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Prevalence and Impact of Social Risk in Patients with Inflammatory Bowel Diseases: National Estimates from the United States

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Abstract

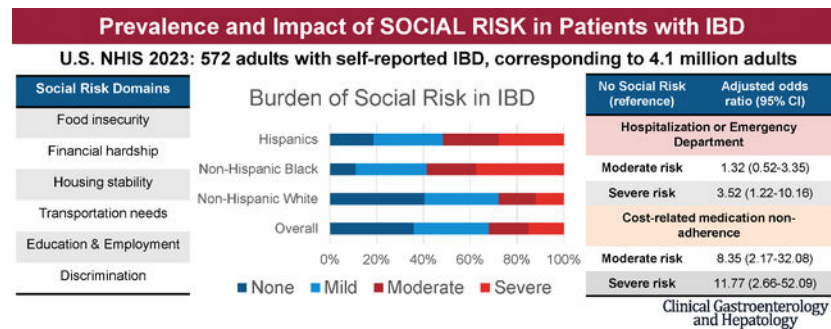
Background and Aims: Social risks are individual-level factors associated with adverse health outcomes. We determined the prevalence and impact of social risks on healthcare use among patients with inflammatory bowel diseases (IBD) in the United States (US).

Methods: In the US National Health Interview Survey 2023, we estimated social risks across six domains (food insecurity, financial hardship, housing instability, transportation needs, education and employment, discrimination) in adults with IBD. We evaluated the association between burden of social risk (0/6 domains [none], 1/6 domains [mild], 2/6 domains [moderate] and $\geq 3/6$ domains [severe]) and unplanned healthcare utilization (emergency department and/or hospitalization) and medication non-adherence, accounting for differences in age, sex, race/ethnicity, insurance, income and comorbidities.

Results: Of 572 people included in the survey (mean age, 56y; 57% female; 81% non-Hispanic Whites [NHWs], 12.9% Hispanic), 64% (95% CI, 59–69%) experienced social risk across one or more domains (food insecurity, 22%; financial hardship, 28%; housing instability, 14%; transportation needs, 9%; education and employment, 9%; discrimination, 41%). Prevalence of severe social risk was higher in racial and ethnic minority groups (non-Hispanic Blacks vs. Hispanics vs. NHWs: 37% vs. 28% vs. 12%). Higher burden of social risk was associated with higher risk of unplanned healthcare utilization (severe vs. none: OR, 3.5 [1.2–10.2] and cost-related medication non-adherence (OR, 11.8 [2.7–52.1]), after accounting for income and insurance status.

Conclusions: Social risks are prevalent in adults with IBD and negatively impact healthcare utilization and medication non-adherence. Efforts to routinely identify and address social risks in patients with IBD should be part of standard clinical care.

Graphical Abstract



Keywords

Social determinants of health; health disparities; Crohn's disease; ulcerative colitis; financial toxicity

INTRODUCTION

The incidence and prevalence of inflammatory bowel diseases (IBD) is rising globally and in the United States, including in racial and ethnic minority groups.¹ Patients from racial and ethnic minority populations have different phenotypes, and disease journeys compared to non-Hispanic White (NHWs) patients.² They frequently experience higher rates of unplanned healthcare utilization and disease complications and are less likely to be treated with advanced immunosuppressive therapies.³ While there may be biological drivers of differences in disease course, social determinants of health (SDoH) also have a significant impact on outcomes.^{4, 5} SDoH encompass the entirety of social, economic and physical circumstances in which individuals are born and live and are influenced by geopolitical landscape and public policies. Social risks are downstream factors, defined by the United States Preventive Services Task Force as “measurable and intervenable individual-level social and economic conditions that are shaped by broader social, economic, and structural determinants of health”.⁶

While several studies have used neighborhood-level measures of social deprivation, socioeconomic status, and income to examine health disparities in IBD, there have been limited studies directly examining social risk factors in patients with IBD. In a single-center study of 316 patients with IBD, Damas and colleagues observed that 25–40% patients may experience social barriers, and this is associated with higher prevalence of depressive symptoms and lower medication use.⁷ Using the National Health Interview Survey (NHIS) 2015, we estimated that one in four patients with IBD report financial hardship due to medical bills, one in six report cost-related medication non-adherence, one in seven report food insecurity and over 50% report inadequate social support.⁸ However, updated studies of the prevalence and consequences of social risk among patients with IBD remain a pressing research gap.

