Relationships between headache frequency, disability, and disability-related unemployment among adults with migraine

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Plain language summary

We used a large survey to study the relationship between how many headaches a person has and their job status. People with more than 15 headache days each month were almost 3 times more likely to say they were not working because of disability than people with less than 5 headache days each month. This is important for helping those living with migraine to have better quality of life and understand how migraine affects employment.

Implications for managed care pharmacy

These findings demonstrate a link between frequency of migraine attacks and unemployment. This is important for employers and policymakers. Our findings can inform the design of targeted interventions for migraine prevention to facilitate the gainful employment of adults with migraine and to help guide decisions on disability benefits eligibility.

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ABSTRACT

BACKGROUND: Migraine is the second most common cause of disability worldwide. Understanding the relationship between migraine and employment status is critical for policymakers, as disability-related unemployment is associated with eligibility for private or governmental disability insurance payments and other associated support for those unable to work because of disability.

OBJECTIVE: To assess the association between migraine frequency and self-reported employment status and overall disability in a US representative survey.

METHODS: Using data from the 2019 National Health and Wellness Survey (NHWS) (Kantar Health), adults in the United States (aged 18-65 years) reporting at least 1 migraine day in the past 30 days were categorized by headache frequency: low-frequency episodic migraine (LFEM) (≤4 days/month), moderate-frequency EM (MFEM) (5-9 days/month), high-frequency EM (HFEM) (10-14 days/month), or chronic migraine (CM) (≥15 days/month). A control group of adults without migraine with similar baseline characteristics was identified by propensity score matching. Disability-related unemployment was defined as participants responding "short-term disability" or "long-term disability" to occupational status on the NHWS. The frequency of short- or long-term disability was then evaluated across headache frequency groups. In addition, participants were asked to assess migraine-related disability via the Migraine Disability questionnaire (MIDAS).

RESULTS: A total of 1,962 respondents with LFEM, 987 with MFEM, 554 with HFEM, and 926 with CM were included in this analysis, along with 4,429 matched controls. Headache frequency was associated both with increased MIDAS score and with employment disability ($P<0.001$); 12.3% (n=114 of 926) of participants with CM reported employment disability, as did 4.4% (n=86 of 1,962) of the LFEM group and 6.9% (n=306 of 4,429) of matched controls. There was considerable discordance between the proportion of participants classified as disabled via MIDAS vs those reporting employment-related disability.

CONCLUSIONS: More frequent migraine headaches are associated with a higher likelihood of self-reported short- and long-term employment disability and overall migraine-related disability, suggesting that health and economic policymakers must seek ways to maximize the employment opportunities for people living with migraine that may benefit from novel preventive treatments.

Disability is defined by the International Classification of Functioning, Disability, and Health as impairments or limitations to activity participation caused by a health condition that alter an individual's relationship with themselves and/or their personal/working environment.[1-4] Medical and health services researchers typically assess disability by quantifying impairment associated with a disease. For example, migraine is the second-ranked cause of disability worldwide and the most common cause of years lived with disability (YLD) among those aged 15-49,[5] with YLD generally increasing with greater disease severity.[6] In particular, migraine contributes to reduced overall labor force participation, increased long-term disability, and overall work impairment.[7,8] In addition, according to data from the Baltimore County Migraine Study, MEDSTAT's MarketScan, medical claims, and statistics from the Census Bureau and the Bureau of Labor Statistics, patients with migraine reported approximately 112 million bedridden days (ie missed or impaired work days) per year.[9]

Migraine-associated disability is frequently measured using validated patient-reported outcomes, such as the Migraine Disability Assessment (MIDAS) questionnaire.[10-12] MIDAS consists of 5 questions that measure the extent of disability across 3 contextual domains: school or work for pay; household role; and participation in social, family, and leisure activities. The responses to each question are provided in number of days, which are then totaled to determine the level of disability: "little or no disability" (0-5 days); "mild disability" (6-10 days); "moderate disability" (11-20 days); and "severe disability" (21-40 days).[11,13,14]

Although the extent of disability in migraine has been characterized across multiple domains, including occupational, academic, familial, and social,[15-18] and the disabling effects of migraine are known to contribute to large direct and indirect economic costs,[9,19-20] this body of research has not fully elucidated the relationship between disability and the impact of migraine on employment status (ie, disability-related unemployment).[21-23] Understanding this relationship is critical for policymakers, as unemployment that is a function of impairment may imply eligibility for private or governmental disability insurance payments and other associated support for those physically or mentally unable to work.

In the current study, we aimed to explore the relationship between headache frequency and disability-related unemployment among a large population-based cohort of adults living with migraine in the United States. We also examined the association between disability and employment status.

Methods

STUDY DESIGN

This retrospective cross-sectional study included data from the 2019 National Health and Wellness Survey (NHWS) from respondents in the United States. The NHWS is a self-administered, Internet-based survey conducted annually (Cerner Enviza, North Kansas City, MO) in the United States and several other countries.[24-27] The NHWS collects information on more than 200 health conditions, including a module dedicated to migraine, which assesses migraine-related symptomology, interactions with health care providers (eg, physicians, physician assistants, and nurse practitioners), and medication use.[28] All respondents, regardless of migraine status, provided information on demographic and baseline health factors. Survey respondents were recruited through participation in opt-in online survey panels, with quota sampling within the survey panel to ensure country-specific representativeness in age, sex, and race and ethnicity distributions based on the US Census.

