The Impact of Private Insurance Access on Nonurgent Inflammatory Bowel Disease-Related Emergency Department Use

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Background: Inflammatory bowel disease (IBD)-related Emergency Department (ED) visits are a costly component to current healthcare expenditures. Patients who are discharged directly from the ED for nonurgent issues (aka “treat and release” ED visits) present an opportunity for quality improvement.

Purpose: To determine the impact of private insurance on IBD-related treat and release ED visits. The secondary outcome was cost per IBD-related ED visit.

Methodology: A retrospective cohort study was performed on the 2006 Nationwide Emergency Department Sample (NEDS). Comparisons were made between patients with access to private insurance vs those without. Multivariable survey-weighted logistic and linear regression models with clustering by hospital were created for the primary and secondary outcomes, respectively.

Results: In total, 19,324 patient encounters were included in the stratified analytic sample. Of these, 9272 (47.98%) patients reported private insurance as their primary payment method. An additional 10,052 (52.02%) patients reported an alternative payment form. The private insurance group was statistically younger, less likely to reside in an urban setting and had more representation within the highest income quartile. The OR of a treat and release ED visit was 1.47 (95% confidence interval 1.34–1.62) for no private insurance compared to private insurance. On average, the cost per ED visit of patients without private insurance was $214.80 ± 48.48, $P < 0.001 less than those with private insurance.

Conclusions: Lack of private insurance is an important predictor of IBD-related treat and release ED visits.
METHODOLOGY

This was a retrospective cohort study using the 2006 Nationwide Emergency Department Sample (NEDS).

NEDS Database

The Healthcare Cost and Utilization Project (HCUP) is the largest data source for US hospital encounters. The NEDS is sampled from the State Inpatient Databases (SID) and the State Emergency Department Databases (SEDD) and contains information on patients of all ages seen in the ED. The NEDS contains all ED visits for included hospitals. US census region, trauma center designation, urban–rural location, ownership, and teaching status were used to stratify the sample. Additionally, hospitals were stratified by State and 3-digit ZIP code to ensure accurate geographic representation. To obtain nationwide representativeness at a national scale, a multi-stratum sampling design was used to select 20% of the actual EDs and ED visits. The final NEDS is a stratified sample with sampling probabilities calculated to select 20% of the actual EDs within each stratum. The NEDS contains over 100 clinical and nonclinical variables and is available from 2006 to 2016.

Outcome and Predictor Variables

The outcome variables selected included disposition (ie, treat and release ED visits vs other) and cost per ED visit. Any transfers to other facilities, home health care involvement, the patient leaving against medical advice, admissions to hospital or deaths were considered “other”.

The predictor variables selected included diagnosis (only CD and UC were included in the analysis), the primary payer for the ED visit, patient age, patient sex, the rurality of the patient’s residential location, the patient’s income quartile and whether the ED visit occurred over the weekend. Several hospital-level variables (ownership/control category, region, trauma designation, urban/rural category, and teaching status) were used for descriptive purposes only. These variables were already used to stratify the NEDS sample to ensure its representativeness at a national scale.

Statistical Analyses

SAS v9.4 (Cary, NC) was used to perform all statistical tests. Survey-weighted descriptive statistics clustered by hospital for each variable were performed. Normally distributed continuous variables were described in terms of mean and standard error (SE). Non-normally distributed continuous variables were described in terms of median, 25th percentile and 75th percentile. Categorical variables were described in terms of frequency and percentage. Survey-weighted comparisons with hospital-level clustering were made between patients with access to private insurance vs those without. Continuous variables were compared using a survey-weighted linear regression model. Categorical variables were compared using the Rao-Scott $\chi^2$. Alpha (type 1 error; 2-tailed) was set at <0.05. Multivariable survey-weighted logistic regression with hospital-level clustering was used for ED disposition (categorical outcome). Multivariable survey-weighted linear regression with hospital-level clustering was used for cost per IBD-related ED visit. Private insurance was the primary predictor variable in the model. Age, sex, IBD diagnosis (CD vs UC), weekend (vs weekday), urban (vs rural), and income quartile were included as covariates. Variables were selected to explore the association between outcome and predictors using an a priori method for the primary outcome. For the secondary outcome, a univariable screening strategy was used. A split sample validation process followed. Multi-collinearity of variables included was assessed using the Variance Inflation Factor. Variance Inflation Factor > 4 was considered concerning for multicollinearity and prompted sequential removal of the collinear variable(s).

RESULTS

There were 19,324 ED patient encounters included in the final sample. Of these, 9272 were within the private insurance group and 10,052 were within the no private insurance group.

