

RESEARCH SUBMISSION

Barriers to care in episodic and chronic migraine: Results from the Chronic Migraine Epidemiology and Outcomes Study

Dawn C. Buse PhD¹ | Cynthia E. Armand MD¹ | Larry Charleston IV MD, MSc² |
Michael L. Reed PhD³ | Kristina M. Fanning PhD³ | Aubrey Manack Adams PhD⁴ |
Richard B. Lipton MD¹

¹Department of Neurology, Albert Einstein College of Medicine, Bronx, NY, USA

²Department of Neurology, University of Michigan, Ann Arbor, MI, USA

³Department of Outcomes Research, Vedanta Research, Chapel Hill, NC, USA

⁴Department of US Medical Affairs, AbbVie, Irvine, CA, USA

Correspondence

Dawn C. Buse, Department of Neurology, Albert Einstein College of Medicine, 1300 Morris Park Avenue, Van Etten Building Room 3C9B, Bronx, NY 10461, USA.
Email: DBUSE@montefiore.org

Funding information

This study was sponsored by Allergan (prior to its acquisition by AbbVie)

Abstract

Objective: To assess rates of and factors associated with traversing fundamental barriers to good medical outcomes and pharmacologic care in individuals with episodic migraine (EM) and chronic migraine (CM), including socioeconomic status and race.

Background: Barriers to good outcomes in migraine include the lack of appropriate medical consultation, failure to receive an accurate diagnosis, not being offered a regimen with acute and preventive pharmacologic treatments (if indicated), and not avoiding medication overuse.

Methods: The Chronic Migraine Epidemiology and Outcomes (CaMEO) Study was a longitudinal Internet-based survey. Respondents who met criteria for migraine consistent with the International Classification of Headache Disorders, 3rd edition, had a Migraine Disability Assessment score ≥ 6 , and provided health insurance coverage status were included in this analysis. Successfully traversing each barrier to care and the effects of sociodemographic characteristics were examined.

Results: Among 16,789 respondents with migraine, 9184 (54.7%; EM: 7930; CM: 1254) were eligible. Current headache consultation was reported by 27.6% (2187/7930) of EM and 40.8% (512/1254) of CM respondents. Among consulters, 75.7% (1655/2187) with EM and 32.8% (168/512) with CM were accurately diagnosed. Among diagnosed consulters, 59.9% (992/1655) with EM and 54.2% (91/168) with CM reported minimally appropriate acute and preventive pharmacologic treatment. Among diagnosed and treated consulters, in the EM group 31.8% (315/992) and in the CM group 74.7% (68/91) met medication overuse criteria. Only 8.5% (677/7930) of EM and 1.8% (23/1254) of CM respondents traversed all four barriers. Higher income was positively associated with likelihood of traversing each barrier. Blacks and/or African Americans had higher rates of consultation than other racial groups. Blacks and/or African Americans and multiracial people had higher rates of acute medication overuse.

Abbreviations: AMPP, American Migraine Prevalence and Prevention; AMS, American Migraine Study; CaMEO, Chronic Migraine Epidemiology and Outcomes; CM, chronic migraine; ED, emergency department; EM, episodic migraine; HCP, health care professional; ICHD-3, International Classification of Headache Disorders, 3rd edition; MIDAS, Migraine Disability Assessment; NSAID, nonsteroidal anti-inflammatory drug; UC, urgent care.

Conclusions: Efforts to improve care should focus on increasing consultation and diagnosis rates, improving the delivery of all appropriate guideline-based treatment, and avoidance of medication overuse.

KEYWORDS

consultation, headache, health services accessibility, missing diagnosis, prescription drug overuse, socioeconomic factors

INTRODUCTION

Migraine is a prevalent, chronic neurologic disease characterized by attacks of headache pain often accompanied by sensitivity to light and/or sound, and/or nausea in various combinations.¹ The prevalence of migraine is higher in women than in men, and increases as socioeconomic status measured by household income declines.²⁻⁵ The prevalence of migraine is higher in Whites than in Blacks and/or African Americans after adjusting for socioeconomic status and other variables.⁶⁻⁹ Studies that did not adjust for socioeconomic status found that the age-adjusted prevalence is highest in Native Americans; similar among Whites, Blacks and/or African Americans, and Latinx people; and lowest in Asians.^{3,4} Migraine can be disabling and is associated with a negative impact on all aspects of life, including physical and mental health, relationships, career, and financial well-being.^{7,10-12} The Global Burden of Disease study has shown that migraine is one of the leading causes of years lived with disability worldwide.^{13,14} The severity of migraine-associated disability has not been shown to be independently related to race or income.^{2,15} However, sociodemographic differences in migraine diagnosis and treatment patterns indicate that these factors may impact the likelihood of receiving appropriate care for migraine.^{4,16,17}

Individuals with migraine who experience fewer than 15 headache days per month are considered to have episodic migraine (EM).¹ Chronic migraine (CM) is defined as headache occurring on 15 or more days per month for more than 3 months, with the features of migraine on at least 8 days/month.¹ CM comprises approximately 8% of the migraine population and is associated with higher levels of disability.¹⁸ In the American Migraine Prevalence and Prevention (AMPP) study, unadjusted analyses showed that the prevalence of CM was highest among Blacks and/or African Americans, Latinx people, and individuals with the lowest household income.¹⁸ However, only household income was significantly associated with prevalence of CM after multivariable adjustment.¹⁸

Acute treatments for migraine aim to relieve pain and restore function, while preventive treatments are designed to reduce the frequency, severity, and duration of attacks.¹⁹⁻²¹ Migraine-specific acute and preventive medications are available by prescription in the United States. Poor optimization of acute treatments has been associated with increased disability and risk of disease progression from EM to CM.²² In addition, poorly optimized acute treatment combined with anxiety, lack of education, and lack of preventive behavioral and lifestyle therapies may lead to overuse of acute medications,²³

which is, in turn, associated with increased risks of migraine progression, greater headache-related disability, and comorbid anxiety and depression.²⁴⁻²⁶

Good medical care for people with migraine minimally requires that individuals seek care from a health care professional (HCP) knowledgeable in the management of migraine, receive an accurate diagnosis, and receive an individualized treatment plan with evidence-based and guideline-appropriate acute pharmacologic treatment, and preventive pharmacologic treatment, if indicated, as well as lifestyle education and other evidence-based, guideline-recommended therapies (e.g., behavioral interventions, neurostimulation) as appropriate.^{16,27} The current study focused on pharmacologic treatments.

Individuals with migraine who do receive appropriate acute treatment may be at risk for medication overuse and medication overuse headache,²³ especially if not given appropriate guidance on the parameters for limiting acute medication use and the potential for negative outcomes associated with medication overuse. Overuse of over-the-counter analgesics used for acute treatment of migraine may contribute to medication overuse headache.^{1,28} Avoidance of medication overuse is another component of good care. Effective care requires that individuals with migraine traverse each step of a multistep process successfully, from consultation and diagnosis to treatment and avoidance of medication overuse. Failure at any step is a barrier to adequate care and makes positive outcomes less likely.

Previous studies have evaluated rates of traversing “barriers” to diagnosis and treatment successfully among individuals with EM¹⁷ or CM¹⁶ independently, but none have compared rates in the overall migraine population or between these two subgroups of migraine in the same sample. In addition, prior studies did not consider preventive treatment for those with EM who met criteria for preventive treatment, nor did they assess avoidance of acute medication overuse as a barrier, or the impact of sociodemographic factors on the likelihood of traversing barriers. Race, ethnicity, and socioeconomic status have been shown to be associated with differences in migraine care,^{17,29} and thus are important factors when evaluating barriers to good care in individuals with migraine.

We hypothesized that individuals with EM and CM who have unmet treatment needs encounter multiple barriers to good care. To further understand the barriers to appropriate pharmacologic migraine treatment in the United States, data from the Chronic Migraine Epidemiology and Outcomes (CaMEO) Study were analyzed. To define a population with unmet treatment needs, the analysis focused

on individuals who had at least mild migraine-related disability on their current treatment. The objective of this analysis was to estimate the proportion of individuals with migraine who had unmet treatment needs and traversed each of four prespecified barriers to care, including: (1) current medical consultation with an HCP, (2) accurate migraine diagnosis, (3) receipt of minimally appropriate acute and preventive pharmacologic treatment (if indicated), and (4) absence of acute medication overuse. As the likelihood of traversing these barriers is unlikely to be uniform across the US population, the potential impact of sociodemographic factors, including race and ethnicity, on traversing each of these barriers was also evaluated.