Hence, we utilized the NHIS 2023, to estimate prevalence of social risk across racial and ethnic minority groups and examine how the burden of social risk impacts risk of unplanned healthcare utilization (emergency department and/or hospitalization) and

medication adherence. We hypothesized that the prevalence of social risk will be high, particularly in racial and ethnic minority groups, and adversities across multiple social risk domains will be associated with adverse healthcare use in patients with IBD.

METHODS

Data source

We utilized the NHIS 2023, an annual cross-sectional nationally representative household survey of the U.S. civilian noninstitutionalized population administered by the National Center for Health Statistics (NCHS) in collaboration with the Centers for Disease Control and Prevention (CDC).⁹ The NHIS captures self-reported demographic, health, household, and socioeconomic data from a representative sample of U.S. residents. For 2023, the survey included 29,522 adults and 7,692 children from 30,670 households across all 50 states and the District of Columbia, of whom 66% were NHW individuals; by incorporating complex, multistage sampling, it can provide estimates on noninstitutionalized, U.S. population. As the data used in this study were publicly available and de-identified, our research was exempt from Institutional Review Board review.

Patient population

We identified adult individuals (aged 18 and above) with IBD in the NHIS 2023 Sample Adult Interview dataset, if they responded affirmatively to either of the questions: “Have you ever been told by a doctor or other healthcare professional that you had Ulcerative Colitis?” or “Have you ever been told by a doctor or other healthcare professional that you had Crohn’s Disease?” To augment self-reported diagnosis, we conducted sensitivity analyses limiting to a subset of patients who besides self-reporting a diagnosis of ulcerative colitis (UC) or Crohn’s disease (CD), also answered ‘yes’ to “Have you ever had a colonoscopy or sigmoidoscopy?” (88% of those who self-reported a diagnosis of IBD).

Social risk factor assessment

We examined social risk across six domains: food insecurity, financial hardship, housing instability, transportation needs, employment, and discrimination. Since there is no standard, validated and universally accepted questionnaire for assessing social risk, we classified social risk across each domain based on functional definitions from questionnaires in NHIS, as detailed in Table 1.^{6, 10, 11} For example, adults were classified as being food insecure based on the U.S. Department of Agriculture Economic Research Service’s 10-item questionnaire, which focuses on being worried about food running out, inability to afford a balanced meal, cutting portions or skipping meals due to costs, etc. or based on whether they used food stamps in the last 12 months.¹² Financial hardship was ascertained based on difficulty paying medical bills or foregoing medical care due to costs. Housing instability was based on whether individuals reported difficulty paying for housing or if they lived in government-subsidized low-income housing.⁸ We were unable to cover social risk factor domains related to social support, household utilities and interpersonal violence due to lack of relevant questions.

In the absence of clear guidance on quantifying social risk beyond the need to measure it across multiple domains, we defined individual social risk burden was defined based on the number of domains (out of six) for which the respondent was classified as adverse similar to prior studies: 0/6 domains, no risk; 1/6 domains, mild risk; 2/6 domains, moderate risk; and $\geq 3/6$ domains, severe risk.¹³

Outcomes

Our primary outcome was the proportion of adults experiencing unplanned healthcare utilization defined as emergency department (ED) use and/or hospitalization in the preceding 12 months. Our secondary outcome was prevalence of cost-related medication non-adherence. Cost-related medication non-adherence was defined based on affirmative to any of the following four survey questions: (1) “Did you need but could not afford prescription medicines over the past 12 months?”, (2) “Did you take less medication to save money over the past 12 months?”, (3) “Did you skip medication doses to save money over the past 12 months?”, (4) “Did you delay refilling medications to save money over the past 12 months?”⁸

Covariates

We collected data on the following covariates: age, sex, race/ethnicity, body mass index (BMI), tobacco use, marital status, education, employment history in the past 12 months, family size, family income (calculated based on ratio of family income to federal poverty limit from the Census Bureau: high-income [≥ 4.00], middle-income [2.00–3.99], low-income [1.00–1.99]) and below poverty line [< 1.00]), insurance status (private insurance or Medicare vs. Medicaid/Children’s Health Insurance Program/uninsured), and self-reported medical comorbidities (e.g., diabetes, hypertension, coronary artery disease, stroke, heart attack, chronic obstructive pulmonary disease [COPD], arthritis, and positive screens for depression and/or anxiety).

