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The association between inflammatory bowel disease and migraine or severe headache among US adults: Findings from the National Health Interview Survey, 2015–2016

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Abstract

Objective: To assess prevalence of migraine or severe headache among US adults by inflammatory bowel disease (IBD) status.

Background: Emerging evidence in clinical settings suggests a higher prevalence of migraine among patients with IBD than those without IBD.

Methods: Data from 60,436 US adults aged ≥ 18 years participating in the 2015 and 2016 National Health Interview Survey (NHIS) were analyzed. The relationship between IBD status and migraine or severe headache were assessed overall and stratified by levels of selected characteristics including sex, age, race/ethnicity, education, poverty status, marital status, smoking status, obesity status, serious psychological distress, and major chronic condition status.

Results: Overall, the age-adjusted prevalence of migraine or severe headache was 15.4% (n=9,062) and of IBD was 1.2% (n=862). A higher age-adjusted migraine or severe headache prevalence was reported among participants with IBD than those without IBD (28.1% vs. 15.2%, $p<0.0001$). The association of migraine or severe headache with IBD remained significant overall [adjusted prevalence ratio (95% CI)=1.59 (1.35–1.86)] and within the levels of most other selected characteristics after controlling for all other covariates.

Conclusions: Our results confirmed a higher prevalence of migraine or severe headache among US adults with IBD than those without. Healthcare providers might assess migraine or severe headache among patients with IBD to improve management and quality of life.

Keywords

headache; migraine; inflammatory bowel disease; population study

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Introduction

Migraine, a recurrent primary headache disorder that in 2018 affected 15.9% of US adults aged 18 years in the previous 3-month period, is one of the most common disability conditions.^{1,2} The International Classification of Headache Disorders-3rd Edition can be used for the diagnosis of migraine.³ Migraine disproportionately affects women (21.0% for women vs. 10.7% for men)¹ and is more likely to occur among young adults (20.1% for those aged 30–39 years vs. 4.0% for those aged 70 years).⁴ Furthermore, migraine is often comorbid with other chronic conditions including depression or anxiety, asthma, heart disease, stroke, insomnia, and some gastrointestinal diseases such as irritable bowel syndrome and celiac disease.^{5–9} Inflammatory bowel disease (IBD), which includes Crohn’s disease and ulcerative colitis, is characterized by chronic inflammation of the gastrointestinal tract and affected about 3.1 million (1.3%) US adults in 2015.¹⁰ Diagnosis of Crohn’s disease or ulcerative colitis is usually determined based on the findings of a comprehensive physical examination, laboratory test, imaging, and endoscopy.^{11,12} IBD is a lifetime systemic disorder that may demonstrate similar aforementioned epidemiological characteristics of migraine or severe headache such as being more likely to be first diagnosed among children or young adults and more likely to co-occur with other chronic conditions including asthma, depression or anxiety, headache, and other neurological disorders.^{13–17} To date, the association of migraine with IBD has been reported only in clinically-based research with small samples.^{18–21} A Swiss study using a large insurance claims dataset also observed an association of migraine with IBD²² but did not report association with sociodemographic characteristics and risk factors. In this study, we used US national survey data to assess the hypothesis that adults with IBD would have a higher prevalence of migraine or severe headache than those without IBD.

Methods

The National Health Interview Survey (NHIS) is a cross-sectional household survey that provides nationally representative estimates of self-reported health information for the civilian, noninstitutionalized US population. The IBD question was included in the 2015 and 2016 NHIS Sample Adult Core. To gain more statistical power for comparisons among subgroups, data from both 2015 and 2016 were combined. Detailed information about the study design and questionnaire related to sample adults is available.^{23,24} The final response rate was 55.2% in 2015 and 54.3% in 2016.^{23,24}

Measures

Outcome and exposure variables

Migraine or severe headache was defined by an affirmative response to the question “During the past 3 months, did you have migraine or severe headache?” The interviewees were asked to report pain that last a whole day or more rather than fleeting or minor pain.^{23,24} IBD was defined by an affirmative response to the question about having been told by a health professional that one had Crohn’s disease or ulcerative colitis. Previous research indicated that self-reported physician-diagnosed IBD and migraine or severe headache were feasible and reliable measures in a large population-based study.^{25,26}