The NHWS was granted exemption by the Pearl Institutional Review Board (Indianapolis, IN) because of the low risk to participants of its deidentified/anonymized secondary data. The current study was conducted in accordance with the Good Pharmacoepidemiology Practices guidelines issued by the International Society for Pharmacoepidemiology.[29]

STUDY SAMPLE

From the total 2019 NHWS survey (N=74,994), respondents aged 18-65 years with a self-reported physician diagnosis of migraine who reported experiencing at least 1 migraine attack in the past 30 days (n=4,487, total eligible respondents) were analyzed in aggregate and stratified by headache frequency (Supplementary Figure 1, available in online article). Episodic migraine (EM) and chronic migraine (CM) were defined using the cutoff of 15 headache days per month, as recommended by the *International Classification of Headache Disorders, Third Edition* (ICHD-3).[30]

To facilitate comparisons to individuals without migraine or nonmigraine controls, we selected an additional cohort of adults from the NHWS who had not been diagnosed with migraine and did not report experiencing migraine symptoms in the past year (n=45,962 total eligible respondents). Thus, the impact of headache frequency could be characterized within the migraine cohort, in addition to being contextualized against the wider nonmigraine group.

MEASURES

Migraine Frequency. EM subtypes were defined in accordance with ICHD-3 criteria. Low-frequency EM (LFEM)

(n=1,971 total eligible respondents): no more than 4 headache days/month, moderate-frequency EM (MFEM) (n=998): 5-9 headache days/month, and high-frequency EM (HFEM) (n=565): 10-14 headache days/month.[31,32] Nevertheless, the definition used for this study does not include "migraine days" because the information necessary to characterize a headache episode due to migraine is not available in the NHWS, as the reported headaches could have been caused by reasons other than migraine.

Disability Status. Disability status was characterized based on 2 different measures: (1) self-reported employment status and (2) MIDAS score.

Self-reported employment status. In the NHWS, respondents were asked, "What is your employment status?" Choices were employed full-time, self-employed, employed part-time, homemaker, retired, student, short-term or long-term disability, not employed but looking for work, or not employed and not looking for work. Respondents selected the single response that best characterized their current employment. We assumed that those who selected short-term or long-term disability self-assessed that they were unable to work for some period of time because of impairments (migraine or other existing comorbidities) and might therefore be eligible for entitlements such as sick leave, Social Security benefits, workers' compensation, or private disability insurance. All survey participants in both the matched control population and migraine population reported on employment status.

MIDAS score. For the purposes of this study, individuals with higher MIDAS scores were defined as having greater levels of disability as a result of disruptive headache days.[11,13,14] These scores were further categorized as indicating no disability (0-5), mild disability (6-10), moderate disability (11-20), or severe disability (≥21).[13] We assumed that, in this context, "disability" as measured by the MIDAS may be a more general assessment of disability beyond employment status. Of the respondents with migraine, 100% completed the MIDAS portion of the survey.

Demographics. Demographic characteristics reported from the NHWS included age, sex, employment status, race and ethnicity, marital status, education, household income, and insurance status. Self-reported clinical characteristics of the migraine sample included years since diagnosis, monthly headache days, current use of prescription and over-the-counter medications, duration of medication use, and prescribing patterns (eg, types of prescribers, reasons for adding/switching medications).

General Health and Lifestyle Characteristics. General health variables reported from the NHWS included body mass index, smoking status, alcohol use, and exercise behavior. The Charlson Comorbidity Index (CCI) was used to capture overall comorbidity burden.[33] Given the high prevalence of migraine among women, we also examined the comorbidity burden associated with key women's health conditions available within the NHWS. The total number of diagnoses per person (range 0-11) were tallied across the following conditions: breast cancer, cervical cancer, ovarian cancer, uterine cancer, endometriosis, fibroids, dysmenorrhea, heavy menstrual bleeding, hot flashes, premenstrual dysphoric disorder, and premenstrual syndrome. The use of oral contraceptives was not assessed.

Mental Health Characteristics. Anxiety and depression are well known to be comorbid with migraine and are known to play a role in transformation of migraine from episodic to chronic.[34-37] We explored both anxiety and depression in 2 ways: via self-reported diagnoses available in the NHWS and via symptom severity, as assessed by the Generalized Anxiety Disorder questionnaire (7-item instrument) (GAD-7)[38] and the Patient Health Questionnaire (9-item instrument) (PHQ-9).[39] Among diagnosed patients, prevalence of anxiety/depression was subdivided by medication usage: patients who reported currently using a medication to treat their anxiety/depression were coded as "treated," whereas patients who did not report using any anxiety/depression medication were coded as "untreated." For all patients, irrespective of self-reported diagnosis, symptom severity was ascertained via the GAD-7 and the PHQ-9. Both instruments query about anxiety/depressive symptoms experienced in the past 2 weeks, with items scored on a 0 (not at all) to 3 (nearly every day) scale. Scores of 5, 10, 15, and 20 serve as cutoffs indicating mild, moderate, moderately severe, and severe levels of depression on the PHQ-9. Scores of 5, 10, and 15 serve as cutoffs indicating mild, moderate, and severe anxiety on the GAD-7.