METHODS

Study design

The CaMEO Study (ClinicalTrials.gov identifier: NCT01648530) was a longitudinal Internet-based survey designed to characterize the course of migraine over 1 year in a broad cohort of respondents sampled to be demographically representative of the US population. Details of the study design have been published.³⁰ Between September and October 2012, participants were screened and recruited from an Internet research panel (Research Now, renamed Dynata [https://www.dynata.com], Plano, Texas, USA) with 2.4 million active US members. In addition to longitudinal assessments completed every 3 months over 15 months, the study included a series of cross-sectional surveys assessing health care use, family burden, and comorbidities or endophenotypes. The current analysis evaluated data from the Screening, Core, and Barriers to Care modules, which were administered at baseline. The Screening Module was a brief survey capturing headache information and demographics. The Core Module included assessments of migraine treatments, treatment satisfaction, and health care resource utilization. The Barriers to Care Module assessed types and patterns of medical consultation, reasons for consultation, self-reported medical diagnosis, and treatment availability and utilization in respondents who were appropriately diagnosed. Together, the Screening, Core, and Barriers to Care modules were completed by respondents in a median time of 38 min. The CaMEO Study was approved by the Albert Einstein College of Medicine Institutional Review Board (12-04-177E). The institutional review board waived written informed consent for study volunteers, who had the right to accept or refuse participation in the survey. All authors had full access to all data from the survey.

Study population

The CaMEO Study used quota sampling to recruit a demographically representative sample of the US population based on age, sex, and income.³⁰ Eligible respondents were adults (aged ≥ 18 years) who agreed to participate, completed initial surveys within a reasonable time frame (at least 10 min), reported consistent age and sex throughout the survey, provided data on headache frequency,

and met criteria for migraine consistent with the International Classification of Headache Disorders, 3rd edition (ICHD-3)¹ based on the validated American Migraine Study (AMS)/AMPP study migraine diagnostic screener.⁶ (Note: the AMS/AMPP diagnostic module was based on ICHD-2 migraine criteria,^{30,31} but no significant changes occurred between ICHD-2,³¹ ICHD-3-beta,³² and the final ICHD-3¹ criteria related to the classification of migraine in this study). The survey was Internet-based, potentially precluding participation by individuals without access to a computer and the Internet. Migraine was classified as EM or CM using monthly headache day criteria (headache frequency of fewer than 15 days [EM] or at least 15 days [CM] per month over the preceding 3 months).^{1,33} The analysis population for this study included only eligible respondents who had evidence of migraine-related disability (Migraine Disability Assessment [MIDAS] score ≥ 6)³⁴ and provided a valid response to the health insurance coverage question (yes or no). The health insurance question (Table S1) had six response options for which the respondent could endorse any type of health insurance coverage (doctor, hospital, prescription, or other) to be considered as having insurance. Participants who responded "don't know or prefer not to answer" were excluded from this analysis. Participant-reported race, ethnicity, and annual household income were determined based on responses to questions in the Screener Module shown in Table S1.

Defining barriers to care

The primary outcomes of the current analysis were the proportions of migraine respondents who reported consultation for headache with a prespecified prescribing HCP (Barrier 1), reported receiving an accurate migraine diagnosis (Barrier 2), reported receiving minimally appropriate acute and preventive pharmacologic treatment for migraine (Barrier 3), and reported acute medication use frequency below criteria for medication overuse (Barrier 4). Criteria for traversing each barrier to care were differentially defined for EM and CM respondents.

Barrier 1: HCP consultation

Consultation for headache was evaluated based on responses to the following question: "What type of doctor is currently managing or treating your headaches?" A complete list of possible responses is in Table S2. For respondents with EM and respondents with CM, successfully traversing the consulting barrier required endorsing any of the following HCPs who were identified as those most likely and well suited for ongoing headache care: general practitioner, family physician, internal medicine doctor, nurse practitioner, physician assistant, neurologist, pain specialist, headache specialist, or obstetrician-gynecologist. We acknowledge that clinicians in other specialties may be exceptionally skilled in the diagnosis and treatment of headache disorders, and no disrespect to these fine

clinicians is intended. We did not include HCPs in emergency department (ED) or urgent care (UC) settings or non-prescribing HCPs as target providers.

Barrier 2: Diagnosis

Accurate diagnosis was evaluated based on respondents' selections from a list of headache types in response to the following question: "Have you ever been diagnosed by a doctor or other health professional with any of the following types of headaches?" Respondents were instructed to select all applicable options from the list (Table S3). A fictional response option of "citriene headache" was included to identify inaccurate patterns of responding. Accurate diagnosis was defined as a response of migraine for respondents with EM and as a response of "CM or transformed migraine" or "chronic daily headache" for respondents with CM.

While some may consider a diagnosis of "migraine" as adequate for persons with CM, we made the judgment that recognition of CM is needed for adequate management. We do report the proportion of respondents with CM diagnosed with "migraine" for full transparency.

Barrier 3: Minimally appropriate pharmacologic treatment

Appropriate acute pharmacologic treatment

Minimally appropriate acute pharmacologic treatment was evaluated based on selections from a list of medications in response to the question: "Which of these medications (if any) are you currently using (or typically keep on hand) to treat your headaches when you have them?" (Table S4). For respondents with EM and respondents with CM, minimally appropriate acute pharmacologic treatment was defined as a response of any prescription nonsteroidal anti-inflammatory drug (NSAID), triptan, ergotamine derivative, or isometheptene.

Appropriate preventive pharmacologic treatment

Characterizing appropriate use of preventive medications in people with EM is not straightforward because not all individuals with EM need preventive treatment. In this analysis of individuals with at least mild disability per MIDAS, we conservatively required that respondents with EM who reported eight or more monthly headache days should have received preventive treatment. All respondents with CM were required to report receiving preventive treatment. Minimally appropriate preventive pharmacologic treatment was determined based on respondents' selections for two questions about treatments taken to prevent or reduce the frequency of headaches (Table S4). Appropriate preventive treatments included guideline-approved, data-supported traditional oral preventive medications, including a range of anti-seizure medications, anti-depressants

(including doxepin, duloxetine, venlafaxine, amitriptyline, imipramine, nortriptyline, and desvenlafaxine; escitalopram oxalate, sertraline, fluoxetine, and paroxetine were not included as acceptable preventive medications), blood pressure medications, and toxin injections. Behavioral and neuromodulatory therapies were not included as "appropriate" preventive or acute treatments, not because the authors do not consider them "appropriate," but because they were not highly endorsed in our sample and including them would have added additional complexity to the analyses (Table S5).

Barrier 4: Avoidance of medication overuse

Medication overuse was operationalized using ICHD-3 criteria¹ for overuse of a single acute medication class and combined overuse of multiple acute medication classes. Respondents with EM and respondents with CM were considered to have medication overuse if they reported use of any over-the-counter or prescription naproxen sodium, aspirin, ibuprofen, acetaminophen, or prescription NSAID on 15 or more days per month; any ergotamine derivative, triptan, opioid, or combination analgesic on 10 or more days per month; two or more classes of medication (ergotamine, triptans, non-opioid analgesics, opioids) with cumulative use on 10 or more days per month; or two or more non-opioid analgesics (acetaminophen, aspirin, NSAID, or other) with cumulative use on 15 or more days per month. Questions and responses used to assess medication overuse are shown in Table S4.

Statistical analysis

Frequencies and percentages were computed for baseline categorical and ordinal scale sociodemographic variables (sex, race, ethnicity, income, marital status, employment status, education level, and health insurance coverage). Means and standard deviations were calculated for interval (body mass index) and ratio-scaled variables (age). Sociodemographic characteristics were compared between respondents with EM versus CM using Pearson's chi-squared test for categorical variables and independent samples *t*-test for continuous variables. The frequency and percentage of respondents traversing each barrier was computed in total, among those screening as having EM or CM, and by sociodemographic variables (sex, race, ethnicity, annual household income, and health insurance coverage) in the total population. The relationship between sex, ethnicity, and likelihood of traversing each barrier to care was assessed using Pearson's chi-squared test. The relationship between annual income and traversing each barrier was assessed with a chi-square test for trend. The threshold for statistical significance was 0.05. No formal sample size calculations were performed. All statistical tests were two-tailed and were not adjusted for multiple comparisons. All analyses were performed using IBM SPSS Statistics version 24.0 (IBM, Armonk, NY; 2011).

