Migraine-specific health resource utilization in chronic and episodic migraine across six countries

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Abstract

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Background: Though studies have consistently revealed variation in resource utilization between chronic and episodic migraineurs, less is known about how these differences compare across countries. This research describes migraine-specific health resource utilization in chronic and episodic migraineurs across the United States (US), Canada, the United Kingdom (UK), Germany, France and Australia.

Methods: A web-based screening survey, used to determine eligibility, was administered to 32,782 panelists who had previously reported experiencing headaches or migraines. Screener respondents (n=16,663) were eligible for the main questionnaire if they were ≥ 18 years of age, reported at least one headache (not associated with a cold, flu, head injury, or hangover) during the prior three months, and reported symptoms meeting the revised second International Classification of Headache Disorders (ICHD-IIR) diagnostic criteria for migraine. For the main questionnaire, respondents provided data concerning sociodemographic and clinical characteristics, attitudes, and utilization of health resources.

Results: In bivariate analyses, the intensity of resource use differed across countries in each migraine type. In multivariate regression, the odds of visiting a provider for headache in the three months prior to completing the survey were higher in all countries relative to the US. The odds of having a typical provider of headache care were also higher in all countries relative to the US, but this was only significant for France (OR 1.85, 95% CI 1.04, 3.32). Relative to the US, the odds of having ever visited the emergency room for headache were significantly lower in France (OR 0.37, 95% CI 0.22, 0.62), the UK (OR 0.25, 95% CI 0.14, 0.45) and Germany (OR 0.31, 95% CI 0.18, 0.53). Respondents from Australia (OR 1.83, 95% CI 1.13, 2.96) and France (OR 1.51, 95% CI 1.00, 2.28) were more likely than those from the US to report ever trying more than three abortive agents. The odds of currently using a prescription abortive agent were significantly higher in France (OR 1.80, 95% CI 1.19, 2.74), the UK (OR 2.68, 95% CI 1.72, 4.17), Australia (OR 1.88, 95% CI 1.16, 3.03) and Germany (OR 2.10, 95% CI 1.37, 3.23) than in the US.

Conclusion: Migraineurs differed significantly across countries in their demographic and clinical characteristics, and in the resources they utilized. Migraineurs from the US were generally less likely to report use of preventative services, such as recent provider visits and use of prescription abortive agents, and more likely to report emergency room visits, relative to migraineurs from the other countries studied. However, US migraineurs were also less likely to report ever being hospitalized for headache compared to migraineurs from Canada and Australia. Further research on the sources of this variability, including the influence of healthcare system design features, and the effects of the variability on outcomes in migraineurs is warranted.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure Number Page

LIST OF TABLES

Background

Migraine is a chronic headache disorder that is generally episodic in nature. However, it can become persistent in some patients over time. The revised second International Classification of Headache Disorders (ICHD-IIR) defines chronic migraine (CM) as having 15 or more headache days per month for three months, with at least eight headaches per month meeting the criteria for migraine without aura.[1] CM affects approximately 2% of the worldwide population and has a significantly greater effect on quality of life than episodic migraine (EM), defined as experiencing fewer than 15 headache days per month.[2,3] Chronic migraineurs are much more debilitated; they are more likely to miss work or to have decreased productivity than EM patients.[4] CM patients tend to suffer from more comorbid conditions, especially psychiatric and pain disorders.[3,4] They also have a higher level of health resource utilization than EM patients, including more emergency room (ER) and clinic visits and greater use of abortive medications.[4,5]

Though studies have consistently revealed variation in resource utilization between chronic and episodic migraineurs, less is known about how these differences compare across countries. One multinational study concluded that migraine-based resource utilization was comparable across the 25 countries included.[6] However, several questions remain unanswered. Sample sizes were quite small for some countries (e.g. <20 subjects), and statistical hypothesis testing was not employed to compare utilization across countries (countries were pooled into larger regions). The study also excluded subjects reporting >8 migraine attacks per month, which includes all CM patients. Finally, the study is over ten years old; patterns of resource utilization may have changed in this time, for example, due to changes in healthcare systems. To our knowledge, no other studies have compared migraine-specific resource utilization across countries.