Descriptive Statistics

See Table 1 for descriptive statistics of the total sample and divided by insurance group. The mean age of the private insurance group was 36.92 ± 0.40 (vs 44.49 ± 0.35, $P < 0.0001$). Within the private insurance group, 1961 (21.15%) resided in an urban area (vs 2455 patients [24.42%], $P < 0.01$). More patients within the private insurance group occupied the highest income quartile [3132 (34.31%)] whereas more patients in the no insurance group occupied the lowest income quartile [3035 (30.91%), $P < 0.0001$. All other patient-level predictor variables showed no statistical differences.

Univariable Analysis

Primary outcome

In the total sample, 6150 (31.89%) were treat and release IBD-related ED visits. There were 2701 (29.13%) in the private insurance group (vs 3449 (34.31%), $P < 0.0001$).

Secondary outcome

In the total sample, the mean cost per IBD-related ED visit was $1772.76 ± 46.30 [United States Dollars (USD)]. The mean cost per ED visit was higher in the private insurance group than the non-private insurance group ($1838.53 USD vs $1712.96 USD, $P = 0.01$).

See Table 2 for univariable analyses.

Sensitivity Analysis

To breakdown further the impact of insurance status on treat and release ED visits, we further separated payer category. Patients reporting Medicare as their primary payment method
### TABLE 1. Characteristics of Patients Presenting to the ED for an IBD-Related Reason and Captured in the 2006 National Emergency Department Sample Database

| Demographic and Clinical Characteristics                      | All Patients (n = 19,324) | Patients With Private Insurance (n = 9272) | Patients Without Private Insurance (n = 10,052) | P     |
|---------------------------------------------------------------|---------------------------|------------------------------------------|-----------------------------------------------|-------|
| **Patient-level predictors**                                 |                           |                                          |                                               |       |
| Age, mean [SD]                                               | 40.8 [17.9]               | 36.9 [14.3]                              | 44.5 [20.0]                                   | <0.0001*|
| Sex, n (%)                                                   | 10,827 (55.9)             | 5233 (56.5)                              | 5594 (55.7)                                   | 0.3   |
| Primary diagnosis (CD), n (%)                                | 13,404 (69.3)             | 6405 (69.1)                              | 6999 (69.6)                                   | 0.6   |
| Residential diagnosis, n (%)                                 |                           |                                          |                                               |       |
| “Urban” areas with >250,000 population                      | 4416 (22.7)               | 1961 (21.2)                              | 2455 (24.4)                                   | <0.01*|
| Median household income quartile, n (%)                     |                           |                                          |                                               |       |
| 0–25th percentile                                           | 4575 (24.5)               | 1540 (16.9)                              | 3035 (30.9)                                   | <0.0001*|
| 26th to 50th percentile                                     | 4681 (24.4)               | 1969 (21.6)                              | 2712 (27.6)                                   |       |
| 51st to 75th percentile                                     | 4780 (25.1)               | 2487 (27.3)                              | 2293 (23.4)                                   |       |
| 76th to 100th percentile                                     | 4911 (26.1)               | 3132 (34.3)                              | 1779 (18.1)                                   |       |
| Weekend status of ED visit, n (%)                           |                           |                                          |                                               | 0.3   |
| **Hospital-level predictors (reported for descriptive purposes)** |                       |                                          |                                               |       |
| Hospital control/ownership, n (%)                           |                           |                                          |                                               |       |
| Government-funded                                           | 1087 (5.2)                | 450 (4.9)                                | 637 (6.3)                                     | <0.0001|
| Privatel funded                                              | 12,606 (68.3)             | 2387 (25.7)                              | 3244 (32.3)                                   |       |
| Other                                                        | 4937 (26.5)               | 6437 (69)                                | 6171 (61.4)                                   |       |
| Hospital region, n (%)                                      |                           |                                          |                                               |       |
| NorthEast                                                    | 4388 (23.5)               | 2354 (25.4)                              | 2034 (20.2)                                   | <0.0001|
| MidWest                                                     | 4642 (24.1)               | 2537 (27.4)                              | 2105 (20.9)                                   |       |
| South                                                       | 7337 (35.5)               | 33,032 (32.7)                            | 4305 (42.8)                                   |       |
| West                                                        | 2957 (16.9)               | 1349 (14.6)                              | 1608 (16.0)                                   |       |
| Hospital trauma designation, n (%)                          |                           |                                          |                                               | 0.5   |
| Trauma level I, II or II                                     | 5921 (34.5)               | 2936 (31.7)                              | 2985 (29.7)                                   |       |
| No trauma level designation                                 | 11,236 (65.5)             | 6334 (68.3)                              | 7066 (70.3)                                   |       |
| Hospital urban–rural designation, n (%)                     |                           |                                          |                                               |       |
| Metropolitan                                                | 1967 (89.3)               | 920 (95.6)                               | 1047 (94.1)                                   | 0.1   |
| Non-metropolitan                                             | 108 (10.7)                | 42 (4.4)                                 | 66 (5.9)                                      |       |
| Hospital teaching status, n (%)                             |                           |                                          |                                               |       |
| Metropolitan teaching                                        | 8700 (41.2)               | 4080 (44.0)                              | 4620 (46.0)                                   | <0.0001|
| Non-metropolitan                                             | 8213 (44.8)               | 4201 (45.3)                              | 4012 (39.9)                                   |       |
| **Hospital teaching status, n (%)                           |                           |                                          |                                               |       |
| Metropolitan non-teaching                                    | 2411 (14.0)               | 991 (10.7)                               | 1420 (14.1)                                   |       |

