

Original Article

The Cost of Use of the Emergency Department by Persons With Inflammatory Bowel Disease Living in a Canadian Health Region: A Retrospective Population-Based Study

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Abstract

Background: We aimed to determine the costs of emergency department (ED) attendance by persons with inflammatory bowel disease (IBD) not admitted to hospital from the ED.

Methods: This was a population-based administrative database study linking the University of Manitoba IBD Epidemiology Database with the Winnipeg Regional Health Authority (WRHA) ED Information Service database. We identified persons with IBD who presented to the ED and were not admitted between January 1, 2009 and March 31, 2012. We then applied costs in Canadian dollars for these visits including an average ED visit cost plus 26% for overhead (total = \$508), an average estimated cost of laboratory investigations (\$50), and costs for each of radiographic imaging, lower endoscopy and consultation with an internist/gastroenterologist or a surgeon. We tallied the costs of each unique ED presentation. We determined average costs for visits associated with specific consultations or investigations.

Results: One thousand six hundred and eighty-two persons with IBD (4,853 individual visits) attended the ED and did not get hospitalized. The average cost per ED visit by a person with IBD who did not get hospitalized was \$650. This resulted in a total expenditure of \$3,152,227 on these persons for their ED attendance or \$969,916 per year. The visits with the highest mean costs were those associated with an abdominal computerized tomography scan (\$979), those associated with surgical consultation (\$1019), and those associated with an internist/gastroenterologist consultation (\$942).

Conclusion: Better strategies for management of acute issues for persons with IBD that can reduce the use of an ED are needed and can be considerably cost saving.

Keywords: *Emergency department; Health care costs; Inflammatory bowel disease; Population-based*

Persons with inflammatory bowel disease (IBD) are known to be high consumers of health care services (1), and the initial point of care for persons having acute health issues related to their IBD may be the emergency department (ED). ED care is not the optimal venue for managing acute problems for persons with IBD. In

the ED, IBD patients will often be evaluated by health care providers who have not previously been involved in their care, leading to duplication of testing, consultation with specialists who are unfamiliar with the patient and the established treatment plan, and the potential for inappropriate prescription of medications

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such as corticosteroids and opioids. Further, prescriptions of corticosteroids or opioids in the ED are often stopgap measures that do not solve the underlying problem. The cost of providing care for chronic diseases such as IBD is likely much higher in the ED than if urgent care was provided in an outpatient setting. Considering that IBD is a lifelong chronic disease, the costs of ED use will be compounded over time.

In our health region, there is not a centralized or specialized IBD clinic that provides an alternative to ED use when patients are acutely ill. We recently reported on the excess use of the ED by persons with IBD in our health region, and determined that persons with known IBD were 1.7 times more likely to attend the ED than matched unaffected population controls (2). Moreover, only 15% of the persons with known IBD and 44% of the persons with a new diagnosis of IBD were admitted to hospital from the ED (2). This suggests that the vast majority of IBD care provided in the ED could have been effectively managed in an alternate outpatient setting that potentially could be lower cost. It is thus of critical importance to health care providers and payers to have an optimal understanding of the current costs associated with ED care for IBD patients, in order to determine whether the costs of developing and implementing strategies to redirect patients with nonemergent IBD issues away from the ED will be offset by savings in ED costs. Therefore, we aimed to determine the direct costs of ED attendance by persons with IBD who were not admitted to hospital from the ED, and to evaluate the predictors of high costs ED care.

