal Fistula	565.1	K60.3
Anal Abscess	566.x	K61.0 K61.1 K61.2 K61.3 K61.4
Ureteral Fistula	593.8	N28.81 N28.88
Urethral Fistula	599.1	N36.0
Fistula of stomach & duodenum	537.4	K31.6
Vesical fistula	596.2	N32.2
Fistula involving female GU	619.x	N82.x
Haemorrhoids, including: (455.9) Anal skin tags	455.x	I84.x
Rheumatoid arthritis	713.1	M052 M053 M058 M059 M060 M061

		M062 M064 M068 M069 M070 M080 M081 M082 M083 M084 M088 M089 M090 M091 M092 M098 M130 M131 M139
Arthropathy associated with GI cause	713.3	M074 M075 M076
Inflammatory spondylopathies, including: (720.0) Ankylosing spondylitis (720.1) Spinal enthesopathy (720.2) Sacroiliitis (720.8) Other inflammatory (720.9) Other unspecified inflammatory	720.x	M45.x M46.x
Scleritis & episcleritis	379.x	H15.x
Unspecified iridocyclitis (uveitis NOS)	364.3	H20.9
Chorioretinitis, unspecified (unveitis, posterior NOS)	363.2	H30.9
Acute and subacute iridocyclitis	364.0	H20.0
Erythema nodosum	695.2	L52
Pyoderma	686.0	L08.0
Pyogenic granuloma of the skin and soft tissue	686.1	L98.0
Oral aphthae	528.2	K12.0
Short stature	783.4	E34.3
Osteoporosis	733.0 733.1	M80.x M81.x M82.x M83.x
Osteomyelitis	730.0 730.1 730.2	M86.x
Acute glomerulonephritis	580.x	N00.x
Nephrolithiasis	592.x	N20.x
Primary Sclerosing Cholangitis	576.1	K83.0
Venous embolism/thrombosis	453.x	I82.x

Table B: List of Canadian Classification of Health Interventions (CCI) codes used to identify surgeries for IBD in the hospital discharge abstracts database. This code list was developed by Benchimol et al., 2018.†

RESECTIVE SURGERY	
1.NK.87	**Excision partial, small intestine**
1.NK.87.BA	Simple excision, per orifice
1.NK.87.DA	Simple excision,
1.NK.87.LA	laparoscopic Simple
1.NK.87.DN	excision, open
1.NK.87.RE	Enterocolostomy anastomosis, laparoscopic
1.NK.87.DP	Enterocolostomy anastomosis, open
1.NK.87.RF	Enteroenterostomy anastomosis, laparoscopic
1.NK.87.DX	Enteroenterostomy anastomosis, open
1.NK.87.TF	Stoma formation with distal closure, laparoscopic
1.NK.87.DY	Stoma formation with distal closure, open
1.NK.87.TG	Stoma formation with mucous fistula, laparoscopic
	Stoma formation with mucous fistula,, open
1.NM.87	**Excision partial, large intestine**
1.NM.87.BA	Simple excision, per orifice
1.NM.87.DA	Simple excision,
1.NM.87.LA	laparoscopic Simple
1.NM.87.DF	excision, open
1.NM.87.RN	Colocolostomy anastomosis, laparoscopic
1.NM.87.DE	Colocolostomy anastomosis, open
1.NM.87.RD	Colorectal anastomosis, laparoscopic
1.NM.87.DN	Colorectal anastomosis, open
1.NM.87.RE	Enterocolostomy anastomosis, laparoscopic
1.NM.87.DX	Enterocolostomy anastomosis, open
1.NM.87.TF	Stoma formation and distal closure, laparoscopic
1.NM.87.DY	Stoma formation and distal closure, open
1.NM.87.TG	Stoma formation with mucous fistula, laparoscopic
	Stoma formation with mucous fistula, open
1.NM.89	**Excision total, large intestine**
1.NM.89.DF	Ileorectal anastomosis,
1.NM.89.RN	laparoscopic Ileorectal
1.NM.89.DX	anastomosis, open
1.NM.89.TF	Stoma formation with distal closure, laparoscopic
	Stoma formation with distal closure, open
1.NM.91	**Excision radical, large intestine** (including en bloc resection)
1.NM.91.DF	Colocolostomy anastomosis, laparoscopic Colocolostomy
1.NM.91.RN	anastomosis, open
1.NM.91.DE	Colorectal anastomosis, laparoscopic
1.NM.91.RD	Colorectal anastomosis, open
1.NM.91.DN	Enterocolostomy anastomosis, laparoscopic
1.NM.91.RE	Enterocolostomy anastomosis, open
1.NM.91.DX	Stoma formation with distal closure, laparoscopic
1.NM.91.TF	Stoma formation with distal closure, open