*Statistical significance (P < 0.05).

### TABLE 2. Univariable Analyses of the Primary and Secondary Outcomes According to the Primary Predictor Variable Access to Private Insurance

| Outcomes                                           | All Patients (n = 19,324) | Patients With Private Insurance (n = 9272) | Patients Without Private Insurance (n = 10,052) | P     |
|----------------------------------------------------|---------------------------|------------------------------------------|-----------------------------------------------|-------|
| Disposition following ED visit, n (%)              | Treat and release         | 6150 (31.9)                              | 2701 (29.1)                                   | 3449 (34.3) | <0.0001*|
| Cost per ED visit (USD)                            | Mean [SE]                 | 1772.76 [46.3]                           | 1838.53 [60.3]                                | 1712.96 [44.2] | 0.01*  |

*Statistical significance (P < 0.05).
were significantly less likely than their private insurance counterparts to present to the ED with this type of visit \{0.7 \[95\% confidence interval (CI) 0.6–0.8\]\}. Patients with Medicaid were significantly more likely to present \{1.7 \[95\% CI 1.5–1.9\]\}. Patients who were self-pay were also significantly more likely to present \{2.0 \[95\% CI 1.8–2.3\]\].

**Multivariable Analysis**

**Primary outcome**

A multivariable survey-weighted logistic regression model with hospital-level clustering was used to predict IBD-related treat and release ED visits. The adjusted OR of a treat and release IBD-related ED visit was 1.47 \[95\% CI 1.34–1.62\] for no private insurance compared to private insurance. The OR for patients <18 compared to those ≥65 was 4.62 \[95\% CI 3.60–5.92\]. The OR for patients 18–64 compared to those ≥65 was 5.08 \[95\% CI 4.27–6.05\]. The OR for CD compared to UC was 1.43 \[95\% CI 1.30–1.56\]. The OR was 0.88 for a weekday compared to a weekend \[95\% CI 0.82–0.95\]. The OR was 0.81 for a patient residing in a center populated by <250,000 people compared with populations >250,000 \[95\% CI 0.70–0.93\]. The OR for the lowest income quartile compared to the highest income quartile was 1.47 \[95\% CI 1.26–1.72\]. The OR for the second income quartile compared to the highest quartile was 1.35 \[95\% CI 1.15–1.59\]. See Table 3 for the survey-weighted multivariable logistic regression analysis of the primary outcome.

**Secondary outcome**

A survey-weighted multivariable linear regression model taking into account hospital-level clustering was used to predict the cost per IBD-related ED visit. Private insurance was the primary predictor variable in the model. Age, sex, IBD diagnosis (CD vs UC), weekend (vs weekday), urban (vs rural), and income quartile were explored as potential covariates.

A univariable screening strategy was used. A conservative \( P \)-value ≤ 0.25 was used as a threshold for inclusion. However, access to private insurance, age, and sex were included a priori. Urban (vs rural), income quartile, weekend (vs weekday) were ultimately excluded from the final model.

On average, the cost per ED visit of patients without private insurance was $214.80 ± 48.48 (USD), \( P < 0.001 \) less than those with private insurance. The cost per ED visit for those patients “treated and released” was $1855.14 ± 77.67, \( P < 0.0001 \) more than those patients who were not. The cost per ED visit of patients <18 was $341.44 ± 100.20, \( P = 0.0007 \), less than patients ≥65. The cost per ED visit of patients 18–64 was $208.57 ± 52.34, \( P < 0.0001 \) less than patients ≥65. No statistical differences were found according to IBD diagnosis or sex. See Table 4 for the survey-weighted multivariable linear regression analysis of the secondary outcome.

