

# Out-of-pocket Cost Burden in Pediatric Inflammatory Bowel Disease: A Cross-sectional Cohort Analysis

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**Background:** Pediatric inflammatory bowel disease (IBD), consisting of Crohn's disease (CD) and ulcerative colitis (UC), can result in significant morbidity requiring frequent health care utilization. Although it is known that the overall financial impact of pediatric IBD is significant, the direct out-of-pocket (OOP) cost burden on the parents of children with IBD has not been explored. We hypothesized that affected children with a more relapsing disease course and families in lower income strata, ineligible for need-based assistance programs, disparately absorb ongoing financial stress.

**Methods:** We completed a cross-sectional analysis among parents of children with IBD residing in California using an online HIPAA-secure Qualtrics survey. Multicenter recruitment occurred between December 4, 2013 and September 18, 2014 at the point-of-care from site investigators, informational flyers distributed at regional CCFA conferences, and social media campaigns equally targeting Northern, Central, and Southern California. IBD-, patient-, and family-specific information were collected from the parents of pediatric patients with IBD patients younger than 18 years of age at time of study, carry a confirmed diagnosis of CD or UC, reside in and receive pediatric gastroenterology care in California, and do not have other chronic diseases requiring ongoing medical care.

**Results:** We collected 150 unique surveys from parents of children with IBD (67 CD; 83 UC). The median patient age was 14 years for both CD and UC, with an overall 3.7 years (SD 2.8 yr) difference between survey completion and time of IBD diagnosis. Annually, 63.6%, 28.6%, and 5.3% of families had an OOP cost burden >\$500, >\$1000, and >5000, respectively. Approximately one-third (36.0%) of patients had emergency department (ED) visits over the past year, with 59.2% of these patients spending >\$500 on emergency department copays, including 11.1% who spent >\$5000. Although 43.3% contributed <\$500 on procedure and test costs, 20.0% spent >\$2000 in the past year. Families with household income between \$50,000 and \$100,000 had a statistically significant probability (80.6%) of higher annual OOP costs than families with lower income <\$50,000 (20.0%;  $P < 0.0001$ ) or higher income >\$100,000 (64.6%;  $P < 0.05$ ). Multivariate analysis revealed that clinical variables associated with uncontrolled IBD states correlated to higher OOP cost burden. Annual OOP costs were more likely to be >\$500 among patients who had increased spending on procedures and tests (odds ratio [OR], 5.63; 95% confidence interval [CI], 2.73–11.63), prednisone course required over the past year (OR, 3.19; 95% CI, 1.02–9.92), at least 1 emergency department visit for IBD symptoms (OR, 2.84; 95% CI, 1.33–6.06), at least 4 or more outpatient primary medical doctor visits for IBD symptoms (OR, 2.82; 95% CI, 1.40–5.68), and history of 4 or more lifetime hospitalizations for acute IBD care (OR, 2.60; 95% CI, 1.13–5.96).

**Conclusions:** Previously undocumented, a high proportion of pediatric IBD families incur substantial OOP cost burden. Patients who are frequently in relapsing and uncontrolled IBD states require more acute care services and sustain higher OOP cost burden. Lower middle income parents of children with IBD ineligible for need-based assistance may be particularly at risk for financial stress from OOP costs related to ongoing medical care.

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**Key Words:** costs, out-of-pocket, inflammatory bowel disease, Crohn's disease, ulcerative colitis, pediatric, Qualtrics, cross-sectional analysis, health care

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Pediatric inflammatory bowel disease (IBD), consisting of Crohn's disease (CD) and ulcerative colitis (UC) varieties, is a relapsing and remitting chronic disease that occurs with a peak incidence in the adolescent and young adult years. Compared with IBD presentation in adults, children often present with more severe disease requiring acute care services and subsequent escalation through higher levels of medical and surgical therapies.<sup>1-3</sup> This results in a concomitant increase in total costs of which a component is out-of-pocket (OOP) by patients' families. Both health care providers and patients know from experience that the direct financial burden of pediatric IBD is high. In particular, parents of children with more relapsing or uncontrolled IBD subtypes may absorb substantial financial stress, disparately burdening families in lower income strata not covered by private or government-subsided assistance programs. OOP financial impact on families responsible for children and young adult-dependents with pediatric IBD is incompletely described in the literature.<sup>4</sup>

Although incompletely characterized, it is clear from existing studies that the OOP costs of pediatric IBD for patients and their families are substantial. One study demonstrated that the cost of pediatric IBD in patients younger than 20 years is significantly higher than for adults (~\$9500 versus ~\$8100 annually) without variation based on geographical region with the United States.<sup>5</sup> Other studies suggest that since the early 2000s, IBD health care costs have shifted away from hospitalization and surgery expenses, with outpatient visits and medication expenditures accounting for the majority of dollars spent on the disease,<sup>6,7</sup> likely driven by increasing use of anti-tumor necrosis factor- $\alpha$  (anti-TNF $\alpha$ ) agents. Recognition of this trend is also important in considering that other existing cost studies may have predated the widespread or first-line use of anti-TNF $\alpha$  agents.<sup>8-11</sup>

At the federal policy level, the shift towards higher OOP cost burden for pediatric patients with IBD and their families is an example of the context for which the guidance by the Institute of Medicine aims to deliver higher value medical care at lower costs.<sup>12</sup> Cost-effective pediatric IBD medical care is particularly important because early-onset worse disease severity will necessitate a longer lifetime course with greater potential for direct and indirect financial stress on patients and families.<sup>13,14</sup> However, increased OOP costs run counter to the Institute of Medicine vision to achieve the best care at lower costs.

In this analysis, we hypothesized that children with pediatric IBD who have relapsing disease requiring more health care utilization and families with lower annual income disparately absorb substantial OOP cost burden. To our knowledge, there is no study to date characterizing the OOP costs burden in families with children affected by IBD. There were 2 aims of this study: (1) to describe the mean and variability of the annual OOP costs for families with children affected by IBD and (2) to identify IBD attributes that correlate with higher OOP cost burden.

