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ORIGINAL RESEARCH—CLINICAL

The Impact of Incarceration on Readmissions Among Patients With Inflammatory Bowel Disease Hospitalized at a Community Hospital

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BACKGROUND AND AIMS: Individuals who are incarcerated often have limited access to first-line treatment and comprehensive health care. In this study, we aimed to compare the frequency of readmissions among patients with inflammatory bowel disease (IBD) receiving care at a community hospital who were and were not incarcerated at the time of hospitalization. **METHODS:** We analyzed records from Lemuel Shattuck Hospital for all patients admitted between January 1, 2011, and December 31, 2019. Patients with IBD were identified using International Classification of Diseases codes. The primary outcome was all-cause readmission at 1 year following an IBD-related admission. Secondary outcomes were (1) all-cause readmission at 30 days, (2) IBD-related readmission at 30 days, and (3) IBD-related readmission at 1 year. Our indicator of interest was incarceration. Multivariable logistic regression models were built to describe predictors of all-cause readmissions at 1 year. **RESULTS:** Among the 6511 individuals hospitalized at Lemuel Shattuck Hospital between 2011 and 2019, 90 individuals (1.4%) had International Classification of Diseases codes for IBD, either ulcerative colitis (n = 44) and/or Crohn's disease (n = 39). Half (n = 46) of patients with IBD were incarcerated during hospital admission. Individuals who were incarcerated had a higher rate of all-cause readmissions at 1 year than those who were not incarcerated at the time of hospitalization (76.0% vs 41.5%, $P = .005$). Multivariable analysis showed patients who were incarcerated had 3.98 (95% confidence interval: 1.39–12.78) increased odds of all-cause readmission within 1 year. **CONCLUSION:** Our results suggest individuals with IBD who are incarcerated may experience worse health outcomes than individuals who are not incarcerated, adding to a body of literature documenting the negative impact of incarceration on health.

Keywords: Access to care; Prison and jail; Health equity

Background and Aims

Inflammatory bowel disease (IBD), including ulcerative colitis (UC) and Crohn's disease (CD), is increasing among the general American population, with an estimated 3 million (1.3%) Americans diagnosed with the disease.[1] Undertreated and untreated IBD can result in serious health complications including fistulas, abdominal infections, and increased risk colon cancer, and is associated with poor ratings of quality of life.[2] Health complications from IBD often result in repeated and prolonged hospitalizations among patients. Fortunately, the recent addition of biologic agents to medical treatment options for IBD is considered one of the major advances in the field of gastroenterology. Biologic agents have been shown to reduce the risk of hospitalization, the need for major surgeries, and increase quality of life among patients with IBD in both randomized trials and population cohorts.[3–5]

Despite advances in IBD treatment, access to IBD treatment and treatment outcomes has not been equitable. Data have shown that compared to patients in the general public, patients with a history of incarceration are diagnosed with IBD later than those who are not incarcerated and may experience more severe disease following diagnosis.[6] There are several barriers to health care individuals with a history if incarceration experience, including limited financial resources, lack of providers, frequent interruptions in care, and stigma. While people who are incarcerated have the constitutional right to quality medical care, illness severity and mortality rates are often higher than people living in the community and historically, newer

Abbreviations: **IBD, inflammatory bowel disease; ICD-9, International Classification of Disease, 9th edition; ICD-10, International Classification of Disease, 10th edition; UC, ulcerative colitis.**

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medical advances are not readily available in jails and prisons.[7–10]

A better understanding of IBD health outcomes among incarcerated individuals is required to inform future interventions and advocacy efforts. Few papers have examined the association between incarceration and IBD-related hospitalizations. In this study, we aimed to determine the frequency of readmissions among patients with IBD receiving care at a community hospital in Massachusetts. We hypothesized that patients who were hospitalized while incarcerated would be more likely to be readmitted than patients admitted from the community.