Statistical Analysis

We examined the prevalence and burden of social risk across multiple domains, overall and by racial and ethnic minority groups. We used the chi-square test to compare categorical variables across racial and ethnic minority groups and Kruskal-Wallis test to compare continuous variables. We calculated the weighted mean of each variable and the corresponding 95% confidence interval (CI). We accounted for the complex survey design of the NHIS by using survey-specific descriptive statistics to provide weighted national estimates. Subsequently, we examined the association between burden of social risk and outcomes in survey-weighted logistic regression models, both unadjusted and adjusted for covariates including age, sex, BMI, smoking status, major comorbidities including diabetes, hypertension, hyperlipidemia, coronary artery disease, COPD/emphysema/bronchitis, arthritis, and positive screening for depression and/or anxiety. To examine whether race/ethnicity, income and insurance type modify this association between social risk factors and outcomes, we conducted two additional analyses: (1) additionally adjusted for race/ethnicity (Hispanics vs. non-Hispanic Blacks vs. NHWs), and (2) additionally adjusted for family income and insurance status. We also examined univariate association between race/ethnicity, family income and insurance status with outcomes. Of note, since NHIS is a cross-

sectional survey, we were unable to ascertain a causal association between the exposure and outcome. As noted earlier, sensitivity analyses were performed by restricting the sample to patients with IBD with a history of colonoscopy or sigmoidoscopy. All statistical analyses were implemented in R version 4.2.2. (R Project for Statistical Computing), with statistical significance set at the 5% level.

RESULTS

Study Population

We identified 572 adults who self-reported a diagnosis of UC or CD in NHIS 2023. Using survey weights, this corresponded to approximately 4.1 million (95% CI, 3.6–4.5 million) adults living with IBD in the United States, of whom 2.9 million report UC, and 1.2 million report CD (Table 2). Using an alternative definition of IBD based on self-reported UC or CD and receipt of colonoscopy or sigmoidoscopy, the estimated prevalence of IBD is 2.75 million.

Mean age of patients with IBD was 56 years (95% CI, 54–58y), of whom 57% were female and 24% reported use of immunosuppressive therapies. Approximately 81% identified as NHW (estimated 3.3 million [95% CI, 2.9–3.6 million]), 12.9% as Hispanic (estimated 0.53 million [95% CI, 0.34–0.71 million]), and 6.6% as non-Hispanic Blacks (estimated 0.27 million [95% CI, 0.17–0.37 million]). Hispanic and Non-Hispanic Black individuals reported the highest prevalence of obesity (46% and 44%, respectively), and non-Hispanic Blacks individuals reported the highest prevalence of hypertension (68%) and diabetes (46%). Approximately 35% (95% CI, 30–40%) adults with IBD reported emergency department visit, and 17% (95% CI, 13–21%) reported hospitalization within the preceding 12 months; 14% (95% CI, 11–18%) experienced cost-related medication non-adherence.