## METHODS

### Methodological Overview

This was a cross-sectional cohort analysis with 3 distinct stages: development of an online HIPAA-secure survey using the Qualtrics web-based platform (Qualtrics, Provo, UT), collection of results from the parents of pediatric patients with IBD with primary residence in California, and analysis of results using descriptive statistics and multivariate analysis. In the first stage, an online survey was drafted to capture both family- and patient-specific characteristics that may be clinically correlated with higher OOP costs. The survey and the study protocol received approval by the Stanford University Human Subjects Research Institutional Review Board. In the second stage, the online Qualtrics survey was available between December 4, 2013 and September 18, 2014. Based on a power calculation, the recruitment target was set at 150 individual surveys (details described below). The online Qualtrics survey used predata collection of participant eligibility logic to confirm inclusion and exclusion parameters. Patient's inclusion criteria included a valid e-mail address for the adult parent, patient younger than 18 years at time of study with a biopsy-confirmed diagnosis of CD or UC, primary residence, and medical care in California by a board-certified or board-eligible pediatric gastroenterologist or licensed pediatric gastroenterology nurse practitioner, and lack of other complex chronic diseases (e.g., other autoimmune diseases) requiring ongoing medical care. Survey recruitment was limited to California to assist in the feasibility of a deidentified cross-sectional survey of this nature because there is precedence in the literature for direct reporting of average OOP costs per patient and overall generalizability of OOP.<sup>15</sup> In the third stage, collected data without identifiers were aggregated and analyzed using Stata 13 (StataCorp, College Station, TX). Only the study coordinator (A.T.S.) and principal investigator (K.T.P.) had access to the database generated by the Qualtrics software. Coinvestigators were blind to whether patients had completed the survey.

### Electronic Qualtrics Survey Development

The survey was systematically designed to take 15 minutes to complete and capture a wide range of direct and indirect OOP costs related to pediatric IBD management from the parent's perspective. The final Qualtrics survey was made available in content-identical English and Spanish versions. All components of the survey are shown in Table 1. Questions seeking quantified results had preselected categories of answers in multiple-choice format. Qualitative responses were collected using "Yes/No" options and free text fields. No specific patient health identifiers were captured from this survey. To ensure that only 1 survey was captured per patient, the Qualtrics web-based software screened computer IP addresses matched with provided e-mails and unique inclusion/exclusion variables (e.g., name of the pediatric gastroenterologist). Qualtrics logic only permitted the survey to be taken on desktop computers, laptops, and tablets. Mobile

**TABLE 1.** Variables Evaluated for Correlation with High Pediatric OOP Cost Burden for IBD Families

Patient-specific Attributes	Family-specific Attributes
Age/date of birth	Highest education level of parents
Zip code	Total annual household income
Ethnicity	Number of family members
Medical insurance	Private financial assistance programs
Age of IBD diagnosis	Round-trip travel distance to GI appointments
CD versus UC diagnosis	Transportation method
Active medications and OOP expenditures	Transportation costs
Medication compliance (global estimate)	Missed work (parents)
Insurance medication coverage problems	Lost wages (parents)
Emergency room evaluations and costs	
Hospitalizations for IBD	
Procedures and tests cost	
Pediatric gastroenterology visits	
PMD visits related to IBD	
Special diet and cost	

phone devices were not allowed because varying IP addresses emitted from mobile phone browsers would prevent confirmation of the unique study identification for the participant.

### Study Participant Recruitment

The target participant population was the adult parents or legal guardians of pediatric patients with IBD followed by a board-certified/eligible pediatric gastroenterologist or pediatric gastroenterology nurse practitioner (GI NP) practicing in California and patient's primary residence in California. Criteria for exclusion included not meeting the above inclusion criteria and/or the presence of any complex chronic disease requiring ongoing medical care. Examples included were systemic lupus, rheumatoid arthritis, and diabetes mellitus. Recruitment was completed at the point-of-care by site investigators in the outpatient or inpatient setting, phone calls to known patient's families, informational flyer distribution at local/regional Crohn's & Colitis Foundation of America conferences, and online outreach through social media, including status updates from Crohn's & Colitis Foundation of America's Facebook and Twitter accounts. All social media campaigns were evenly targeted to cover Northern, Central, and Southern California. Each participant who completed the survey in full was provided an electronic \$15 target gift card that was distributed through e-mail.

### Sample Size Determination

To determine the sample size ( $n$ ) per group, we used a standard power calculation formula for comparing 2 proportions:

$$n = (Z_{\alpha/2} + Z_{\beta})^2 \frac{\bar{p}(1-\bar{p})(r+1)}{(d^*)^2 r},$$

where  $n$  = sample size per group,  $Z_{(\alpha/2)}$  = level of significance for a 2-sided test,  $Z_{\beta}$  =  $Z$  value corresponding to the power desired,  $d^*$  = effect size or difference between proportions you would like to detect ( $p_1 - p_2$ ),  $r$  = ratio of (number of subjects in group 2)/(number of subjects in group 1) =  $n_2/n_1$ , and  $\bar{p}$  = weighted average of  $p_1$  and  $p_2$ . For a standard level of significance  $\alpha$  of 0.05,  $Z_{(\alpha/2)} = 1.96$ , and for a standard power of 80%,  $Z_{\beta} = 0.84$ . By testing for a  $d^*$  of 10% (at  $Z_{(\alpha/2)} = 1.96$  and  $Z_{\beta} = 0.84$ ), which is equivalent to testing for a 10% effect size difference between  $p_1$  and  $p_2$  (set at 1.0 and 0.9 for calculation purposes), the calculated sample size ( $n$ ) per group is 75. Because we were comparing 2 proportions at any one time in our analyses, a total minimum sample size of 150 was deemed necessary.

