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Incremental Health Care Spending Associated With Crohn Disease Quadrupled Across Therapeutic Eras: A US All-Payer Analysis, 1999–2023

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Abstract

Background

Treatment of Crohn disease has shifted toward biologics and targeted small-molecule therapies, many approved after 2015, but national all-payer estimates of Crohn disease spending do not cover this period.

Aims

To estimate changes in incremental health care spending among US adults with Crohn disease from 1996 to 2023 and their drivers.

Methods

In this serial cross-sectional analysis of the Medical Expenditure Panel Survey (1996–2023; 609,670 adult person-years), adults with a Crohn disease–linked health care event were compared with adults without Crohn disease or ulcerative colitis. A two-part model fitted to the comparison group predicted expected spending without Crohn disease. Incremental spending was observed minus predicted spending, in 2023 US dollars.

Results

Incremental annual spending per adult increased from $6,973 (95% CI, $3,570–$10,377) in 1999–2006 to $13,964 ($10,085–$17,844) in 2007–2015 and $27,891 ($19,392–$36,390) in 2016–2023 (ratio, 4.0; 95% CI, 2.2–7.2). Prescription drugs accounted for 79% of the increase. In 2016–2023, 30% of adults with Crohn disease filled ≥ 1 advanced-therapy prescription in a year; these agents made up 82% of their prescription spending. 5-Aminosalicylate use declined from 65% to 24%. Incremental inpatient spending did not change significantly (−$775; 95% CI, −$3,285 to $1,735). Private insurers paid most of the increase, while incremental out-of-pocket spending remained similar ($1,192 vs $1,448). National incremental spending reached $16.2 billion annually in 2016–2023.

Conclusions

Incremental spending associated with Crohn disease increased fourfold from 1999–2006 to 2016–2023, mainly from advanced therapies. Private insurers covered most of the increase, without a measurable reduction in inpatient spending.

Introduction

Crohn disease (CD) is a chronic, relapsing inflammatory bowel disease (IBD) that often begins in early adulthood and requires lifelong treatment. The standardized prevalence of IBD in US claims data was 721 per 100,000 people, or about 2.39 million Americans when extrapolated to the 2020 US population [1]. A national survey found that 1.3% of US adults, or approximately 3.1 million people, reported a clinician-diagnosed IBD [2].

Estimates of IBD-related health care spending vary widely because they use different methods and populations. Among commercially insured and Medicare Advantage enrollees, annual costs were $22,987 for patients with IBD and $6,956 for matched controls, with biologic drugs accounting for a large share of spending [3]. National estimates range from $8.5 billion in 2018, based on encounters with an IBD diagnosis (71% for medicines) [4], to $25.4 billion in 2016 in the Disease Expenditure Project, which accounts for all personal health care spending across conditions [5]. The most recent national estimate reported $13.9 billion in spending for CD and ulcerative colitis in 2021, with 61% spent on prescription medicines [6]. However, none of these national estimates reports CD-specific spending.

As biologic therapies became more widely used, IBD spending shifted from hospital care toward medications. In the Medical Expenditure Panel Survey (MEPS) from 1998 to 2015, median annual IBD spending nearly doubled, pharmacy costs accounted for the largest share (44%), and inpatient spending declined [7]. Per-patient spending in the Disease Expenditure Project increased from $5,714 in 1996 to $14,033 in 2016 [5], while a systematic review identified biologics as a major driver of rising IBD costs across several countries [8]. Previous MEPS analyses reporting CD separately covered 1996–2009 [9], 1996–2011 [10], and 2003–2013 [11]. A matched analysis estimated annual medical costs of $13,446 for patients with CD compared with $6,029 for those without CD [12].

Two important gaps remain. First, no national CD-specific spending estimate covers the period after 2015, when ustekinumab, risankizumab, and upadacitinib were approved for CD, self-injected biologics became more widely used, and biosimilars entered the market. Second, most existing estimates are based on insured populations or diagnosis-linked encounters. They may therefore not reflect the additional health care spending associated with CD across all payers, including patients themselves. MEPS captures health care spending from all payers, verifies payments using sampled provider and pharmacy records, and links health care events to the conditions treated. This provides an opportunity to address both gaps using a nationally representative data source.

We estimated incremental annual health care spending associated with treated CD among US adults from 1996 to 2023. Incremental spending was defined as observed spending among adults with CD minus the spending predicted for similar adults without CD. We examined changes in total spending, cost components, and payer contributions across therapeutic eras, and identified the drug classes that accounted for changes in prescription spending.

Materials and Methods

This study used de-identified, publicly available data from the Medical Expenditure Panel Survey and involved no interaction with participants and no access to identifiable private information. It therefore did not meet the definition of human subjects research under 45 CFR 46, and institutional review board review and informed consent were not required. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement (Online Resource 1, STROBE checklist).

Data source

MEPS is a nationally representative survey of the US civilian, noninstitutionalized population, conducted by the Agency for Healthcare Research and Quality (AHRQ). Each year, a new panel of households is enrolled and followed for 2 years, with data collected on health care use, costs, and associated medical conditions. Payment data from a sample of the hospitals, physicians, and pharmacies identified by households (the Medical Provider Component) are used to replace or impute household-reported payments [13, 14]. We used the public-use Full-Year Consolidated, Medical Conditions, event, and condition-event link files for 1996–2023 (Online Resource 1, Table S1) [15], along with the pooled variance files (HC-036 and HC-036BRR) for variance estimation across years [16]. Before analyzing outcomes, we verified that our code reproduced published AHRQ summary-table and condition-table estimates and then froze the analysis file (Online Resource 1).

Population and case definition

We included adults aged 18 years or older with a positive person weight. The unit of analysis was the person-year. MEPS assigns each reported condition a 3-digit ICD-9-CM code (1996–2015) or ICD-10-CM code (2016–2023). Following the AHRQ definition of a treated condition, we identified CD cases as adults with at least one health care event (visit, hospital stay, or prescribed medicine) linked to code 555 (ICD-9-CM) or K50 (ICD-10-CM) during the year. The comparison group included adults with no record of CD or ulcerative colitis (UC) that year. We excluded adults with a CD record but no CD-linked event and those with a UC record but no CD record. Because AHRQ did not release the UC code for 2017 or 2021–2023, adults with UC could not be excluded from the comparison group in those years (Online Resource 1).

Therapeutic eras

We grouped survey years into four eras based on FDA approvals for CD [17] (Online Resource 1, Fig. S1): 1996–1998, before infliximab approval in August 1998; 1999–2006, when infliximab was the only approved biologic; 2007–2015, when self-injected anti–tumor necrosis factor agents became available (adalimumab in 2007 and certolizumab pegol in 2008); and 2016–2023, beginning with ustekinumab in September 2016, followed by risankizumab in 2022 and upadacitinib and subcutaneous infliximab in 2023.

Natalizumab (2008) and vedolizumab (2014) did not define separate eras. Natalizumab use in CD was limited by its restricted-distribution program and risk of progressive multifocal leukoencephalopathy, and its approval fell within era 3. Both drugs are administered by infusion, so MEPS captures their costs as part of outpatient, office-based, or home health event payments rather than as prescribed medicines. These costs are included in total incremental spending but cannot be attributed to either drug specifically. A separate 2014–2015 era would also have been shorter and less precise than the other eras.

We pooled the survey years within each era and divided person weights by the number of years to estimate annual averages [16]. The 1996–1998 era included only 42 unique adults with treated CD, below the AHRQ minimum of 60 [16]. We therefore used 1999–2006 as the reference era. The earliest years appear only in the 1996–1999 window of the trend analysis and in Online Resource 1.