Covariates

Sociodemographic characteristics included in this study were sex, age group (18–44, 45–64, and 65 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other), education level (less than high school, high school diploma or general equivalency diploma (GED), some college or technical school, and college graduate), marital status (married or member of unmarried couple, divorced/separated/widowed, and never married), and federal poverty status (<100% federal poverty level (FPL), 100%–<200% FPL, 200%–<399% FPL, and 400 FPL, which was calculated using NHIS imputed income files at [<https://www.cdc.gov/nchs/data/nhis/tecdoc16.pdf>]). Smoking status was defined by two questions “Have you smoked at least 100 cigarettes in your entire life?” and “Do you currently smoke every day, some days, or not at all?” Participants were categorized as current smokers (smoked at least 100 cigarettes during their lifetime and currently smoked every day or some days), former smokers (smoked at least 100 cigarettes during their lifetime but did not currently smoke), and never smokers (never smoked at least 100 cigarettes during their lifetime). Body mass index (BMI, kg/m²), calculated from self-reported height and weight, was categorized as non-obese (BMI<30.0) and obese (BMI ≥30.0).

An indicator for chronic conditions was created and defined as “yes” when a respondent had an affirmative response to any of six major chronic conditions: 1) heart disease including coronary heart disease, angina pectoris, heart attack or a heart condition/disease; 2) stroke; 3) arthritis; 4) asthma ever; 5) cancer; and 6) chronic obstructive pulmonary disease (COPD) including emphysema, chronic bronchitis, or COPD. Serious psychological distress was based on responses to six core questions; “During the past 30 days, how often did you feel 1) So sad that nothing could cheer you up?; 2) Nervous?; 3) Restless or fidgety?; 4) Hopeless?; 5) That everything was an effort?; 6) Worthless?” The responses were recorded on a Likert scale (0=“none of the time”; 1=“a little of the time”; 2=“some of the time”; 3=“most of the time”; 4=“all of the time”) and summed (range 0–24). Serious psychological distress, which is a proxy for mental health status, was defined if the summed scale ≥13.²⁷

Statistical Analysis

No differences were found when comparing the distribution of NHIS data including IBD and migraine or severe headache between 2015 and 2016. The 2015 and 2016 data sets were combined resulting in a total of sample of 60,436 adults with complete information after 571 pregnant women and 5,693 observations with missing values were excluded (1,199 on age, 260 on education, 135 on marital status, 242 on smoking status, 2,276 on obesity status, 2,251 on serious psychological distress, 22 on any of six major chronic conditions, 90 on IBD status, and 44 on migraine or severe headache). Prevalence of migraine or severe headache and 95% confidence intervals (CIs) and by selected characteristics were calculated. The estimates were age-standardized to the 2000 projected US population aged 18 years (using the age distribution #8: 18–24, 25–44, 45–64, 65 years).²⁸ Multivariable logistic regression analyses were performed to assess the association between IBD status and migraine or severe headache overall and stratified by levels of selected characteristics in the subgroup analyses, after controlling for sex, age group, race/ethnicity, education, employment status, marital status, poverty status, smoking status, obesity status, and having

any of the aforementioned chronic conditions. Appropriate analytic methods were applied to take sampling weights and the complex sampling design into account (#2 method).²⁹ Unreliable estimates are not presented if the relative standard error was >0.3. All analyses were performed using SAS (SAS International Institute, version 9.3) and SAS-callable SUDAAN (Research Triangle Institute, version 11.0.3). Statistical significance for comparisons was tested using a two-sided t-test at $p < 0.05$.

Results

There were 862 adults (1.2%) who reported having IBD in the combined 2015 and 2016 NHIS. Compared to participants without IBD, those with IBD were more likely to be women; middle-aged or older adults (aged ≥ 45 years); non-Hispanic white; widowed, divorced, or separated; former smokers; to have reported serious psychological distress; to have reported any chronic condition; and to have reported migraine or severe headache (Table 1).