RESULTS

Analysis population and sociodemographics

A total of 489,537 respondents were invited to participate in the CaMEO Study, of whom 16,789 qualified for inclusion and completed the Screening, Core, and Barriers to Care modules at baseline.³⁰ Of the 16,789 respondents with migraine, 9184 (54.7%) had migraine-related disability (MIDAS score ≥ 6 ; at least mild disability) and had valid health insurance data (Figure 1). Of this subgroup, 7930 (86.3%) respondents met criteria for EM, and 1254 (13.7%) met criteria for CM. Demographic and socioeconomic characteristics are shown for respondents with EM and CM and overall in Table 1. Individuals with CM in comparison to those with EM were more likely to be older (mean age: 41.0 vs. 39.6 years; $p = 0.001$), female (83.0% vs. 79.0%; $p = 0.001$), and White (84.5% vs. 79.1%; $p < 0.001$). The CM group also had higher mean body mass index (29.8 kg/m² vs. 28.9 kg/m²; $p < 0.001$), a lower rate of full- or part-time employment (56.8% vs. 67.1%; $p < 0.001$), and higher rates of less than a 4-year college degree (64.8% vs. 55.6%; $p < 0.001$) and annual household income less than \$75,000 (72.6% vs. 64.6%; $p < 0.001$). The majority of respondents with EM (86.2%) or CM (84.1%) had health insurance coverage ($p = 0.048$). The proportion of insured respondents was similar across race and ethnicity categories (data not shown). Races reported by the respondents included in the “other” and “2 or more races” categories are shown in Table S6.

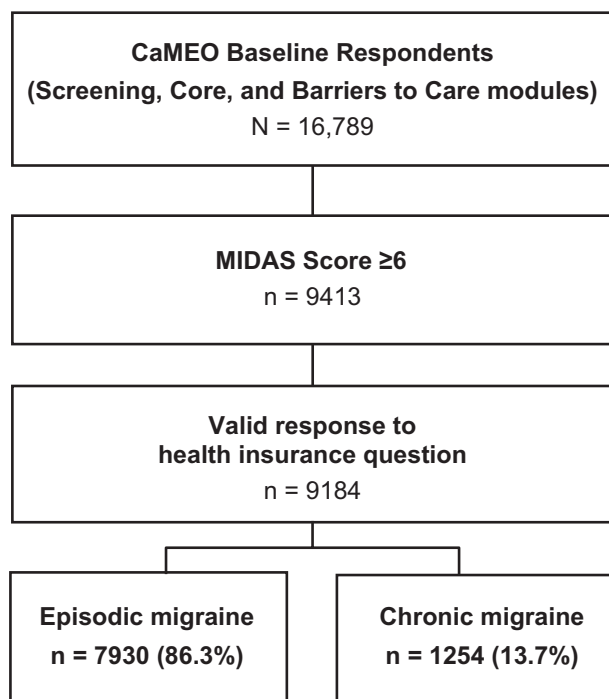


FIGURE 1 Analysis population. CaMEO, Chronic Migraine Epidemiology and Outcomes; MIDAS, Migraine Disability Assessment

Barriers to care

Barrier 1: HCP consultation

Successfully traversing the consulting barrier was achieved by 2699 (29.4%) of 9184 respondents overall (Figure 2; Table 2). Greater proportions of respondents with CM (40.8% [512/1254]) than with EM (27.6% [2187/7930]) reported consultation with an “appropriate” provider. Among 202 respondents who consulted other HCPs for headache, the most commonly endorsed providers were ear, nose, and throat specialists (22.3% [45/202]) and allergists (16.3% [33/202]; Table S7). We contextualize this finding in the Discussion.

Barrier 2: Accurate diagnosis

Among respondents who successfully traversed the previous barrier to care (i.e., consultation), 67.5% (1823/2699) reported an accurate diagnosis based on their migraine classification (EM or CM; Figure 2). Consulters with EM were more likely to have received an accurate diagnosis than those with CM (75.7% [1655/2187] vs. 32.8% [168/512]). Among 532 respondents with EM who had not been accurately diagnosed, the most commonly reported diagnoses were sinus headache (49.1% [261/532]), stress headache (43.8% [233/532]), and tension-type headache (31.4% [167/532]) (Table 3). Among 344 respondents with CM without an accurate diagnosis, the most common diagnoses were migraine (78.5% [270/344]), sinus headache (47.4% [163/344]), stress headache (45.6% [157/344]), and tension-type headache (37.8% [130/344]) (Table 3). If we considered migraine a correct diagnosis in those with CM, the overall proportion with an accurate diagnosis would be 85.5% (438/512).

Overall, 1823 (19.8%) of 9184 respondents successfully traversed barriers to current consulting and accurate diagnosis (Figure 2). Within migraine subgroups, 1655 (20.9%) of 7930 respondents with EM versus 168 (13.4%) of 1254 with CM traversed the barriers to consulting an HCP and receiving an accurate diagnosis.

Barrier 3: Minimally appropriate acute and preventive pharmacologic treatment

Among all respondents who successfully traversed the first two barriers to care (consultation and diagnosis), 1246 (68.3%) of 1823 respondents reported receiving the minimally appropriate acute pharmacologic treatment. Rates of appropriate acute pharmacotherapy were 68.5% (1133/1655) for EM and 67.3% (113/168) for CM. Although everyone with CM needs preventive treatment, only 75.6% (127/168) had received appropriate preventive pharmacologic treatment. Among those with EM, 409 (24.7%) of the 1655 diagnosed consulters met criteria for needing preventive treatment. Of those individuals, 195 (47.7%) of 409 received preventive pharmacologic treatment. Pooling the EM and CM participants, 322 of 577 (55.8%) diagnosed consulters with migraine

TABLE 1 Demographics and socioeconomic characteristics at screening

Characteristic	Episodic migraine (n = 7930)	Chronic migraine (n = 1254)	Total (N = 9184)	p value
Age, mean (SD), years	(n = 7930) 39.6 (13.4)	(n = 1254) 41.0 (13.4)	(n = 9184) 39.8 (13.4)	0.001 ^a
Sex, n (%)	(n = 7930)	(n = 1254)	(n = 9184)	
Female	6265 (79.0)	1041 (83.0)	7306 (79.6)	0.001 ^b
Male	1665 (21.0)	213 (17.0)	1878 (20.4)	
Race, n (%) ^c	(n = 7907)	(n = 1249)	(n = 9156)	<0.001 ^b
White only	6258 (79.1)	1056 (84.5)	7314 (79.9)	
Black and/or African American only	836 (10.6)	102 (8.2)	938 (10.2)	
≥2 race categories	282 (3.6)	40 (3.2)	322 (3.5)	
Other	531 (6.7)	51 (4.1)	582 (6.4)	
Ethnicity, Latinx, n (%) ^d	(n = 7928)	(n = 1253)	(n = 9181)	0.265 ^b
No	6810 (85.9)	1091 (87.1)	7901 (86.1)	
Yes	1118 (14.1)	162 (12.9)	1280 (13.9)	
BMI, mean (SD), kg/m ²	(n = 7930) 28.9 (7.8)	(n = 1254) 29.8 (8.3)	(n = 9184) 29.0 (7.9)	<0.001 ^a
Marital status, n (%) ^e	(n = 7928)	(n = 1254)	(n = 9182)	0.834 ^b
Not married	4217 (53.2)	671 (53.5)	4888 (53.2)	
Married	3711 (46.8)	583 (46.5)	4294 (46.8)	
Employment status, n (%)	(n = 7930)	(n = 1254)	(n = 9184)	<0.001 ^b
Employed full- or part-time	5324 (67.1)	712 (56.8)	6036 (65.7)	
Not employed	2606 (32.9)	542 (43.2)	3148 (34.3)	
Health insurance coverage, n (%)	(n = 7930)	(n = 1254)	(n = 9184)	0.048 ^b
Yes	6837 (86.2)	1055 (84.1)	7892 (85.9)	
No	1093 (13.8)	199 (15.9)	1292 (14.1)	
Educational status, n (%)	(n = 7930)	(n = 1254)	(n = 9184)	<0.001 ^b
<4-year degree	4410 (55.6)	813 (64.8)	5223 (56.9)	
≥4-year degree	3520 (44.4)	441 (35.2)	3961 (43.1)	
Annual household income, n (%) ^f	(n = 7897)	(n = 1242)	(n = 9139)	<0.001 ^b
<\$30,000	1827 (23.1)	370 (29.8)	2197 (24.0)	
\$30,000–\$49,999	1481 (18.8)	259 (20.9)	1740 (19.0)	
\$50,000–\$74,999	1791 (22.7)	273 (22.0)	2064 (22.6)	
≥\$75,000	2798 (35.4)	340 (27.4)	3138 (34.3)	

Abbreviations: BMI, body mass index; SD, standard deviation.