Outcomes

The primary outcome was total annual health care spending from all payers. Secondary outcomes were incremental spending by type of care and by payer; incremental health care use (hospital discharges, emergency department visits, office-based and outpatient visits, and prescription fills); CD-linked spending (payments for events linked to CD), reported descriptively for adults with CD; and use of and spending on CD drug classes. Spending was converted to 2023 US dollars with the Personal Consumption Expenditures (PCE) health-by-function price index, which reflects all-payer prices and is recommended for total medical expenditures [18]. As a sensitivity analysis, we first adjusted spending using the PCE health price index through the last year of each era, then used the gross domestic product (GDP) implicit price deflator to convert spending to 2023 dollars. The PCE health price index reflects changes in medical care prices, whereas the GDP deflator reflects price changes across the broader economy, allowing comparison of health care spending with the purchasing power of the same amount outside health care [18]. Index values were obtained from the Bureau of Economic Analysis [19].

Drug classes

We classified each prescribed-medicine fill of adults with CD by drug name as an advanced therapy (a biologic or targeted small-molecule agent), a 5-aminosalicylate (5-ASA), an immunomodulator (azathioprine, mercaptopurine, or methotrexate), or a systemic corticosteroid (Online Resource 1). Advanced therapies not approved for CD were included because they may be used off-label or for a coexisting condition. MEPS replaces some drug names with a therapeutic class label in the public files. We therefore also counted as an advanced therapy any fill labeled only as an immunologic or miscellaneous agent that had a payment of at least $1,000 and was linked to CD. Use of a drug class was defined as at least one fill in the survey year and reported as a weighted share of person-years. In sensitivity analyses, we set the payment threshold for masked fills at $0, $500, and $2,500 and removed the CD-link requirement. Drugs given by infusion are not recorded as prescribed medicines; their cost is included in the payments for the visit at which they were given.

Covariates

Models adjusted for age group (18–44, 45–64, and ≥ 65 years), sex, race and ethnicity as reported by the household respondent (Hispanic, non-Hispanic Black, and non-Hispanic White or other race; Online Resource 1), census region, family income relative to the federal poverty line, education, and survey year. Race and ethnicity were included because they are associated with health care use and spending. Health insurance was not included in the main model because CD can change coverage, for example through disability-related Medicare or Medicaid eligibility; it was added in a sensitivity analysis. Missing covariate values were coded as a separate category.

Statistical analysis

We used a two-part model, building on the two-part cost-of-illness approach applied to MEPS by AHRQ and CDC investigators [20], to account for adults with no health care spending and the highly skewed distribution of health care costs [21, 22]. The first part used logistic regression to estimate the probability of any spending. The second used a gamma generalized linear model with a log link to estimate spending among adults with nonzero costs. Both models were fitted separately for each era using survey weights and data from the comparison group only. We then used the models to predict the spending expected for each adult with CD if

they did not have CD, based on their observed characteristics. Incremental spending was calculated as the weighted mean observed spending among adults with CD minus the weighted mean predicted spending. This represents an adjusted association rather than a causal effect. We used the same approach for individual types of care, payers, and measures of health care use. National incremental spending was calculated by multiplying the per-person estimate by the weighted annual number of adults with treated CD.

We did not use a single regression model with CD as the main exposure for the primary analysis. With a log link, this approach assumes that CD increases spending by the same proportion for everyone. However, much of the additional spending associated with CD comes from relatively large, fixed costs, such as biologic therapy. Results from this model are provided in Online Resource 1, Table S3. We also fitted a second model that included 12 comorbidities. Because some of these conditions, including mood and anxiety disorders and arthritis, may be related to or result from CD, adjusting for them may underestimate incremental spending.

We calculated standard errors and 95% confidence intervals using the 128 AHRQ balanced repeated replication weights, repeating the full analysis for each replicate [16]. We compared eras using pairwise differences, the ratio of incremental spending in 2016–2023 to that in 1999–2006, and a Wald test for differences across the three reported eras. We also estimated incremental spending in consecutive 4-year windows to assess whether the trends were sensitive to the choice of era boundaries.

Following AHRQ precision guidelines [16], we suppressed estimates based on fewer than 60 unique persons or with a relative standard error (RSE) above 50%. Estimates with an RSE of 30%–50% are marked with an asterisk. These rules were applied to descriptive estimates (means and percentages) but not to incremental estimates or differences between eras, which are reported with their 95% confidence intervals. All tests were two-sided, with a significance level of .05. Comparisons across spending components were descriptive and were not adjusted for multiple testing.

Sensitivity analyses

We repeated the main analysis with alternative case definitions (any CD record in the year; CD in either year of the 2-year panel); with added or removed covariates (12 comorbidities; health insurance; removal of income and education, which may lie on the pathway between CD and spending); with spending above the 99th percentile set to the 99th percentile; with the two-step deflator; without 2020–2021 (COVID-19 pandemic); and with alternative era boundaries (era 3 starting in 2008; 1996–2006 as one era). To check for a break at the change to ICD-10-CM, we compared 2014–2015 with 2016–2017.

Every adult with CD had at least one CD-linked event and therefore some spending, whereas the comparison group included adults with no health care use. To assess how much this difference contributed to the estimates, we restricted the comparison group to adults with any spending and, separately, to adults with at least one office-based visit. As a benchmark, we applied the same method to adults with a rheumatoid arthritis record and no CD or UC record, a chronic inflammatory disease also treated with biologics, which Click and colleagues used as the comparison condition in an earlier MEPS study of IBD [7]. We compared the two increases with the ratio of their era ratios (2016–2023 vs 1999–2006), with its CI from the replicate weights.

Analyses were performed in Python 3.12 (pandas, NumPy, SciPy), and figures were produced in R (ggplot2). Code validation is described in the Methods section of Online Resource 1. Claude (Anthropic) and ChatGPT (OpenAI) were used to assist with analysis and figure code and with language editing; the authors reviewed and verified all code, results, and text and take full responsibility for the content.

Results

Study sample

The analysis included 609,670 adult person-years. In the three reported eras, 881 person-years (537 unique persons) had treated CD (Table 1; Online Resource 1, Table S2). The estimated number of adults with treated CD doubled, from 0.29 million per year (95% CI, 0.23–0.36) in 1999–2006 to 0.58 million (0.47–0.68) in 2016–2023. These figures were 0.1% and 0.2% of US adults.