There are many factors that differ amongst countries that could impact health resource utilization. Previous research has described substantial differences in the structure of health care systems across countries.[7] Healthcare systems vary in many ways that could influence health care utilization, including both supply and demand factors, such as type of insurance

(public, private or both), covered benefits, percent of population insured, out-of-pocket expenses, and accessibility (e.g. amount of paperwork and wait times). These differences may impact healthcare access and utilization. Results from a study investigating access to care revealed that out of 11 countries (Australia, Canada, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, the United Kingdom (UK) and the United States (US)), subjects from the US were most likely to report that in the last year they: (1) had problems paying medical bills, (2) had out-of-pocket-expenses exceeding $1000, (3) skipped medication doses due to cost, and (4) did not receive recommended care due to cost. Subjects from the US also reported the least confidence in their ability to pay for medical expenditures. Conversely, subjects from the US were less likely than subjects from other countries, other than Switzerland and Germany, to report waiting for two months or more to see a specialist. [7] Other country-specific factors may influence health resource utilization as well, such as cultural and economic differences.

The overall objective of this research is to describe differences in migraine-specific health resource utilization amongst chronic and episodic migraineurs in the US, Canada, the UK, Germany, France and Australia.

Specifically, we address the following questions.

1. Do patterns of use of migraine-related healthcare services differ across countries?
2. Does migraine-related medication use differ across countries?

Methods

Design and Data Source:

The second international burden of migraine study (IBMS-II) investigated the burden of illness in CM and EM across the US, Canada, the UK, Germany, France and Australia. A web-based, cross-sectional screening survey, used to determine eligibility, was administered to 32,782 Lightspeed Research panelists who had previously reported experiencing headaches or migraines.[8] The Lightspeed Research panel consists of individuals from several countries who express interest in and register online to complete health-related surveys. Lightspeed Research compensates panelists for survey participation with small, country-specific prizes. Recruitment continued until target sample sizes, specific to each country and migraine type, were met.

Screener respondents (n=16,663) were eligible for the main questionnaire if they were ≥ 18 years of age, reported at least one headache (not associated with a cold, flu, head injury, or hangover) during the prior three months, and reported symptoms meeting ICHD-IIR diagnostic criteria for migraine.[1] Specifically, respondents must meet the following two requirements. First, they must report that for either their most severe or second most severe headache type, they experienced at least two of the following symptoms "half the time or more" or "less than half the time:" (1) moderate to severe pain, (2) throbbing pain, (3) pain worsening with routine physical activity, or (4) unilateral pain. Second, they must report that for either their most severe or second most severe headache type, they experienced at least one of the following symptoms "half the time or more" or "less than half the time:" (1) nausea, or (2) photophobia and phonophobia. Eligible respondents (n= 1,183) were divided into two groups, CM and EM, based on reported headache frequency on the screener survey (EM: <15 headache days per month, CM: ≥ 15 headache days per month).

The main questionnaire collected data concerning sociodemographic and clinical characteristics, comorbid conditions, attitudes, and utilization of health resources. Within resource utilization, information was collected about headache-related provider visits,

emergency room visits, hospital admissions, and use of abortive and prophylactic pharmaceuticals.

All data were de-identified. This research was approved as exempt by the Institutional Review Board of the University of Washington.

Statistical analyses:

Because sampling for each country differed by migraine type, we stratified all analyses by migraine type (CM vs. EM). We described respondents in each country by demographic and clinical characteristics, using means and standard deviations for continuous variables and proportions for categorical variables. Box plots and histograms were also used to visualize quantitative variables.

We performed inferential analyses to test the association between country and utilization of specific health resources. Basic bivariate inferential analyses allowed for simple descriptions of these relationships. We used analysis of variance (ANOVA) to determine whether means of continuous variables varied across countries, and chi squared (χ^2) tests to determine whether the proportion of respondents reporting use of a given resource differed by country. Converting discrete outcomes, such as the number of prophylaxis agents currently used, to categorical outcomes (0, 1 or >1, in this case) facilitated the use of χ^2 tests.