STATISTICAL ANALYSIS

Unadjusted Bivariate Analyses. Propensity score matching was used to generate comparable cohorts of adults with and without migraine that possessed similar demographic and general health characteristics. First, bivariate analyses were performed to identify baseline characteristics (shown in Table 1) that were unbalanced between the migraine and matched control cohorts. This analysis yielded 14 variables that were included as covariates in the propensity score model: age (mean), sex (male, female), race and ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), marital status (married/living with partner, other), university education (4-year degree, <4-year degree), household income (<$75k, >$75k), insurance status (insured, uninsured), CCI (mean), body mass index (overweight/obese,

TABLE 1 Demographics and Health Characteristics

	Migraine frequency												
	LFEM (≤4 days) (n=1,962)		MFEM (5-9 days) (n=987)		HFEM (10-14 days) (n=554)		Chronic (≥15 days) (n=926)		Matched control (no migraine) (n=4,429)		Total (N=8,858)		
	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	*P* value
Age (years)	41.2$_a$	12.9	39.5$_b$	12.8	39.6$_{a,b}$	12.8	41.2$_a$	12.9	40.9$_a$	13.8	40.8	13.4	0.002
Sex													
Male	26.9%	528$_a$	23.8%	235$_{a,b}$	23.1%	128$_{a,b}$	21.0%	194$_b$	25.7%	1,140$_a$	25.1%	2,225	0.005
Female	73.1%	1,434$_a$	76.2%	752$_{a,b}$	76.9%	426$_{a,b}$	79.1%	732$_b$	74.3%	3,289$_a$	74.9%	6,633	
Race and ethnicity													
African American	10.1%	198$_a$	9.0%	89$_{a,b}$	9.2%	51$_{a,b}$	6.5%	60$_b$	9.9%	437$_a$	9.4%	835	<0.001
American Indian	1.0%	20$_a$	0.7%	7$_a$	0.9%	5$_a$	1.3%	12$_a$	0.6%	25$_a$	0.8%	69	
Asian	4.8%	95$_a$	4.1%	40$_a$	3.1%	17$_{a,b}$	1.6%	15$_b$	5.1%	228$_a$	4.5%	395	
Hispanic	13.4%	263$_a$	12.8%	126$_a$	15.0%	83$_a$	13.2%	122$_a$	15.1%	668$_a$	14.2%	1,262	
Non-Hispanic White	66.4%	1,303$_a$	69.8%	689$_{a,b}$	68.2%	378$_{a,b}$	72.5%	671$_b$	65.4%	2,896$_a$	67.0%	5,937	
Mixed	3.0%	59$_a$	2.8%	28$_a$	2.9%	16$_a$	3.5%	32$_a$	3.1%	137$_a$	3.1%	272	
Other	1.2%	24$_a$	0.8%	8$_a$	0.7%	4$_a$	1.5%	14$_a$	0.9%	38$_a$	1.0%	88	
Marital status													
Single/not living with partner	42.0%	825$_a$	44.8%	442$_a$	42.1%	233$_a$	46.4%	430$_a$	45.5%	2,014$_a$	44.5%	3,944	0.05
Married/living with partner	57.8%	1,135$_a$	55.2%	545$_a$	57.8%	320$_a$	53.3%	494$_a$	54.2%	2,400$_a$	55.2%	4,894	
Decline to answer	0.1%	2$_a$	0%	0^a	0.2%	1$_a$	0.2%	2$_a$	0.3%	15$_a$	0.2%	20	
Education													
Less than university education	36.4%	714$_a$	39.4%	389$_{a,c}$	41.9%	232$_{a,c}$	51.3%	475$_b$	42.8%	1,897$_c$	41.8%	3,707	<0.001
University education or higher	51.1%	1,002$_a$	47.9%	473$_{a,b}$	42.8%	237$_b$	35.0%	324$_c$	43.8%	1,942$_{b,d}$	44.9%	3,978	
Decline to answer	12.5%	246$_a$	12.7%	125$_a$	15.3%	85$_a$	13.7%	127$_a$	13.3%	590$_a$	13.2%	1,173	
Annual household income													
<$25K	15.7%	308$_a$	17.9%	177$_{a,c}$	17.9%	99$_{a,c}$	26.8%	248$_b$	19.1%	848$_c$	19.0%	1,680	<0.001
$25K to <$50K	22.0%	432$_a$	25.2%	249$_{a,b}$	27.1%	150$_{a,b}$	27.9%	258$_b$	24.9%	1,105$_{a,b}$	24.8%	2,194	
$50K to <$75K	19.5%	382$_a$	16.7%	165$_a$	19.1%	106$_a$	17.0%	157$_a$	18.6%	825$_a$	18.5%	1,635	
≥$75K	40.0%	784$_a$	37.2%	367$_{a,c}$	33.6%	186$_{a,c}$	25.2%	233$_b$	33.7%	1,493$_c$	34.6%	3,063	
Decline to answer	2.9%	56$_a$	2.9%	29$_a$	2.3%	13$_a$	3.2%	30$_a$	3.6%	158$_a$	3.2%	286	

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not overweight/obese), smoking status (current/former smoker, nonsmoker), exercise status (exercise, do not exercise), comorbid anxiety (treated, untreated, none), comorbid depression (treated, untreated, none), and region of residence (northwest, midwest, south, west). This list represents the variables that exhibited the largest differences across groups and/or the variables of most a priori relevance in relation to disability (eg, CCI as a measure of comorbidity burden, which could additively contribute to disability aside from headache frequency).

Matched Bivariate Analyses. Using recommended methods,[40] the above covariates were entered into a logistic regression model predicting the presence/absence of migraine. Respondents' regression-estimated probabilities were saved and used as propensity scores. Following a 1:1