METHODS

Primary Data Sources

For our previous report on IBD attendance in the ED, we linked our population-based University of Manitoba IBD Epidemiology Database (UMIBDED) (3) with a regional database of all ED visits for the City of Winnipeg (Winnipeg Regional Health Authority Emergency Department Information System database [WHRA-EDIS]) for January 2009 to March 2012. The WRHA is the largest health authority in Manitoba, with a catchment area of approximately 750,000 of the 1.3 million residents of the province. We analyzed incident cases, defined as persons with a first contact for IBD to the health system after July 1, 2008, separate from prevalent cases. We explored the rates of ED attendance by persons with IBD compared to age, sex and geography-matched unaffected controls. For persons with IBD, we discerned who among the ED attenders was admitted to hospital versus those who were discharged from the ED. Data that were available from the UMIBDED included radiographic and endoscopic procedures performed and specialist consultations obtained while the patient was in the ED. The UMIBDED provides tariffs billed for each radiological or endoscopic procedure and for each consultation. The EDIS also provided data

on time (in hours and minutes) spent in the ED from presentation to discharge. The accuracy and comprehensiveness of these databases have been previously established (4–6).

Cost Data

All cost data are in Canadian dollars and adjusted to 2017 dollars. As noted above, the physician tariffs reimbursed were available in the UMIBDED. Tariffs billed to Manitoba Health are reimbursed at a rate of near 100%. The WRHA provided us with an average cost of ED visit (\$403), which includes the costs of staff salaries (nurses, aids, clerks and doctors) and supplies used in an average visit (i.e., intravenous lines, blood tubes, gloves, etc.). There is an additional charge of 26% to cover overhead (which includes housekeeping, administration, nonclinical support, pharmacy, etc.) which was applied to the average cost of ED visits. Allied health charges were not included (i.e., psychiatry nurses, social workers, dietitians, etc.) because we were not able to define the utilizations of these services. This overhead cost was also provided by the WRHA.

After discussion with Diagnostic Services Manitoba which provides all laboratory services for WRHA EDs, the cost estimated for laboratory services for each ED visit was \$50. This accounts for basic biochemistry and a complete blood count. The WRHA Department of Radiology provided us with costs for the conduct of abdominal computerized tomography (CT scans, \$75), magnetic resonance imaging (\$122), chest x-ray (CXR, \$39) and abdominal x-ray (AXR, \$39), independent of the physicians' fee. The Central Endoscopy Intake program that coordinates all hospital-based endoscopy services in the WRHA provided us with the cost for lower endoscopy (\$270). The costs used are given in Table 1.

Analyses

We tallied the costs and duration of each unique ED presentation for all persons with IBD who did not get admitted to the hospital within 48 hours of presentation to the ED. Some ED stays that are not considered to be admissions in our region can be delayed; so, we chose a conservative estimate of 48 hours to account for admissions from the ED. We analyzed costs for persons with ulcerative colitis compared with Crohn's disease, for males versus females, for persons who had an abdominal CT versus those who did not, for incident versus prevalent cases, for persons who received an ED consultation from an internist/gastroenterologist versus those who did not, for those who received an ED consultation from a general or colorectal surgeon versus those who did not, and among those who attended the ED during the study period once, two to four times, or five or more times. We also compared costs by age (18 to 39 years versus 40 to 69 years versus 70 years and older). We calculated the impact of each of these variables over or above the median cost and median duration of each ED visit, using quantile regression modelling. Finally, we

Table 1. Descriptions of costs for all visits and subsets which include characteristics of interest

	N	Mean cost (\$)	% with physician claims	Mean physician claims (\$)	Unit cost (excluding physician tariffs)	Mean visit length (hours)
All	4,853	650	58%	67	582	8.1
With Physician Claims	2,824	715		116	600	10.0
Without Physician Claims	2,029	558			558	4.0
Colonoscopy	21	1,566	100%	698	508	35.0
CT Abdomen	348	979	100%	308	270	18.4
MRI Abdomen	9	1,411	100%	676	75	27.1
X-ray						
Chest	1,040	738	100%	111	39	12.3
Abdomen	658	794	100%	151	39	15.4
Steroids Prescribed	229	695	45%	100		10.9
Consultation By						
Internist/Gastroenterologist	406	942	100%	325		19.3
Surgeon	240	1,019	100%	397		17.5

CT, Computerized tomography; MRI, Magnetic resonance imaging.

determined whether consultation with an internist or surgeon during an ED visit was more or less likely to lead to further ED visits. All costs were adjusted to 2017 Canadian dollars, using the Consumer Price Index. In our earlier paper, we compared use of the ED by persons with IBD compared with matched unaffected controls (2). It is from this paper where we had the data for duration of time in the ED by controls matched to this cohort of persons with IBD attending the ED who did not get admitted.