We ran multivariate logistic regression models to determine whether the odds of reporting use of a given resource differed by country, relative to the US, while controlling for covariates. Outcome variables were dichotomized, if needed, to use logistic regression models. Models included the following clinical and demographic covariates, which were selected a priori: age, gender, income (above or below the country-specific median), ethnicity (Caucasian, Black, Asian, Hispanic, or other/prefer not to say), residential region (urban, suburban, or rural), work status (working, not working, student, homemaker, or prefer not to say), BMI category, migraine type, and number of comorbid conditions. We completed all statistical analyses using Stata, version 12.[9]

Results

Of the panelists who responded to the screener survey and met the eligibility criteria (n= 1,183), 1,165 (98.5%) completed the main questionnaire.

Tables 1 and 2 present sociodemographic and clinical characteristics of chronic and episodic migraineurs, respectively, by country. Amongst EM respondents, age, gender, residential region, work status, BMI, and Migraine Disability Assessment Score (MIDAS) [10] grade differed significantly by country. There was less cross-country variability in demographic and clinical characteristics amongst CM respondents; only age, ethnicity and residential region differed significantly. CM respondents were older than EM respondents in all countries, except Germany and the UK. Mean age differed significantly by country in both migraine types; in CM, Canadian respondents were the oldest (mean 45.8, SD 11.3 years) and German respondents were the youngest (mean 38.2, SD 12.5 years), while in EM, UK respondents were the oldest (mean 47.8, SD 11.6 years) and Australian respondents were the youngest (mean 40.9, SD 13.3 years). Respondents were predominantly female in all countries and in both migraine types. However, gender distribution varied significantly by country in EM respondents; the proportion that was female was lowest in Australia (55.6%) and highest in Canada (83.6%). In all countries, fewer CM respondents than EM respondents reported an annual income above the country-specific median, but within each migraine type, the proportion of respondents with income above median did not differ significantly by country. Over 80% of respondents were Caucasian in all countries and both migraine types. Ethnicity varied significantly by country, but this may have been driven partially by the proportion of German respondents who reported their ethnicity as "other or prefer not to say." Home region also varied significantly by country in both migraine types; the US, the UK and Australia reported the most suburban living; Canada and Germany reported more urban living; France was split between urban and rural. CM respondents were less likely to report currently working than EM respondents in all countries, and work status varied significantly by country in EM respondents. More CM respondents were obese than EM respondents in all countries except for the US and the UK, where the proportion obese was

similar across migraine types. BMI distribution differed significantly by country in EM respondents, with the highest prevalence of obesity in the US (40.3%) and the lowest prevalence in France (13.8%). The number of comorbid conditions was also higher in CM respondents but did not differ significantly by country. The MIDAS grade was higher, indicating more severe disability, in CM respondents than EM respondents; MIDAS grade distribution varied significantly by country in EM respondents only.

Table 1. Sociodemographic and clinical characteristics of chronic migraineurs by country