Burden of Social Risk Factors

The burden of social risk in patients with IBD was substantial (Table 3). Overall, 22% (95% CI, 18–27%) reported food insecurity, including 15% who reported using food stamps in the last 12 months; 28% (95% CI, 23–32%) reported financial hardship, including 10% who delayed medical care due to costs and 9% who did not get medical care due to costs. Approximately 14% (95% CI, 10–17%) patients reported housing instability, and 9% (95% CI, 6–12%) reported delaying care due to transportation barrier. Overall, 8.7% reported having less than high school education and were either unemployed or, if employed, were in a job which did not provide paid sick leave. Approximately 41% (95% CI, 36–46%) reported discrimination with frequent encounters where they were treated with less respect (30%), received poor service (11%), were treated as not smart (21%) or felt threatened or harassed (9%). Overall, 15% (95% CI, 11–19%) adults experienced severe burden of social risk (across 3 or more domains), 17% (95% CI, 13–21%) experienced moderate burden, 32% (95% CI, 27–37%) experienced mild burden and 36% (95% CI, 31–41%) experienced no burden of social risk (Table 3). Findings were similar on sensitivity analysis focusing only patients with self-reported diagnosis of UC or CD and previous receipt of colonoscopy and/or sigmoidoscopy (eTable 1).

There were significant racial and ethnic disparities in the burden of social risk (Figure 1, Table 3). Overall, non-Hispanic Black adults with IBD and Hispanic adults with IBD had the highest burden of social risk, with 58% and 52% reporting moderate to severe burden of social risk, respectively, compared with 28% of NHW adults. While there were significant differences in prevalence of social risk across the domains of food insecurity, financial hardship, housing instability and education and employment, no differences were observed in the prevalence of transportation needs and discrimination. Among racial and ethnic minority groups, Non-Hispanic Black adults experienced higher burden of food insecurity, housing instability and discrimination, whereas Hispanic adults faced higher burden of financial hardship and adversities in education and employment.

Impact of Social Risk on Health Outcomes

Social risk burden was significantly associated with unplanned healthcare utilization including hospitalizations and ED visits. Compared to patients with IBD with no social risk factors, patients with severe burden of social risk had significantly higher risk of hospitalization and/or ED visits, after adjusting for key confounding variables (Table 4). This trend remained significant after additional adjusting for race and ethnicity, and additionally adjusting for family income and health insurance status. Similar findings were observed for the risk of cost-related medication non-adherence (Table 4). Race and ethnicity were not independently associated with risk of hospitalization and/or ED visits, nor with cost-related medication non-adherence.

DISCUSSION

Social risk factors are important drivers of health and disease but have been understudied. In this national survey-based study, we made several key observations on the burden and impact of social risk on healthcare use in patients with IBD. First, we observed that approximately one in four patients with IBD experience food insecurity, financial hardship, one in six experience housing instability, and one in ten experience transportation difficulty and low education and underemployment. Approximately one-third of adults with IBD experience adversities in at least 2 or more domains. Second, there are significant differences in the burden of social risk by race and ethnicity, with over half of non-Hispanic Black and Hispanic adults with IBD experiencing moderate-severe burden of social risk, compared with approximately one in four NHW adults. Third, a higher burden of social risk is associated with higher risk of unplanned healthcare utilization and medication non-adherence due to costs. This remains true even after accounting for family income and insurance status. Overall, this study highlights that social risk is a common but an infrequently measured driver of adverse outcomes in patients with IBD and is a key determinant of health disparities observed in IBD. This burden of social risk is similar to slightly higher in patients with IBD compared with the general population.¹⁴ Direct measurement of patient-level social risk factors offers a greater insight into the burden of adversities, beyond what income and insurance status can tell us. This can also help us identify specific health-related social needs that patients may have where health system interventions may be warranted. Several multi-level strategies targeted to the medical trainee, provider, health system and/or practice, community, industry, and policy levels

have been proposed to achieve health equity in IBD and in the general population.^{5, 6} These include improved processes (e.g., intervention or program activities such as delivery of social services or patient use of referrals), reduced social risks (e.g., better access to transportation), reduced health care costs, and improvements for clinicians (e.g., a better understanding of a person's social risk and greater confidence in addressing social risks). However, there has been limited evidence to link these improvements with improved health outcomes for patients, such as improved quality or length of life. Hence, systematic evaluation of these interventions through pragmatic trials and quasi-experimental studies are warranted.