^ap value calculated using an independent samples t-test; ^bp value calculated using Pearson's chi-squared test; ^cRace data were missing for 23 episodic migraine, five chronic migraine, and 28 total respondents; ^dEthnicity data were missing for two episodic migraine, one chronic migraine, and three total respondents; ^eMarital status data were missing for two episodic migraine and two total respondents; ^fHousehold income data were missing for 33 episodic migraine, 12 chronic migraine, and 45 total respondents.

who needed preventive pharmacologic treatment had received it. Overall, 1083 (59.4%) of 1823 accurately diagnosed current consultants traversed the barrier to receiving the minimally appropriate acute and preventive pharmacologic treatments. This rate was slightly higher among those with EM (59.9% [992/1655]) than with CM (54.2% [91/168]).

Among all 9184 respondents with migraine, 1083 (11.8%) successfully traversed the first three barriers (consultation, diagnosis,

and minimally appropriate acute and preventive pharmacologic treatment).

Barrier 4: Avoidance of medication overuse

Medication overuse was relatively common among respondents who had traversed the first three barriers, with 383 (35.4%) of 1083

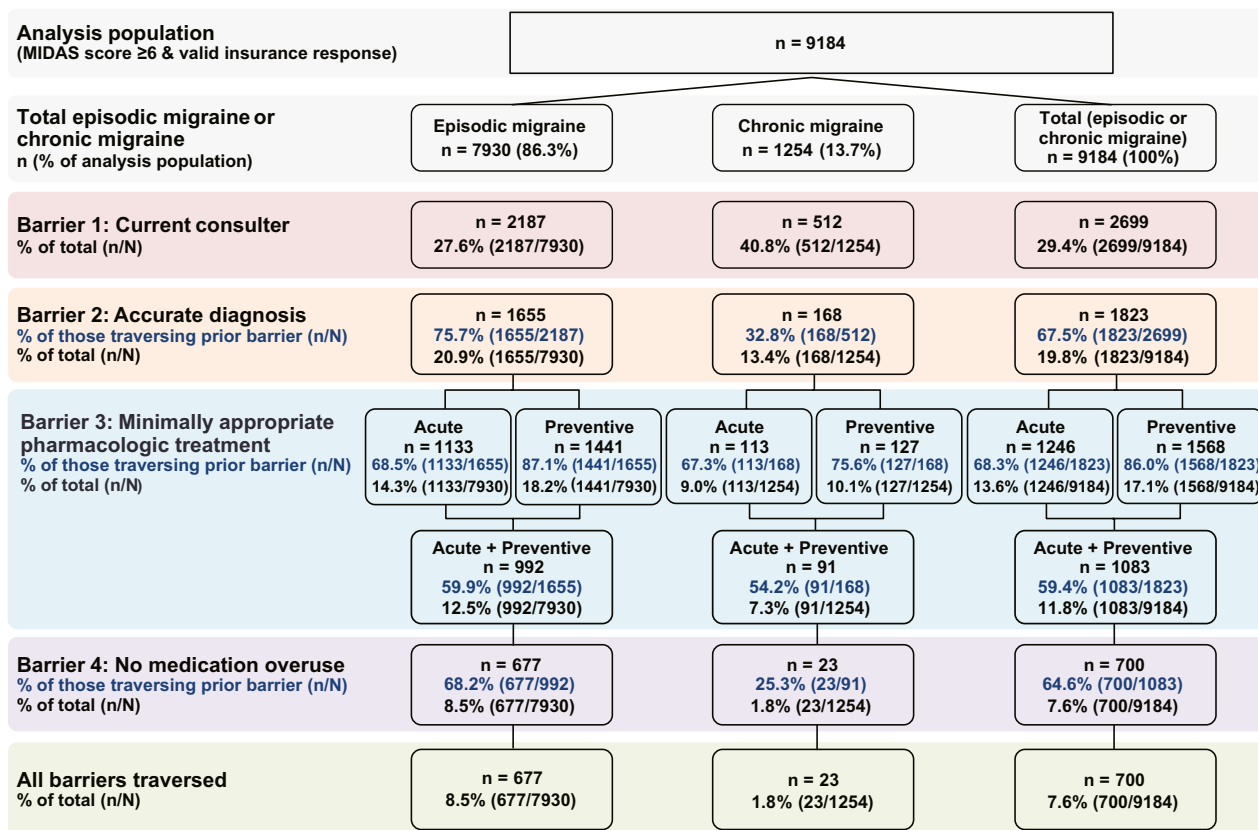


FIGURE 2 Proportions of respondents traversing barriers to care. MIDAS, Migraine Disability Assessment [Color figure can be viewed at wileyonlinelibrary.com]

Respondents, n/N (%)	Episodic migraine (n = 7930)	Chronic migraine (n = 1254)	Total (N = 9184)
Currently consulting a criteria-accepted HCP for headache	2187/7930 (27.6)	512/1254 (40.8)	2699/9184 (29.4)
Criteria-accepted HCPs ^a			
General practitioner, family physician, or internal medicine doctor	1583/2187 ^a (72.4)	280/512 ^a (54.7)	1863/2699 ^a (69.0)
Neurologist	343/2187 ^a (15.7)	139/512 ^a (27.1)	482/2699 ^a (17.9)
Nurse practitioner or physician assistant	128/2187 ^a (5.9)	40/512 ^a (7.8)	168/2699 ^a (6.2)
Pain specialist or doctor at pain clinic	55/2187 ^a (2.5)	34/512 ^a (6.6)	89/2699 ^a (3.3)
Headache specialist or doctor at headache clinic	44/2187 ^a (2.0)	17/512 ^a (3.3)	61/2699 ^a (2.3)
Obstetrician-gynecologist	34/2187 ^a (1.6)	2/512 ^a (0.4)	36/2699 ^a (1.3)

TABLE 2 Current consultation patterns

Abbreviation: HCP, health care professional.

^aDenominator is the number of participants who were currently consulting a criteria-accepted HCP for headache. There were no missing data.

TABLE 3 Diagnoses reported by respondents who failed to traverse the diagnosis barrier

Reported diagnoses, ^a n/N (%)	Episodic migraine without accurate diagnosis ^b n = 532	Chronic migraine without accurate diagnosis ^b n = 344
Migraine	0	270/344 (78.5)
Sinus headaches	261/532 (49.1)	163/344 (47.4)
Stress headaches	233/532 (43.8)	157/344 (45.6)
Tension-type headache	167/532 (31.4)	130/344 (37.8)
Menstrual headaches or menstrual migraines	86/532 (16.2)	70/344 (20.3)
Cluster headache	48/532 (9.0)	45/344 (13.1)
Chronic daily headache	14/532 (2.6)	0
Chronic migraine or transformed migraine	13/532 (2.4)	0
Rebound headache or medication overuse headache	12/532 (2.3)	22/344 (6.4)
New daily persistent headache	6/532 (1.1)	4/344 (1.2)
Citriene headache ^c	4/532 (0.8)	0
Never been diagnosed with specific type of headache	100/532 (18.8)	15/344 (4.4)
Don't know/don't remember	16/532 (3.0)	5/344 (1.5)
Other	28/532 (5.3)	32/344 (9.3)

^a Respondents could select multiple diagnoses. There were no missing data; ^b Accurate diagnosis was defined as “migraine” for respondents with episodic migraine and “chronic migraine,” “transformed migraine,” or “chronic daily headache” for respondents with chronic migraine; ^c “Citriene headache” is not a medical condition. It was added as a distractor to identify inaccurate patterns of responding.

accurately diagnosed and appropriately treated consulters meeting the ICHD-3 criteria¹ for medication overuse based on days per month of medication taken without considering overall monthly headache days. Among diagnosed and treated consulters, the rate of medication overuse was higher in the CM group (74.7% [68/91]) than in the EM group (31.8% [315/992]).