Materials and methods

Data

We analyzed administrative records from Lemuel Shattuck Hospital (LSH) in Boston, Massachusetts for all patient admissions between January 1, 2011, and December 31, 2019. Research methods using this data set have been previously published.[11] Briefly, LSH is the preferred public hospital for people who are incarcerated and require hospitalization but do not need tertiary-level hospitalization. The hospital also provides inpatient healthcare to people from the greater Boston community, with an emphasis on care for people without health insurance, those with substance use disorder, and people who face other barriers to healthcare. For all patients hospitalized, billing and admission records included data on race, ethnicity, age, gender, month and year of hospital admission and discharge, and primary, secondary, and up to 49 additional diagnosis codes, classified using International Classification of Diseases (ICD) codes. Records from January 2011 to September 2015 were classified with 9th edition (ICD-9) codes and records from October 2015 through December 2019 were classified with 10th edition (ICD-10) codes. We categorized patients as having IBD based on the existence of ICD codes of UC (ICD-9: 556.xxx; ICD-10: K51.xxx) or CD (ICD-9.xxx: 555; ICD-10: K50.xxx). All patients with IBD listed as any diagnosis (primary, secondary, or remaining) in the admission record were included in the final data set.

Outcomes and Indicators

The primary outcome of interest was all-cause hospital readmission at one year following an IBD-related admission. An IBD-related admission was defined as an admission with IBD listed as the primary or secondary diagnosis of admission. All-cause readmission was defined as a hospital admission because of any cause occurring within 1 year of discharge from an IBD-related admission. The three secondary outcomes of interest were (1) all-cause hospital readmission at 30 days following discharge for an IBD-related admission, (2) IBD-related hospital readmission at 30 days following discharge for an IBD-related admission, and (3) IBD-related hospital readmission at 1 year following an IBD-related admission. Our indicator of interest was incarceration at any time of hospitalization. Patients were categorized as having never been incarcerated while hospitalized or ever been incarcerated while hospitalized. Incarceration status at each admission was determined by the insurance payer. Patients with a payer listed as House of Corrections or Department of Corrections were categorized as incarcerated at the time of hospital admission. Other variables included in the analysis were age at time of first hospital admission, sex, race, ethnicity, and severity of comorbidities. To characterize the severity of comorbidities for each patient, we calculated an Elixhauser index, a score calculated with points for the presence of 30 comorbidities.[12] The Elixhuaser index has been used extensively as a comorbidity risk adjustment in studies using administrative claims data and has been validated among individuals with IBD.[13,14]

Analysis

Descriptive statistics were performed to compare characteristics at the time of first admission among all individuals incarcerated at LSH from 2011 to 2019 and among individuals with IBD. Differences by incarceration status were assessed using Wilcoxon's t tests, chi-square tests, Fisher's exact tests where appropriate. Multivariable logistic regression models were built to compare the odds of all-cause readmissions at 1 year, all-cause hospital readmission at 30 days, IBD-related hospital readmission at 30 days following discharge for an IBD-related admission, and IBD-related hospital readmission at 1 year following an IBD-related admission between individuals with a history of incarceration and those without. Covariates included in the analysis were age at time of first hospital admission, sex, race, ethnicity, and severity of comorbidities. Statistical analyses were completed with R Studio.[15] All authors had access to the study data. All authors reviewed and approved the final manuscript.

Results

Between 2011 and 2019, 6511 individuals were hospitalized at LSH, accounting for 9890 admissions. Characteristics of all patients hospitalized at LSH between 2011 and 2019 are presented in the supplementary Table S1. An administrative diagnosis code for IBD was reported for 90 individuals (1.4%), including 44 individuals with UC and 39 individuals with CD. IBD-related disease accounted for 172 hospitalizations between 2011 and 2019 (Figure 1). Most patients with IBD were male (n = 75, 83%), and most (n = 69, 78%) identified as White, non-Hispanic (Table 1). The average age at the time of first admission was 42.8 years (standard deviation: 12.3 years). Half (n = 46, 51%) of individuals admitted for IBD were incarcerated during a hospital admission. In comparison to individuals with IBD who were never incarcerated while hospitalized, those who were incarcerated were more likely to be male (93.5% vs 72.7%, $P = .011$) and have a diagnosis of UC (71.7% vs 36.4%, $P = .002$). Those who were never incarcerated were more likely to have CD (65.9% vs 28.3%, $P = .001$).