RESULTS

There were 3,694 persons with IBD living in the WRHA catchment area during the years of this study. There were 1,880 persons with IBD who attended the ED during the study period for a total of 6,027 ED visits. There were 1,682 persons with IBD (4,853 individual visits) whose ED attendance did not result in a hospitalization. Hence, 80.5% of ED visits did not result in an admission. The average cost per ED visit by a person with IBD who did not get hospitalized from the ED was \$650. This resulted in a total expenditure of \$3,152,227 on these persons for their ED attendance or \$969,916 per year.

For the visits that did not lead to a hospitalization, 348 of 4,853 visits had an abdominal CT. Visits where a CT was performed costed a mean of \$979, which was \$329 more than the average of all IBD visits. They often included an abdominal x-ray (49%) and other physician claim costs (23% had an internist claim and 24% included a claim from a surgeon, and these values include 6% with both specialists claiming). Visits where an abdominal x-ray was obtained costed a mean of \$794. Only nine persons had an abdominal magnetic resonance imaging during the ED visit. Visits that include a claim for a

internist/gastroenterologist consultation cost a mean of \$942. The mean cost of a visit including a claim from a surgeon was \$1019. Being 70 years or older, having an ED visit associated with any of abdominal CT scan, internist/gastroenterologist consultation or surgeon consultation all were associated with a significantly associated with increased costs per visit (Table 2).

In the 3.25 years of the study, 44% of all ED attendees attended only one time. 24% attended twice, 11% attended three times, 7% attended four times and 14% attended five or more times during the study period. This latter group (who presented five or more times) accounted for 47% of the total cost of the use of the ED by persons with IBD.

An analysis was performed comparing the 25% of participants with the highest number of visits with the rest, who accessed the ED less frequently. Repeat visitors to the ED were more likely to have had an ED consult with an internist/gastroenterologist (three more visits during the 3.25 years of the study, 95% confidence interval [CI] 2.4 to 3.6; $P < 0.0001$) or a surgeon (1.5 more visits, 95% CI 0.7 to 2.2; $P < 0.001$) in the ED.

The median time spent in the ED was nearly 8.1 hours for persons with IBD who were not hospitalized and was significantly higher than matched controls (5.3 hours, $P < 0.001$) (2). Being female, being 70 years or older, having the fifth or more ED visit, having an abdominal CT scan, internist/gastroenterologist consultation and/or surgeon consultation were all associated with a significantly increased duration per visit (Table 3).

Nearly 40% of all visits to the ED by persons with IBD were initiated during regular work hours (08:00 to 17:00), Monday through Friday. One-third of the visits were initiated between 17:00 and 08:00 on weekdays. An additional 13% of the visits were during evening and overnight hours on weekends. Finally,

Table 2. Variables that impact on the cost and duration of ED visits

Variables that affect cost (in \$) of a visit based on median cost for 4,853 visits				
Parameter	Estimate	95% confidence limits		P
Intercept	567	565	569	<0.0001
Male vs. Female	0	-1	1	1
Age				
<40	-6	-8	-4	<0.0001
40-69	Ref			
70-96	13	6	20	0.0001
Visits				
Only	Ref			
First	-3	-6	0	0.0264
2-4	-3	-5	-1	0.012
5+	-3	-5	-1	0.0101
CD vs. UC	0	-1	1	1
Incident vs. Prevalent	0	-1	1	1
CT Abdomen	235	229	241	<0.0001
Internist/Gastroenterologist yes vs. no	225	209	242	<0.0001
Surgeon yes vs. no	232	217	246	<0.0001

CD, Crohn's disease; CT, Computerized tomography; ED, Emergency Department; UC, Ulcerative colitis.