Among the 9184 eligible CaMEO respondents in the analysis population, only 700 (7.6%) traversed all four barriers. Respondents with CM traversed all four barriers at a lower rate than those with EM (1.8% [23/1254] vs. 8.5% [677/7930]; Figure 2).

Effects of sociodemographic characteristics on traversing barriers to care

Table 4 shows possible associations among sociodemographic factors and rates of current consultation, accurate diagnosis among consulters, minimally appropriate treatment among the diagnosed, and medication overuse among the treated. Women and men were equally likely to consult ($p = 0.574$). Blacks and/or African Americans had higher consultation rates than other race groups ($p = 0.025$). Latinx ethnicity was not associated with consultation in comparison with non-Latinx ethnicity (29.2% vs. 29.4%; $p = 0.894$). Consultation rates significantly increased with household income ($p < 0.001$), and health insurance was associated with consultation ($p < 0.001$).

Among consulters, women were more likely than men to be diagnosed ($p < 0.001$), but race ($p = 0.060$) and ethnicity ($p = 0.490$)

were not statistically significantly associated with rates of accurate diagnosis. Diagnosis rates increased with household income ($p = 0.014$) and were higher in those with health insurance ($p < 0.001$).

Among those who were diagnosed, variables associated with the use of minimally appropriate pharmacotherapy included higher income ($p < 0.001$) and health insurance ($p = 0.001$), but not sex ($p = 0.645$), race ($p = 0.535$), or ethnicity ($p = 0.918$).

Finally, among those consulting, diagnosed, and treated, men were more likely than women to have medication overuse ($p = 0.039$). Multiracial people and Blacks and/or African Americans had higher rates of medication overuse than Whites and people of other races ($p = 0.007$). Latinx people were marginally more likely than non-Latinx ($p = 0.054$), and those from lower-income households were more likely than those with higher income to have medication overuse ($p = 0.018$). Insurance status was not associated with medication overuse ($p = 0.617$).

DISCUSSION

In this analysis of data from the CaMEO Study, we identified individuals with EM or CM who had unmet medical needs based on migraine-associated disability, and assessed four levels of barriers to good medical care, including consultation, accurate diagnosis, receiving appropriate pharmacologic treatment, and avoidance of acute medication overuse. Among 9184 eligible respondents with migraine, only 7.6% traversed all four barriers, with substantially lower proportions

TABLE 4 Effect of sociodemographic characteristics on traversing barriers to care

Characteristic	Current consultant		Accurately diagnosed among current consultants		Minimally appropriate acute and preventive pharmacologic treatment among diagnosed current consultants		Medication overuse among appropriately treated and diagnosed current consultants	
	Yes ^a	χ^2 test	Yes ^a	χ^2 test	Yes ^a	χ^2 test	Yes ^{a,b}	χ^2 test
Sex								
Women	2157/7306 (29.5)	0.317	1516/2157 (70.3)	36.765	897/1516 (59.2)	0.213	305/897 (34.0)	4.242
Men	542/1878 (28.9)	$p = 0.574$	307/542 (56.6)	$p < 0.001$	186/307 (60.6)	$p = 0.645$	78/186 (41.9)	$p = 0.039$
Race ^c								
White only	2132/7314 (29.1)	9.312	1459/2132 (68.4)	7.417	867/1459 (59.4)	2.184	289/867 (33.3)	11.969
Black and/or African American only	311/938 (33.2)	$p = 0.025$	202/311 (65.0)	$p = 0.060$	126/202 (62.4)	$p = 0.535$	57/126 (45.2)	$p = 0.007$
Other	153/582 (26.3)		90/153 (58.8)		50/90 (55.6)		16/50 (32.0)	
≥2 races	95/322 (29.5)		67/95 (70.5)		36/67 (53.7)		19/36 (52.8)	
Ethnicity, Latinx ^d								
No	2323/7901 (29.4)	0.018	1576/2323 (67.8)	0.477	937/1576 (59.5)	0.011	321/937 (34.3)	3.723
Yes	374/1280 (29.2)	$p = 0.894$	247/374 (66.0)	$p = 0.490$	146/247 (59.1)	$p = 0.918$	62/146 (42.5)	$p = 0.054$
Annual household income ^e								
<\$30,000	539/2197 (24.5)	51.913 ^f	346/539 (64.2)	6.01 ^f	167/346 (48.3)	27.291 ^f	73/167 (43.7)	5.595 ^f
\$30,000–\$49,999	474/1740 (27.2)	$p < 0.001$	310/474 (65.4)	$p = 0.014$	179/310 (57.7)	$p < 0.001$	69/179 (38.5)	$p = 0.018$
\$50,000–\$74,999	628/2064 (30.4)		431/628 (68.6)		258/431 (59.9)		81/258 (31.4)	
≥\$75,000	1042/3138 (33.2)		726/1042 (69.7)		474/726 (65.3)		160/474 (33.8)	
Health insurance coverage								
Yes	2544/7892 (32.2)	219.137	1728/2544 (67.9)	219.137	1042/1728 (60.3)	10.974	367/1042 (35.2)	0.250
No	155/1292 (12.0)	$p < 0.001$	95/155 (61.3)	$p < 0.001$	41/95 (43.2)	$p = 0.001$	16/41 (39.0)	$p = 0.617$

^aValues are n/N (%). ^bValues are numbers (percentages) of participants who met criteria for medication overuse (i.e., did not traverse the final barrier of avoiding medication overuse); ^cRace data were missing for 28 respondents; ^dEthnicity data were missing for three respondents; ^eHousehold income data were missing for 45 respondents; ^fRelationship between income and traversing each barrier was analyzed using a chi-square test for trend.

Bold values represent a statistically significant difference.

of respondents with CM than with EM (1.8% vs. 8.4%) traversing all four barriers. The greatest barrier was at the level of consultation; approximately 70% of respondents failed to traverse this barrier. Respondents with CM were more likely than those with EM to consult for headache (40.8% vs. 27.6%), but were less likely to have received an accurate diagnosis during consultation (32.8% vs. 75.7%). For diagnosis to be considered accurate in the group with CM, a diagnosis of CM, transformed migraine, or chronic daily headache was required. If we consider migraine as an accurate diagnosis, differences in diagnostic accuracy between EM and CM are mitigated. Persons with CM were also less likely to receive minimally adequate acute and preventive pharmacologic treatment despite accurate diagnosis (54.2% vs. 59.9%). This difference is largely accounted for by the fact that everyone with CM required prevention, whereas only 24.7% of diagnosed consulters in the EM group required prevention based on the high threshold we specified in this analysis. Respondents with CM were more likely to have medication overuse, with 74.7% of respondents with CM versus 31.8% with EM traversing the first three barriers meeting criteria for medication overuse. Only 8.5% of respondents with EM and 1.8% with CM successfully traversed all four barriers.