Twenty-five (27.8%) individuals with IBD had a readmission for any cause within 1 year of an IBD admission, 9 (10.0%) of whom had more than one readmission for any cause within 1 year following a primary IBD-related admission (Table 2). Nineteen individuals (21.1%) had one or more IBD-related readmissions within 1 year following an IBD-related admission. Individuals who were incarcerated had a higher rate of all-cause readmissions at 1 year than those

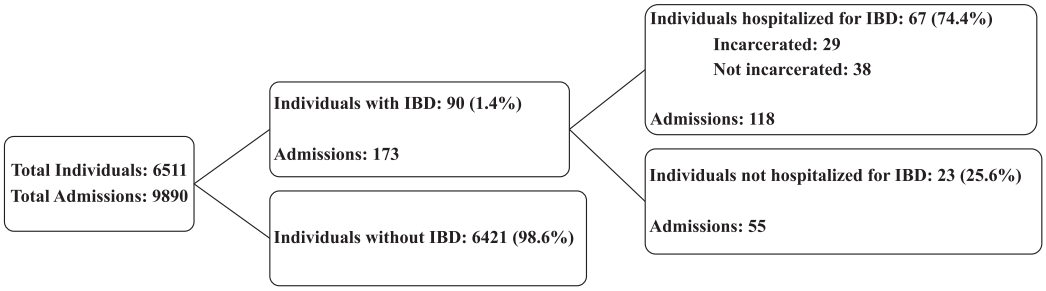

Figure 1. Schematic of admission and patients hospitalized at Lemuel Shattuck Hospital 2011–2019.

Table 1. Characteristics of Patients With IBD at Lemuel Shattuck Hospital 2011–2019 by Incarceration Status (n = 90)

Characteristic	Incarceration Status		Overall (N = 90)	*P*-value[a]
	Never incarcerated while hospitalized (N = 44)	Incarcerated while hospitalized (N = 46)		
Sex				
Female	12 (27.3%)	3 (6.5%)	15 (16.7%)	.011
Male	32 (72.7%)	43 (93.5%)	75 (83.3%)	
Age				
Mean (SD)	41.4 (12.2)	44.2 (12.3)	42.8 (12.3)	.283
Race/Ethnicity				
Hispanic	5 (11.4%)	2 (4.3%)	7 (7.8%)	
Asian, non-Hispanic	1 (2.3%)	0 (0%)	1 (1.1%)	.404
Black, non-Hispanic	7 (15.9%)	6 (13.0%)	13 (14.4%)	
White, non-Hispanic	31 (70.5%)	38 (82.6%)	69 (76.7%)	
Elixhauser comorbidity score				
Mean (SD)	1.59 (7.77)	1.57 (5.65)	1.58 (6.73)	.986
Ulcerative colitis	16 (36.4%)	33 (71.7%)	49 (54.4%)	.002
Crohn's disease	29 (65.9%)	13 (28.3%)	42 (46.7%)	.001

Abbreviations: SD, standard deviation; IBD, inflammatory bowel disease, classified by ICD-9 (555.xxx, 556.xxx) and ICD-10 codes (K50, K51).
[a]Independent t-tests for continuous variables and chi-square or Fisher test for categorical variables.

who were not incarcerated at the time of hospitalization (76.0% vs 41.5%, $P = .005$). Fifteen individuals (16.7%) had one or more 30-day readmission for any cause and 11 (12.2%) individuals were readmitted at least once for an IBD-related cause within 30 days of a prior hospitalization. The frequency of 30-day all cause and 30-day IBD-related readmissions did not differ by incarceration status (Table 2).

In multivariable analyses, adjusting for age, Elixhauser comorbidity score, and sex, those who were incarcerated while hospitalized had a 3.98 (95% confidence interval [CI]: 1.39–12.78) increased odds of all-cause readmission within 1 year in comparison to those who were never incarcerated while hospitalized (Table 3). Male sex (odds ratio [OR]: 0.99, 95% CI: 0.24–5.02), age (OR: 1.00, 95% CI: 0.10–1.04), and Elixhauser comorbidity score (OR: 0.97, 95% CI: 0.88–1.05) did not differ by readmission status in multivariable modeling.