† Benchimol EI et al. Rural and urban disparities in the care of Canadian patients with inflammatory bowel disease: a population-based study. Clin Epidemiol. 2018;10:1613–26. https://doi.org/10.2147/CLEP.S178056

Table C: List of Canadian Classification of Diagnostic (CCP) codes used to identify surgeries for IBD in the hospital discharge abstracts database. This code list was developed by Benchimol et al., 2018.‡

RESECTION/COLECTOMY FOR CD	COLECTOMY FOR UC
5741- multiple segmental resection of small intestine	
5742- Another partial resection of small intestine	
5743- Total removal of small intestine	
575- partial excision of large intestine	575- partial excision of large intestine
5751- multiple segmental resection of large intestine	5751- multiple segmental resection of large intestine
5753-right hemicolectomy	5753-right hemicolectomy
5755-left hemicolectomy	5755-left hemicolectomy
576-total colectomy	576-total colectomy
5752- cecectomy	5752- cecectomy
5754- resection of transverse colon	5754- resection of transverse colon
5756- sigmoidectomy	5756- sigmoidectomy
5759- other partial excision of large intestine	5759- other partial excision of large intestine

Table D: List of Canadian Classification of Diagnostic (CCP) and Canadian Classification of Health Interventions (CCI) codes used to identify colon and sigmoidoscopies in the hospital discharge abstracts database.

	CANADIAN CLASSIFICATION OF DIAGNOSTIC – CCP
0120	Nonoperative endoscopy of lower gastrointestinal tract
0122	Other nonoperative colonoscopy
0124	Other nonoperative proctosigmoidoscopy
0125	Anoscopy
5793	Brush biopsy of large intestine
5794	Other biopsy of large intestine
5795	Biopsy of intestine, unquantified
	CANADIAN CLASSIFICATION OF HEALTH INTERVENTIONS – CCI
2.NM.70	Colonoscopy (for inspection) /Sigmoidoscopy (for inspection)
2.NM.71	Colonoscopy with biopsy
2.NQ.70	Rectoscopy (for inspection)
2.NQ.71	Biopsy of rectum

‡ Benchimol EI et al. Rural and urban disparities in the care of Canadian patients with inflammatory bowel disease: a population-based study. Clin Epidemiol. 2018;10:1613–26. https://doi.org/10.2147/CLEP.S178056

Table E: List of drug identification numbers (DINs) used to identify medications for IBD in the prescription medication claims database. This code list was previously developed by Peña-Sánchez et al, 2017.[§]