Characteristic n (%), unless otherwise stated	US (n= 205)	Canada (n= 50)	France (n= 57)	UK (n= 50)	Germany (n= 81)	Australia (n= 50)	p*
Age in years, mean (SD)	44.3 (11.9)	45.8 (11.3)	43.7 (12.1)	42.6 (13.5)	38.2 (12.5)	45.0 (9.6)	<0.01
Female	166 (81.0)	39 (78.0)	42 (73.7)	39 (78.0)	67 (82.7)	39 (78.0)	0.82
Income > country-specific median	83 (42.1)	17 (40.5)	17 (32.1)	17 (37.0)	20 (28.2)	17 (38.6)	0.38
Ethnicity							
· Caucasian/white (includes Arab/Middle Eastern)	178 (86.8)	45 (90.0)	52 (91.2)	44 (88.0)	53 (65.4)	49 (98.0)	<0.01
· Black	9 (4.4)	1 (2.0)	2 (3.5)	0 (0)	1 (1.2)	0 (0)	
· Asian	3 (1.5)	0 (0)	0 (0)	6 (12.0)	0 (0)	0 (0)	
· Hispanic or Latino/Latin American	7 (3.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
· Other or prefer not to say	8 (3.9)	4 (8.0)	3 (5.3)	0 (0)	27 (33.3)	1 (2.0)	
Home region							
· Urban	41 (20.0)	25 (50.0)	21 (36.9)	14 (28.0)	45 (55.5)	7 (14.0)	<0.01
· Suburban	99 (48.3)	17 (34.0)	17 (29.8)	24 (48.0)	19 (23.5)	30 (60.0)	
· Rural	65 (31.7)	8 (16.0)	19 (33.3)	12 (24.0)	19 (21.0)	13 (26.0)	
Work status							
· Working full or part time	78 (38.0)	19 (38.0)	21 (36.8)	25 (50.0)	45 (55.6)	18 (36.0)	0.12
· Unemployed (retired, disabled, seeking employment)	93 (45.4)	23 (46.0)	24 (42.1)	19 (38.0)	24 (29.6)	23 (46.0)	
· Student	3 (1.5)	3 (6.0)	2 (3.5)	0 (0)	3 (3.7)	3 (6.0)	
· Homemaker	30 (14.6)	5 (10.0)	9 (15.8)	4 (8.0)	9 (11.1)	6 (12.0)	
· Prefer not to say	1 (0.5)	0 (0)	1 (1.8)	2 (4.0)	0 (0)	0 (0)	
BMI category							
· Underweight (<18.5)	6 (2.9)	1 (2.0)	1 (1.7)	5 (10.0)	5 (6.2)	2 (4.0)	0.20
· Normal (18.5-24.9)	62 (30.3)	14 (28.0)	25 (43.9)	16 (32.0)	23 (28.4)	9 (18.0)	
· Overweight (25.0-29.9)	55 (26.8)	14 (28.0)	12 (21.1)	16 (32.0)	24 (29.6)	14 (28.0)	
· Obese (>30.0)	82 (40.0)	21 (42.0)	19 (33.3)	13 (26.0)	29 (35.8)	25 (50.0)	
Number of comorbid conditions							
· 0	21 (10.2)	3 (6.0)	5 (8.8)	7 (14.0)	4 (4.9)	3 (6.0)	0.13
· 1	27 (13.2)	2 (4.0)	10 (17.5)	4 (8.0)	12 (14.8)	3 (6.0)	
· 2	30 (14.6)	8 (16.0)	3 (5.3)	9 (18.0)	13 (16.1)	3 (6.0)	
· >2	127 (62.0)	37 (74.0)	39 (68.4)	30 (60.0)	52 (64.2)	41 (82.0)	
MIDAS grade							
· Grade I (little disability)	10 (4.9)	1 (2.0)	5 (8.8)	1 (2.0)	4 (4.9)	3 (6.0)	0.38
· Grade II (mild disability)	12 (5.8)	2 (4.0)	3 (5.3)	2 (4.0)	1 (1.2)	4 (8.0)	
· Grade III (moderate disability)	10 (4.9)	2 (4.0)	6 (10.5)	3 (6.0)	3 (3.7)	4 (8.0)	
· Grade IVa (severe disability)	33 (16.1)	4 (8.0)	11 (19.3)	8 (16.0)	11 (13.6)	2 (4.0)	
· Grade IVb (very severe disability)	140 (68.3)	41 (82.0)	32 (56.1)	36 (72.0)	62 (76.6)	37 (74.0)	

p value for age from ANOVA test (all others from χ^2 tests)

Table 2. Sociodemographic and clinical characteristics of episodic migraineurs by country