Discussion

In this analysis, we found that individuals who were incarcerated during a hospitalization for IBD were readmitted more frequently for any cause within 1 year in comparison to individuals admitted from the community. When adjusting for comorbidities, age and sex of patient, we found a nearly 4-fold risk of readmission within 1 year of an IBD-related hospitalization among individuals who were incarcerated when hospitalized.

These findings suggest that incarcerated individuals with IBD experience worse healthcare outcomes than patients from the community. The cause of this disparity is likely multifactorial. One potential explanation for increased hospitalizations for individuals in prisons and jails is that they may not have access to biologics and/or may not be receiving first-line therapy and therefore experience more frequent relapses of disease requiring hospitalization.[16] While access to biologics has become nearly universal for patients living in the community in the United States,[17] the availability of biologics to treat IBD in carceral settings is unknown. Access to gold-standard therapies is often limited in the penal system due to the high cost of newer therapies compared to older therapies and restrictive formularies. As a recent example, access to treatment for hepatitis C in jails

Table 2. Readmissions Among Patients With IBD at Lemuel Shattuck Hospital 2011–2019 by Incarceration Status (n = 90)

Readmisison Category	Incarceration Status: Never incarcerated while hospitalized (N = 44)	Incarcerated while hospitalized (N = 46)	Overall (N = 90)	*P*-value[a]
1-y all-cause readmissions				
None	38 (86.4%)	27 (58.7%)	65 (72.2%)	
One or more	6 (13.6%)	19 (41.3%)	25 (27.8%)	.005
30-d all-cause readmissions				
None	40 (90.9%)	35 (76.1%)	75 (83.3%)	
One or more	4 (9.1%)	11 (23.9%)	15 (16.7%)	.089
1-y primary IBD readmissions				
None	38 (86.4%)	33 (71.7%)	71 (78.9%)	
One or more	6 (13.6%)	13 (28.3%)	19 (21.1%)	.122
30-d primary IBD readmissions				
None	40 (90.9%)	39 (84.8%)	79 (87.8%)	
One or more	4 (9.1%)	7 (15.2%)	11 (12.2%)	.523

Abbreviations: IBD, inflammatory bowel disease, classified by ICD-9 (555.xxx, 556.xxx) and ICD-10 codes (K50, K51).
[a]Chi-square or Fisher test.

Table 3. Factors Associated With 1-Y All-Cause Readmission Following an IBD Hospitalization, Bivariate Analysis

Characteristic	Readmission Status: No readmission (N = 65)	Readmission (N = 25)	Overall (N = 90)	Multivariate aOR
Sex				
Female	12 (18.5%)	3 (12.0%)	15 (16.7%)	Ref
Male	53 (81.5%)	22 (88.0%)	75 (83.3%)	0.99 (0.24–5.02)
Age				
Mean (SD)	42.6 (12.2)	43.4 (12.6)	42.8 (12.3)	1.00 (0.10–1.04)
Incarcerated while hospitalized				
No	38 (58.5%)	6 (24.0%)	44 (48.9%)	Ref
Yes	27 (41.5%)	19 (76.0%)	46 (51.1%)	3.98 (1.39–12.78)
Elixhauser comorbidity score				
Mean (SD)	1.85 (7.48)	0.880 (4.28)	1.58 (6.73)	0.97 (0.88–1.05)
Ulcerative colitis	34 (52.3%)	15 (60.0%)	49 (54.4%)	
Crohn's disease	32 (49.2%)	10 (40.0%)	42 (46.7%)	

SD, standard deviation.

remains scarce largely due to high cost and stigma.[18–20] It may also be that the conditions of incarceration, including but not limited to restricted dietary options, increased stress, and delayed access to outpatient care before and during incarceration are contributing to more frequent and severe IBD flares.[21] Despite constitutionally protected health care, individuals incarcerated often experience barriers to adequate healthcare while in jail and prison, particularly those with chronic, relapsing conditions and those whose diseases required expensive treatment, such as biologics. Overall, the health of people who are incarcerated is often worse than the health of people in the community as a result of mental health, substance use disorders, poverty, and other structural drivers of health. Our finding underscores the need for further research and advocacy to understand key health care barriers and improve the health of those who are detained.