The overall age-adjusted prevalence of migraine or severe headache was 15.4% ($n=9,062$) and of IBD was 1.2% ($n=862$). Participants with IBD reported a higher age-adjusted prevalence of migraine or severe headache than those without IBD [(28.1% vs. 15.2%, $p < 0.0001$, Table 2]. The association of migraine or severe headache with IBD remained significant overall [adjusted prevalence ratio (PR) (95% CI)=1.59 (1.35–1.86)] and within most levels of other selected characteristics after controlling for all covariates (except for those who were aged ≥ 65 years, had a high school diploma or GED, or 4-year college degree or above, and with poverty level $\geq 200\%$ FPL). For example, a higher prevalence of migraine or severe headache was observed among both men [adjusted PR (95% CI)=1.68 (1.20–2.35)] and women [adjusted PR (95% CI)=1.54 (1.30–1.82)] with IBD than their counterparts without IBD after controlling for all covariates. In addition, a high prevalence of migraine or severe headache ($>40\%$) was observed among adults with IBD who had less than a high school education, poverty level $<100\%$ FPL, were current smokers, obese, and with serious psychological distress.

Previous studies indicated that chronic pain was also a common symptom in adults with IBD.³⁰ To distinguish the association of IBD with migraine or severe headache from chronic pain in general, we conducted a post hoc sensitivity analysis by excluding those who reported having chronic pain in 2016 (a chronic pain question was available in the 2016 but not in the 2015 NHIS). Chronic pain was defined as a response of ‘most days’ or ‘every day’ to the question “In the past 6 months, how often did you have pain?” In this analysis, the prevalence of migraine or severe headache in 2016 remained significantly higher among the respondents with IBD than those without IBD [age-adjusted prevalence (95% CI): 20.7% (13.1–31.1) vs. 11.1% (10.6–11.7)].

Discussion

Our results from a US national survey confirmed a higher prevalence of migraine or severe headache among adults with IBD than their counterparts without IBD in the general population after adjustment for covariates such as age, poverty status, health-risk behaviors,

serious psychological distress, and some major chronic conditions. The magnitude of the association between IBD and migraine was consistent with results from prior studies in clinical settings^{18,19,21}. To the best of our knowledge, this is the first report to demonstrate an association between self-reported physician-diagnosed IBD and recent severe headache or migraine in a nationally representative sample of US civilian, non-institutionalized adults.

The mechanism between migraine and IBD is not fully understood. Evidence indicates that IBD and migraine or severe headache might be linked through a complex gut-brain interaction.³¹ Our findings, which add insights into a growing body of research, show that migraine or severe headache is not only more prevalent in women than in men, but also is associated with lower socioeconomic status, smoking, obesity, serious psychological distress, and greater comorbidities among adults with IBD.^{18,19,21} Although IBD currently cannot be prevented, our results indicate that screening for migraine or severe headache among patients with IBD, especially among the high-risk population, may be important. In addition, adequate pharmacological and nutritional therapy might reduce migraine or severe headache among adults with IBD and improve quality of life.^{32,33}

The strength of this study is that our results were based on a large national population survey. However, our findings are subject to the following limitations. First, both migraine and IBD were ascertained by single questions, which were not confirmed by medical records. The NHIS question does not differentiate migraine from severe headache, nor does it ascertain subtype of migraine. Further, we were unable to distinguish primary migraine/severe headache from secondary causes.³⁴ Nonetheless, our results among a large national survey align with results from clinical populations and add to the growing evidence of an association between migraine and IBD. Further, our sensitivity analysis, using 2016 data only suggested that associations remained when excluding adults who reported chronic pain in general. In addition, the NHIS question does not differentiate subtypes of migraine or migraine from other types of severe headache. The NHIS migraine question also only captures the information of adult respondents who had migraine or a severe headache three month prior to the interview. Therefore, the prevalence of migraine in this study could be underestimated. Further studies on migraine may distinguish Crohn's disease and ulcerative colitis to assess different disease mechanisms and epidemiological characteristics. Second, the survey does not include a measure about frequency or intensity of migraine. Therefore, we were unable to differentiate chronic migraine from episodic migraine. Third, self-reported variables are subject to recall bias. Fourth, we were unable to assess association of other risk factors associated with migraine that were not ascertained in the survey, such as sleep apnea and anemia.^{8,35} However, several major common chronic conditions were included in our analyses so that the variations derived from less common conditions may not be so great as to substantially attenuate the observed associations. Finally, our results cannot be applied to active duty military personnel, or institutionalized adults who are living in long-term care facilities or prisons.