Table 1

Sample and characteristics of adults with treated Crohn disease and the comparison group, by therapeutic era

Characteristic	1999–2006 CD	1999–2006 Comp.	P	2007–2015 CD	2007–2015 Comp.	P	2016–2023 CD	2016–2023 Comp.	P
Sample									
Person-years, n	204	173,647		343	214,590		334	165,919	
Unique persons, n	129	99,707		216	123,991		219	98,915	
Adults with treated CD, millions per year	0.29 (0.23 to 0.36)			0.51 (0.42 to 0.60)			0.58 (0.47 to 0.68)		
Treated CD, % of adults	0.1 (0.1 to 0.2)			0.2 (0.2 to 0.3)			0.2 (0.2 to 0.3)		
Age, mean, years	48.9	45.7	.104	48.1	46.8	.432	49.4	48.1	.291
Age group, %			.003			.182			.131
18–44	37.3	51.3		40.8	47.2		37.6	45.4	
45–64	44.8	31.8		42.2	34.4		38.6	32.4	
≥ 65	17.9	16.9		17.0	18.4		23.8	22.1	
Sex, %			.458			.038			.423
Male	52.5	48.1		39.5	48.4		45.3	48.6	
Female	47.5	51.9		60.5	51.6		54.7	51.4	
Race and ethnicity, %			< .001			< .001			.006
Non-Hispanic White or other	90.9	76.6		90.6	73.8		84.2	71.2	
Hispanic	2.1*	12.1		2.5*	14.6		8.2*	16.8	
Non-Hispanic Black	6.9*	11.3		6.9	11.6		7.7*	12.0	
Census region, %			.706			< .001			< .001
Northeast	16.9	19.0		25.3	18.3		24.5	17.4	
Midwest	28.8	22.6		33.1	21.5		20.6	20.7	
South	33.0	35.8		23.3	37.0		41.9	38.1	

Characteristic	1999–2006 CD	1999–2006 Comp.	P	2007–2015 CD	2007–2015 Comp.	P	2016–2023 CD	2016–2023 Comp.	P
Sample									
West	21.3	22.5		18.3	23.2		12.9	23.8	
Family income, %			.082			.170			.049
Poor	12.1	10.5		11.4	12.3		10.2	10.6	
Near poor	2.0*	4.1		2.4*	4.4		2.0*	3.7	
Low income	10.2*	13.2		12.9	13.5		8.0	11.9	
Middle income	25.1	31.1		28.2	29.9		29.9	28.6	
High income	50.6	41.1		45.0	40.0		49.8	45.2	
Health insurance, %			.001			< .001			.091
Any private	78.3	72.6		79.5	67.7		69.0	68.2	
Public only	15.7	13.9		14.6	18.1		27.2	24.1	
Uninsured	6.1*	13.4		6.0*	14.2		3.8*	7.7	
Education, %			.035			< .001			.248
Less than high school	15.7	20.4		5.6	15.7		12.5	12.7	
High school	23.9	32.2		24.2	28.7		21.8	28.1	
Some college or more	59.1	46.7		69.7	54.9		65.2	58.4	
Missing	1.3*	0.7		0.5*	0.7		0.5*	0.7	
Comorbidities, %									
Diabetes	5.7*	6.8	.673	9.9	9.7	.926	5.2	10.2	< .001
Hypertension	20.0	18.7	.766	29.1	26.5	.500	23.8	24.7	.774
Ischemic heart disease	0.0	1.8	—	6.8	5.7	.521	4.2	4.3	.919
Heart failure	0.0	0.8	—	0.7*	0.8	.874	0.1*	0.7	< .001
COPD	7.3*	4.6	.300	9.6	5.9	.157	5.9	3.4	.079
Asthma	3.6*	4.1	.689	7.3*	6.0	.597	12.3	6.1	.024
Cancer	6.9*	3.8	.155	8.2	5.1	.131	6.2	5.2	.551
Mood disorder	18.3	8.9	.018	19.7	10.4	.003	15.0	9.6	.071

Characteristic	1999–2006 CD	1999–2006 Comp.	P	2007–2015 CD	2007–2015 Comp.	P	2016–2023 CD	2016–2023 Comp.	P
Sample									
Anxiety	10.9	5.3	.054	15.3	8.4	.011	19.7	10.0	.005
Rheumatoid arthritis	0.6*	0.6	.985	3.2*	1.5	.217	3.7*	1.9	.162
Osteoarthritis	3.2*	1.0	.279	13.0	6.0	.025	13.7	8.2	.047
Chronic kidney disease	0.0	0.0	—	0.0	0.1	—	0.6*	0.2	.403

Values are weighted percentages of person-years unless otherwise specified. Adults with treated CD (millions per year) represents the weighted mean annual number (95% CI). P values were calculated using design-based Wald tests with 128 balanced repeated replication weights. For categorical variables, P values represent tests of the overall distribution. Family income is reported relative to the federal poverty line (FPL): poor, < 100%; near poor, 100%–124%; low income, 125%–199%; middle income, 200%–399%; and high income, ≥ 400%. *Relative standard error 30%–50%. —, not shown because fewer than 60 unique persons were included, the relative standard error exceeded 50%, or variance could not be estimated. The 1996–1998 era included 42 unique persons with CD and is not shown (Online Resource 1, Table S1). The total number of unique persons with CD across eras was 564, compared with 537 overall, because 27 adults contributed person-years in 2 eras (11 in 2006–2007 and 16 in 2015–2016). CD, Crohn disease; Comp., comparison group (adults without a record of CD or ulcerative colitis); COPD, chronic obstructive pulmonary disease.

In 2016–2023, adults with treated CD and the comparison group had similar mean age (49.4 vs 48.1 years) and similar rates of private insurance (69.0% vs 68.2%). Adults with treated CD were more often non-Hispanic White or other race (84.2% vs 71.2%), and they more often had an anxiety disorder (19.7% vs 10.0%).

Total and incremental spending

Mean annual spending of adults with treated CD was $13,045 in 1999–2006, $21,020 in 2007–2015, and $36,602 in 2016–2023 (Table 2). Over the same period, mean spending in the comparison group rose from $5,427 to $7,815.

Table 2
Health care spending and incremental spending associated with treated Crohn disease, by therapeutic era (2023 US$ per person per year)

Mean annual spending per person	**1999–2006**	**2007–2015**	**2016–2023**	**Change, 2016–2023 vs 1999–2006**
Adults with treated CD	13,045 (9,761 to 16,328)	21,020 (17,120 to 24,919)	36,602 (28,121 to 45,083)	23,557 (14,659 to 32,455)
Comparison group	5,427 (5,310 to 5,543)	6,260 (6,127 to 6,393)	7,815 (7,653 to 7,977)	2,389 (2,186 to 2,592)
Unadjusted difference	7,618 (4,328 to 10,908)	14,759 (10,854 to 18,664)	28,787 (20,347 to 37,226)	21,168 (12,300 to 30,036)
Expected spending of adults with CD without CD (model)	6,072 (5,330 to 6,813)	7,055 (6,478 to 7,633)	8,711 (8,071 to 9,351)	2,640 (1,621 to 3,658)
Incremental spending per adult with treated CD				
Main model	6,973 (3,570 to 10,377)	13,964 (10,085 to 17,844)	27,891 (19,392 to 36,390)	20,918 (11,838 to 29,997)
Model with 12 comorbidities (may understate)	6,578 (3,142 to 10,014)	11,405 (7,634 to 15,176)	26,702 (18,405 to 34,998)	20,124 (11,100 to 29,148)
National incremental spending, US$ billions per year				
Main model	2.06 (0.94 to 3.18)	7.15 (4.74 to 9.56)	16.15 (10.53 to 21.78)	14.10 (8.47 to 19.73)
CD-linked spending (events linked to CD), per adult with CD				
All CD-linked care	4,958 (3,863 to 6,053)	10,250 (7,379 to 13,120)	25,715 (17,592 to 33,837)	20,756 (12,449 to 29,064)
CD-linked prescription medicines	1,176 (906 to 1,445)	5,464 (3,725 to 7,203)	17,584 (10,241 to 24,927)	16,409 (9,079 to 23,739)
CD-linked inpatient care	1,979 (1,114 to 2,843)	1,392 (608 to 2,176)	2,078 (1,003 to 3,153)	100 (− 1,209 to 1,408)
CD-linked care, % of all spending of adults with CD	38.0 (27.2 to 48.8)	48.8 (40.6 to 56.9)	70.3 (62.5 to 78.0)	32.2 (18.0 to 46.5)

Values are estimates (95% CI) in 2023 US dollars per person per year (PCE health price index); national spending is in US$ billions per year. Incremental spending is the observed mean spending of adults with

treated CD minus their expected spending without CD, predicted by a two-part model fitted to the comparison group. National incremental spending is incremental spending × the weighted annual number of adults with treated CD. CD-linked spending is descriptive, not incremental. Test of equal incremental spending across eras: $\chi^2 = 22.4$, 2 df, $P < .001$. Ratio, 2016–2023 vs 1999–2006: 4.0 (2.2–7.2); comorbidity-adjusted, 4.1 (2.1–7.8). CD, Crohn disease; PCE, Personal Consumption Expenditures.