TABLE 1 Demographics and Health Characteristics *(continued)*

	Migraine frequency												
	LFEM (≤4 days) (n=1,962)		MFEM (5-9 days) (n=987)		HFEM (10-14 days) (n=554)		Chronic (≥15 days) (n=926)		Matched control (no migraine) (n=4,429)		Total (N=8,858)		
	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	*P* value
Currently employed (FT/PT/SE)	71.5%	$1,402_{a}$	69.9%	690_{a}	67.0%	$371_{a,c}$	54.1%	501_{b}	64.0%	$2,834_{c}$	65.5%	5,798	<0.001
Currently insured	91.9%	$1,803_{a}$	90.6%	894_{a}	91.7%	508_{a}	88.9%	823_{a}	90.4%	$4,003_{a}$	90.7%	8,031	0.087
Charlson Comorbidity Index (1987)	0.5_{a}	1.0	$0.6_{a,b}$	1.1	$0.6_{b,c}$	1.2	0.7_{c}	1.2	$0.6_{b,c,d}$	1.3	0.6	1.2	<0.001
Women's health comorbidities[b]	0.7_{a}	1.0	$0.7_{a,b}$	1.1	0.8_{b}	1.1	$0.9_{b,c}$	1.2	0.4_{d}	0.8	0.6	1.0	<0.001
BMI (kg/m²)	28.1_{a}	7.8	$28.4_{a,b,d}$	7.8	$29.2_{b,c,d}$	8.2	30.0_{c}	8.5	28.8_{d}	7.9	28.8	8.0	<0.001
Uses alcohol	74.3%	$1,458_{a}$	73.2%	722_{a}	71.7%	$397_{a,c}$	60.9%	564_{b}	67.8%	$3,002_{c}$	69.3%	6,143	<0.001
Uses tobacco													
Never smoked	58.9%	$1,155_{a}$	58.8%	580_{a}	55.6%	308_{a}	54.0%	500_{a}	55.2%	$2,444_{a}$	56.3%	4,987	
Former smoker	20.0%	393_{a}	18.7%	185_{a}	21.7%	$120_{a,b}$	22.4%	$207_{a,b}$	24.3%	$1,076_{b}$	22.4%	1,981	<0.001
Current smoker	21.1%	414_{a}	22.5%	222_{a}	22.7%	126_{a}	23.7%	219_{a}	20.5%	909_{a}	21.3%	1,890	
Engages in exercise	73.8%	$1,447_{a}$	73.5%	725_{a}	71.1%	$394_{a,b}$	64.5%	597_{b}	68.1%	$3,015_{b,c}$	69.7%	6,178	<0.001
Comorbid anxiety													
Treated (Rx use)	19.8%	389_{a}	24.6%	243_{b}	28.0%	$155_{b,c}$	32.8%	304_{c}	24.2%	$1,070_{b}$	24.4%	2,161	
Untreated (no Rx use)	15.3%	300_{a}	17.8%	$176_{a,b}$	17.0%	$94_{a,b}$	21.2%	196_{b}	18.1%	$802_{a,b}$	17.7%	1,568	<0.001
No anxiety	64.9%	$1,273_{a}$	57.6%	568_{b}	55.1%	305_{b}	46.0%	426_{c}	57.7%	$2,557_{b}$	57.9%	5,129	
Comorbid depression													
Treated (Rx use)	22.5%	442_{a}	26.3%	$260_{a,c}$	26.0%	$144_{a,c}$	35.2%	326_{b}	27.1%	$1,199_{c}$	26.8%	2,371	
Untreated (no Rx use)	16.6%	326_{a}	19.7%	$194_{a,b}$	22.2%	123_{b}	23.0%	$213_{b,c}$	20.3%	$898_{b,d}$	19.8%	1,754	<0.001
No depression	60.9%	$1,194_{a}$	54.0%	533_{b}	51.8%	287_{b}	41.8%	387_{c}	52.7%	$2,332_{b}$	53.4%	4,733	
PHQ-9 score (0-27)	7.4_{a}	7.0	8.7_{b}	6.9	10.1_{c}	7.4	11.0_{c}	7.6	7.2_{a}	7.0	8.0	7.2	<0.001

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matching ratio, nearest neighbor matches were obtained using a 0.2 caliper restriction. To ensure that the matched control sample would be broadly representative of each of the migraine subgroups, 2 sets of matches were conducted: one to identify individuals from the matched control group similar to the LFEM plus MFEM migraine cohorts (n=2,949; <10 headache days per month) and a second to identify individuals from the matched control group similar to the HFEM plus CM cohorts (n=1,480; ≥10 headache days per month). These subgroups were combined into a common matched control cohort (n=4,429) for all subsequent analyses.

Standardized mean differences (SMDs) confirmed that the matched control cohort was acceptably matched to the aggregate migraine cohort (all SMDs <0.10),[41] as well as to each of the migraine frequency subgroups (all SMDs <0.25).[42,43] See Supplementary Table 1 and Supplementary Table 2 in the Supplementary Materials for further details. Analyses were performed using IBM SPSS version 25.0, SAS version 9.4, and R version 3.6.0.

Descriptive analyses were conducted. Categorical variables were reported as counts and percentages and analyzed using chi-square tests; continuous variables were reported as means±SDs and analyzed using 1-way analysis of variance tests. P values were provided for the omnibus test, and statistically significant pairwise differences between the groups were denoted using subscripts. Two-tailed P values of <0.05 were considered statistically significant.