In conclusion, our results from a US national survey confirmed a higher prevalence of migraine or severe headache among adults with IBD than those without. Healthcare providers might assess migraine among IBD patients who may benefit from the treatment and prevention of migraine or severe headache.

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Abbreviations:

IBD	inflammatory bowel disease
NHIS	National Health Interview Survey
CI	confidence interval
FPL	federal poverty level
BMI	body mass index
COPD	chronic obstructive pulmonary disease

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Table 1.

Distribution of selected characteristics among 60,436 adults aged 18 years, by IBD status*, United States, 2015–2016 National Health Interview Survey

Characteristic	IBD (n=862)		No IBD (n=59,574)	
	n [†]	% (95% CI) [¶]	n [†]	% (95% CI) [¶]
Sex				
Men	315	40.7 (36.5–45.1)	27,675	49.7 (49.2–50.3)
Women	547	59.3 (54.9–63.5)	31,899	50.3 (49.7–50.8)
Age group (year)				
18–44	230	30.4 (26.5–34.6)	24,529	47.3 (46.7–48.0)
45–64	356	43.3 (39.0–47.7)	19,313	33.0 (32.4–33.5)
65	276	26.3 (22.7–30.3)	15,732	19.7 (19.2–20.2)
Race/ethnicity				
Non-Hispanic white	677	75.6 (71.1–79.7)	39,271	64.5 (63.5–65.4)
Non-Hispanic black or African American	53	5.3 (3.7–7.4)	7,038	11.6 (11.1–12.2)
Hispanic	91	14.3 (10.7–18.9)	8,436	15.9 (15.1–16.7)
Non-Hispanic other	41	~	4,829	8.0 (7.6–8.4)
Educational level				
High school or less	94	12.6 (9.2–17.1)	6,373	10.2 (9.8–10.6)
High school graduate or GED	231	27.0 (23.3–31.1)	16,047	26.9 (26.3–27.5)
Some college	278	30.6 (26.7–34.7)	18,782	31.2 (30.6–31.8)
College graduate	259	29.8 (25.9–33.9)	18,372	31.8 (31.0–32.5)
Marital status				
Married	398	59.2 (54.7–63.6)	29,923	60.4 (59.8–61.1)
Widowed, divorced, separated	305	25.6 (22.0–29.6)	15,863	16.9 (16.6–17.3)
Never married	159	15.1 (12.2–18.6)	13,788	22.6 (22.1–23.2)
Federal poverty status**				
<100% FPL	148	14.1 (11.3–17.4)	9,093	12.4 (11.9–12.8)
100–199% FPL	177	17.3 (14.0–21.0)	11,654	17.9 (17.4–18.4)
200–399% FPL	234	28.3 (24.2–32.8)	17,336	29.1 (28.5–29.6)
400% FPL	303	40.3 (35.8–45.0)	21,491	40.6 (39.8–41.4)
Smoking status				
Current smoker	167	17.8 (14.7–21.3)	9,676	15.3 (14.9–15.8)
Former smoker	275	30.4 (26.3–34.8)	14,231	21.9 (21.5–22.4)
Non-smoker	420	51.9 (47.5–56.2)	35,667	62.8 (62.1–63.4)
Body mass index (BMI, kg/m²)				
Non-obese (BMI<30.0)	585	69.2 (64.8–73.2)	41,462	70.1 (69.6–70.7)
Obese (BMI ≥30.0)	277	30.8 (26.8–35.2)	18,112	29.9 (29.3–30.4)
Serious psychological distress^{¶¶}				

Characteristic	IBD (n=862)		No IBD (n=59,574)	
	n [†]	% (95% CI) [¶]	n [†]	% (95% CI) [¶]
Yes	593	65.6 (60.8–70.0)	27,450	42.0 (41.4–42.6)
No	269	34.4 (30.0–39.2)	32,124	58.0 (57.4–58.6)
Any of 6 major chronic conditions[‡]				
Yes	78	8.1 (5.7–11.3)	2,215	3.5 (3.2– 3.7)
No	784	91.9 (88.7–94.3)	57,359	96.5 (96.3–96.8)
Migraine or severe headache^{~~}				
Yes	226	27.2 (23.1–31.7)	8,836	14.8 (14.4–15.2)
No	636	72.8 (68.3–76.9)	50,738	85.2 (84.8–85.6)

* Inflammatory bowel disease (IBD) was defined based on the response to the question “Have you ever been told by a doctor or other health professional that you had Crohn’s disease or ulcerative colitis?”