Prior studies have addressed the concepts of SDoH in IBD using surrogates such as race/ethnicity, insurance status, income and education level.^{15–18} These studies have demonstrated lower utilization of advanced medical and surgical therapies, inferior healthcare access, lower adherence to therapy and inferior IBD-related outcomes in low-income patients, those without insurance, and Hispanic and Non-Hispanic Black patients.^{2, 3, 19} However, they have not been able to examine the complex interplay of social and economic factors that influence health outcomes. By specifically examining individual-level social risk across multiple domains, we were able to confirm that social disadvantage affects individuals of all races and ethnicities, albeit disproportionately and has an impact on health outcomes independent of income and insurance status. Our study builds on recent findings from other single center studies on social barriers. In Miami, surveying their clinic population, Damas and colleagues observed that non-Hispanic Black and Hispanic individuals have a higher prevalence of social barriers including financial strain, food insecurity, and low educational attainment, and this was significantly associated with lower compliance with medications, higher prevalence of depressive symptoms and UC disease activity.⁷ Similarly, in an online survey of patients with IBD at a single health system, Shah *et al* observed that compared with NHW adults, non-Hispanic Black and Hispanic adults with IBD experienced significantly higher prevalence of social barriers including difficulty accessing IBD specialists, financial instability, low social/emotional support, and concurrently greater ED visits and concerns related to IBD medications.²⁰ In our study, we scaled this evaluation to a nationally representative cohort, and systematically examined multiple domains of social risk and how the burden of social risk is associated with outcomes in patients with IBD. In a previous study using NHIS 2015, our group has demonstrated the co-existence of financial toxicity across multiple domains, and potential tradeoffs associated with financial hardship due to medical bills.⁸ Over 30% patients with financial hardship who were able to pay medical bills, and over 50% patients who were unable to pay medical bills reported medication nonadherence and maladaptive coping strategy. Seven in ten patients reported inability to afford healthcare, having difficulty establishing care with a specialist or being able to afford follow-up care.

While our findings provide key insights into the national estimates of prevalence and impact of social risk factors across multiple domains in adults with IBD, there are important limitations. First, identification of patients with IBD are based on self-reported diagnoses without validation. We attempted to improve the validity by conducting a sensitivity analysis focusing on patients with self-reported diagnosis of IBD and had undergone colonoscopy or flexible sigmoidoscopy, although the reason for the procedure was not known (screening

or diagnostic) and observed similar results. However, we recognize that we may have overestimated the number of patients with IBD. Second, the NHIS does not collect information on IBD disease activity nor IBD-related medications, so we are unable to assess the effect of these factors on specific IBD-related outcomes and vice versa. Third, since the NHIS is a cross-sectional survey, we are unable to establish causality between social risk factors and outcomes such as unplanned healthcare utilization. It is also unclear whether certain variables we included as ‘confounders’ such as family income and insurance status are truly confounders or whether they might fall in the causal pathway between social risk and outcomes. Fourth, we were unable to measure social risk across all plausible domains. In particular, the NHIS 2023 did not capture certain domains of social risk such as social support and neighborhood, interpersonal violence and access to utilities for daily living such as gas, electricity, etc. Finally, there may be an over-representation of older patients with IBD in our study limiting the generalizability of our findings on the prevalence and impact of SDoH in younger patients with IBD.