### Analysis of Results

Upon completion of 150 surveys, individual and aggregate data from Qualtrics were exported to Microsoft Excel (Microsoft Corporation, Redmond, WA) for data cleaning. All statistical analyses were run using the Stata 13 Statistical Software (StataCorp). To evaluate the hypothesized correlations between high cost burden (>\$500 OOP annually) and both lower family income and higher IBD disease severity, we performed multivariate conditional logistic regressions. Results were assumed to be statistically significant at a  $P$  value of <0.05. Cost burden was defined through pediatric IBD-related medical care expenditures using interquartile ranges. A surrogate for low socioeconomic status was created using a binary variable comparing poor patients to nonpoor patients, with poverty defined as having a family income less than \$50,000. This threshold was chosen as per 2014 Federal Poverty Level (FPL) guidelines, 250% FPL for a family of 3 is \$49,475, and \$59,625 for a family of 4. Of note, 250% FPL is the cutoff used by California for its Healthy Families Program for Children younger than 19 years.<sup>16,17</sup>

## RESULTS

### Patient and Family Characteristics

The patient-specific characteristics in the study cohort are shown in Table 2. Among the 150 unique pediatric patients with IBD, 67 indicated "CD" and 83 indicated "UC" as the IBD type. The median age was 14 years for both CD and UC patients at the time of survey completion. The mean age difference between the time of diagnosis and survey completion was 3.7 years overall (SD 2.8) with no significant difference between patients with CD (3.6 yr, SD 2.9) and UC (3.8 yr, SD 2.7). Consistent with racial and socioeconomic status differences already reported in IBD literature, the majority of our patients were white (64.0%), and 87.3% of patients had private medical insurance, whereas 7.3% had either MediCal or California Children's Services coverage (i.e., need-based health care programs). The majority of patients

**TABLE 2. Summary of Patient Characteristics**

	n (%)		
	CD	UC	IBD Total
No. unique patients	67 (44.7)	83 (55.3)	<b>150 (100.0)</b>
Race and ethnicity			
Caucasian	45 (30.0)	51 (34.0)	<b>96 (64.0)</b>
Hispanic/Latino	6 (4.0)	6 (4.0)	<b>12 (8.0)</b>
African American	5 (3.3)	11 (7.3)	<b>16 (10.7)</b>
Asian	1 (0.7)	2 (1.3)	<b>3 (2.0)</b>
Indian	1 (0.7)	3 (2.0)	<b>4 (2.7)</b>
Pacific Islander	1 (0.7)	1 (0.7)	<b>2 (1.3)</b>
Middle Eastern	4 (2.7)	4 (2.7)	<b>8 (5.3)</b>
African	1 (0.7)	0 (0.0)	<b>1 (0.7)</b>
Native American or Alaskan	0 (0.0)	1 (0.7)	<b>1 (0.7)</b>
Other	3 (2.0)	4 (2.7)	<b>7 (4.7)</b>
Median age, yr			
Initial diagnosis	11	9	<b>10</b>
Time of study	14	14	<b>14</b>
Insurance coverage			
Private	60 (40.0)	71 (47.3)	<b>131 (87.3)</b>
MediCal	2 (1.3)	6 (4.0)	<b>8 (5.3)</b>
CCS	1 (0.7)	2 (1.3)	<b>3 (2.0)</b>
Other	1 (0.7)	0 (0.0)	<b>1 (0.7)</b>
Multiple	2 (1.3)	3 (2.0)	<b>5 (3.3)</b>
Unknown	1 (0.7)	1 (0.7)	<b>2 (1.3)</b>

surveyed were from the Los Angeles Metropolitan Statistical Area (27.3%), defined as Los Angeles and Orange counties, and the San Francisco Bay Area (51.4%), defined as San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, Napa, Marin, and Sonoma counties. Per Rural-Urban Commuting Areas (RUCA) coding by zip code, 92.0% of participants resided in a metropolitan area core with primary flow within an urban area.<sup>18</sup>

The family-specific characteristics in the study cohort are shown in Table 3. Four-fifths (80.0%) of patients had at least 1 parent with college education or higher. Annual household income was reported in \$50,000 increments: 32.0% reported >\$100,000; 41.3% reported \$50,001–\$100,000; 16.6% reported <\$50,000; and 10.0% did not disclose this information. We calculated the frequency-weighted mean household income for families included in the study based on their residential zip code. The mean was projected to be \$106,000. In California, the reported mean household income is \$85,265, with the median household income estimated to be even lower at \$61,400.<sup>19</sup> In our cohort, 78.0% of families received no financial assistance for pediatric IBD medical care over the past year. Regarding travel, 66.7% traveled 60 or fewer miles round-trip for IBD-related medical care visits, and 42.0% spent \$200 or less per year on travel expenses. However, 24.7% spent >\$500 OOP for traveling. Approximately, two-thirds (67.4%) of parents of pediatric patients with IBD