After adjustment, incremental spending per adult with treated CD was:

• 1999–2006: $6,973 (95% CI, 3,570–10,377)

• 2007–2015: $13,964 (10,085–17,844)

• 2016–2023: $27,891 (19,392–36,390)

The estimates differed across eras ($\chi^2 = 22.4$, 2 df, $P < .001$). The 2016–2023 estimate was $20,918 (11,838–29,997) higher than the 1999–2006 estimate, a ratio of 4.0 (2.2–7.2). It was also $13,927 (4,957–22,896) higher than the 2007–2015 estimate. Adjustment for 12 comorbidities gave slightly lower estimates ($6,578, $11,405, and $26,702) and a similar ratio (4.1; 2.1–7.8). The difference in median spending between the two groups rose from $6,021 to $16,280 (Online Resource 1, Table S3).

In 4-year windows, incremental spending was $13,422 (5,381–21,462) in 1996–1999. It was lowest in 2004–2007 ($5,700; 2,769–8,632) and then rose in every later window, reaching $32,060 (18,908–45,212) in 2020–2023 (Fig. 1; Online Resource 1, Table S4).

National incremental spending was $2.1 billion (0.9–3.2) per year in 1999–2006, $7.2 billion (4.7–9.6) in 2007–2015, and $16.2 billion (10.5–21.8) in 2016–2023.

Spending by type of care

Prescription medicines accounted for most of the increase (Table 3; Fig. 2; Online Resource 1, Tables S5 and S6). Incremental prescription spending rose from $1,608 (1,015–2,201) in 1999–2006 to $18,208 (10,758–25,658) in 2016–2023. This increase of $16,600 (9,175–24,024) was 79% of the increase in total incremental spending. Incremental office-based spending rose by $2,382 (738–4,026), and incremental emergency department spending rose by $808 (59–1,556).

Table 3
Incremental spending associated with treated Crohn disease by type of care and payer, by therapeutic era (2023 US$ per person per year)

By type of care	1999–2006	2007–2015	2016–2023	Change, 2016–2023 vs 1999–2006
Prescription medicines	1,608 (1,015 to 2,201)	6,076 (4,136 to 8,016)	18,208 (10,758 to 25,658)	16,600 (9,175 to 24,024)
Inpatient	2,685 (507 to 4,864)	2,564 (968 to 4,160)	1,910 (601 to 3,219)	−775 (− 3,285 to 1,735)
Hospital outpatient	1,210 (421 to 1,999)	2,378 (199 to 4,556)	2,572 (663 to 4,481)	1,361 (− 724 to 3,447)
Office-based	1,199 (523 to 1,875)	2,364 (1,514 to 3,215)	3,581 (2,061 to 5,102)	2,382 (738 to 4,026)
Emergency department	24 (− 37 to 84)	507 (157 to 858)	831 (82 to 1,581)	808 (59 to 1,556)
Dental	251 (− 56 to 558)	163 (4 to 321)	101 (− 118 to 319)	−150 (− 500 to 200)
Home health	1 (− 254 to 257)	−110 (− 191 to − 29)	663 (− 735 to 2,060)	661 (− 765 to 2,088)
Other (vision, equipment, services)	81 (− 78 to 240)	79 (− 9 to 167)	66 (− 58 to 189)	−16 (− 219 to 188)
By payer				
Out-of-pocket	1,192 (657 to 1,728)	929 (532 to 1,325)	1,448 (578 to 2,318)	256 (− 746 to 1,257)
Private insurance	2,853 (1,432 to 4,273)	8,672 (5,430 to 11,914)	18,870 (11,577 to 26,162)	16,017 (8,505 to 23,529)
Medicare	2,080 (− 187 to 4,346)	1,969 (495 to 3,443)	3,664 (1,237 to 6,092)	1,585 (− 1,684 to 4,853)
Medicaid	509 (− 362 to 1,380)	1,259 (126 to 2,392)	3,354 (538 to 6,169)	2,844 (− 152 to 5,841)
Other payers	414 (− 252 to 1,081)	1,285 (143 to 2,427)	627 (20 to 1,234)	212 (− 693 to 1,118)
Total (all care, all payers; Table 2**)**	6,973 (3,570 to 10,377)	13,964 (10,085 to 17,844)	27,891 (19,392 to 36,390)	20,918 (11,838 to 29,997)

Values are estimates (95% CI). Each type of care and payer was modeled separately using a two-part model; therefore, the estimates may not sum exactly to the total. The relative standard error rule was not applied to incremental estimates or differences (see Methods). Confidence intervals that include 0 indicate no statistically detectable difference. Other payers include Veterans Affairs, TRICARE, other public sources, workers' compensation, and other sources. CD, Crohn disease.

Incremental inpatient spending was $2,685 (507–4,864) in 1999–2006 and $1,910 (601–3,219) in 2016–2023. This difference was not statistically significant (−$775; −3,285 to 1,735).

Spending by payer

Private insurance paid $16,017 (8,505–23,529) of the increase. Incremental out-of-pocket spending did not change significantly: it was $1,192 (657–1,728) in 1999–2006, $929 (532–1,325) in 2007–2015, and $1,448 (578–2,318) in 2016–2023 (change, $256; −746 to 1,257). Incremental Medicaid spending rose from $509 to $3,354, but this change was imprecise ($2,844; −152 to 5,841).

CD-linked spending

Spending on events linked to CD rose from $4,958 per adult with treated CD in 1999–2006 to $25,715 in 2016–2023 (Table 2). Its share of all spending of adults with treated CD rose from 38.0% to 70.3% (difference, 32.2 percentage points; 18.0–46.5). CD-linked prescription spending rose from $1,176 to $17,584. CD-linked inpatient spending did not change ($1,979 vs $2,078).

Prescription drug classes

In 1999–2006, no adult with treated CD filled a self-administered advanced therapy (Table 4). Infliximab, the only biologic approved for CD at that time, is given by infusion and is not recorded in the prescribed-medicine files. The share of adults who filled an advanced therapy rose from 11.9% (7.2–16.6) in 2007–2015 to 29.8% (22.2–37.4) in 2016–2023 (Online Resource 1, Fig. S2). In 2016–2023, advanced therapies made up 82.0% (73.6–90.4) of the prescription spending of adults with treated CD.