[†] Unweighted sample size.

[¶] Weighted percentage and 95% confidence interval (CI).

[~] Unreliable estimates if the relative standard error > 0.3.

** Federal poverty level (FPL) was defined based on 2017 HHS guidelines at <https://aspe.hhs.gov/2017-poverty-guidelines>.

[‡] Serious psychological distress was based on responses to six questions: “During the past 30 days, how often did you feel 1) Feeling so sad that nothing could cheer you up?; 2) Nervous?; 3) Restless or fidgety?; 4) Hopeless?; 5) That everything was an effort?; 6) Worthless?” The responses were recorded on a Likert scale (0=“none of the time”; 1=“a little of the time”; 2=“some of the time”; 3=“most of the time”; 4=“all of the time”) and summed (range 0–24). Serious psychological distress, which is a proxy for mental health status, was defined if the summed scale ≥ 13.

^{¶¶} Any of 6 major chronic conditions was defined as “Yes” if the respondent reported being told by a doctor or other health professional that they had any of the following conditions: 1) coronary heart disease, or angina pectoris, or a heart attack, or a heart condition/disease; 2) stroke; 3) arthritis; 4) asthma ever; 5) cancer; 6) chronic obstructive pulmonary disease (COPD) including emphysema, or chronic bronchitis, or COPD.

^{~~} Migraine or severe headache was defined based on the response to the question “During the past 3 months, did you have severe headache or migraine?”

Table 2.

Age-adjusted prevalence^{*} and adjusted prevalence ratio[†] of migraine or severe headache among 60,436 US participants aged ≥ 18 years, by IBD status[‡], United States, 2015–2016 National Health Interview Survey

Characteristic	Age-adjusted prevalence of migraine or severe headache, % (95% CI) [*]		Adjusted prevalence ratio [†] (95% CI)
	IBD (n=862)	No IBD (n=59,574)	
Crude prevalence	27.2 (23.1–31.7)	14.8 (14.4–15.2)	
Age-adjusted prevalence	28.1 (23.5–33.1)	15.2 (14.8–15.7)	1.59 (1.35–1.86)
Sex			
Men	20.8 (14.7–28.6)	10.0 (9.5–10.5)	1.68 (1.20–2.35)
Women	33.2 (27.5–39.5)	20.6 (19.9–21.3)	1.54 (1.30–1.82)
Age group (year)			
18–44	29.8 (21.9–39.0)	17.9 (17.1–18.7)	1.30 (1.00–1.68)
45–64	37.5 (29.7–46.0)	16.6 (15.9–17.4)	1.89 (1.52–2.34)
65	16.0 (11.9–21.3)	8.3 (7.8– 8.8)	1.31 (0.84–2.05)
Race/ethnicity			
Non-Hispanic whites	26.8 (21.8–32.6)	15.9 (15.3–16.5)	1.42 (1.21–1.67)
Non-Hispanic black or African American	_**	15.2 (14.1–16.5)	_**
Hispanic	38.6 (26.2–52.6)	14.6 (13.7–15.6)	2.31 (1.52–3.52)
Non-Hispanic others	_**	13.1 (12.0–14.4)	_**
Educational level			
High school or less	48.7 (34.8–62.9)	19.0 (17.6–20.5)	2.32 (1.58–3.42)
High school graduate or GED	24.2 (16.8–33.5)	15.6 (14.8–16.4)	1.29 (0.92–1.81)
Some college	34.9 (27.0–43.8)	16.7 (16.0–17.5)	1.76 (1.41–2.20)
College graduate	13.6 (9.3–19.5)	12.5 (11.8–13.3)	1.17 (0.82–1.66)
Marital status			
Married	26.6 (19.2–35.6)	15.4 (14.8–16.1)	1.48 (1.20–1.83)
Widowed, divorced, separated	31.3 (21.8–42.8)	18.5 (16.6–20.5)	1.76 (1.34–2.32)
Never married	28.1 (20.2–37.8)	15.4 (14.5–16.3)	1.59 (1.15–2.22)
Federal poverty status[‡]			
<100% FPL	53.1 (42.3–63.7)	21.5 (20.3–22.8)	2.09 (1.66–2.63)
100–199% FPL	38.6 (27.0–51.6)	19.6 (18.6–20.7)	1.66 (1.22–2.24)
200–399% FPL	26.4 (18.2–36.8)	14.9 (14.2–15.7)	1.36 (0.94–1.97)
400% FPL	16.5 (10.4–25.0)	11.9 (11.2–12.7)	1.41 (0.99–2.01)
Smoking status			
Current smoker	41.8 (30.8–53.6)	21.2 (20.1–22.3)	1.52 (1.21–1.91)
Former smoker	26.6 (18.5–36.5)	15.9 (14.8–17.2)	1.66 (1.23–2.24)
Non-smoker	24.4 (18.5–31.5)	13.7 (13.2–14.2)	1.58 (1.22–2.06)
Body mass index (BMI, kg/m²)			