To the best of our knowledge, our study is the first to directly compare barriers to migraine care between respondents with CM versus EM. Other studies have reported similarly low proportions of individuals with EM or CM traversing barriers to consultation, diagnosis, and treatment, although rates are not directly comparable because of differences in sampling and operational definitions of barrier criteria.^{16,17,35} Previous analyses are consistent with respect to a high proportion of respondents with migraine failing to report medical consultation for headache.^{16,17}

We chose not to include visits to the ED or UC in the criteria for successfully traversing the consultation barrier, although headache is one of the leading causes for ED visits in the United States.³ In this analysis, only 7% of respondents who did not traverse the consultation barrier reported that they consulted an ED or UC HCP for headache. We made this choice because the purpose of ED or UC visits is not to provide ongoing management. Patients are less likely to receive guideline-recommended acute and preventive treatment in the ED and UC settings than in other ambulatory settings. This is not a criticism of care given in ED and UC settings, and reflects their important role in excluding secondary headache and providing immediate short-term relief.^{36,37} Although we did not include ear, nose, and throat specialists or allergists as appropriate HCPs for migraine, we acknowledge that many of these specialists can, and do, diagnose and treat migraine appropriately. Given the overlap in symptoms associated with migraine and sinus problems, there may be a need for increased awareness of migraine among these specialists. This is supported by the observation that sinus headache was one of the most common misdiagnoses in the current analysis. Evidence from other sources suggests that many patients with migraine are diagnosed with sinus headache.³⁸⁻⁴⁰ For individual participants in an Internet-based survey, there may be diagnostic error in other directions; some people we classified as having migraine may have had recurrent sinusitis, though the rate is likely to be low.

In a previous analysis of barriers to care among people with EM, the assumption was made that no one with EM requires preventive medication.¹⁷ In the present report, we made the conservative assumption that individuals with migraine, some disability, and eight or more monthly migraine days require prevention. We found that 24.7% of respondents with EM who were consulting and had received a medical diagnosis were candidates for preventive therapy, and that 47.7% of these eligible EM respondents were receiving prevention. One factor that contributes to the lower rate of traversing all barriers to care among persons with EM relative to the previous report,¹⁷ is the requirement for prevention in this subgroup. An analysis of AMPP data found that 13% of people with migraine aged 12 years or older were currently taking preventive medication for migraine, 43.3% had never used a migraine preventive, 25.5% were previous users, and 18% were using a migraine preventive medication without attributing its use to migraine prevention.⁷ Similar data were found in a recent analysis of US national survey data.⁴¹ Among those who had never used a preventive, 32.4% met expert guideline criteria for preventive medication being offered or considered.⁷

This analysis also differs from previous reports in that we included avoidance of medication overuse as a barrier to good medical care.^{16,17} Among those traversing the first three barriers to care, 23.8% of EM and 74.7% of CM respondents met criteria for acute medication overuse and failed to traverse the final barrier. While it may be difficult to discern the underlying reasons for medication overuse, capturing the rate of medication overuse is an important factor in characterizing care. HCPs play an important role in preventing medication overuse by ensuring medication prescriptions are not written for more than the threshold days per month, informing patients about the dangers of medication overuse, considering adding preventive treatment when appropriate, including both pharmacologic and nonpharmacologic therapies, and providing healthy lifestyle education.^{1,42,43}

Our analyses of the effect of sociodemographic characteristics on traversing barriers to care showed that self-reported annual household income had a significant impact on the likelihood of traversing all four barriers. Higher household income was associated with a greater likelihood of obtaining a consultation, receiving an accurate diagnosis, receiving minimally adequate acute and preventive treatment, and not overusing medication. Previous studies have reported significant relationships between annual household income and the likelihood of receiving acute^{17,44} and preventive³⁵ medications for migraine. However, a previous analysis of CaMEO respondents with CM did not find a significant relationship between income (\geq \$75,000 vs. $<$ \$75,000) and receipt of minimal acute and preventive pharmacologic treatment.¹⁶ Differences in the population (inclusive of EM and CM) and the different categorization of income categories used in the current analysis may contribute to this difference in results.

Cost concerns may contribute to the observed relationships between income and current consultation and adequate treatment. This is consistent with the observation that respondents with health insurance were significantly more likely to have sought

a consultation for headache and received minimally appropriate pharmacologic treatment. An analysis of data from the National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey from 1997 to 2007 showed that patients with migraine with no insurance or with Medicaid were less likely than patients with private insurance to receive appropriate acute and preventive medication after controlling for covariates.³⁶ This is a concern, especially because the prevalence of migraine is greater among individuals in lower versus higher income groups.^{2,7} Plausible solutions and strategies to migraine care in underinsured and uninsured adults have been described.^{45,46}

This analysis showed that race had a significant effect on the rate of consultation. Current consultation rates were highest among Blacks and/or African Americans and lowest among those reporting race categorized as "other." The reasons for the low rate in the "other" category are unclear. In this category, more than 50% of respondents reported that they were of Asian descent (e.g., Chinese, Korean, other). Nearly 40% reported that they were "some other race," the majority indicating they were Latinx. One study of 186 headache patients in a headache treatment clinic in Ohio reported that Blacks and/or African Americans were significantly less likely than Whites to receive a diagnosis of EM without aura, but no significant differences were observed in rates of diagnosis of EM with aura and CM with or without aura.⁴⁷ In this study, race was not a statistically significant variable in accurate migraine diagnosis. Nevertheless, there was a trend ($p = 0.060$) toward significance. An analysis of data from the National Ambulatory Medical Care Survey showed that race did not significantly affect the likelihood of receiving acute or preventive treatment for migraine.⁴¹ However, data from the Ohio headache clinics study showed that Blacks and/or African Americans were more likely than Whites to terminate their headache treatment once they received treatment.⁴⁷

Race was also shown to be associated with medication overuse in this analysis. Among current consulters who had received an accurate diagnosis and minimally adequate treatment, medication overuse rates were highest among those reporting two or more races (53%) and Blacks and/or African Americans (45%) and lowest among Whites (33%) and those categorized as "other" race (32%). Ethnic and cultural differences in headache literacy may contribute to differences in medication overuse. Headache literacy has been defined as the personal characteristics and social resources that empower individuals and communities to access, understand, and use information and services for informed decision making regarding headaches.⁴⁸ Increased headache literacy may lead to early and safe health intervention-seeking behaviors, improved awareness and use of headache-specific treatments, and decreased medication overuse.⁴⁸ Differential access to empirically supported nonpharmacologic therapies (e.g., cognitive behavioral therapy, biofeedback, relaxation training, mindfulness-based therapies, neurostimulation) as well as complimentary and integrative approaches such as yoga, acupuncture, exercise, and nutraceuticals may contribute to differences in rates of medication overuse. Populations without private insurance coverage may not have access to these health care services.

Vulnerable populations may not have the luxury to take time off and may not have control or privacy in their work setting to care for themselves during a migraine attack and, therefore, may feel more compelled to take an acute medication to not miss work. We did not examine rates of consulting, access, or treatment by sex within race, which may have masked some potential additional differential findings.⁴

Sex differences were observed in the rates of accurate diagnosis and avoidance of medication overuse in the current study. Approximately 70% of women consulters versus 57% of men consulters had received an accurate diagnosis. This is consistent with results of previous studies showing that being female is associated with receiving a medical diagnosis of migraine.^{16,17,35} Migraine is two to three times more prevalent among women than men.^{3,7} Therefore, HCPs may have an increased index of suspicion for migraine in women. Women may be more likely than men to report their symptoms.⁹ Migraine is underdiagnosed, especially in men, and there is a need to improve HCP awareness about migraine in both men and women.^{9,49}

Strengths and limitations

A strength of the CaMEO Study is that it included a large sample size that was systematically recruited to be representative of the US population. Demographic and headache-related characteristics between the AMPP and CaMEO Study populations were generally similar, suggesting these results may be generalizable to the US migraine population. Black and/or African American respondents represented 10% of the CaMEO Study population compared with 13% of the US population in 2012.⁵⁰

An additional strength was in the design of the survey question about headache diagnosis. This question included the response option of "citriene headache" (a fictional medical condition) that was endorsed by only four of 876 current consulters in our analysis, suggesting most respondents read and responded carefully when completing the survey.

Despite the large sample size for this analysis, potential sources of selection bias exist. Respondents were assumed to have access to a home computer to complete the survey. Therefore, lack of computer access may represent an economic and technological barrier to participation. The questionnaire was available only in English, likely reducing the inclusion of Spanish language speakers. This may have confounded the possibility of detecting ethnicity-based differences in traversing each barrier to care. The CaMEO survey was conducted 8 years ago (2012–2013); therefore, the data may not reflect current patterns of care or available therapies.