Table 4

Prescription drug classes and use of care among adults with treated Crohn disease, by therapeutic era

Prescription drugs, adults with treated CD	1999–2006	2007–2015	2016–2023	Change, 2016–2023 vs 1999–2006
Advanced therapy,□ % with ≥ 1 fill in the year	0□	11.9 (7.2 to 16.6)	29.8 (22.2 to 37.4)	
Named agents only,□ % with ≥ 1 fill in the year	0□	10.3 (6.1 to 14.4)	10.9 (6.2 to 15.7)	
Advanced therapy, % of prescription spending	0□	35.7 (20.8 to 50.6)	82.0 (73.6 to 90.4)	
Advanced therapy spending per person, $	0□	2,735 (1,039 to 4,431)*	16,670 (9,303 to 24,036)	
Spending on all other drugs per person, $	2,844 (2,204 to 3,485)	4,932 (4,044 to 5,820)	3,655 (2,726 to 4,584)	
Fills of all other drugs per person	27.92 (22.97 to 32.86)	27.06 (23.02 to 31.09)	20.74 (16.88 to 24.60)	
5-ASA, % with ≥ 1 fill in the year	64.7 (55.6 to 73.8)	53.0 (45.9 to 60.1)	23.6 (18.1 to 29.1)	
Immunomodulator, % with ≥ 1 fill in the year	19.8 (12.3 to 27.4)	18.7 (12.9 to 24.5)	6.8 (3.0 to 10.6)	
Systemic corticosteroid, % with ≥ 1 fill in the year	25.7 (19.4 to 32.1)	30.3 (23.2 to 37.4)	26.0 (19.5 to 32.6)	
Hospital discharges per person per year				
Adults with treated CD	0.43 (0.16 to 0.70)*	0.29 (0.21 to 0.38)	0.25 (0.17 to 0.33)	−0.18 (− 0.46 to 0.10)
Comparison group	0.12 (0.12 to 0.13)	0.11 (0.11 to 0.12)	0.10 (0.10 to 0.10)	−0.02 (− 0.03 to − 0.02)
Incremental (adjusted)	0.31 (0.04 to 0.58)	0.18 (0.09 to 0.26)	0.15 (0.07 to 0.22)	−0.16 (− 0.44 to 0.12)
Incremental use per adult with CD per year (adjusted)				
Emergency department visits	0.17 (0.07 to 0.27)	0.29 (0.16 to 0.43)	0.28 (0.16 to 0.41)	0.11 (− 0.05 to 0.27)
Office-based visits	4.03 (2.47 to 5.60)	6.43 (3.96 to 8.89)	4.69 (2.48 to 6.91)	0.66 (− 2.32 to 3.63)
Hospital outpatient visits	0.72 (0.15 to 1.30)	1.92 (0.10 to 3.73)	0.95 (0.40 to 1.50)	0.23 (− 0.58 to 1.03)

Prescription drugs, adults with treated CD	1999–2006	2007–2015	2016–2023	Change, 2016–2023 vs 1999–2006
Prescription fills	14.99 (10.60 to 19.38)	13.60 (9.65 to 17.55)	10.24 (6.60 to 13.87)	−4.76 (− 10.79 to 1.27)

Values are estimates (95% CI). Dollar amounts are expressed in 2023 US dollars per person per year; percentages represent weighted shares of person-years. Incremental use is the difference between the observed mean use among adults with treated CD and the expected mean use in the absence of CD, estimated using a two-part model fitted to the comparison group. *Relative standard error 30%–50%.

Biologic or targeted small-molecule agents identified by name, along with fills that MEPS classified only as an immunologic or miscellaneous agent, cost at least $1,000, and were linked to CD (Online Resource 1, Tables S7 and S8).

Infliximab was the only biologic approved for CD during 1999–2006 and is administered by infusion. MEPS includes payments for infused drugs in office-based or outpatient visit expenditures rather than prescribed medicine expenditures.

MEPS masked the names of most advanced therapies beginning in 2020. As a result, counts based on named agents underestimate their use during 2016–2023 (Online Resource 1, Fig. S3).

95% CIs for percentages use the normal approximation. Logit-scale CIs for the same estimates are given in Online Resource 1 (Methods, Pooled years and variance; Table S8 and Fig. S2); point estimates are identical.

5-ASA, 5-aminosalicylates; CD, Crohn disease; MEPS, Medical Expenditure Panel Survey.

Use of older drugs fell. From 1999–2006 to 2016–2023, 5-aminosalicylate use fell from 64.7% to 23.6%, and immunomodulator use fell from 19.8% to 6.8%. Corticosteroid use was stable (26%–30%). Spending on all other drugs was $2,844 per person in 1999–2006 and $3,655 in 2016–2023 (peak, $4,932 in 2007–2015; difference, $811; −240 to 1,861), and fills of these drugs declined from 27.9 to 20.7 per person per year (difference, − 7.2; −13.8 to − 0.5).

After 2019, most advanced-therapy fills had masked drug names (Online Resource 1, Fig. S3). In 2016–2019, 23.7% (13.6–33.8) of adults with treated CD filled a named advanced therapy and 1.5% filled a masked one. In 2020–2023, the figures were 1.7% and 32.0% (21.5–42.5). Use of any advanced therapy did not fall between the two periods (25.2% and 33.1%). Of masked fills costing at least $1,000, 89% were linked to a CD condition record, which was similar to named advanced therapies (92%; Online Resource 1, Table S7). Across payment thresholds, with or without the CD-link requirement, 29.6% to 31.0% of adults with treated CD filled an advanced therapy in 2016–2023. In the same analyses, these drugs made up 82.0% to 83.7% of prescription spending (Online Resource 1, Table S8). Counting only named drugs gave 10.9%. This lower figure reflects the masking of drug names, not lower use.

Use of care

Hospital discharges per adult with treated CD were 0.43 per year in 1999–2006 (relative standard error, 30%–50%), 0.29 in 2007–2015, and 0.25 in 2016–2023 (Table 4). In the comparison group, discharges fell slightly, from 0.12 to 0.10. After adjustment, incremental discharges were 0.31 (0.04–0.58) in 1999–2006 and 0.15 (0.07–0.22) in 2016–2023. This difference was not statistically significant (− 0.16; −0.44 to 0.12). Incremental prescription fills fell from 15.0 to 10.2 per year, which was also not significant (− 4.8; −10.8 to 1.3).

Sensitivity analyses

In 2016–2023, the sensitivity analyses gave incremental spending of $22,668 to $27,891 (Online Resource 1, Table S9). The main estimate was at the upper end of this range. The lowest value came from capping spending at the 99th percentile. Excluding 2020–2021 gave $26,761 (16,823–36,699).

Restricting the comparison group to adults with any spending gave $6,346, $13,297, and $27,069 in the three eras. Restricting it to adults with at least one office-based visit gave $5,814, $12,760, and $26,479. Removing income and education changed the estimates by less than 1%. The two-step deflator gave $7,214, $15,040, and $27,891. Incremental spending was $19,682 (12,906–26,458) in 2014–2015 and $22,700 (10,690–34,709) in 2016–2017, so there was no step at the change to ICD-10-CM (Online Resource 1, Table S10).

For adults with a rheumatoid arthritis record, incremental spending was $7,198 (4,968–9,428) in 1999–2006, $7,206 (5,942–8,470) in 2007–2015, and $10,929 (9,288–12,570) in 2016–2023, a ratio of 1.5 (1.0–2.2). The increase for CD was larger: the ratio of the CD ratio to the rheumatoid arthritis ratio was 2.6 (1.3–5.4).

Ordinary least squares gave estimates within 1% of the main estimates (Online Resource 1, Table S3). A single model with a CD indicator over-predicted the spending of adults with treated CD by 14% to 23% (Online Resource 1, Table S3).