Characteristic	Age-adjusted prevalence of migraine or severe headache, % (95% CI)*		Adjusted prevalence ratio [†] (95% CI)
	IBD (n=862)	No IBD (n=59,574)	
Non-obese (BMI<30.0)	22.8 (17.8–28.7)	14.0 (13.5–14.6)	1.40 (1.11–1.78)
Obese (BMI ≥30.0)	40.4 (31.1–50.4)	18.2 (17.3–19.1)	1.90 (1.53–2.36)
Serious psychological distress^{‡‡}			
Yes	71.4 (54.7–83.8)	45.9 (42.8–49.1)	1.75 (1.48–2.07)
No	24.3 (20.0–29.2)	14.1 (13.7–14.5)	1.49 (1.25–1.77)
Any of 6 major chronic conditions^{***}			
Yes	38.6 (31.3–46.5)	22.9 (22.0–23.8)	1.56 (1.34–1.81)
No	18.1 (11.9–26.6)	11.2 (10.7–11.7)	1.55 (1.01–2.37)

* Age-adjusted prevalence (except for age groups and crude total) was standardized to the 2000 projected US population aged ≥18 years (using age groups 18–24, 25–44, 45–64, ≥65 years).

[†] Adjusted prevalence ratio (prevalence in IBD/prevalence in non-IBD) and 95% confidence ratio (CI) were derived from a multivariable logistic regression model that include sex, age group, race/ethnicity, education, poverty status, marital status, smoking status, obesity status, serious psychological distress, and major chronic condition status.

^{‡‡} Inflammatory bowel disease (IBD) was defined based on the response to the question “Have you ever been told by a doctor or other health professional that you had Crohn’s disease or ulcerative colitis?”

** Unreliable estimates if the relative standard error>0.3.

[‡] Federal poverty level (FPL) was defined based on 2017 HHS guidelines at <https://aspe.hhs.gov/2017-poverty-guidelines>.

^{‡‡‡} Serious psychological distress was based on responses to six questions: “During the past 30 days, how often did you feel 1) Feeling so sad that nothing could cheer you up?; 2) Nervous?; 3) Restless or fidgety?; 4) Hopeless?; 5) That everything was an effort?; 6) Worthless?” The responses were recorded on a Likert scale (0=“none of the time”; 1=“a little of the time”; 2=“some of the time”; 3=“most of the time”; 4=“all of the time”) and summed (range 0–24). Serious psychological distress, which is a proxy mental health status, was defined if the summed scale ≥13.

^{***} Any of 6 major chronic conditions was defined as “Yes” if the respondent reported being told by a doctor or other health professional that they had any of the following conditions: 1) coronary heart disease, or angina pectoris, or a heart attack, or a heart condition /disease; 2) stroke; 3) arthritis; 4) asthma ever; 5) cancer; 6) chronic obstructive pulmonary disease (COPD) including emphysema, or chronic bronchitis, or COPD.