In conclusion, we observed a high prevalence of social risk in adults with IBD, with certain racial and ethnic minority groups such as non-Hispanic Black and Hispanic adults experiencing a disproportionately higher burden of adversities across multiple domains. This was negatively associated with adverse outcomes including hospitalization and medication non-adherence, independent of family income and insurance status, and across all racial and ethnic minority groups. Population health management strategies should incorporate universal screening for patient-level social risk factors and empower healthcare teams to address social needs to improve the overall quality of healthcare delivery.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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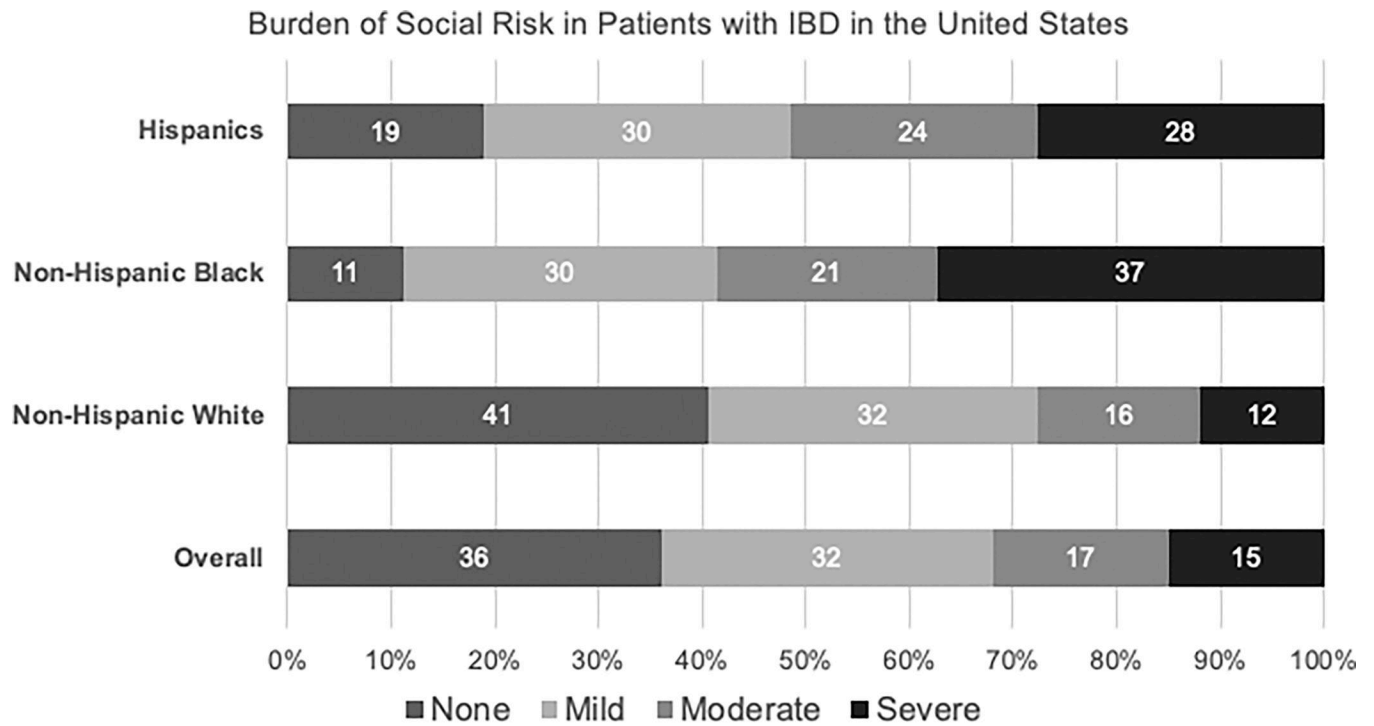


Figure 1.
Prevalence of overall burden of social risk across race and ethnicity in adults with IBD

Table 1. Definitions of social risk across six domains of food insecurity, financial hardship, housing instability, transportation needs, employment, and discrimination

Domains of Adverse Social Risk	Classification as Adverse Social Risk	
	YES	NO
Food Insecurity	• Low or very low food security based on U.S. Department of Agriculture Economic Research Service's 10-item questionnaire, which focuses on being worried about food running out, inability to afford a balanced meal, cutting portions or skipping meals due to costs, etc. OR • Received food stamps in last 12 months	• Food secure based on U.S. Department of Agriculture Economic Research Service's questionnaire AND • Did not receive food stamps in last 12 months
Financial Hardship	In the past 12 months, • Problems paying medical bills OR • Unable to pay medical bills OR • Delayed medical care due to costs OR • Did not get medical care due to costs OR • "very worried" about paying medical bills	Did not report problems paying medical bills, delaying or declining medical care due to costs and "not worried" or "somewhat worried" about paying medical bills
Housing Stability	In the past 12 months, • Had trouble paying for housing OR • Paying lower rent for housing because the Federal, State, or local government is paying part of the cost	No trouble paying for housing and either own or rent house
Transportation Needs	In the past 12 months, • Delayed care because of no reliable transportation	No delay in care due to lack of reliable transportation
Education and Employment	• Less than high school education AND • Either unemployed, OR if employed, then job does not offer paid sick leave	• At least college, bachelor, GED or high school diploma OR • If less than high school education, then employed with paid sick leave offered at job
Discrimination	If "frequent" encounters where, • Treated with less courtesy or respect, OR • Receive poor service at restaurant or store, OR • Treated as not smart, OR • People act afraid of you, OR • You are threatened or harassed	If "never" or "less than once a year" encounters where, • Treated with less courtesy or respect, OR • Receive poor service at restaurant or store, OR • Treated as not smart, OR • People act afraid of you, OR • You are threatened or harassed