**TABLE 3. Summary of Family Characteristics**

	n (%)		
	CD	UC	IBD Total
Highest level of education			
Some high school	2 (1.3)	3 (2.0)	<b>5 (3.3)</b>
High school	2 (1.3)	8 (5.3)	<b>10 (6.7)</b>
Some college	5 (3.3)	10 (6.7)	<b>15 (10.0)</b>
Bachelor's degree	26 (12.2)	34 (22.7)	<b>60 (40.0)</b>
Graduate or doctorate	32 (21.3)	28 (18.7)	<b>60 (40.0)</b>
Annual income, USD			
≤\$25,000.00	3 (2.0)	2 (1.3)	<b>5 (3.3)</b>
\$25,000.01–\$50,000.00	4 (2.7)	16 (10.7)	<b>20 (13.3)</b>
\$50,000.01–\$100,000.00	22 (14.7)	40 (26.7)	<b>62 (41.3)</b>
>\$100,000.00	27 (18.0)	21 (14.0)	<b>48 (32.0)</b>
Decline to state	11 (7.3)	4 (2.7)	<b>15 (10.0)</b>
Private financial assistance (past yr), USD			
None	54 (36.0)	63 (42.0)	<b>117 (78.0)</b>
≤ \$500.00	2 (1.3)	4 (2.7)	<b>6 (4.0)</b>
\$500.01–\$1000.00	9 (6.0)	11 (7.3)	<b>20 (13.3)</b>
\$1000.01–\$2000.00	1 (0.7)	4 (2.7)	<b>5 (3.3)</b>
> \$2000.00	1 (0.7)	1 (0.7)	<b>2 (1.3)</b>
Travel distance (round-trip), miles			
<20	16 (10.7)	26 (17.3)	<b>42 (28.0)</b>
20–60	23 (15.3)	35 (23.3)	<b>58 (38.7)</b>
61–100	16 (10.7)	14 (9.3)	<b>30 (20.0)</b>
101–140	5 (3.3)	6 (4.0)	<b>11 (7.3)</b>
141–180	3 (2.0)	0 (0.0)	<b>3 (2.0)</b>
181+	4 (2.7)	2 (1.3)	<b>6 (4.0)</b>
Travel cost (past yr), USD			
≤ \$200.00	25 (16.7)	38 (25.3)	<b>63 (42.0)</b>
\$200.01–\$500.00	22 (14.7)	28 (18.7)	<b>50 (33.3)</b>
\$500.01–\$1000.00	17 (11.3)	17 (11.3)	<b>34 (22.7)</b>
> \$1000.00	3 (2.0)	0 (0.0)	<b>3 (2.0)</b>
Missed work (past yr), d			
None	20 (13.3)	29 (19.3)	<b>49 (32.7)</b>
1–2	13 (8.7)	18 (12.0)	<b>31 (20.7)</b>
3–4	10 (6.7)	15 (10.0)	<b>25 (16.7)</b>
5+	24 (16.0)	21 (14.0)	<b>45 (30.0)</b>
Lost wages (past yr), USD			
None	41 (27.3)	48 (32.0)	<b>89 (59.3)</b>
≤ \$1000.00	7 (4.7)	19 (12.7)	<b>26 (17.3)</b>
\$1000.01–\$2000.00	9 (6.0)	14 (9.3)	<b>23 (15.3)</b>
\$2000.01–\$5000.00	5 (3.3)	1 (0.7)	<b>6 (4.0)</b>
> \$5000.00	5 (3.3)	1 (0.7)	<b>6 (4.0)</b>

reported missing one or more days of work over the past year due to IBD, and 40.7% of families experienced lost wages. Of note, 80.0% of families with ≤\$50,000 annual income reported missing one or more days of work over the past year and 56.0%



**TABLE 4.** Summary of Cost Burden and Health Care Utilization

	n (%)		
	CD	UC	IBD Total
<b>Total out-of-pocket costs (past yr)</b>			
≤ \$100.00	10 (6.7)	16 (10.7)	<b>26 (17.3)</b>
\$100.01–\$500.00	15 (10.0)	14 (9.3)	<b>29 (19.3)</b>
\$500.01–\$1000.00	21 (14.0)	31 (20.7)	<b>52 (34.7)</b>
\$1000.01–\$5000.00	17 (11.3)	18 (12.0)	<b>35 (23.3)</b>
> \$5000.00	4 (2.7)	4 (2.7)	<b>8 (5.3)</b>
<b>Medications, by patient</b>			
Prednisone	10 (6.7)	13 (8.7)	<b>23 (15.3)</b>
5-aminosalicylate acid	10 (6.7)	32 (21.3)	<b>42 (28.0)</b>
6-mercaptopurine	11 (7.3)	24 (16.0)	<b>35 (23.3)</b>
Azathioprine	8 (5.3)	8 (5.3)	<b>16 (10.7)</b>
Cyclosporine	1 (0.7)	2 (1.3)	<b>3 (2.0)</b>
Adalimumab	9 (6.0)	4 (2.7)	<b>13 (8.7)</b>
Infliximab	15 (10.0)	10 (6.7)	<b>25 (16.7)</b>
Antibiotic	4 (2.7)	5 (3.3)	<b>9 (6.0)</b>
Other	33 (22.0)	30 (20.0)	<b>63 (42.0)</b>
None	3 (2.0)	1 (0.7)	<b>4 (2.7)</b>
<b>Medication compliance</b>			
Always	47 (31.3)	46 (30.7)	<b>93 (62.0)</b>
Almost always	16 (10.7)	27 (18.0)	<b>43 (28.7)</b>
Most of the time	3 (2.0)	8 (5.3)	<b>11 (7.3)</b>
Rarely	1 (0.7)	2 (1.3)	<b>3 (2.0)</b>
Missed medications due to cost	7 (4.7)	9 (6.0)	<b>16 (10.7)</b>
ED visit (past yr)	25 (16.7)	29 (19.3)	<b>54 (36.0)</b>
<b>ED copay (past yr), USD</b>			
≤ \$100.00	3 (5.6)	6 (11.1)	<b>9 (16.7)</b>
\$100.01–\$500.00	5 (9.3)	8 (14.8)	<b>13 (24.1)</b>
\$500.01–\$1000.00	8 (14.8)	8 (14.8)	<b>16 (29.6)</b>
\$1000.01–\$5000.00	5 (9.3)	5 (9.3)	<b>10 (18.5)</b>
> \$5000.00	4 (7.4)	2 (3.7)	<b>6 (11.1)</b>
<b>Procedure and test cost (past yr), USD</b>			
≤ \$100.00	14 (9.3)	21 (14.0)	<b>35 (23.3)</b>
\$100.01–\$500.00	12 (8.0)	18 (12.0)	<b>30 (20.0)</b>
\$500.01–\$1000.00	15 (10.0)	27 (18.0)	<b>42 (28.0)</b>
\$1000.01–\$2000.00	8 (5.3)	5 (3.3)	<b>13 (8.7)</b>
> \$2000.00	18 (12.0)	12 (8.0)	<b>30 (20.0)</b>
Special diet	23 (15.5)	12 (8.1)	<b>35 (23.7)</b>
<b>Diet cost (past yr), USD</b>			
≤ \$200.00	9 (25.7)	3 (8.6)	<b>12 (34.3)</b>
\$200.01–\$400.00	7 (20.0)	4 (11.4)	<b>11 (31.4)</b>
\$400.01–\$600.00	4 (11.4)	2 (5.7)	<b>6 (17.1)</b>
\$600.01–\$800.00	1 (2.9)	1 (2.9)	<b>2 (5.7)</b>
\$800.01–\$1000.00	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>
> \$1000.00	2 (5.7)	2 (5.7)	<b>4 (11.4)</b>