TABLE 1 Demographics and Health Characteristics *(continued)*

	Migraine frequency												
	LFEM (≤4 days) (n=1,962)		MFEM (5-9 days) (n=987)		HFEM (10-14 days) (n=554)		Chronic (≥15 days) (n=926)		Matched control (no migraine) (n=4,429)		Total (N=8,858)		
	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	*P* value
PHQ-9 severity													
None or minimal (0-4)	44.0%	864_{a}	35.3%	348_{b}	28.9%	$160_{b,c}$	23.8%	220_{c}	45.8%	$2,028_{a}$	40.9%	3,620	<0.001
Mild depression (5-9)	24.4%	479_{a}	25.4%	251_{a}	24.5%	136_{a}	23.8%	220_{a}	23.2%	$1,026_{a}$	23.8%	2,112	
Moderate depression (10-14)	14.4%	282_{a}	18.5%	183_{b}	18.6%	$103_{a,b}$	21.6%	200_{b}	14.6%	647_{a}	16.0%	1,415	
Moderately severe depression (15-19)	9.6%	188_{a}	13.2%	130_{b}	15.3%	85_{b}	14.8%	137_{b}	9.3%	411_{a}	10.7%	951	
Severe depression (20-27)	7.6%	149_{a}	7.6%	75_{a}	12.6%	70_{b}	16.1%	149_{b}	7.2%	317_{a}	8.6%	760	
GAD-7 score (0-21)	5.8_{a}	5.7	7.0_{b}	5.7	8.3_{c}	6.4	8.4_{c}	6.3	5.7_{a}	5.7	6.3	5.9	<0.001
GAD-7 severity													
None or minimal (0-4)	51.4%	$1,008_{a}$	39.7%	392_{b}	32.5%	180_{c}	31.2%	289_{c}	51.1%	$2,265_{a}$	46.7%	4,134	<0.001
Mild anxiety (5-9)	24.8%	486_{a}	30.8%	304_{b}	29.2%	$162_{a,b}$	28.6%	$265_{a,b}$	25.2%	$1,118_{a}$	26.4%	2,335	
Moderate anxiety (10-14)	14.3%	281_{a}	16.9%	$167_{a,b}$	17.9%	$99_{a,b}$	20.5%	190_{b}	14.5%	641_{a}	15.6%	1,378	
Severe anxiety (15-21)	9.5%	$187_{a,c}$	12.6%	124_{a}	20.4%	113_{b}	19.7%	182_{b}	9.1%	405_{c}	11.4%	1,011	

Values in the same row and subtable not sharing the same subscript are significantly different at P<0.05 in the 2-sided test of equality for column proportions. Cells with no subscript are not included in the test. Tests assume equal variances. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

[a]This category is not used in comparisons because its column proportion is equal to 0 or 1.

[b]Sum of the following diagnosed conditions: breast cancer, cervical cancer, ovarian cancer, uterine cancer, endometriosis, fibroids, dysmenorrhea, heavy menstrual bleeding, hot flashes, premenstrual dysphoric disorder, and premenstrual syndrome.

BMI=body mass index; FT/PT/SE=full-time/part-time/self-employed; GAD-7=Generalized Anxiety Disorder questionnaire 7-item; HFEM=high-frequency episodic migraine; LFEM=low-frequency episodic migraine; MFEM=moderate-frequency episodic migraine; PHQ-9=Patient Health Questionnaire 9-item; Rx=prescription.

Results

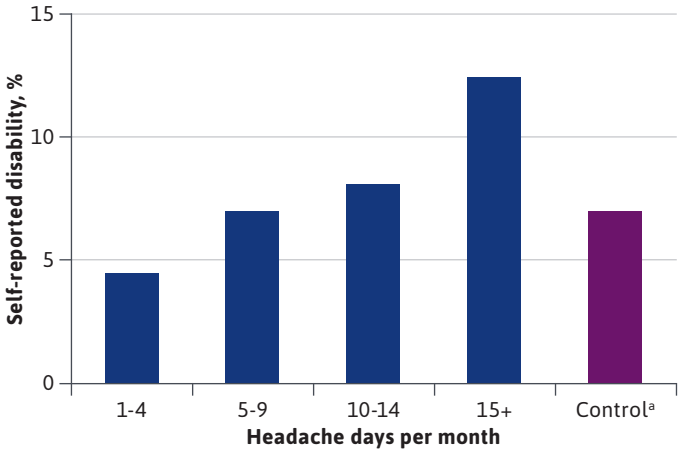
PATIENT DEMOGRAPHICS

Prematch observations in the migraine cohort (N=4,429) indicated that 44.3% experienced LFEM, 22.3% experienced MFEM, 12.5% experienced HFEM, and 20.9% experienced CM. All groups had a similar duration of illness (15.1-15.7 mean years), with the majority (60.8%; 2,660 of 4,487) of respondents having received their diagnosis more than 10 years earlier. Additional information on the self-reported clinical characteristics (eg, symptomology, treatment history) can be found in Supplementary Table 3.

Postmatch analyses, conducted after creation of the propensity-matched groups, revealed several differences between migraine cohorts relative to the matched control group. As shown in Table 1, individuals with CM were more likely to be female (79.1% [vs matched control, 74.3%]), more likely to be White (72.5% [vs matched control, 65.4%]), less likely to report completion of a 4-year degree (35.0% [vs matched control, 43.9%]), less likely to be employed (54.1% [vs matched control, 64.0%]), and more likely to earn less than $25k per year (26.8% [vs matched control, 19.2%]) (all P<0.001). Whereas CM was associated with lower socioeconomic status relative to the matched control group, individuals with LFEM were characterized by higher socioeconomic status than matched control group (completion of a 4-year degree, 51.5%; employed, 71.5%; earning <$25k per year, 15.7%) (P<0.001). MFEM and HFEM respondents did not consistently differ from the matched control group.