GROUP	DIN	NAME	GENERIC NAME
BIOLOGICS	00950898	REMICADE	INFLIXIMAB
BIOLOGICS	00950899	REMICADE (EDS)	INFLIXIMAB
BIOLOGICS	02244016	REMICADE (EDS)	INFLIXIMAB
BIOLOGICS	02258595	HUMIRA (EDS)	ADALIMUMAB
BIOLOGICS	02324776	SIMPONI (EDS)	GOLIMUMAB
BIOLOGICS	02324784	SIMPONI (EDS)	GOLIMUMAB
BIOLOGICS	02331675	CIMZIA (EDS)	CERTOLIZUMAB PEGOL
BIOLOGICS	02413175	SIMPONI	GOLIMUMAB
BIOLOGICS	02413183	SIMPONI	GOLIMUMAB
BIOLOGICS	02417472	SIMPONI I.V.	GOLIMUMAB
BIOLOGICS	02419475	INFLECTRA	INFLIXIMAB
BIOLOGICS	02419483	REMSIMA	INFLIXIMAB
BIOLOGICS	02436841	ENTYVIO	VEDOLIZUMAB
BIOLOGICS	97799756	HUMIRA PF SYRINGE (EDS)	ADALIMUMAB
BIOLOGICS	97799757	HUMIRA PEN (EDS)	ADALIMUMAB
BIOLOGICS	02320673	STELARA	USTEKINUMAB
BIOLOGICS	02320681	STELARA	USTEKINUMAB
BIOLOGICS	02459671	STELARA	USTEKINUMAB
IMMUNUMODULATORS	00004596	IMURAN	AZATHIOPRINE
IMMUNUMODULATORS	00004723	PURINETHOL (EDS)	MERCAPTOPURINE
IMMUNUMODULATORS	00014915	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00321397	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00321400	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00519286	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00593249	SANDIMMUNE (EDS)	CYCLOSPORINE (T)
IMMUNUMODULATORS	00614327	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00614335	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00614343	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00632619	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	00755591	SANDIMMUNE (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	00755605	SANDIMMUNE (EDS)	CYCLOSPORINE (T)
IMMUNUMODULATORS	00950513	SANDIMMUNE (EDS)	CYCLOSPORINE (P)
IMMUNUMODULATORS	00950521	SANDIMMUNE (EDS)	CYCLOSPORINE (P)
IMMUNUMODULATORS	00950548	SANDIMMUNE (EDS)	CYCLOSPORINE (P)
IMMUNUMODULATORS	00950556	SANDIMMUNE (EDS)	CYCLOSPORINE (P)
IMMUNUMODULATORS	00950792	NEORAL (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	00950793	NEORAL (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	00950807	NEORAL (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	00950815	NEORAL (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	00950823	NEORAL (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	00950887	CELLCEPT (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00950888	CELLCEPT (EDS)	MYCOPHENOLATE MOFETIL

[§] Peña-Sánchez JN et al. Impact of an integrated model of care on outcomes of patients with inflammatory bowel diseases: Evidence from a population-based study. Journal of Crohn's and Colitis. 2017;11(12): 1471-9. http://dx.doi.org/10.1093/ecco-jcc/jjx106

IMMUNUMODULATORS	00950897	MYCOPHENOLATE	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00950937	CELLCEPT	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951163	APO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951164	APO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951165	MYLAN-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951166	MYLAN-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951167	NOVO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951168	NOVO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951169	SANDOZ MYCOPHENOLATE(EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951170	SANDOZ MYCOPHENOLATE(EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951171	CO MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951172	MYCOPHENOLATE MOFETIL(EDS	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951174	MYCOPHENOLATE MOFETIL(EDS	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951175	JAMP-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	00951176	JAMP-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	01907182	SANDIMMUNE (EDS)	CYCLOSPORINE (T)
IMMUNUMODULATORS	01907204	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02099705	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02150662	NEORAL (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	02150670	NEORAL (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	02150689	NEORAL (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	02150697	NEORAL (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	02161168	METHOTREXATE SODIUM INJEC	METHOTREXATE (METHOTREXATE SODIUM)
IMMUNUMODULATORS	02170663	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02170671	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02170698	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182750	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182777	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182947	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182955	METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182963	APO-METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02182971	METHOTREXATE INJECTION, U	METHOTREXATE (METHOTREXATE SODIUM)
IMMUNUMODULATORS	02192748	CELLCEPT (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02231491	MYLAN-AZATHIOPRINE	AZATHIOPRINE
IMMUNUMODULATORS	02236799	RATIO-AZATHIOPRINE	AZATHIOPRINE
IMMUNUMODULATORS	02236819	TEVA-AZATHIOPRINE	AZATHIOPRINE