**TABLE 4 (Continued)**

	n (%)		
	CD	UC	IBD Total
<b>Hospitalizations (lifetime)</b>			
0–3	50 (33.3)	59 (39.3)	<b>109 (72.7)</b>
4–6	13 (8.7)	21 (14.0)	<b>34 (22.7)</b>
7–10	2 (1.3)	3 (2.0)	<b>5 (3.3)</b>
11+	2 (1.3)	0 (0.0)	<b>2 (1.3)</b>
<b>Gastroenterology visits (past yr)</b>			
0–3	6 (4.0)	13 (8.7)	<b>19 (12.7)</b>
4–6	34 (22.7)	46 (30.7)	<b>80 (53.3)</b>
7–10	19 (12.7)	16 (10.7)	<b>35 (23.3)</b>
11+	8 (5.3)	8 (5.3)	<b>16 (10.7)</b>
<b>Pediatric visits (past yr)</b>			
0–3	43 (28.7)	37 (24.7)	<b>80 (53.3)</b>
4–6	22 (14.7)	41 (27.3)	<b>63 (42.0)</b>
7–10	2 (1.3)	5 (3.3)	<b>7 (4.7)</b>
11+	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>

experienced lost wages, but the proportions were lower for families with >\$50,000 annual income (64.8% and 37.6%, respectively).

### Summary of Cost Burden and Health Care Utilization

The patient-specific cost burden and health care utilization results (i.e., emergency department [ED] visits, procedure and test cost, hospitalization, gastroenterology visits, and primary medical doctor [PMD] visits for IBD) are shown in Table 4. Our data show that 63.6% of families had an annual OOP cost burden >\$500; 28.6% of patients had total OOP costs over the past year >\$1000; and 5.3% spent >\$5000. The majority of patients (62.0%) report consistent compliance with their medications. The 4 most common medications were 5-aminosalicylate (28.0%), 6-mercaptopurine (23.3%), infliximab (16.7%), and prednisone (15.3%). Approximately, one-third (36.0%) of patients had ED visits over the past year, with 59.2% spending more than \$500 on ED copays, including 11.1% who spent more than \$5000. Although 43.3% contributed less than \$500 on procedure and test costs, 20.0% spent more than \$2000. Four or more lifetime hospitalizations, ≥4 outpatient PMD visits, and ≥4 gastroenterology visits were reported to be 27.3%, 87.3%, and 46.7%, respectively.

The differential OOP cost burden among the surveyed parents, stratified by 3 annual income categories: <\$50,000, \$50,000–100,000, and >\$100,000 is shown in Figure 1. Among the 150 completed surveys, 15 declined to disclose annual household income. Based on our data, 80.6% of the middle income

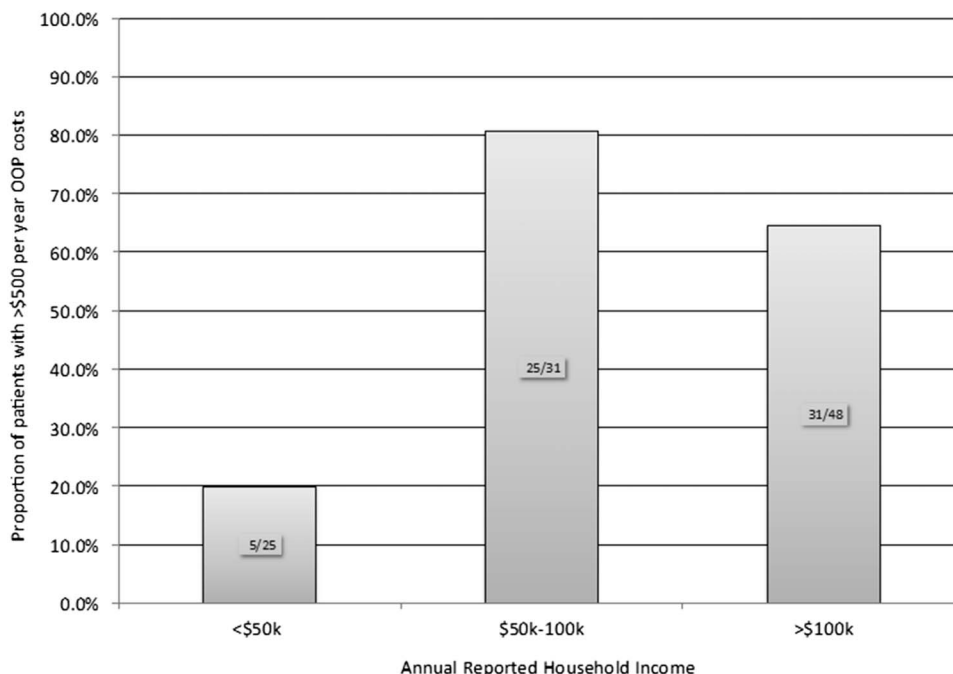


FIGURE 1. Disparate annual OOP cost burden. Of the 150 survey participants, 15 declined to answer the question on annual household income. Two-sample test of proportion indicates  $P < 0.0001$  and  $P < 0.05$  between <\$50,000 versus \$50,000–100,000 and \$50,000–100,000 versus >\$100,000 household income groups, respectively.

group earning between \$50,000 and \$100,000 reported higher proportion of OOP cost burden compared with parents earning <\$50,000 (20.0%;  $P < 0.0001$ ) and >\$100,000 (64.6%;  $P < 0.05$ ).

### Multivariate Logistic Regressions

The covariates in the final multivariate logistic regression model are summarized in Table 5. The independent variables were identified based on univariate analyses for all variables shown in Table 4 conferring statistical significance and clinical importance. We found that clinical variables associated with uncontrolled IBD disease states correlated to higher health care utilization and higher OOP cost burden (>\$500 per yr) for

families. Specifically, reportedly spending >\$500 on procedure and test costs increased the odds of having high annual OOP cost burden by approximately 5.6 times (odds ratio [OR], 5.63; 95% confidence interval [CI], 2.73–11.63). There were 3.2 times increased odds of high annual OOP cost burden if a prednisone treatment course was required over the past year (OR, 3.19; 95% CI, 1.02–9.92). If at least 1 ED visit was necessary over the past year for IBD symptoms, there were approximately 2.8 times increased odds (OR, 2.84; 95% CI, 1.33–6.06) for high annual OOP cost burden. Similarly, when having 4 or more outpatient PMD visits over the past year for IBD symptoms, there were approximately 2.8 times increased odds of a high annual OOP cost burden (OR, 2.82; 95% CI, 1.40–5.68). Finally, with 4 or more lifetime hospitalizations for acute IBD care, there were 2.6 times increased odds of a high annual OOP cost burden (OR, 2.60; 95% CI, 1.13–5.96).