Discussion

In this nationally representative study, the additional annual health care spending associated with treated CD among US adults rose about fourfold, from about $7,000 in 1999–2006 to about $27,900 in 2016–2023. Prescription medicines accounted for nearly 80% of the increase, and by 2016–2023 advanced therapies made up more than four-fifths of the prescription spending of adults with CD. Incremental inpatient spending and hospital discharges did not change significantly over the same period. Private insurers paid most of the increase, whereas the incremental out-of-pocket spending of adults with CD remained at about $900 to $1,450 per year.

Our findings extend consistent evidence that the cost of IBD care has moved from the hospital to the pharmacy since biologics were introduced. In US commercial claims from 2003–2004, the disease-attributable cost of CD was $8,265 per patient-year; pharmaceuticals made up 35% of this cost and hospitalization 31% [23]. In MEPS data for 1998–2015, median annual IBD spending nearly doubled, pharmacy became the largest cost category (44%), and inpatient spending fell by 40% [7]. In the Disease Expenditure Project, per-patient IBD spending rose from $5,714 in 1996 to $14,033 in 2016 [5].

The same pattern appears outside the US. A population-based Manitoba study used a case-minus-control design similar to ours. It found that IBD-attributable cost per person more than doubled between 2005 and

2015, from CAD $3,354 to CAD $7,801, and that anti–tumor necrosis factor costs, which rose from CAD $181 to CAD $5,270, accounted for most of the rise [24]. A systematic review attributes rising IBD costs mainly to biologics [8], and a Lancet Gastroenterology & Hepatology Commission identifies expensive long-term therapy as a major driver in high-income countries [25]. Our study adds three things: the years after 2015, a single all-payer incremental method applied across 25 years, and a breakdown of the increase by payer and drug class.

Our estimates for the early biologic era agree with earlier MEPS studies. Incremental spending in 1999–2006 ($6,973) is close to the adjusted increment of $6,442 reported for 2003–2013 [11]. Mean spending of adults with CD in 1999–2006 ($13,045) lies within the range of $10,364 to $13,446 reported in earlier MEPS analyses, although the dollar years differ [10, 12]. Our estimates are lower than claims-based estimates from the same period [23]. This is expected for two reasons: MEPS includes few persons with very high spending [26, 27], and claims-based case finding favors patients with more active disease [8].

Park and colleagues reported annual costs of $22,987 for adults with IBD and $6,956 for matched controls in 2007–2016 [3]. These values resemble ours for 2007–2015 ($21,020 and $6,260), but the populations differ. Their study combined CD and UC, required 24 months of continuous commercial or Medicare Advantage enrollment, and used claims-based costs. Because spending is usually higher in CD than in UC, the similarity should not be read as close agreement.

National spending estimates

Published national totals for IBD differ about threefold because they count different spending. An encounter-based estimate attributed $8.5 billion to IBD in 2018, 71% of it for medicines [4]. The most recent update drew on MEPS 2021, attributed spending by condition category, covered all ages, and estimated $13.9 billion for CD and UC combined, 61% of it for prescription medicines [6]. The Disease Expenditure Project, which allocates all personal health care spending to conditions, estimated $25.4 billion in 2016; in 2011–2016, inpatient and emergency care made up 55.8% of that spending and pharmaceuticals 19.9% [5]. Our estimate of $16.2 billion per year in 2016–2023 is for treated CD only. It counts all extra spending of adults with CD, whether or not the care was coded to CD.

The low drug share in the Disease Expenditure Project partly reflects its earlier years. In our data, prescription medicines made up 23% of incremental spending in 1999–2006, 44% in 2007–2015, and 65% in 2016–2023. For the early period, our national estimate of $2.1 billion for 1999–2006 is similar in magnitude to the estimate of $2.29 billion per year in 2010 dollars (about $2.9 billion in 2023 dollars, PCE health price index) reported by Gunnarsson and colleagues [9].

Drug spending, prices, and payers

The rise in drug spending reflects a change in how adults with CD were treated. Between 1999–2006 and 2016–2023, the share who filled an advanced therapy rose to 30%, 5-aminosalicylate use fell from 65% to 24%, and spending on all other drugs did not increase significantly ($2,844 vs $3,655 per person). This pattern fits a shift from many low-cost fills to fewer high-cost ones.

National data show the same trend in uptake. In IQVIA ambulatory electronic health records, the share of patients with CD prescribed a biologic rose from 13.3% in 2011 to 32.1% in 2020 [28]. In US commercial claims, biologic use in CD rose from 21.8% in 2007 to 43.8% in 2015 while immunomodulator and 5-aminosalicylate use declined [29]. Both sources may include infused agents, which MEPS records as visit spending rather than prescribed medicines, so our estimate of about 30% for pharmacy-dispensed agents is at the upper end of what these sources would predict. In 2016–2019, before most drug names were masked, 23.7% of adults with treated CD filled a named advanced therapy, a lower bound that does not depend on the masked-name rule.

Our data cannot separate higher prices per agent from greater use of these agents. They also understate total advanced-therapy spending. Infliximab, vedolizumab, and intravenous ustekinumab induction are given in clinics and recorded as office-based or outpatient spending, and both of these categories also rose.

MEPS records payments at the point of service, so prescription payments do not reflect manufacturer rebates. These rebates are large for biologics that face competition. For tumor necrosis factor inhibitors, discounts offset 56% of the 166% rise in list prices between 2007 and 2018, so net prices rose 73% [30]. These net prices reflect manufacturer revenue and do not capture fees retained by pharmacy benefit managers and pharmacies, so net costs to payers may be somewhat higher. For infliximab, non-Medicaid discounts grew by 50.6 percentage points from 2007 to 2019, and net prices began falling before biosimilars entered the market [31]. The net cost to insurers, and probably the net increase over time, is therefore smaller than the payments we report.

With these caveats, incremental out-of-pocket spending stayed at about $900 to $1,450 per year despite a fourfold rise in total incremental spending. At the population level, the increase was paid by insurers, mainly private insurers, not by patients. This average may hide high costs for some patients. MEPS cannot separate manufacturer copay assistance from patient payments. Medicare beneficiaries cannot use manufacturer copay assistance. In 2022, their annual out-of-pocket costs for self-administered biologics and small molecules ranged from $5,438 to $10,158, before the 2025 Part D cap of $2,000 [32].

Hospital use

We found no significant decline in incremental inpatient spending or hospital discharges between 1999–2006 and 2016–2023. This agrees with US national data: age-adjusted rates of hospitalization with CD as the first-listed diagnosis did not change between 2003 and 2013 [33], and the rate of CD-related discharges per 10,000 hospital encounters rose from 16.2 to 20.0 between 2005 and 2016 [34]. A systematic review likewise found stable rates of hospitalization with a primary diagnosis of CD in North America, Western Europe, and Oceania (average annual percent change, 0.20%; 95% CI, − 1.78 to 2.17) [35]. Those rates were mostly per general population; because CD prevalence is rising, a stable population rate implies a falling rate per patient. In contrast, among 45,235 prevalent patients in Ontario, CD-related hospitalizations fell 32.4% (from 154 to 104 per 1,000 patients) and inpatient surgeries fell 39.6% between 2003 and 2014 [36], all-cause hospitalizations among prevalent patients with IBD in Alberta fell from 37 to 17 per 100 patients between fiscal years 2002–2003 and 2018–2019 (the same measure as our discharge rate) [37], and in Manitoba, Targownik and colleagues found that CD-attributable inpatient costs fell by about CAD $99 per person per year between 2005 and 2015, with no change for UC [24]. A recent US cohort of newly diagnosed, commercially insured adults found a lower risk of all-cause hospitalization among those diagnosed in 2019–2023 than in 2007–2012

(adjusted hazard ratio, 0.76; 95% CI, 0.62–0.94), although IBD-related hospitalization did not decline significantly (0.80; 0.62–1.03) [38].