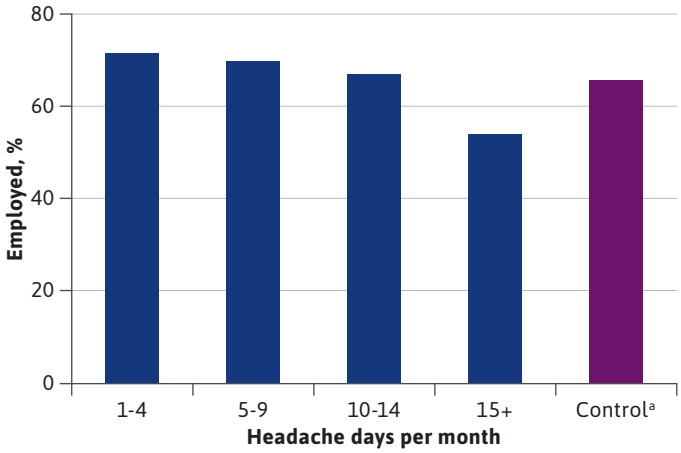
Overall health status was associated with headache frequency, with respondents reporting more frequent headaches that were associated with greater comorbidity burden (mean CCI: LFEM 0.5±1.0, MFEM 0.6±1.1, HFEM 0.6±1.2, CM 0.7±1.2, matched control 0.6±1.3; P<0.001), and more frequent self-reported diagnoses of depression (LFEM 39.1%, MFEM 46.0%, HFEM 48.2%, CM 58.2%, matched control 47.3%; P<0.001) and anxiety (LFEM 35.1%, MFEM 42.5%, HFEM 45.0%, CM 54.0%, matched control 42.3%;

FIGURE 1 Self-Reported Short- or Long-Term Disability Was Significantly Associated With Headache Frequency



[a]*Matched control group of respondents.*

FIGURE 2 Self-Reported Employment Participation Was Significantly Associated With Headache Frequency



[a]*Matched control group of respondents.*

P<0.001). Headache frequency was also positively associated with the severity of one's depression and anxiety, as measured by the PHQ-9 (LFEM 7.4±7.0, MFEM 8.7±6.9, HFEM 10.1±7.4, CM 11.0±7.6, matched control 7.2±6.9; P<0.001) and GAD-7 (LFEM 5.8±5.7, MFEM 7.0±5.7, HFEM 8.3±6.4, CM 8.4±6.3, matched control 5.7±5.7; P<0.001) scores. Given that more than 70% of our sample was female, we examined diagnoses specific to women's health, including breast, cervical, ovarian, and uterine cancer, endometriosis, fibroids, dysmenorrhea, heavy menstrual bleeding, hot flashes, premenstrual dysphoric disorder, and premenstrual syndrome. Although infrequently reported, these diagnoses were more frequently reported by women with migraine compared with the matched control population, at proportions approximately 2-fold higher among those with CM and HFEM (mean number of diagnosed women's health conditions: LFEM 0.7±1.0, MFEM 0.7±1.1, HFEM 0.8±1.1, CM 0.9±1.2, matched control 0.4±0.8; P<0.001) (Table 1).

Employment Status. As shown in Figure 1, headache frequency was higher in respondents who self-reported short- or long-term disability, which was reported roughly twice as often among those with CM, relative to the matched control group (LFEM 4.4%, MFEM 6.4%, HFEM 7.9%, CM 12.3%, matched control 6.9%; P<0.001). Interestingly, reports of short- or long-term disability among those with LFEM were significantly lower than that observed in the matched control group (P<0.05). This finding was true whether the LFEM cohort was compared with the matched control cohort propensity matched to the overall migraine cohort or with the subset matched control cohort that was propensity matched to LFEM/MFEM cohorts (data available on request). Consistent with this observation, the likelihood of being employed was lower in respondents reporting higher migraine frequency (Figure 2).

MIDAS scores evaluating migraine-related disability were also higher in respondents reporting greater headache frequency (LFEM 11.4±17.7, MFEM 22.5±27.5, HFEM 33.1±37.3, CM 56.5±58.5; P<0.001) (Table 2), with 49.5% and 64.0% of respondents with HFEM and CM, respectively, being classified as having the most severe level of disability measured by the instrument.

The percentage of individuals who reported either short- or long-term disability represented only a small fraction of respondents (13.9% [614 of 4,429 total migraine cohort]), compared with those who were classified as disabled by MIDAS score (34.2% [1,516 of 4,429 total migraine cohort]) (Figure 3). Whereas 14.5% of respondents with LFEM were characterized as severely disabled according to MIDAS, only 4.4% of this group self-reported having employment status as short- or long-term disability. This disparity was magnified by increased headache frequency (frequency of severe disability by MIDAS vs frequency of self-reported short- or long-term disability observed in the sample: MFEM 36.9% vs 6.4%, HFEM 49.5% vs 7.9%, CM 64.0% vs 12.3%).