To perform this analysis, we formulated working criteria for success and failure for traversing each barrier. To operationalize these criteria, we made a series of imperfect categorization choices. We chose to limit our focus and definition of good care to pharmacologic treatments only and did not include empirically and guideline-supported nonpharmacologic therapies including

behavioral therapies or neurostimulation, among other treatments. As such, we only included HCPs who are licensed to prescribe pharmacologic therapies in our list of criteria-accepted providers. With respect to consulting, we grouped HCPs by specialty who traditionally have experience in the ongoing treatment of individuals with migraine. Consequently, some respondents reported consulting about their headache with HCPs who were not included in our criteria. We acknowledge that some otolaryngologists and allergists are outstanding headache clinicians, and that in some cases our analysis could misclassify respondents receiving expert care as not consulting an appropriate HCP. In addition, many HCPs in ED and UC settings are highly knowledgeable in caring for people with migraine, but may choose different strategies based on the urgency of the visit, and lack of history, continuity, and follow-up.³⁷ With respect to migraine diagnosis, we required that individuals with CM received a diagnosis of CM, transformed migraine, or chronic daily headache. Many (78.5%) of the individuals who had not received one of these diagnoses received a diagnosis of migraine, which we did not categorize as an accepted diagnosis in this analysis. This approach was also taken in a previous report on barriers to CM care.¹⁶ We did this based on the assumption that proper management of CM requires the recognition of CM as a distinct disorder. For full transparency, we have provided data on the proportion of people with CM who reported having received a diagnosis of “migraine.”

The CaMEO survey offered “menstrual headaches or menstrual migraines” as a diagnostic option. Because the study questionnaire could not distinguish “menstrual migraine” and “menstrual headache,” we made the conservative decision to not count the diagnosis.

Defining a subgroup of persons with EM in need of preventive pharmacologic treatment is challenging. In our analysis, we set a threshold of at least eight migraine headache days for requiring preventive treatment and acknowledge this is a conservative decision. A recent American Headache Society position paper recommends that preventive treatment should be offered to people with migraine experiencing six or more monthly headache days, regardless of their level of disability, four or more headache days with at least some functional disability, or three or more headache days with severe disability.²⁷ Migraine-related disability was not accounted for in our criteria for requiring a preventive treatment, although mild disability per MIDAS was an inclusion criterion for the analysis population. In clinical practice, the decision to start preventive treatment is multifactorial and depends on headache-day frequency, disability, treatment history, patient preference, comorbidities, medication overuse, and other factors. The eight headache-days per month criterion in this study was established as an operational rule for epidemiologic research to conservatively identify respondents for whom preventive treatment would most likely be indicated. A less restrictive threshold might have uncovered even higher rates of undertreatment. Preventive treatment may include pharmacologic and/or nonpharmacologic approaches. Efficacy and duration of effects are greatest when both approaches are combined.⁵¹

Finally, our analysis found a significant impact of race on successfully traversing certain barriers to care; however, socioeconomic status showed a strong influence on the likelihood of traversing all barriers and may or may not be related to race and ethnicity, but in this case, may account for a share of the variance. We did not subdivide participants by sex within racial groups. It is possible that men and women have different experiences within racial or ethnic groups. Additionally, there may be bias in our sample, which may have not included individuals who face greater barriers to care.

CONCLUSIONS

Only 8% of individuals with migraine and associated disability successfully traversed the barriers of consultation, diagnosis, minimally appropriate pharmacologic treatment, and avoidance of medication overuse. Women were more likely than men to be accurately diagnosed and avoid medication overuse. Household income showed a positive relationship with likelihood of traversing all barriers, whereas being Black and/or African American was associated with both higher rates of consultation and medication overuse. Public health efforts should focus on improving rates of consultation and diagnosis, particularly in men, Latinx people, and those with lower income, as well as educating people with migraine about the dangers of medication overuse.

CLINICAL TRIALS REGISTRATION NUMBER

NCT01648530 (clinicaltrials.gov).

INSTITUTIONAL REVIEW BOARD APPROVAL

The study was approved by the institutional review board of the Albert Einstein College of Medicine.

ACKNOWLEDGMENTS

This study was sponsored by Allergan (prior to its acquisition by AbbVie). Medical writing and editorial assistance were provided to the authors by Peloton Advantage, LLC, an OPEN Health company, Parsippany, NJ, USA, and was funded by AbbVie.

CONFLICTS OF INTEREST

Dawn C. Buse, PhD, has received grant support and honoraria from AbbVie, Amgen, Avanir, Biohaven, Eli Lilly and Company, and Promius, and for work on the editorial board of *Current Pain and Headache Reports*. Cynthia E. Armand, MD, has served as an advisory board member and has received honoraria from Biohaven and Impel Regional. Larry Charleston IV, MD, MSc, has served as consultant, advisory board member, or has received honoraria from AbbVie, Alder/Lundbeck, and Biohaven. He has performed medical legal consultation for the Vaccine Injury Compensation Program. He is on the advisory board of BrainWeekend and Ctrl M Health, and serves on the editorial board of *Headache*. Michael L. Reed, PhD, is Managing Director of Vedanta Research, which

has received research funding from AbbVie, Amgen, Dr. Reddy's Laboratories, Eli Lilly, and the National Headache Foundation. Vedanta Research has received funding directly from AbbVie for work on the CaMEO Study. Kristina M. Fanning, PhD, is an employee of Vedanta Research, which has received research funding from AbbVie, Amgen, Dr. Reddy's Laboratories, Eli Lilly, and the National Headache Foundation. Vedanta Research has received funding directly from AbbVie for work on the CaMEO Study. Aubrey Manack Adams, PhD, is an employee of AbbVie, and may hold AbbVie stock. Richard B. Lipton, MD, holds stock options in Biohaven Holdings and CtrlM Health. He serves as consultant, advisory board member, has received honoraria from or research support from: Abbvie, American Academy of Neurology, American Headache Society, Amgen, Biohaven, Biovision, Dr. Reddy's (Promius), electroCore, Eli Lilly, eNeura, Equinox, GlaxoSmithKline, Grifols, Lundbeck (Alder), Merck, Pernix, Pfizer, Teva, Vector, and Vedanta.

AUTHOR CONTRIBUTIONS

Study concept and design: Dawn C. Buse, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton. *Acquisition of data:* Dawn C. Buse, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton. *Analysis and interpretation of data:* Dawn C. Buse, Cynthia E. Armand, Larry Charleston IV, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton. *Drafting of the manuscript:* Dawn C. Buse, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton. *Revising the manuscript for intellectual content:* Dawn C. Buse, Cynthia E. Armand, Larry Charleston IV, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton. *Final approval of the completed manuscript:* Dawn C. Buse, Cynthia E. Armand, Larry Charleston IV, Michael L. Reed, Kristina M. Fanning, Aubrey Manack Adams, Richard B. Lipton.