Characteristics and outcomes of adults with IBD living in the United States, overall and by race and ethnicity, based on the National Health Interview Survey 2023

Table 2.

	Overall (N = 572)	Non-Hispanic Black (N = 36)	Hispanic (N = 54)	Non-Hispanic White (N = 453)	p-value
Estimated number of patients (Weighted sample, n, [%I])	4,075,468 (100%)	271,775 (6.6%)	526,093 (12.9%)	3,277,599 (81%)	N/A
Age in years, mean (95% CI)	56 (54–58)	57 (51–63)	50 (44–56)	57 (55–59)	0.130
Sex, % (95% CI)					0.802
• Male	43 (39–48)	38 (21–55)	46 (29–64)	43 (38–49)	
• Female	57 (52–61)	62 (45–79)	54 (36–71)	57 (51–62)	
Tobacco use, % (95% CI)	28 (22–33)	37 (16–57)	15 (5–25)	29 (23–35)	0.077
Body mass index, % (95% CI)					0.002
• Healthy weight	30 (26–34)	36 (17–55)	13 (5–21)	32 (28–37)	
• Underweight	0.9 (0–2)	0 (0–0)	5.3 (0–13)	0.3 (0–1)	
• Overweight	33 (29–38)	20 (6–34)	35 (20–51)	34 (30–39)	
• Obese	35 (31–40)	44 (25–63)	46 (30–62)	33 (28–38)	
On immunosuppressive therapy, % (95% CI)	24 (20–28)	15 (3–27)	16 (3–28)	26 (21–31)	0.205
Comorbidities, % (95% CI)					<0.001
• Diabetes	15 (12–19)	46 (27–65)	15 (4–26)	13 (9–16)	
• Hypertension	43 (38–47)	68 (51–86)	34 (22–45)	42 (37–47)	0.009
• Hyperlipidemia	43 (38–48)	37 (19–55)	41 (27–56)	44 (39–49)	0.800
• Coronary artery disease	11 (8–15)	17 (3–31)	12 (1–23)	11 (8–14)	0.651
• Stroke	9 (6–12)	8 (0–18)	17 (3–31)	8 (5–11)	0.153
• Chronic lung disease	12 (8–15)	14 (0–29)	9 (0–19)	12 (9–15)	0.800
• Screen positive for anxiety (GAD-2)	15 (11–19)	23 (6–39)	14 (1–26)	15 (11–19)	0.600
• Screen positive for depression (PHQ-2)	13 (9–16)	20 (5–34)	7 (0–14)	13 (9–17)	0.200
Family income to poverty ratio, % (95% CI)					<0.001
• 0–0.99	11 (8–14)	35 (16–54)	18 (6–30)	8 (5–11)	
• 1–1.99	18 (14–22)	24 (8–39)	24 (10–38)	16 (12–20)	