Beyond moral and health care implications, a 4-fold increased risk of rehospitalization among those who are incarcerated carries significant cost consequences. The average annual direct medical cost for IBD is over 5000 USD with a third of those costs for IBD attributed to hospitalizations.[22–24] A nationwide study examining readmissions for IBD among those in the general population found that readmissions within 90 days cost an additional $576 million in 2013.[25]

While to our knowledge this is the first analysis to study readmissions of individuals with IBD who are incarcerated, our results do join prior work studying readmissions rates among individuals with IBD.[25–28] Prior work in the general population of patients with IBD has estimated that all-cause readmission rates at 30 days range from 5 to 14 percent.[26–28] We observed a similar frequency among patients hospitalized from the community (9.1%). However, a much higher proportion (23.9%) of patients hospitalized while incarcerated

experienced a readmission within 30 days. Prior research has identified male sex, non-White race, depression, and anxiety to be associated with higher rates of readmission among patients with IBD.[25,27] While we did not find a difference by sex or race/ethnicity in our study, we may be been limited by sample size and a sample that was predominantly male.

The study includes several limitations. Our data set was limited to one hospital system in Massachusetts and includes a small number of patients with IBD (n = 95, primary outcome n = 25). Results of our model must be interpreted with the small sample size in mind and results may not be generalizable. Future work that includes a larger cohort and multisite data is needed. As we did not have records for all hospitals in the area, we could not capture readmissions of patients at an outside hospital following an admission at LSH. Thus, we may have underestimated the frequency of readmissions. We did not have data to explore difference in IBD severity or disease activity between patients, and importantly by incarceration status. We were unable to assess pharmaceutical treatment during or prior to hospitalization. As we did not have access to pharmaceutical records during hospitalization or as an outpatient, in this analysis we can hypothesize but cannot determine if access to biologics and other medications is a driver of increased readmissions. Future research is needed to understand and address barriers in accessing first-line treatments due to restrictive formularies in penal settings, as well as patients with follow-up care by gastroenterology.[29] We were unable to assess smoking status, which is an important factor in the development of IBD and outcomes among patients.[30]

Conclusion

Individuals with IBD who are incarcerated are more likely to experience readmission during the year following a hospitalization for IBD than individuals who are not incarcerated. This suggests that the care provided, or lifestyle experienced during incarceration has a significant negative impact on the health, which carries both health and financial consequences for the patient and society. Further research is needed to determine if access to first-line therapy for IBD is limited in jails and prisons and to determine other contributors to poorer outcomes among those with IBD who are incarcerated.

Supplementary materials

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.gastha.2023.03.016.

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Authors' Contributions:
AGW conceived of the analysis with contribution from Katherine M. Rich. Alysse G. Wurcel with support from Rubeen Guardado led data curation, with support from Katherine M. Rich and Zahna R. Bigham. Katherine M. Rich with primary support from Rubeen Guardado and Alysse G. Wurcel led the formal analysis of data, and with review from Zahna R. Bigham, Okechi Boms, and Michelle Long. Katherine M. Rich led the writing of the original draft with support from Alysse G. Wurcel, Rubeen Guardado, Zahna R. Bigham, Okechi Boms, and Michelle Long. Alysse G. Wurcel led revisions with support from all coauthors. All authors reviewed and agreed to the final manuscript draft prior to submission.

Conflicts of Interest:
This author discloses the following: Michelle Long works for Novo Nordisk currently, but this work was performed when she was solely working at Boston University School of Medicine. The remaining authors disclose no conflicts.

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Ethical Statement:
The corresponding author, on behalf of all authors, jointly and severally, certifies that their institution has approved the protocol for any investigation involving humans or animals and that all experimentation was conducted in conformity with ethical and humane principles of research. This study was approved by the Institutional Review Board of Tufts University (IRB # 13504).

Data Transparency Statement:
Deidentified individual participant records and analytic methods are available by request to the corresponding author.

Reporting Guidelines:
STROBE.