TABLE 2 Migraine-Related Disability

	Migraine frequency (includes HFEM)												
	LFEM (≤4 days) (n=1,962)		MFEM (5-9 days) (n=987)		HFEM (10-14 days) (n=554)		Chronic (≥15 days) (n=926)		Matched control (no migraine) (n=4,429)		Total (N=8,858)		
	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	% or mean	N or SD	*P* value
Disability-related unemployment: employment													
Employed full-time	54.9%	$1,078_{a}$	50.4%	$497_{a,b}$	45.5%	252_{b}	34.1%	316_{c}	45.9%	$2,034_{b,d}$	47.2%	4,177	
Self-employed	6.7%	132_{a}	8.2%	81_{a}	9.2%	51_{a}	8.4%	78_{a}	7.2%	321_{a}	7.5%	663	
Employed part-time	9.8%	192_{a}	11.3%	112_{a}	12.3%	68_{a}	11.6%	107_{a}	10.8%	479_{a}	10.8%	958	
Homemaker	7.5%	147_{a}	9.2%	$91_{a,b}$	9.6%	$53_{a,b}$	12.3%	114_{b}	8.5%	376_{a}	8.8%	781	
Retired	6.7%	132_{a}	3.5%	35_{b}	4.3%	$24_{a,b}$	5.2%	$48_{a,b}$	6.4%	282_{a}	5.9%	521	
Student	4.13%	81_{a}	4.4%	$43_{a,b}$	4.3%	$24_{a,b}$	6.8%	63_{b}	6.2%	$273_{b,c}$	5.5%	484	<0.001
Disability (long-term or short-term)	4.4%	86_{a}	6.4%	$63_{a,b,d}$	7.9%	$44_{b,c,d}$	12.3%	114_{c}	6.9%	307_{d}	6.9%	614	
Not employed but looking for work	4.9%	97_{a}	5.2%	51_{a}	5.8%	32_{a}	6.2%	57_{a}	6.4%	282_{a}	5.9%	519	
Not employed and not looking for work	0.9%	17_{a}	1.4%	$14_{a,b}$	1.1%	$6_{a,b}$	3.1%	29_{b}	1.7%	75_{a}	1.6%	141	
Disability: MIDAS grade													
Grade 1: little or no disability (0-5)	46.5%	913_{a}	24.6%	243_{b}	18.6%	103_{c}	16.2%	150_{c}	NA	NA	31.8%	1,409	
Grade 1: mild disability (6-10)	19.5%	382_{a}	14.6%	144_{b}	9.7%	54_{c}	5.1%	47_{d}	NA	NA	14.2%	627	<0.001
Grade 3: moderate disability (11-20)	19.5%	382_{a}	23.9%	236_{b}	22.2%	$123_{a,b}$	14.7%	136_{c}	NA	NA	19.8%	877	
Grade 4: severe disability (21+)	14.5%	285_{a}	36.9%	364_{b}	49.5%	274_{c}	64.0%	593_{d}	NA	NA	34.2%	1,516	
Disability: MIDAS score	11.4[a]	17.7	22.5_{b}	27.5	33.1_{c}	37.3	56.5_{d}	58.5	NA	NA	26.0	38.7	<0.001

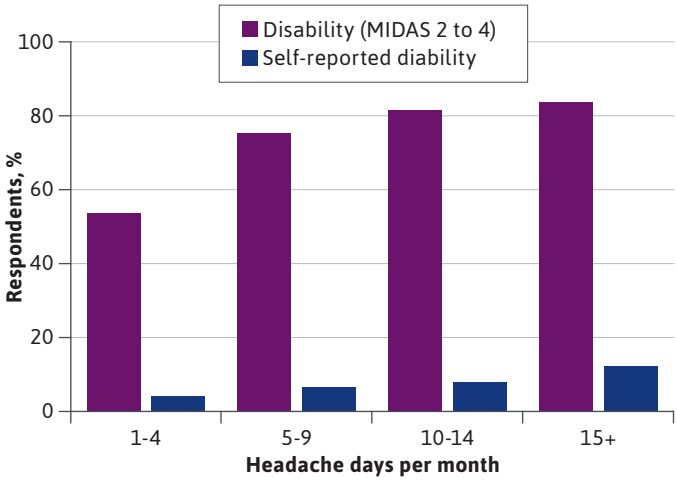
Values in the same row and subtable not sharing the same subscript are significantly different at P<0.05 in the 2-sided test of equality for column proportions. Cells with no subscript are not included in the test. Tests assume equal variances. Tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction.

HFEM=high-frequency episodic migraine; LFEM=low-frequency episodic migraine; MFEM=moderate-frequency episodic migraine; MIDAS=Migraine Disability Assessment; NA=not applicable.

Discussion

In this study, we examined the relationship between headache frequency and unemployment, in which the NHWS captured survey data from individuals who self-reported a diagnosis of migraine from a health care professional. We found that those experiencing more than 15 headache days per month were nearly 3 times more likely to report their employment status as disabled as those with fewer than 4 headache days per month. They were also nearly twice as likely to report a disabled status compared with the matched control group sample, which also reported some disability potentially because of other comorbidities. We also examined the relationship between self-reported short- and long-term disability and overall disability as quantified by the MIDAS questionnaire. Our results indicate that both self-reported short- and long-term disability and MIDAS disability tended to be higher in those respondents reporting greater migraine frequency; however, nearly 3 times more people living with migraine are classified as disabled via MIDAS scores as are those self-reporting employment-related disability. Overall, the data suggest that people with CM are more likely to report unemployment because of their disease status.

FIGURE 3 **The Frequency of Short- or Long-Term Disability and Disability (MIDAS Scores 2-4) Reported Among Adults With Migraine Was Strikingly Disparate, Despite Both Being Positively Associated With Headache Frequency**



MIDAS = Migraine Disability Assessment.

The disparity between the frequency of MIDAS-assessed severe disability and the self-reported short- and long-term disability suggests that many people living with CM continue to work despite impairments due to perceived or actual barriers to entitlements or accommodations.[20] However, people living with migraine might gravitate toward occupations or employers in which accommodations can be made for the challenges faced. Alternatively, people living with migraine may develop coping skills to maintain their employment despite significant disability, or they may have encountered specific legal barriers associated with qualifying for work-related medical disability benefits due to migraine.[44,45] In a tight labor market, efforts to reduce headache days among those with migraine can add to the pool of available employees and, therefore, benefit not only the employee but also employers in the United States. Finally, stigma associated with migraine may contribute to the underreporting of short- and long-term disability (and/or failure to seek work-related medical disability benefits).[45,46] Inability to work has been shown to be the strongest predictor of stigma in migraine[47]; therefore, our findings indicate that exploring the discordance between MIDAS-assessed disability and short- and long-term employment disability might illuminate the impact of this stigma.