**TABLE 5.** Multivariate Logistic Regression Model of Clinical Variables Associated with >\$500 Annual OOP Cost

Characteristic	OR	95% CI
Estimated OOP procedures and tests cost >\$500 over the past yr	5.63	2.73–11.63
Required prednisone course over the past yr	3.19	1.02–9.92
At least 1 ED visit for IBD over the past yr	2.84	1.33–6.06
At least 4 outpatient PMD visits over the past year for IBD-related symptoms	2.82	1.40–5.68
At least 4 lifetime hospitalizations for IBD	2.60	1.13–5.96

### Differences in OOP Costs for CD and UC

Although the total OOP costs for both patients with CD and UC were similar, procedure and test costs and ED copay trended higher in patients with CD (Fig. 2A–C). These 2 differences, although not statistically significant, can be explained by the higher reported OOP (left-skewing of the data) for procedure and test costs and ED copay among patients with CD. There were more respondents who reported higher OOP (>\$1000) for procedure and test costs and ED copay in CD than in UC (Fig. 3A–C). The distribution of lifetime hospitalizations in CD and UC was similar, but patients with UC had more outpatient PMD visits over the

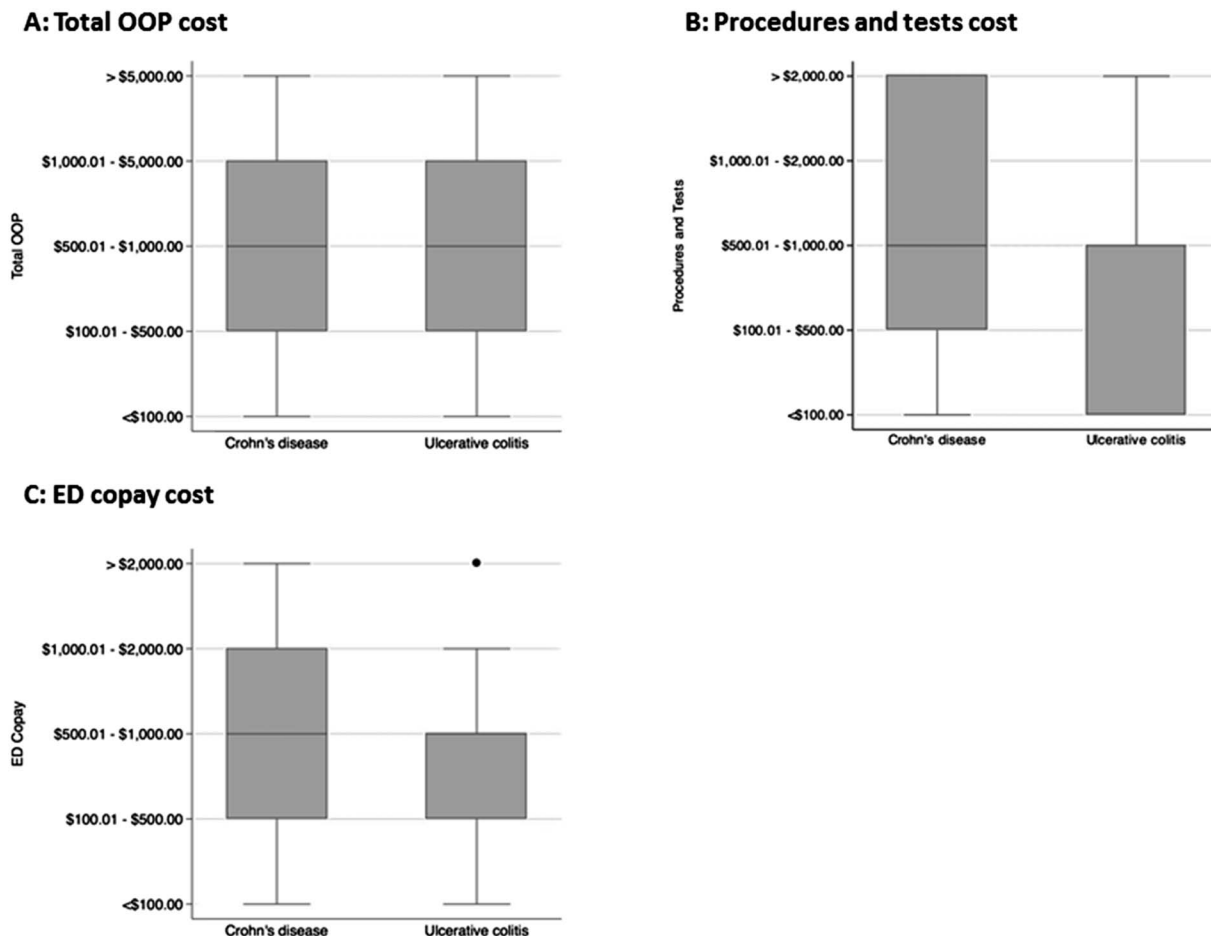


FIGURE 2. Box Plots of total OOP cost (A), procedures and tests cost (B), and ED copay (C), segmented by diagnosis.

past year (Fig. 3D–E) for IBD symptoms. Specifically, 49.4% of patients with UC required 4 to 6 outpatient visits, whereas 64.2% of patients with CD required 0 to 3 outpatient visits over the past year. The number of missed workdays and lost wages for parents over the past year were similar for both CD and UC (Fig. 4A–B).