Characteristic n (%), unless otherwise stated	US (n= 226)	Canada (n= 55)	France (n= 109)	UK (n= 107)	Germany (n= 112)	Australia (n= 63)	p*
Age in years, mean (SD)	43.7 (12.3)	42.7 (12.2)	42.8 (12.3)	47.8 (11.6)	43.9 (11.9)	40.9 (13.3)	<0.01
Female	181 (80.1)	46 (83.6)	84 (77.1)	73 (68.2)	63 (56.2)	35 (55.6)	<0.01
Income above country-specific median	117 (53.7)	22 (46.8)	45 (46.9)	42 (42.4)	52 (53.1)	30 (53.6)	0.46
Ethnicity							
· Caucasian/white (includes Arab/Middle Eastern)	198 (87.6)	53 (96.4)	104 (95.4)	103 (96.2)	94 (83.9)	60 (95.2)	<0.01
· Black	10 (4.4)	1 (1.8)	0 (0)	0 (0)	0 (0)	0 (0)	
· Asian	5 (2.2)	1 (1.8)	1 (0.9)	2 (1.9)	0 (0)	1 (1.6)	
· Hispanic or Latino/Latin American	10 (4.4)	0 (0)	1 (0.9)	0 (0)	1 (0.9)	0 (0)	
· Other or prefer not to say	3 (1.3)	0 (0)	3 (2.7)	2 (1.9)	17 (15.2)	2 (3.2)	
Home region							
· Urban	51 (22.6)	33 (60.0)	37 (33.9)	28 (26.2)	69 (61.6)	15 (23.8)	<0.01
· Suburban	118 (52.2)	13 (23.6)	27 (24.8)	42 (39.2)	26 (23.2)	31 (49.2)	
· Rural	57 (25.2)	9 (16.4)	45 (41.3)	37 (34.6)	17 (15.2)	17 (27.0)	
Work status							
· Working full or part time	125 (55.3)	33 (60.0)	68 (62.4)	67 (62.6)	67 (59.8)	26 (41.3)	<0.01
· Unemployed (retired, disabled, seeking employment)	45 (19.9)	11 (20.0)	20 (18.4)	24 (22.4)	25 (22.3)	21 (33.3)	
· Student	15 (6.6)	1 (1.8)	8 (7.3)	0 (0)	7 (6.3)	1 (1.6)	
· Homemaker	41 (18.1)	7 (12.7)	13 (11.9)	12 (12.2)	13 (11.6)	14 (22.2)	
· Prefer not to say	0 (0)	3 (5.4)	0 (0)	3 92.8)	0 (0)	1 (1.6)	
BMI category							
· Underweight (<18.5)	2 (0.88)	1 (1.8)	8 (7.3)	6 (5.6)	4 (3.6)	2 (3.2)	<0.01
· Normal (18.5-24.9)	70 (31.0)	20 (36.4)	47 (43.1)	42 (39.3)	43 (38.4)	19 (30.2)	
· Overweight (25.0-29.9)	63 (27.9)	14 (25.4)	39 (35.8)	29 (27.1)	36 (32.1)	20 (31.7)	
· Obese (>30.0)	91 (40.3)	20 (36.4)	15 (13.8)	30 (28.0)	29 (25.9)	22 (34.9)	
Number of comorbid conditions							
· 0	36 (15.9)	8 (14.5)	18 (16.5)	17 (15.9)	22 (19.6)	11 (17.4)	0.83
· 1	48 (21.2)	11 (20.0)	19 (17.4)	19 (17.8)	26 (23.2)	10 (15.9)	
· 2	40 (17.7)	11 (20.0)	22 (20.2)	20 (18.7)	10 (8.9)	9 (14.3)	
· >2	102 (45.1)	25 (45.5)	50 (45.9)	51 (47.6)	54 (48.2)	33 (52.4)	
MIDAS grade							
· Grade I (little disability)	41 (18.1)	19 (34.5)	27 (24.8)	31 (29.0)	13 (11.6)	14 (22.2)	0.02
· Grade II (mild disability)	54 (23.9)	15 (27.3)	28 (25.7)	31 (29.0)	22 (19.6)	23 (36.5)	
· Grade III (moderate disability)	71 (31.4)	9 (16.4)	31 (28.4)	24 (22.4)	45 (40.2)	13 (20.6)	
· Grade IVa (severe disability)	46 (20.4)	9 (16.4)	18 (16.5)	17 (16.0)	23 (20.5)	8 (12.7)	
· Grade IVb (very severe disability)	14 (6.2)	3 (5.4)	5 (4.6)	4 (3.7)	9 (8.0)	5 (8.0)	

p value for age from ANOVA test (all others from χ^2 tests)