An association between poor measures of health with more frequent headaches was observed across study measures that impact disability as defined by self-reported short- and long-term disability and MIDAS. Among adults with migraine, more frequent headaches were associated with higher CCI scores. Anxiety and depression were more prevalent and more severe among women with more frequent headaches (Table 1). Consistent with other epidemiological research, we found higher headache frequency and more coexisting health conditions among cisgender women, including amenorrhea, gynecologic malignancies, and uterine fibroids. The complete extent of this relationship is unclear, but it may warrant synthesis of a specific morbidity index for research in women with migraine. Given the disproportionately higher prevalence of migraine in women,[48,49] and the role of the female sex hormones in migraine (including menstrual-related migraine, menstrual migraine, and pure menstrual migraine),[50,51] we explored the relationship between migraine and female-exclusive morbidities.[52,53] We found higher headache frequency among female respondents who had female-exclusive comorbidities, such as amenorrhea, gynecologic malignancies, and uterine fibroids, compared with the matched control group.

We observed several differences between the HFEM and CM cohorts, namely a higher frequency of self-reported short- and long-term disability and a substantially higher rate of severe disability as measured by MIDAS score. HFEM seemed to represent an inflection point in this sample after which there was a dramatic increase in rate of self-reported disability, potentially suggesting that HFEM should not be included in the expanded definition of CM.[54] Prior work has debated the need to distinguish between HFEM and CM respondents, with some studies reporting that 10 headache days per month is substantially burdensome to individuals with migraine, questioning the merits of a threshold of at least 15 headache days.[31] Others have documented concerns around widening the definition of CM.[54] Our findings provide additional evidence that supports early intervention to halt the transition from acute to CM with the goal of preserving function. However, given the cross-sectional nature of the study design, future studies should continue to explore patterns of burden by frequency of headache to discern the potential for the benefits of early intervention.

A wholly novel observation from our analyses was that, relative to the matched control group, individuals with LFEM were less likely to report short- or long-term disability and were more likely to report being currently employed; these results appear to reflect a higher socioeconomic

status among those with LFEM than individuals without migraine in the propensity-matched control cohort. Sensitivity analyses confirmed that this difference in disability status between LFEM and the matched control group persisted after accounting for potential confounders, such as comorbidity burden (CCI) and mental health diagnoses (anxiety and depression). Although speculative, this finding is consistent with patients with LFEM developing coping strategies that confer resilience over time, potentially contributing to greater self-management of symptoms and thus a reduction in short- or long-term disability. Future studies should examine the degree to which headache frequency relates to psychological resilience, and how resilience moderates the degree of self-reported severity and symptomology among adults with migraine. Additionally, it would be interesting to determine whether disability scores would be different if patients were on prophylaxis for migraine; therefore, stratifying study data according to the migraine treatment/prophylaxis status should be included in a future study.

LIMITATIONS

There are several limitations to this analysis. First, these data are self-reported and thereby subject to response bias. Although all respondents were asked whether they had been diagnosed with migraine by a health care provider, we could neither ascertain the diagnosis based on symptom frequency and severity nor fully exclude the presence of other overlapping or confounding headache disorders. Similarly, all treatment information was self-reported; therefore, we could not determine the quality of care received or whether respondents adhered to their prescribed regimens. Second, the migraine case definition in this study differs from the ICHD-3 criteria, as the migraine frequency categorization was based on headache days over the previous month, and patients with CM were not required to have at least 8 migraine days. Further, all respondents who reported having had migraines were required to have experienced at least 1 migraine attack in the past month; this feature of the study design may have biased our sample toward more serious cases, especially regarding a lower estimated prevalence of adults with LFEM and a higher estimated prevalence of adults with CM.[55] In addition, self-reported short- and long-term employment disability was evaluated in the context of general employment and was not specific to migraine alone; thus, although our results demonstrate that employment disability is higher in respondents with greater headache frequency, we cannot rule out the contribution of comorbidities (other than migraine) that may mediate this relationship. Moreover, we assumed that those who selected short-term or long-term disability self-assessed that they were unable to work for some period of time because of impairments related to migraine or other existing comorbidities; however, the type, duration, and extent of employment disability are unknown. Although we presume that this measure of employment disability is a reasonable proxy for those who would be eligible for disability benefits, we had no information on patients' benefit status or the etiology of their qualification for benefits in this survey. These considerations aside, there appears to be little incentive to misrepresent one's disability status in a large, anonymized survey like the NHWS, and many reasons to believe that a person living with migraine is the best authority to legitimately comment on their condition and the limitations that it places on their functioning, including the domain of employment. Likewise, any biases relating to self-report are likely systematically distributed across all respondents and unlikely to account for the incremental differences observed here across migraine frequency subgroups. Lastly, respondents were matched on several demographic and health characteristics, and we were able to confirm that the study cohorts were adequately balanced on these potential confounders; nevertheless, cohorts could not be matched on all possible variables on which there may be preexisting baseline differences, and the observed results may thus be influenced, at least in part, by unmeasured variables.

Conclusions

In this study, we found that more frequent migraine headaches were associated with a higher likelihood of unemployment in terms of self-reported short- or long-term disability. This finding can inform policy approaches for reducing the burden associated with impairment and maximizing the employment opportunities of people living with migraine in our society who may benefit from novel preventive treatments. Future research should also evaluate the association between resilience and disease characteristics for employed individuals with migraine.

DISCLOSURES

Robert E Shapiro is a research consultant for Eli Lilly and Lundbeck. Ashley A Martin and Martine C Maculaitis are employees of Cerner Enviza (formerly Kantar Health), which received payment from Lundbeck to conduct the research. Shiven Bhardwaj was an employee of Lundbeck at the time of study and manuscript development. Heather Thomson and Carlton Anderson are employees of Lundbeck. Steven M Kymes is an employee and stockholder of Lundbeck. Financial support for research conducted and manuscript preparation was provided by Lundbeck.

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