IMMUNUMODULATORS	02237484	CELLCEPT (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02237671	NEORAL (EDS)	CYCLOSPORINE (TRANSPLANT)
IMMUNUMODULATORS	02240347	CELLCEPT IV	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02242145	CELLCEPT (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02242907	APO-AZATHIOPRINE	AZATHIOPRINE
IMMUNUMODULATORS	02243371	AZATHIOPRINE-50	AZATHIOPRINE
IMMUNUMODULATORS	02244324	APO-CYCLOSPORINE (EDS)	CYCLOSPORINE
IMMUNUMODULATORS	02244798	RATIO-METHOTREXATE	METHOTREXATE
IMMUNUMODULATORS	02244895	IMURAN	AZATHIOPRINE (AZATHIOPRINE SODIUM)
IMMUNUMODULATORS	02248843	NU-AZATHIOPRINE	AZATHIOPRINE
IMMUNUMODULATORS	02264560	MYFORTIC (EDS)	MYCOPHENOLATE SODIUM
IMMUNUMODULATORS	02264579	MYFORTIC (EDS)	MYCOPHENOLATE SODIUM
IMMUNUMODULATORS	02304767	METOJECT	METHOTREXATE
IMMUNUMODULATORS	02313855	SANDOZ MYCOPHENOLATE(EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02320029	METOJECT	METHOTREXATE
IMMUNUMODULATORS	02320037	METOJECT	METHOTREXATE
IMMUNUMODULATORS	02320045	METOJECT	METHOTREXATE
IMMUNUMODULATORS	02320053	METOJECT	METHOTREXATE
IMMUNUMODULATORS	02320630	SANDOZ MYCOPHENOLATE(EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02327236	METHOTREXATE INJECTION, B	METHOTREXATE
IMMUNUMODULATORS	02343002	AZATHIOPRINE	AZATHIOPRINE
IMMUNUMODULATORS	02348675	NOVO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02352559	APO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02352567	APO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02364883	NOVO-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02370549	MYLAN-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02371154	MYLAN-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02372738	APO-MYCOPHENOLIC ACID(EDS	MYCOPHENOLATE SODIUM
IMMUNUMODULATORS	02372746	APO-MYCOPHENOLIC ACID(EDS	MYCOPHENOLATE SODIUM
IMMUNUMODULATORS	02378574	MYCOPHENOLATE MOFETIL(EDS	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02379996	CO MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02380382	JAMP-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02383780	MYCOPHENOLATE MOFETIL(EDS	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02386399	JAMP-MYCOPHENOLATE (EDS)	MYCOPHENOLATE MOFETIL
IMMUNUMODULATORS	02398427	METHOTREXATE INJECTION	METHOTREXATE
IMMUNUMODULATORS	02415275	MERCAPTOPURINE TABLETS(ED	MERCAPTOPURINE

IMMUNUMODULATORS	02417626	METHOTREXATE INJECTION, U	METHOTREXATE (METHOTREXATE SODIUM)
IMMUNUMODULATORS	02419173	JAMP-METHOTREXATE	METHOTREXATE (METHOTREXATE SODIUM)
IMMUNUMODULATORS	02422166	METHOTREXATE INJECTION, B	METHOTREXATE
IMMUNUMODULATORS	02422174	METHOTREXATE INJECTION, B	METHOTREXATE
IMMUNUMODULATORS	02422182	METHOTREXATE INJECTION, B	METHOTREXATE
IMMUNUMODULATORS	02422190	METHOTREXATE INJECTION, B	METHOTREXATE
IMMUNUMODULATORS	02422204	METHOTREXATE INJECTION, B	METHOTREXATE
5-ASA	00263869	S.A.S. 500	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	00410640	APO SULFASALAZINE TAB 500	SULFASALAZINE
5-ASA	00445126	S.A.S. 500	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	00598461	PMS-SULFASALAZINE	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	00598488	PMS-SULFASALAZINE	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	00613568	SAS ENEMA 3GM/100ML	SULFASALAZINE
5-ASA	00685925	RATIO-SULFASALAZINE	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	00685933	RATIO-SULFASALAZINE	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	01914030	MESASAL	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	01940384	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	01997580	ASACOL	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02004658	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02004682	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02004690	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02006413	DIPENTUM	OLSALAZINE SODIUM
5-ASA	02063808	DIPENTUM	OLSALAZINE SODIUM
5-ASA	02064472	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02064480	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02064499	SALAZOPYRIN	SULFASALAZINE (SALICYLAZOSULFAPYRIDINE)
5-ASA	02099675	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02099683	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)