Tables 3 and 4 present headache-related resource utilization in CM and EM, respectively, by country. Resource utilization was generally higher in CM than in EM. The proportion of respondents who reported visiting a healthcare provider for headache in the three months prior to the survey differed significant by country in CM only. However, in both CM and EM, respondents from Australia reported the highest proportion of headache-related provider visits in the prior three months (CM 64.0%, EM 36.5%), and respondents from the US reported the lowest (CM 37.1%, EM 19.5%). The percent of respondents who reported ever visiting the ER for headache differed significantly by country in both CM and EM, with respondents from Canada reporting the highest proportion (CM 52.0%, EM 34.5%) and respondents from the UK reporting the lowest (CM 14.0%, EM 8.4%). Similarly, the percent of EM respondents reporting ever being admitted to the hospital for headache differed significantly by country, with Canada having the highest proportion (16.4%) and the UK having the lowest (0%); headache-related hospital admission did not differ significantly by country in CM. The proportion of respondents who reported having a typical provider of headache-related care did not differ significantly by country in either migraine type. The number of prophylaxis agents ever tried and the number currently used also did not differ significantly by country in either migraine type (also see Figures 1 and 2). However, the proportion of EM respondents reporting ever trying more than three abortive agents differed significantly by country, with Australia having the highest proportion (63.5%) and Canada the lowest (45.4%); this did not differ significantly by country in CM. Antidepressants were the most commonly reported prophylaxis agent currently used in all countries and both migraine types. The only exception was EM respondents from Germany, who reported a higher proportion of current beta blocker use (also see Figure 3). Use of over the counter abortive agents was more commonly reported than use of prescription abortive agents in all countries and migraine types except CM respondents from Germany, who reported more prescription abortive use. The proportion of subjects reporting use of prescription abortive agents was lowest in the US (CM 52.7%, EM 42.9%) and highest in the UK for EM (72.9%) and in Australia for CM (76.0%, also see Figure 4).