Several factors may explain the difference. Part of any decline may have occurred before our reference era: Click and colleagues measured falling inpatient IBD spending from 1998–2001 onward [7], and our 1996–1999 estimate was higher than those for 2000–2007. Our sample of prevalent adults with treated CD also differs from inception cohorts and single-payer populations. Finally, discharges fell slightly in the comparison group as well. Our data therefore do not show that advanced therapies reduced hospital use among US adults with CD, but they cannot exclude a modest effect.

Interpretation of the estimates

The main estimate was at the upper end of the sensitivity analyses in 2016–2023. The comorbidity-adjusted estimate probably understates incremental spending, because some of these conditions may be extraintestinal manifestations of CD. Every case had at least one CD-linked event, so part of the increment could reflect the requirement of care. However, restricting the comparison group to adults with any spending or with an office-based visit changed the estimates by only 3% to 17%, and the fourfold increase remained.

Incremental spending for rheumatoid arthritis, another chronic inflammatory disease treated with biologics, rose about 1.5-fold over the same period, and the increase for CD was larger (ratio of ratios, 2.6; 95% CI, 1.3–5.4). Click and colleagues found no difference between IBD and rheumatoid arthritis in the rate of change of cost drivers through 2015 [7]. In our data, incremental spending for rheumatoid arthritis was flat between 1999–2006 and 2007–2015, whereas incremental spending for CD doubled, although this earlier difference was imprecise (ratio of ratios, 2.0; 0.97–4.1).

Our case definition identified about 0.2% of adults as having treated CD. In pooled US claims, the standardized prevalence of CD was 305 per 100,000 population [1]. That figure includes persons who had no CD-related care in a given year, so our national totals describe adults whose CD required care during the year, not all persons with CD.

A single model with a CD indicator, as used in some MEPS cost studies [20], over-predicted the spending of adults with CD by 14% to 23%. When a disease adds a large, roughly fixed cost such as a biologic, the predictions of such a model should be checked against observed spending.

Limitations

This study has several limitations. First, incremental spending represents an adjusted association rather than a causal effect of CD. Unmeasured differences between adults with and without CD may have contributed to the estimates. CD was identified from household-reported conditions coded by MEPS at the 3-digit level. Information on disease severity, phenotype, and duration was not available. Because cases required at least one CD-linked health care event, our estimates reflect adults who received care for CD during the year rather than everyone living with the disease.

Second, MEPS does not fully capture spending on advanced therapies. Infused agents, including infliximab, vedolizumab, and intravenous ustekinumab induction, are included in office-based or outpatient payments and cannot be identified by drug name. As a result, the prescription spending attributed to advanced therapies is

underestimated. Since 2020, most self-administered advanced therapies have been reported only by therapeutic class in the public files. We identified these drugs using their class, payment, and link to CD, with similar results across alternative definitions. Prescription payments also exclude manufacturer rebates, meaning reported spending overestimates insurers' net costs. MEPS cannot distinguish manufacturer copay assistance from patients' out-of-pocket payments.

Third, MEPS captured 17.6% less personal health care spending than the adjusted National Health Expenditure Accounts in 2007 [26], partly because high-cost persons and services are underrepresented [27]. Because biologic users often have high health care costs, this may lead to underestimation of incremental spending. In a validation study of Medicare beneficiaries, households reported inpatient stays accurately but underreported emergency department visits by about one-third and office visits by 19% [39]. Infusions are recorded as office or outpatient events, so missed events would make our incremental office and outpatient spending conservative. MEPS also imputes many event payments: in 2017, expenditures were imputed for 52% to 63% of office-based visits and 32% to 37% of emergency department, inpatient, and outpatient events [14]. Complex, costly office visits are prioritized for provider follow-back, so infusion visits are less likely to be imputed than routine visits.

Fourth, sample sizes were limited. The 1996–1998 era included only 42 unique adults and could not be reported. Several spending component estimates also had wide confidence intervals. Therefore, the lack of a statistically significant change in inpatient spending or hospital discharges does not rule out a modest decline.

Fifth, AHRQ did not release UC codes for 2017 or 2021–2023, so some adults with UC may have been included in the comparison group during these years. In years when the code was available, treated UC accounted for 0.06%–0.24% of adults. Any resulting bias is likely small and would tend to reduce the estimated incremental spending.

Finally, the therapeutic eras also span changes in health care prices, the 2016 transition to ICD-10-CM, and the COVID-19 pandemic. Sensitivity analyses addressing these factors did not materially change the results. The link test suggested some misspecification of the log link, although ordinary least squares estimates were within 1% of the main results. MEPS also excludes people living in institutions.

Conclusions

Between 1999–2006 and 2016–2023, the additional annual health care spending associated with treated CD among US adults rose about fourfold, to about $27,900 per person and $16.2 billion nationally. The increase came mainly from prescription drugs (79% of the increase) and reflected a shift to advanced therapies, paid mainly by private insurers. Hospital spending did not change detectably, and average incremental out-of-pocket spending stayed level. Continued monitoring of net drug costs and of patients' out-of-pocket spending will be needed as biosimilars and new advanced therapies are adopted.

Declarations

Competing Interests:

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval:

This study used de-identified, publicly available data from the Medical Expenditure Panel Survey and involved no interaction with participants and no access to identifiable private information. It therefore did not meet the definition of human subjects research under 45 CFR 46, and institutional review board review was not required.

Consent to participate:

Not applicable (de-identified public-use survey data).

Consent for publication:

Not applicable.

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Author Contribution

S.N. designed the study, obtained and processed the MEPS data, performed the statistical analysis, prepared Figures 1–2 and Tables 1–4, and wrote the main manuscript text. K.N. contributed to data management, verified the analysis and results, and prepared the supplementary material. P.B. and G.E. contributed to the literature review and interpretation of the results and critically revised the manuscript. C.R. supervised the study, contributed to study design and interpretation of the results, and critically revised the manuscript. All authors reviewed and approved the final manuscript.

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None.

Data Availability

The data analyzed in this study are publicly available from the Agency for Healthcare Research and Quality Medical Expenditure Panel Survey (https://meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp). The specific public-use files used for each survey year (Full-Year Consolidated, Medical Conditions, event, condition-event link, HC-036 and HC-036BRR files) are listed in Online Resource 1, Table S1. The analysis code

and the R code used to generate the figures are available from the corresponding author on reasonable request.

Code availability:

The analysis code and the R code for all figures are available from the corresponding author on reasonable request.