5-ASA	02112752	SALOFALK	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02112760	SALOFALK	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02112787	SALOFALK	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02112795	SALOFALK RETENTION ENEMA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02112809	SALOFALK RETENTION ENEMA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02153521	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02153556	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02153564	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02171929	NOVO-5-ASA	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02242146	SALOFALK	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02267217	ASACOL 800	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02297558	MEZAVANT	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02351463	5-AMINOSALICYLIC ACID	5-AMINOSALICYLIC ACID (MESALAMINE)
5-ASA	02399466	PENTASA	5-AMINOSALICYLIC ACID (MESALAMINE)

Appendix 2–Description of inflammatory bowel disease (IBD) case definitions used in the study

Authors	Validation place	Case definition	Use
Bernstein et al[17]	Manitoba, Canada	Within 2 years of health care coverage: - Had five or more separate health care contacts with the diagnosis of IBD In less than 2 years: - Had three or more health care contacts with the diagnosis of IBD Binary classification scores: - Sensitivity, 74.4–89.2%; and specificity, 89.8–93.7%	Main analysis
Rezaie et al[29]	Alberta, Canada	Within a two-year period: - Individuals who experienced at least two hospitalizations or had four physician claims with a diagnosis of IBD Binary classification scores: - Specificity, 99.8%; sensitivity, 83.4%	Sensitivity analysis, matched cohort #2
Benchmiol et al. [22]	Ontario, Canada	Within 4 years: - At least five physician contacts or two hospitalizations with the diagnosis of IBD Binary classification scores: - Sensitivity, 76.8%; specificity, 96.2%	Sensitivity analysis, matched cohort #3

Appendix 3–Measures of association between First Nation status (reference general population) and each of the study outcomes, matched cohort#2 (Rezaie et al case definition)

	Full-group analysis (n=990)		Stratified analysis			
			Crohn's Disease (n=526)		Ulcerative Colitis (n=464)	
Outcomes	Unadjusted HR (95%CI)	Adjusted HR (95%CI)*	Unadjusted HR (95%CI)	Adjusted HR (95%CI)**	Unadjusted HR (95%CI)	Adjusted HR (95%CI)***
Outpatient gastroenterologist visit	0.86 (0.70-1.05)	0.87 (0.71-1.06)	0.80 (0.58-1.10)	0.81 (0.59-1.11)	0.90 (0.70-1.17)	0.91 (0.70-1.18)
Colonoscopy	0.96 (0.79-1.18)	0.90 (0.73-1.10)	0.82 (0.58-1.15)	0.81 (0.58-1.15)	0.95 (0.73-1.22)	0.95 (0.74-1.23)
Prescription claim for IBD	**0.74 (0.61-0.90)**	**0.68 (0.56-0.83)**	**0.61 (0.44-0.86)**	**0.61 (0.43-0.85)**	**0.74 (0.58-0.95)**	**0.74 (0.57-0.95)**
Prescription claim of a Biologic	0.66 (0.42-1.05)	0.74 (0.46-1.17)	0.77 (0.43-1.39)	0.78 (0.43-1.41)	0.67 (0.32-1.41)	0.67 (0.32-1.42)
Prescription claim of an IM	**0.66 (0.44-0.93)**	0.74 (0.52-1.05)	0.63 (0.39-1.04)	0.65 (0.40-1.07)	0.82 (0.50-1.36)	0.85 (0.51-1.42)
Prescription claim of a 5-ASA	0.86 (0.70-1.06)	**0.74 (0.60-0.91)**	**0.66 (0.45-0.97)**	**0.63 (0.43-0.92)**	0.80 (0.62-1.03)	0.79 (0.62-1.02)
IBD-specific hospitalization	1.21 (0.93-1.56)	1.28 (0.99-1.67)	1.28 (0.88-1.86)	1.31 (0.90-1.91)	1.25 (0.87-1.80)	1.25 (0.87-1.80)
IBD-related hospitalization	**1.33 (1.04-1.68)**	**1.39 (1.09-1.77)**	1.29 (0.90-1.84)	1.28 (0.89-1.83)	**1.48 (1.06-2.06)**	**1.47 (1.06-2.05)**
Surgery for IBD	1.06 (0.76-1.48)	1.04 (0.74-1.46)	0.83 (0.48-1.43)	0.82 (0.47-1.43)	1.26 (0.82-1.94)	1.23 (0.80-1.89)