	Overall (N = 572)	Non-Hispanic Black (N = 36)	Hispanic (N = 54)	Non-Hispanic White (N = 453)	p-value
• 2–3.99	29 (24–33)	20 (5–36)	32 (17–47)	29 (24–34)	
• 4 or greater	43 (37–48)	21 (7–36)	26 (11–41)	47 (41–53)	
Language other than English spoken at home, % (95% CI)	14 (9–19)	6 (0–15)	81 (67–95)	6 (2–9)	<0.001
Insurance type, % (95% CI)					
• Medicaid/CHIP/other public insurance [other than Medicare]	12 (8–17)	15 (0–32)	34 (15–53)	9 (5–13)	<0.001
• No health insurance	4 (2–7)	10 (0–23)	13 (3–22)	3 (1–5)	0.004
Emergency department visit, in the last 12 months, % (95% CI)	35 (30–40)	44 (24–63)	40 (24–57)	34 (29–39)	0.50
Hospitalization in the last 12 months, % (95% CI)	17 (13–21)	30 (11–50)	25 (9–41)	15 (11–18)	0.094
Cost-related medication nonadherence, % (95% CI)	14 (11–18)	24 (7–41)	11 (3–19)	14 (10–18)	0.264

Table 3.

Prevalence and burden of social risk overall, and by race and ethnicity

Social risk factor	Overall (N = 572)	Non-Hispanic Black (N = 36)	Hispanic (N = 54)	Non-Hispanic White (N = 453)	p-value
Food insecurity, % (95% CI)	22 (18–27)	47 (27–68)	32 (17–47)	19 (14–24)	0.003
Financial hardship, % (95% CI)	28 (23–32)	27 (11–42)	44 (28–61)	25 (20–30)	0.030
Housing instability, % (95% CI)	14 (10–17)	33 (15–52)	23 (11–36)	11 (7–14)	0.001
Transportation needs, % (95% CI)	9 (6–12)	11 (0–27)	9 (2–16)	9 (6–12)	0.909
Education & employment, % (95% CI)	9 (5–12)	13 (0–27)	23 (8–39)	6 (3–9)	0.003
Discrimination, % (95% CI)	41 (36–46)	62 (44–81)	39 (23–55)	40 (34–45)	0.110
Overall burden of social risk, % (95% CI)					<0.001
• None	36 (31–41)	11 (1–21)	19 (6–31)	41 (35–46)	
• Mild	32 (27–37)	30 (12–49)	30 (15–45)	32 (27–38)	
• Moderate	17 (13–21)	21 (4–39)	24 (8–39)	16 (11–20)	
• Severe	15 (11–19)	37 (17–57)	28 (12–43)	12 (8–15)	

Table 4.

Impact of burden of social risk on outcomes in adults with IBD

Burden of Social Risk (reference: no social risk)	Unadjusted	Adjusted for Covariates *	Additionally adjusted for race and ethnicity **	Additionally adjusted for health insurance type and family income ***
Hospitalization and/or emergency department visits in the last 12 months, Odds Ratio (95% CI)				
Mild	0.70 (0.41–1.19)	0.68 (0.33–1.37)	0.76 (0.38–1.52)	0.69 (0.35–1.38)
Moderate	2.17 (1.15–4.08)	1.75 (0.78–3.92)	1.80 (0.80–4.05)	1.32 (0.52–3.35)
Severe	4.05 (2.07–7.90)	3.95 (1.57–9.96)	5.81 (2.24–15.03)	3.52 (1.22–10.16)
Cost-related medication non-adherence, Odds Ratio (95% CI)				
Mild	1.93 (0.69–5.39)	1.134 (0.32–4.08)	1.25 (0.34–4.61)	1.68 (0.48–5.91)
Moderate	6.98 (2.37–20.59)	5.43 (1.50–19.69)	4.64 (1.25–17.26)	8.35 (2.17–32.08)
Severe	14.29 (5.36–39.93)	10.76 (3.19–36.32)	12.19 (3.13–47.43)	11.77 (2.66–52.09)

* **Adjusted for:** age, sex, BMI, smoking status (current vs. former/never), diabetes, hypertension, hyperlipidemia, coronary artery disease [yes to any of angina, stroke, heart attack], COPD/emphysema/bronchitis, arthritis, PHQ2 screen positive, GAD2 screen positive

** **Adjusted for:** same variables as above + race and ethnicity (Non-Hispanic Black vs. Hispanic vs. Non-Hispanic White)

*** **Additionally adjusted analysis:** same variables as above including race and ethnicity + income (use of family income to poverty ratio thresholds), and health insurance status (Medicaid/CHIP/other public insurance vs. any of Medicare/Private insurance/military insurance)