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Figures

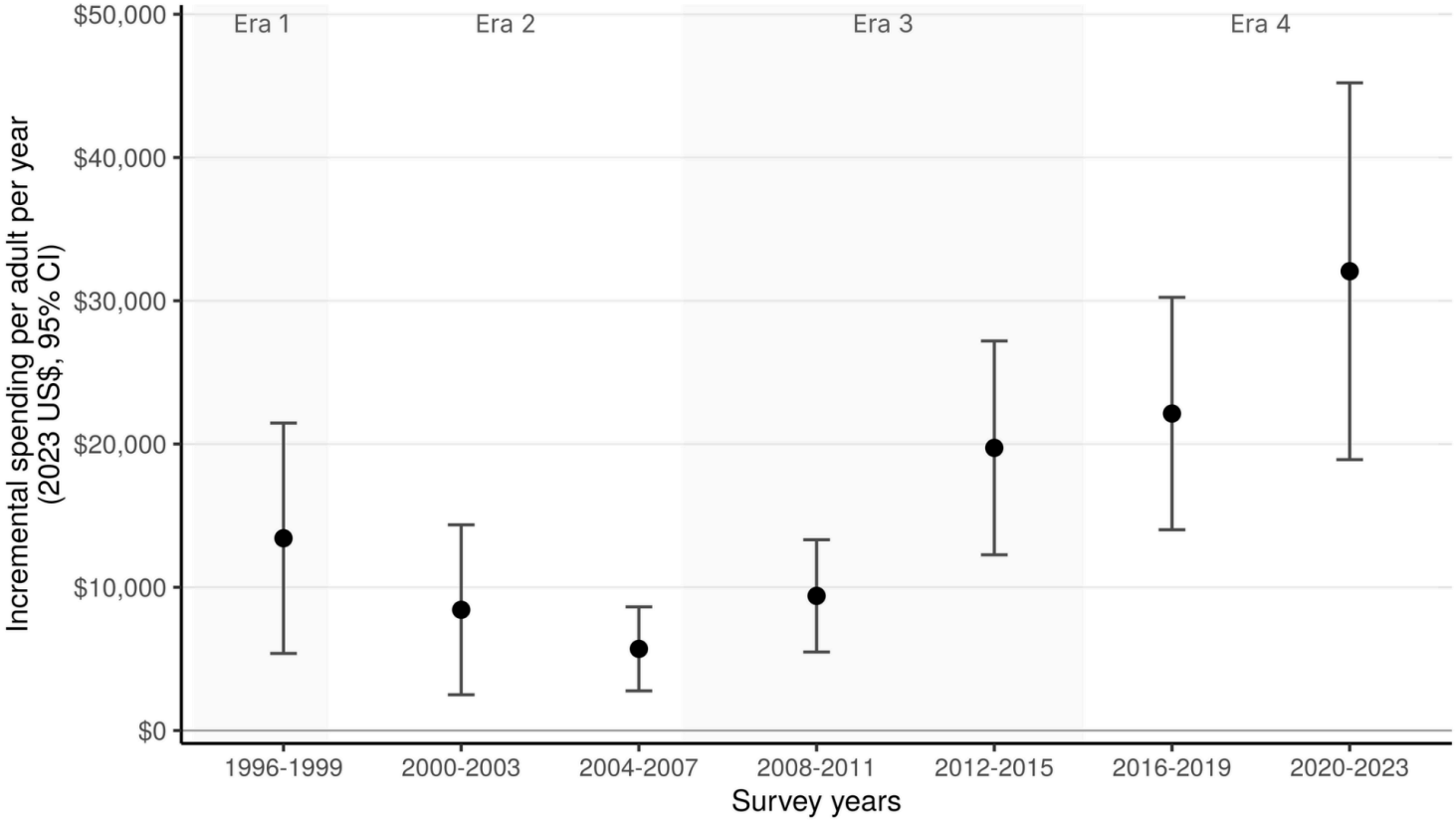

Figure 1

Incremental health care spending associated with treated Crohn disease per adult per year, in consecutive 4-year windows, 1996–2023. Points show estimates from the two-part model fitted separately in each window; bars show 95% CIs from 128 replicate weights. Shading marks the therapeutic eras. Every window included at least 60 unique persons with treated Crohn disease. Values are in 2023 US dollars (PCE health price index)

National incremental spending was $2.1 billion (0.9–3.2) per year in 1999–2006, $7.2 billion (4.7–9.6) in 2007–2015, and $16.2 billion (10.5–21.8) in 2016–2023.

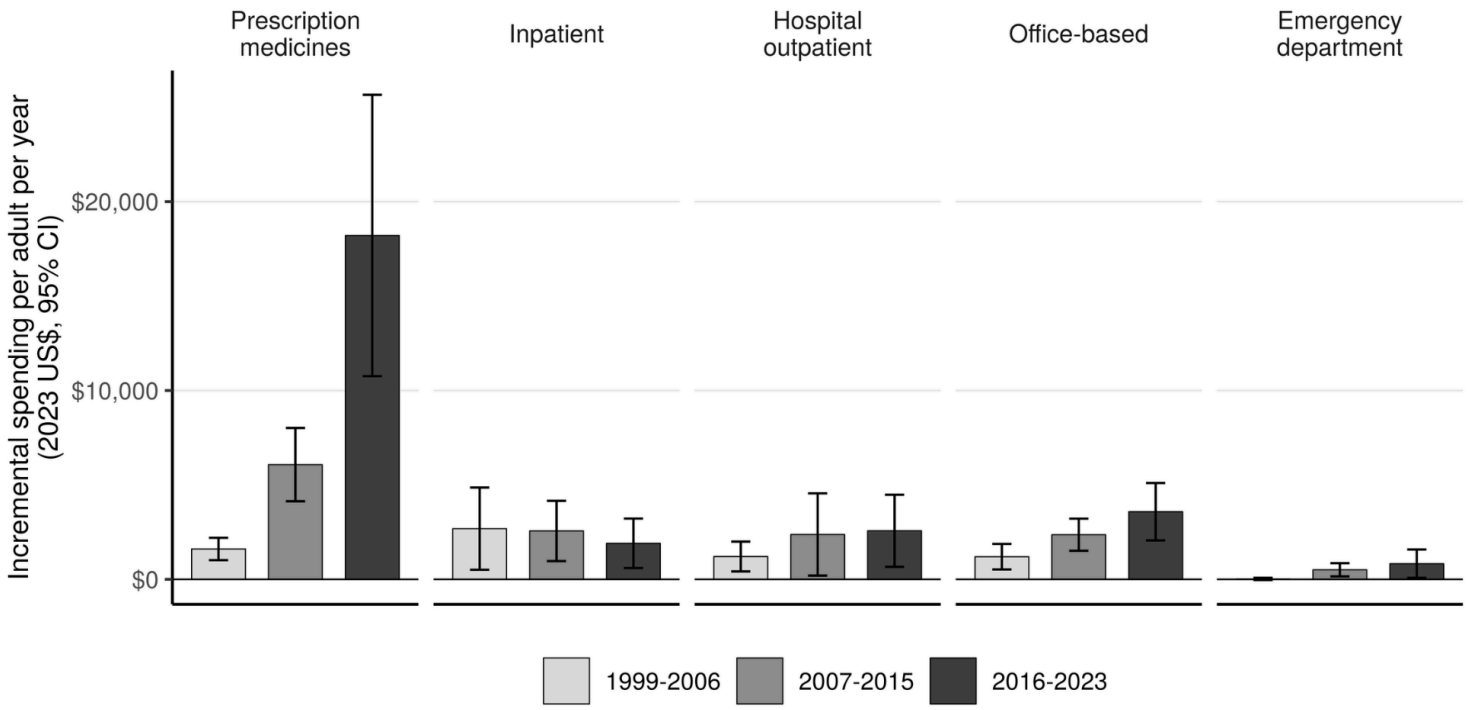

Figure 2

Incremental spending associated with treated Crohn disease by type of care and therapeutic era. Bars show estimates and error bars show 95% CIs (2023 US dollars per adult per year). Dental, home health, and other care are shown in Table 3

Incremental inpatient spending was $2,685 (507–4,864) in 1999–2006 and $1,910 (601–3,219) in 2016–2023. This difference was not statistically significant (–$775; –3,285 to 1,735).

Supplementary Files

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