HR: hazard ratio, 95%CI: 95% confidence interval
* Models adjusted by rural or urban status, and diagnostic type (n=986).
** Crohn's Disease group, models adjusted by rural or urban status (n=524).
*** Ulcerative colitis group, models adjusted by rural or urban status (n=462).

Appendix 4–Measures of association between First Nation status (reference general population) and each of the study outcomes, matched cohort#3 (Benchimol et al case definition)

	Full-group analysis (n=708)		Stratified analysis			
			Crohn's Disease (n=365)		Ulcerative Colitis (n=343)	
Outcomes	Unadjusted HR (95%CI)	Adjusted HR (95%CI)*	Unadjusted HR (95%CI)	Adjusted HR (95%CI)**	Unadjusted HR (95%CI)	Adjusted HR (95%CI)***
Outpatient gastroenterologist visit	1.11 (0.90-1.38)	1.17 (0.93-1.45)	0.85 (0.59-1.24)	0.92 (0.63-1.35)	**1.34 (1.02-1.77)**	**1.36 (1.03-1.80)**
Colonoscopy	1.19 (0.97-1.47)	1.11 (0.90-1.38)	1.04 (0.72-1.50)	1.07 (0.73-1.55)	1.13 (0.87-1.47)	1.15 (0.88-1.49)
Prescription claim for IBD	**0.59 (0.47-0.74)**	**0.50 (0.40-0.63)**	**0.56 (0.38-0.82)**	**0.54 (0.36-0.80)**	**0.48 (0.36-0.64)**	**0.49 (0.37-0.65)**
Prescription claim of a Biologic	0.68 (0.41-1.13)	0.78 (0.47-1.30)	0.78 (0.40-1.55)	0.78 (0.39-1.56)	0.72 (0.34-1.53)	0.77 (0.36-1.64)
Prescription claim of an IM	0.73 (0.50-1.06)	0.83 (0.56-1.21)	0.72 (0.43-1.23)	0.70 (0.41-1.20)	0.93 (0.54-1.59)	0.98 (0.57-1.70)
Prescription claim of a 5-ASA	**0.69 (0.55-0.87)**	**0.54 (0.43-0.69)**	**0.64 (0.41-0.98)**	**0.61 (0.40-0.95)**	**0.51 (0.39-0.68)**	**0.51 (0.39-0.68)**
IBD-specific hospitalization	1.26 (0.95-1.67)	1.30 (0.98-1.74)	**1.53 (1.02-2.28)**	1.37 (0.91-2.08)	1.23 (0.83-1.83)	1.22 (0.82-1.82)
IBD-related hospitalization	**1.46 (1.13-1.89)**	**1.50 (1.16-1.96)**	**1.67 (1.14-2.45)**	**1.51 (1.02-2.24)**	**1.48 (1.04-2.10)**	**1.48 (1.04-2.10)**
Surgery for IBD	1.15 (0.81-1.63)	1.14 (0.80-1.63)	1.16 (0.66-2.02)	1.10 (0.63-1.95)	1.16 (0.74-1.84)	1.17 (0.74-1.86)

HR: hazard ratio, 95%CI: 95% confidence interval
* Models adjusted by rural or urban status, and diagnostic type (n=707).
** Crohn's Disease group, models adjusted by rural or urban status (n=364).
*** Ulcerative colitis group, models adjusted by rural or urban status.