**DISCUSSION**

In this study, 19,324 patients were included in a stratified analytic sample consisting of IBD patients presenting to a US ED. Within this group, patients lacking private insurance were significantly more likely to experience a treat and release ED visit compared to those patients with private insurance. The average cost of an ED visit was significantly less expensive for those without private insurance. Treat and release ED visits are of special concern as they represent ED use for nonurgent issues that could have been addressed via comprehensive ambulatory care.

Although the current study did not investigate the reasons for cost-related differences in ED visits, one could speculate that there are higher hidden costs (eg, administrative) that occur with private insurance billing. It may be possible that physician clinical behavior changes depending on the insurance status of the patient. The threshold to order tests prescribe medications and delay discharge may be affected by cost and reimbursement related concerns.

There is limited selection bias given the stratification of the sample to reflect the general US ED population. However, restricting the sample reduces the overall power of the study. Measurement bias is possible given IBD as a primary diagnostic code has not been previously validated within this database. However, the authors expect that this would at most lead to non-differential misclassification of IBD diagnosis and should, therefore, not significantly bias the point estimates generated.

Although the results of this study lend support to the argument that the expansion of health insurance coverage may reduce the inappropriate use of ED services, the relationship between insurance access and ED use is
complex. This was addressed in a recent commentary published by Sommers et al.3 As they explain, some believe that by expanding insurance, ED use may paradoxically increase given the removal of a financial barrier to its use. Others counter that enhanced coverage results in more robust ambulatory care and a concordant reduction of nonurgent issues addressed in the ED. The impact of the 2008 Medicaid expansion in Oregon on ED use demonstrated that Medicaid coverage increased the mean number of ED visits per person by 0.17 (SE 0.04), estimated to be approximately 65% above the control mean.9 However, a separate study demonstrated that extending parental insurance coverage for young adults until age 26 resulted in a reduction of the quarterly ED visit rate by 1.6 per 1000 (95% CI 1.2–2.1).10 This latter finding was supported by another study in Massachusetts showing that expanding publically subsidized insurance results in a significant reduction in ED use initiated for nonurgent reasons (in this case upper respiratory tract infection). The results of the sensitivity analysis performed in this study support these later findings, indicating that with declining access to insurance, nonurgent use of the ED increases.

Overall, the incidence of IBD-related ED visits have continued to increase over time. Ballou used the NEDS database to show a 51.8% increase in IBD ED visits from 2006 to 2014 compared to an increase of all-case ED use of only 14.8%.11 The specific risk factors for this rising utilization remain under investigation. A recent study published by Dotson et al.12 used data from the Pediatric Health Information System from 2000 to 2013 and evaluated CD patients ≤21 years, showing that the proportion of repeat ED visits was higher for Medicaid patients compared to those privately insured. A separate study by Rumman et al.13 demonstrated that in Canada, patients relying on medication-related public insurance had a longer wait time to antitumor necrosis factor initiation and as a result increased rates of hospitalization and ED visitation. Regueiro et al.14 demonstrated that comprehensive ambulatory care is associated with reduced ED visits. In this study, the institution of a “specialty medical home” comprising of a multidisciplinary team and specialists to manage patients with chronic disease resulted in a 47.3% reduction in ED visits over the course of 1 year.

The significance of this study is that it is the first to evaluate the impact of access to private insurance on IBD-related treat and release ED utilization in the United States. It sheds further light on the most preventable of all ED visits. Treat and release ED visits are an important target for quality improvement initiatives. They can reflect poor disease control, self-management skills, disease-related education, health resource-related education, and psycho-social coping. Lack of private insurance as a significant predictor of treat and release ED visits suggests that quality initiatives should be targeted to this population. These patients may not be receiving continuous ambulatory IBD care, they may have less access to specialist care and their pharmacotherapy choices may be driven by cost-related concerns rather than optimal efficacy. These are important considerations for health care providers managing this population as comorbidities and financial constraints will likely affect disease presentation and behavior.

The limitations of this study include our reliance on health administrative data and pre-selected variables, which can prevent accurate adjustments for the location of IBD disease, its behavior and/or activity. Similarly, there is no information regarding IBD-related medication use and ambulatory follow-up. There is no information regarding each patient’s prior health service utilization profile. These are potentially important predictors that are not included within the regression models used and therefore limit our interpretation. Also, missing from this study is an appreciation of the background prevalence of IBD in the contributing communities and the insurance distribution in those respective locales.

**CONCLUSIONS**

Lack of private insurance is an important predictor of treat and release ED visits. Quality improvement initiatives should investigate potential explanations and target interventions to reduce potentially inappropriate use of emergency services.
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