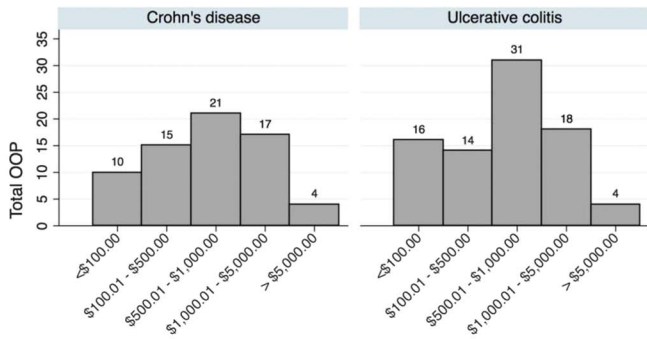
## DISCUSSION

Based on our review of the IBD literature, our study represents the most up-to-date detailed assessment of pediatric IBD-related cost burden to patients' families. From cross-sectional data of families with children affected by IBD in California, we found that a substantial proportion of families incur a sizeable OOP cost burden on an annual basis. Pediatric patients with IBD who have relapsing or uncontrolled IBD states are particularly at risk to require acute care services, which represent high OOP costs for families. Families who are in the lower middle income strata, yet ineligible for need-based assistance programs, may be particularly vulnerable to financial stress from OOP costs. These 2 findings from our analysis warrant further discussion.

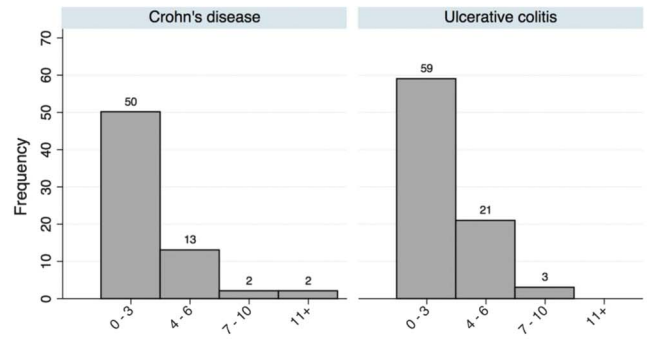
First, although our analysis revealed broad variability of annual OOP costs in IBD, some families are experiencing large

OOP costs to maintain the necessary medical care for their child with IBD. Although >\$500 per year OOP cost may not be a sizeable financial stressor for some families with higher income, such an amount, especially if disbursed in a one-time payment (e.g., procedures and tests), may represent a major portion of the allocated living expenses for the entire family in any given month. The higher rates of missed work and lost wages for low-income families are likely to further exacerbate their ability to cover direct IBD-related OOP costs. While California is typically regarded as a state with very good medical coverage for children living with chronic diseases through the need-based MediCal and CCS programs, families with household incomes near or only slightly above 250% FPL (cutoff for California's Healthy Families Program for Children Under 19) who are not eligible for assistance would face disparate OOP cost burden. Although increased OOP cost burden falling disproportionately on lower middle income families with chronic health care needs is not a novel concept, health policies should address the often-strict binary nature for meeting need-based eligibility to cover health care costs. If high OOP costs are associated with managing pediatric IBD, families in the vulnerable income strata may be averse to seeking appropriate and necessary care, which may adversely affect long-term

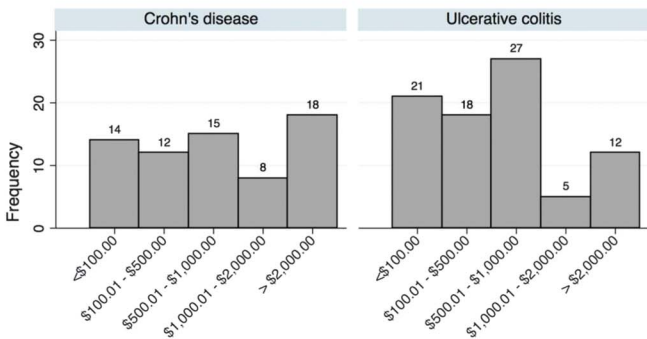
**A: Total OOP cost**



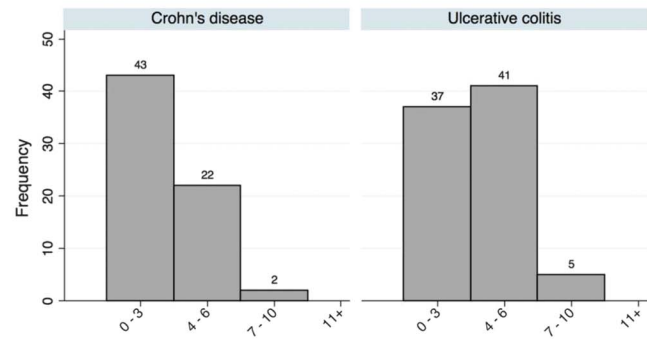
**D: Lifetime hospitalizations**



**B: Procedures and tests cost**



**E: Outpatient pediatrician visits over the past year**



**C: ED copay cost**

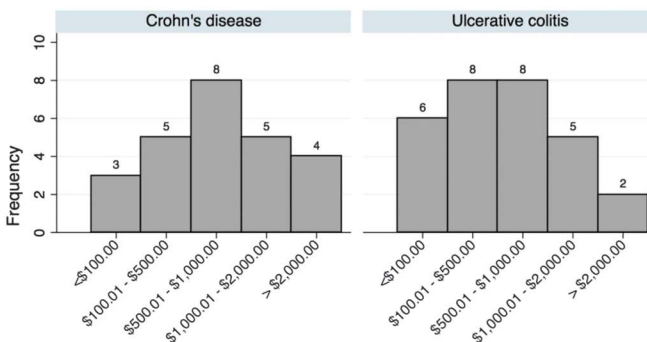


FIGURE 3. Histograms of total OOP cost (A), procedures and tests cost (B), ED copay (C), lifetime hospitalizations (D), and outpatient pediatrician visits over the past year (E), segmented by diagnosis.

health (e.g., bone health, mental health, and risk for collateral health detriments from long-standing uncontrolled IBD). Such a scenario is not uncommon and has been reported in the literature among nonelderly adults with chronic hypertension who tolerate suboptimal medical care to defray growing OOP costs.<sup>20</sup>