Table 3. Variables that impact on the duration of ED visits

Variables that affect length (in hours) of a visit based on the median duration for 4,853 visits				
Intercept	5	4	5	<0.0001
Male vs. Female	-1	-1	0	<0.0001
Age				
Under 40	0	-1	0	0.1669
70-96	1	0	1	0.0004
40-69	ref			
Visits				
2-4	0	-1	0	0.3425
5+	1	0	1	0.0002
First	0	0	0	0.8636
Only	ref			
CD vs. UC	0	0	0	0.5986
Incident vs. Prevalent case	0	-1	0	0.1624
CT Abdomen yes vs. no	8	6	9	<0.0001
Saw Internist/Gastroenterologist yes vs. no	10	8	11	<0.0001
Saw Surgeon yes vs. no	5	4	7	<0.0001

CD, Crohn's disease; CT, Computerized tomography; ED, Emergency Department; UC, Ulcerative colitis.

14% of the visits were initiated during daytime hours on weekends. Hence, 60% of the visits to the ED by persons with IBD were initiated during what would be considered after hours.

DISCUSSION

While previous studies have reported on the excess use of the ED by persons with IBD, we are not aware of any studies that

have calculated the costs of ED use by these patients (2,7-10). Previously, we reported on the excess use of the ED by persons with IBD and in this study we have estimated that the annual cost of ED care for persons with IBD who did not require hospital admission was nearly \$1million annually. Given that some of these costs are incurred by unnecessary testing and consultation, we suspect there may be more cost effective ways to deliver health care to acutely unwell persons with IBD. The use of

the ED by persons with IBD who do not require emergent or urgent care places an avoidable burden on the ED; especially considering that urban EDs across Canada are typically overcrowded (11,12). Further, persons with IBD attending the ED have longer ED visits than unaffected controls and this underscores the cost to the patient and facility in terms of time. We could not determine if the longer stays in the ED by persons with IBD were secondary to longer wait times to be evaluated or simply requiring more attention that took additional time. It has been shown, however, that longer wait times in an ED are associated with greater risk for admission and even death (13).

We found that both use of procedures and consultants increased cost and time in the ED. For example, if an internist/gastroenterologist billed during an ED visit, the mean cost of the visit increased \$293 and the mean length of the visit increased 11 hours. If individuals rather than visits were taken into account, any interaction with an internist/gastroenterologist and to a lesser extent a surgeon during an ED visit made repeat visits more likely.

Previously, we reported that persons with IBD with acute health issues would choose alternate venues for IBD care if they knew that alternative care options were in place (14). While the majority of respondents in that survey study were under the care of a gastroenterologist, only 29% thought they could access their gastroenterologist urgently for an appointment and only 42% felt they could call their gastroenterologist for telephone advice. Our survey respondents reported a willingness to use phone contact with an IBD nurse (77%), phone contact with a gastroenterologist (75%), or going to a walk-in gastroenterology clinic (71%) if urgent attention was needed.

Hence, alternate health care delivery approaches for persons who would otherwise use the ED are needed for the IBD population. It has been shown that at least one-half of all ED encounters among children with IBD could have been avoided in a more responsive and coordinated health care system (10). Of the persons with IBD who attended an ED but were not admitted to hospital in our study (65% of all IBD ED attendees), a significant proportion could also possibly have been managed outside of an ED if the appropriate channels for care were in place. In a Canadian health system where universal access is available, we have shown that even persons with access to primary care physicians or gastroenterologists present to the ED (14). An alternative acute care service is warranted because we and others have reported that after an ED visit, even for a GI complaint, follow-up with a gastroenterologist is incomplete (2,10). The cost of establishing and maintaining an ambulatory acute care service for persons with IBD should cost less than \$1 million annually, however, the true costs are unknown until it is actually established. Further, some ED costs will be retained because some use of the ED will still be necessary. To be an effective alternative to the provision of service through the ED,

a new ambulatory clinic model would need to be available for same day service and at least be accessible for after-hour phone call advice.