REFERENCES

- Headache Classification Committee of the International Headache Society. The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38:1-211.
- Stewart WF, Lipton RB, Celentano DD, Reed ML. Prevalence of migraine headache in the United States. Relation to age, income, race, and other sociodemographic factors. *JAMA*. 1992;267:64-69.
- Burch R, Rizzoli P, Loder E. The prevalence and impact of migraine and severe headache in the United States: figures and trends from government health studies. *Headache*. 2018;58:496-505.
- Loder S, Sheikh HU, Loder E. The prevalence, burden, and treatment of severe, frequent, and migraine headaches in US minority populations: statistics from national survey studies. *Headache*. 2015;55:214-228.
- Stewart WF, Roy J, Lipton RB. Migraine prevalence, socioeconomic status, and social causation. *Neurology*. 2013;81:948-955.
- Lipton RB, Stewart WF, Diamond S, Diamond ML, Reed M. Prevalence and burden of migraine in the United States: data from the American Migraine Study II. *Headache*. 2001;41:646-657.
- Lipton RB, Bigal ME, Diamond M, Freitag F, Reed ML, Stewart WF. Migraine prevalence, disease burden, and the need for preventive therapy. *Neurology*. 2007;68:343-349.
- Stewart WF, Lipton RB, Liberman J. Variation in migraine prevalence by race. *Neurology*. 1996;47:52-59.
- Buse DC, Loder EW, Gorman JA, et al. Sex differences in the prevalence, symptoms, and associated features of migraine, probable migraine and other severe headache: results of the American Migraine Prevalence and Prevention (AMPP) study. *Headache*. 2013;53:1278-1299.
- Buse DC, Fanning KM, Reed ML, et al. Life with migraine: effects on relationships, career, and finances from the chronic migraine epidemiology and outcomes (CaMEO) study. *Headache*. 2019;59:1286-1299.
- Lipton RB, Bigal ME, Scher AI, Stewart WF. The global burden of migraine. *J Headache Pain*. 2003;4:S3-S11.
- Buse DC, Silberstein SD, Manack AN, Papapetropoulos S, Lipton RB. Psychiatric comorbidities of episodic and chronic migraine. *J Neurol*. 2013;260:1960-1969.
- Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392:1859-1922.
- GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390:1211-1259.
- Heckman BD, Merrill JC, Anderson T. Race, psychiatric comorbidity, and headache characteristics in patients in headache subspecialty treatment clinics. *Ethn Health*. 2013;18:34-52.
- Dodick DW, Loder EW, Manack Adams A, et al. Assessing barriers to chronic migraine consultation, diagnosis, and treatment: results from the Chronic Migraine Epidemiology and Outcomes (CaMEO) Study. *Headache*. 2016;56:821-834.
- Lipton RB, Serrano D, Holland S, Fanning KM, Reed ML, Buse DC. Barriers to the diagnosis and treatment of migraine: effects of sex, income, and headache features. *Headache*. 2013;53:81-92.
- Buse DC, Manack AN, Fanning KM, et al. Chronic migraine prevalence, disability, and sociodemographic factors: results from the American Migraine Prevalence and Prevention study. *Headache*. 2012;52:1456-1470.
- Silberstein SD. Migraine. *Lancet*. 2004;363:381-391.
- Silberstein SD. Practice parameter: evidence-based guidelines for migraine headache (an evidence-based review): report of the quality standards subcommittee of the American Academy of Neurology. *Neurology*. 2000;55:754-762.
- Silberstein SD. Preventive migraine treatment. *Continuum*. 2015;21(4 Headache):973-989.
- Lipton RB, Fanning KM, Serrano D, Reed ML, Cady R, Buse DC. Ineffective acute treatment of episodic migraine is associated with new-onset chronic migraine. *Neurology*. 2015;84:688-695.
- Lipton RB, Munjal S, Buse DC, Fanning KM, Bennett A, Reed ML. Predicting inadequate response to acute migraine medication: results from the American migraine prevalence and prevention (AMPP) study. *Headache*. 2016;56:1635-1648.
- Raggi A, Schiavolin S, Leonardi M, et al. Chronic migraine with medication overuse: association between disability and quality of life measures, and impact of disease on patients' lives. *J Neurol Sci*. 2015;348(1-2):60-66.
- Schwedt TJ, Alam A, Reed ML, et al. Factors associated with acute medication overuse in people with migraine: results from the 2017 migraine in America symptoms and treatment (MAST) study. *J Headache Pain*. 2018;19:38.
- Bigal ME, Lipton RB. Migraine chronification. *Curr Neurol Neurosci Rep*. 2011;11:139-148.
- American Headache Society. The American Headache Society position statement on integrating new migraine treatments into clinical practice. *Headache*. 2019;59:1-18.
- Bigal ME, Lipton RB. Excessive acute migraine medication use and migraine progression. *Neurology*. 2008;71:1821-1828.

29. Nicholson RA, Rooney M, Vo K, O'Laughlin E, Gordon M. Migraine care among different ethnicities: do disparities exist? *Headache*. 2006;46:754-765.
30. Manack Adams A, Serrano D, Buse DC, et al. The impact of chronic migraine: the Chronic Migraine Epidemiology and Outcomes (CaMEO) Study methods and baseline results. *Cephalalgia*. 2015;35:563-578.
31. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders, 2nd ed. *Cephalalgia*. 2004;24(Suppl 1):9-160.
32. Headache Classification Committee of the International Headache Society. The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia*. 2013;33:629-808.
33. Silberstein SD, Lipton RB, Sliwinski M. Classification of daily and near-daily headaches: field trial of revised IHS criteria. *Neurology*. 1996;47:871-875.
34. Stewart WF, Lipton RB, Dowson AJ, Sawyer J. Development and testing of the Migraine Disability Assessment (MIDAS) questionnaire to assess headache-related disability. *Neurology*. 2001;56(6 Suppl 1):S20-S28.
35. Diamond S, Bigal ME, Silberstein S, Loder E, Reed M, Lipton RB. Patterns of diagnosis and acute and preventive treatment for migraine in the United States: results from the American Migraine Prevalence and Prevention study. *Headache*. 2007;47:355-363.
36. Wilper A, Woolhandler S, Himmelstein D, Nardin R. Impact of insurance status on migraine care in the United States: a population-based study. *Neurology*. 2010;74:1178-1183.
37. Minen MT, Zhou K, Miller L. A brief look at urgent care visits for migraine: the care received and ideas to guide migraine care in this proliferating medical setting. *Headache*. 2020;60:542-552.
38. Eross E, Dodick D, Eross M. The sinus, allergy and migraine study (SAMS). *Headache*. 2007;47:213-224.
39. Schreiber CP, Hutchinson S, Webster CJ, Ames M, Richardson MS, Powers C. Prevalence of migraine in patients with a history of self-reported or physician-diagnosed "sinus" headache. *Arch Intern Med*. 2004;164:1769-1772.
40. Lipton RB, Diamond S, Reed M, Diamond ML, Stewart WF. Migraine diagnosis and treatment: results from the American Migraine Study II. *Headache*. 2001;41:638-645.
41. Charleston L IV, Burke JF. Do racial/ethnic disparities exist in recommended migraine treatments in US ambulatory care? *Cephalalgia*. 2018;38:876-882.
42. Robblee J, Starling AJ. SEEDS for success: lifestyle management in migraine. *Cleve Clin J Med*. 2019;86:741-749.
43. Usai S, Grazzi L, Andrasik F, D'Amico D, Rigamonti A, Bussone G. Chronic migraine with medication overuse: treatment outcome and disability at 3 years follow-up. *Neurol Sci*. 2004;25(Suppl 3):S272-S273.
44. Bigal ME, Buse DC, Chen Y-T, et al. Rates and predictors of starting a triptan: results from the American Migraine Prevalence and Prevention study. *Headache*. 2010;50:1440-1448.
45. Charleston L, Royce J, Monteith TS, et al. Migraine care challenges and strategies in US uninsured and underinsured adults: a narrative review, part 1. *Headache*. 2018;58:506-511.
46. Charleston L, Royce J, Monteith TS, et al. Migraine care challenges and strategies in US uninsured and underinsured adults: a narrative review, part 2. *Headache*. 2018;58:633-647.
47. Heckman BD, Holroyd KA, O'Donnell FJ, et al. Race differences in adherence to headache treatment appointments in persons with headache disorders. *J Natl Med Assoc*. 2008;100:247-255.
48. Charleston L IV, Heisler M. Headache literacy—a definition and theory to help improve patient outcomes of diverse populations and ameliorate headache and headache care disparities. *Headache*. 2016;56:1522-1526.
49. Scher AI, Wang S-J, Katsarava Z, et al. Epidemiology of migraine in men: results from the chronic migraine epidemiology and outcomes (CaMEO) study. *Cephalalgia*. 2019;39:296-305.
50. The Black alone population in the United States. *Table 1. Population by sex and age, for Black alone and White alone, not Hispanic*: 2012. 2012. <https://www.census.gov/data/tables/2012/demo/race/ppl-ba12.html>. Accessed February 24, 2020.
51. Holroyd KA, Cottrell CK, O'Donnell FJ, et al. Effect of preventive (beta blocker) treatment, behavioural migraine management, or their combination on outcomes of optimised acute treatment in frequent migraine: randomised controlled trial. *BMJ*. 2010;341:c4871.

SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

How to cite this article: Buse DC, Armand CE, Charleston L, et al. Barriers to care in episodic and chronic migraine: Results from the Chronic Migraine Epidemiology and Outcomes Study. *Headache*. 2021;61:628–641. <https://doi.org/10.1111/head.14103>