Table 3. Resource utilization amongst chronic migraineurs by country

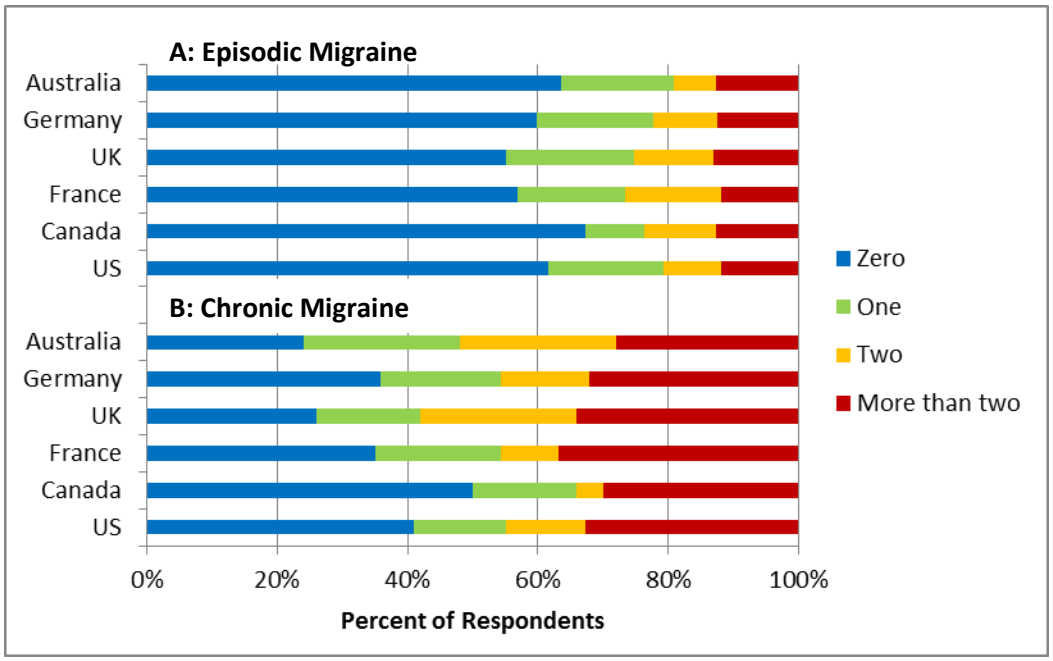
Resources Utilized	n (%)						
	US (n= 205)	Canada (n= 50)	France (n= 57)	UK (n= 50)	Germany (n= 81)	Australia (n= 50)	p
Visited a provider for HA in the last 3 months	76 (37.1)	23 (46.0)	31 (54.4)	26 (52.0)	37 (45.7)	32 (64.0)	0.009
Have a typical provider of HA care	177 (86.3)	44 (88.0)	52 (91.2)	42 (84.0)	73 (90.1)	48 (96.0)	0.379
Have visited the ER for HA	87 (42.4)	26 (52.0)	9 (15.8)	7 (14.0)	13 (16.0)	19 (38.0)	<0.001
Have been admitted to hospital for HA	28 (13.7)	11 (22.0)	10 (17.5)	7 (14.0)	11 (13.6)	12 (24.0)	0.398
Number of migraine prophylaxis agents ever tried							
· Zero	84 (41.0)	25 (50.0)	20 (35.1)	13 (26.0)	29 (35.8)	12 (24.0)	
· One	29 (14.1)	8 (16.0)	11 (19.3)	8 (16.0)	15 (18.5)	12 (24.0)	
· Two	25 (12.2)	2 (4.0)	5 (8.8)	12 (24.0)	11 (13.6)	12 (24.0)	
· > Two	67 (32.7)	15 (30.0)	21 (36.8)	17 (34.0)	26 (32.1)	14 (28.0)	0.077
Number of migraine prophylaxis agents currently using							
· Zero	127 (62.0)	30 (60.0)	35 (61.4)	26 (52.0)	53 (65.4)	24 (48.0)	
· One	57 (27.8)	17 (34.0)	16 (28.1)	15 (30.0)	23 (28.4)	21 (42.0)	
· > One	21 (10.2)	3 (6.0)	6 (10.5)	9 (18.0)	5 (6.2)	5 (10.0)	0.387
Type of migraine prophylaxis agent(s) currently used*							
· Antidepressant	59 (28.8)	12 (24.0)	15 (26.3)	18 (36.0)	20 (24.7)	17 (34.0)	
· Antiepileptic	26 (12.7)	7 (14.0)	5 (8.8)	5 (10.0)	6 (7.4)	10 (20.0)	
· Beta blocker	10 (4.9)	2 (4.0)	10 (17.5)	9 (18.0)	7 (8.6)	3 (6.0)	
· Calcium channel blocker	5 (2.4)	0 (0)	1 (1.7)	2 (4.0)	1 (1.2)	1 (2.0)	N/A
Number of migraine abortive agents ever tried							
· ≤ 3	82 (40.0)	25 (50.0)	18 (31.6)	21 (42.0)	31 (38.3)	12 (24.0)	
· >3	123 (60.0)	25 (50.0)	39 (68.4)	29 (58.0)	50 (61.7)	38 (76.0)	0.115
Type of abortive migraine agent(s) currently used*							
· Prescription	108 (52.7)	35 (70.0)	39 (68.4)	34 (68.0)	58 (71.6)	38 (76.0)	
· OTC	170 (82.9)	38 (76.0)	43 (75.4)	35 (70.0)	50 (61.7)	44 (88.0)	N/A

*Subjects may be using more than one agent, HA: headache, N/A: not available (some respondents taking more than one agent), p values from χ^2 tests