Although some data indicate that health care spending is slowing down, which is likely from a combination of post-2007 to 2009 recession cost-containment measures and grassroots initiatives (e.g., Choosing Wisely Campaign), aimed to reduce overuse of select services,<sup>21</sup> high OOP cost burden for patients and their families seem static and pervasive. Based on a nationally representative 2013 data, approximately 40% of both insured and

uninsured patients spent more than \$1000 on OOP medical expenses and 23% had trouble paying medical bills.<sup>22</sup>

Second, we found that relapsing and uncontrolled IBD states correlate to higher OOP cost burden in pediatric IBD families. Although high OOP costs related to procedures and tests may be a surrogate marker for how frequently a gastroenterology provider obtains surveillance laboratories or performs endoscopic evaluations during remission, other clinical variables in Table 5 (i.e., steroid use, ED and outpatient visits, and hospitalizations) directly correspond to acute care needs when patients with IBD are not in stable clinical remission. Prednisone's correlation with higher OOP cost burden is particularly revealing: although the



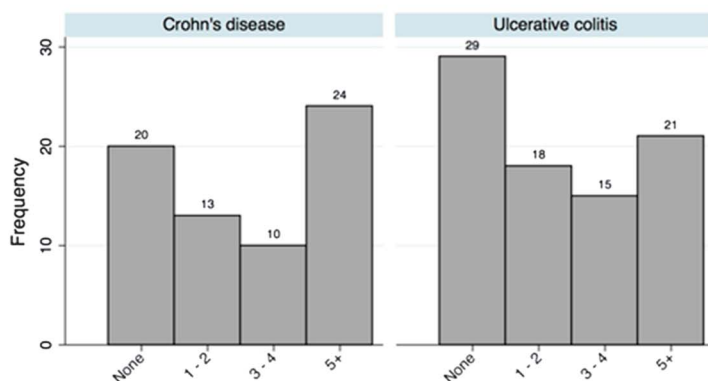
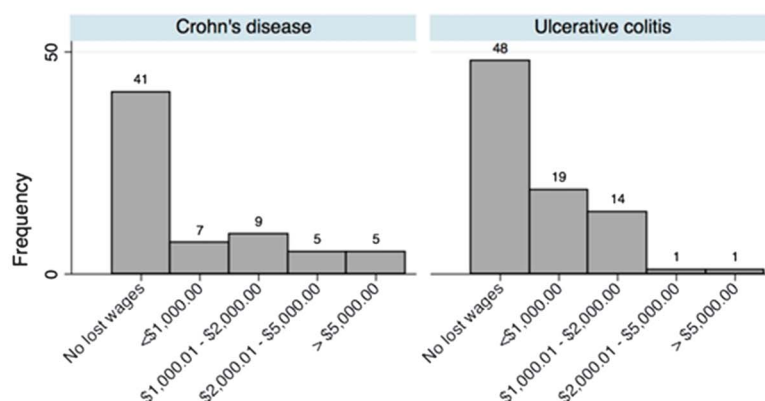
**A: Number of missed workdays****B: Dollar amount of lost wages incurred by patients' families over the past year**

FIGURE 4. Histograms of number of missed workdays (A) and dollar amount of lost wages incurred by patients' parents over the past year (B), segmented by diagnosis.

medication itself is inexpensive, it is very commonly associated with relapsing IBD, which can be costly. Although patients with UC likely have more outpatient PMD visits for IBD symptoms, tests and procedures and ED visits seem to occur more frequently in patients with CD than in patients with UC. Raising gastroenterology providers' awareness of the correlation between higher OOP costs and nonremission IBD states may contribute to improved counseling and outpatient therapy plans aimed to minimize OOP cost burden. Patient education could also highlight important factors, such as medication nonadherence and loss to follow-up, which compound the natural relapsing and remitting disease course. Finally, although outside the scope of our analysis, our findings raise the question of whether "top-down" pharmacotherapies to induce earlier maintenance of remission in pediatric IBD may be the preferred management strategy rather than tailoring therapies around risk avoidance from medication side-effects.

In designing and conducting our study, we took steps to account for potential limitations. We recognize the possible selection bias within our results. Whenever possible, participant recruitment included multiple modalities, including in-person, telephone, and online methods of outreach. Flyers distribution and telephone calls were conducted disregarding socioeconomic status

or disease severity. Online recruitment was limited to Crohn's & Colitis Foundation of America Listservs and newsletters as well as Facebook and Twitter initiatives, which were equally targeted towards all subpopulations of pediatric patients with IBD in California; no other promotional information was provided. Despite these steps, overrepresentation of wealthier urban and suburban areas of the San Francisco Bay Area and Los Angeles areas is likely. Despite this limitation, it is important to note that data skewing of this nature can only underestimate the OOP cost burden for patients. Based on our data, 2 themes remain consistent: disproportionate financial stress among lower income families and high correlation between poor IBD control and increasing OOP costs.

In conclusion, aside from our 2 aforementioned findings discussed above, a detailed literature review revealed that OOP costs in IBD have not received the attention it deserves within health services research in the United States. One recent systematic review<sup>23</sup> highlights the fact that the U.S. outpaces, by manifold, other Western nations in IBD-related health expenditures. Two German studies used "cost diaries" and web-based databases to describe OOP cost burden in their adult patients with IBD.<sup>24,25</sup> U.S. and Canadian studies, using nationally representative data, have described lost wages among adult patients with

IBD.<sup>26,27</sup> However, large databases, even nationally representative ones, cannot quantitatively nor qualitatively capture the impact of IBD-related OOP costs on patients and their families. True to the Institute of Medicine vision, delivering high-value outpatient IBD management should be the gastroenterologists' utmost goal, providing best care at low costs and minimizing financial stress on families with children affected by IBD. Because anti-TNFs represent the class of drugs most likely associated with deep remission, findings from our study may allude to the rationale for improved outpatient management using earlier adoption of anti-TNFs when necessary<sup>28–33</sup> because acute care services are arguably most costly from the patient's perspective.

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