Of note, 14% of our study population presented five or more times to the ED during the 3.25 years of the study and accounted for 47% of the costs of ED use by persons with IBD. These high-use persons would be an important target group who might benefit from an alternate care approach that would reduce their ED use, potentially enhance their care by reducing its fragmentation and potentially save costs. A specialty medical home model is one alternative model that has been successfully instituted for persons with IBD at the University of Pittsburgh. It reduced unplanned care and enhanced clinical outcomes, especially for high users (15). In a systematic review of IBD care models, it was concluded that a holistic approach to IBD care delivered by a gastroenterologist-led, multidisciplinary team, with structured monitoring, active follow-up, patient education and prompt access to care improves outcomes for IBD patients would enhance care for persons with IBD over the current model (16). To what extent this new model would reduce ED visits, reduce costs and enhance outcomes would require prospective study.

Our study has some limitations. As the data are administrative data, we could not be certain as to the exact entrance complaint (how the triage recorded complaint compared with the patient's main reason for being in the ED) or findings during the ED visit. Our study reflects the costs of attendance in the ED in a major urban centre. ED care occurring outside of the WRHA is occurring in rural sites and costs may be different. We assessed a time period ending in 2012 which was 6 years ago, however, the care model for IBD in our province has not changed since then. A question arises as to whether our experience and data reflect the practice elsewhere in Canada. Some major Canadian academic centres have established designate IBD clinics but the model for acute care provision still includes the use of the ED as the principal safety net back-up. In Manitoba patients with IBD are referred by primary care providers to gastroenterologists and follow-up visits are with both gastroenterologists and primary care providers. When a person with IBD is acutely unwell and they cannot access their gastroenterologist or primary care provider they will quite commonly present to an ED (14). Since the general care provision for persons with IBD in Winnipeg is similar to much of Canada, we feel our data reflect what is transpiring in much of the country. Further, the strength of our study is the population-based sample and longitudinal design to account for repeated visits over the study duration.

In conclusion, we have found that in a study population of 1,682 persons with IBD (4,853 individual visits) whose ED attendance did not result in a hospitalization, the average annual cost of these persons attending the ED was nearly \$1 million. These persons may do well with an alternate care model. It is highly likely an alternate

care model can be designed that is much less costly than ED-based care. A non-ED-based care model would likely enhance care, improve patient quality of life and provide them with a more expeditious and more familiar approach to care. Once implemented, it will be important to determine the extent of costs savings, improvement to patient care, and also to determine if after hours use of the ED, in particular, was reduced. It is possible that a novel care model for persons with urgent IBD issues could provide direct and indirect cost savings and free up ED resources.

Conflict of Interest

Guarantor of the article: Charles N. Bernstein, MD

Specific author contributions: Study concept and design: C.N.B., Z.N., L.E.T., H.S., C.S. and J.W.; acquisition of data: C.B. and Z.N.; analysis and interpretation of data: C.N.B., Z.N., L.E.T., H.S., C.S. and J.W.; drafting of the manuscript: C.N.B., Z.N. and J.W.; critical revision of the manuscript for important intellectual content and statistical analysis: C.N.B., Z.N., L.E.T., H.S., C.S. and J.W.

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Potential competing interests: C.N.B. has served on advisory boards of Abbvie Canada, Ferring Canada, Janssen Canada, Napo Pharmaceuticals, Pfizer Canada, Shire Canada, Takeda Canada and has consulted to 4D-Pharma and Mylan Pharmaceuticals. He has received unrestricted educational grants from Abbvie Canada, Janssen Canada, Shire Canada and Takeda Canada. He has been on speaker's bureau of Ferring Canada and Shire Canada.

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