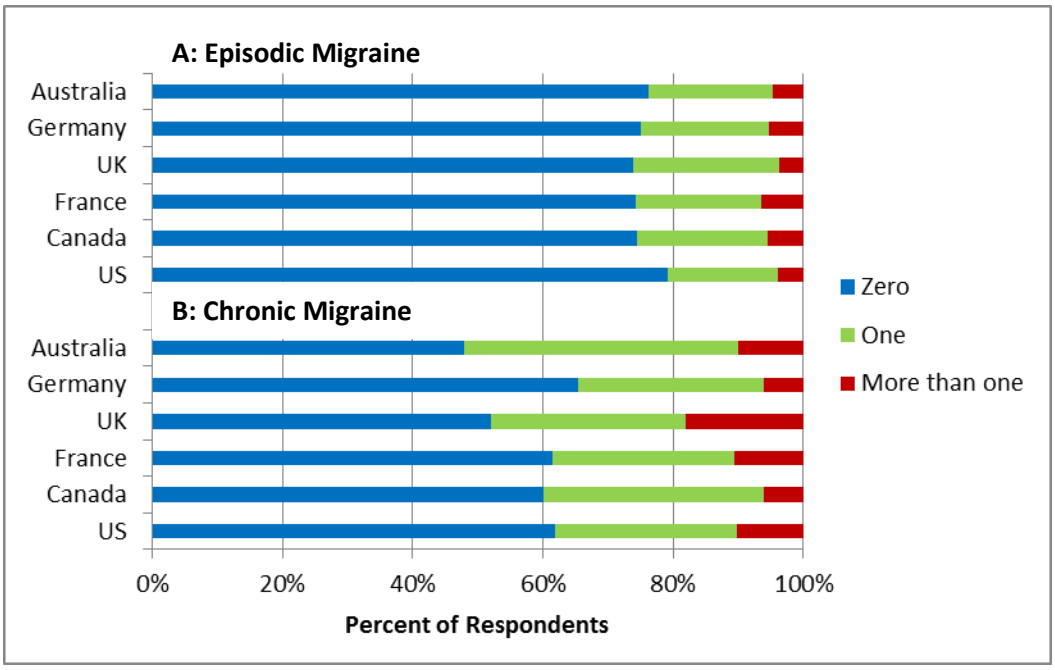
Table 4. Resource utilization amongst episodic migraineurs by country

Resources Utilized	n (%)						
	US (n= 205)	Canada (n= 50)	France (n= 57)	UK (n= 50)	Germany (n= 81)	Australia (n= 50)	p
Visited a provider for HA in the last 3 months	44 (19.5)	16 (29.1)	30 (27.5)	28 (26.2)	29 (25.9)	23 (36.5)	0.108
Have a typical provider of HA care	166 (73.4)	44 (80.0)	91 (83.5)	82 (76.6)	88 (78.6)	50 (79.4)	0.439
Have visited the ER for HA	61 (27.0)	19 (34.5)	15 (13.8)	9 (8.4)	13 (11.6)	17 (27.0)	<0.001
Have been admitted to hospital for HA	13 (5.7)	9 (16.4)	13 (11.9)	0 (0)	11 (9.8)	7 (11.1)	0.001
Number of migraine prophylaxis agents ever tried							
· Zero	139 (61.5)	37 (67.3)	62 (56.9)	59 (55.1)	67 (59.8)	40 (63.5)	
· One	40 (17.7)	5 (9.1)	18 (16.5)	21 (19.6)	20 (17.9)	11 (17.5)	
· Two	20 (8.8)	6 (10.9)	16 (14.7)	13 (12.2)	11 (9.8)	4 (6.3)	
· > Two	27 (11.9)	7 (12.7)	13 (11.9)	14 (13.1)	14 (12.5)	8 (12.7)	0.933
Number of migraine prophylaxis agents currently using							
· Zero	179 (79.2)	41 (74.5)	81 (74.3)	79 (73.8)	84 (75.0)	48 (76.2)	
· One	38 (16.8)	11 (20.0)	21 (19.3)	24 (22.4)	22 (19.6)	12 (19.0)	
· > One	9 (4.0)	3 (5.4)	7 (6.4)	4 (3.8)	6 (5.4)	3 (4.8)	0.981
Type of migraine prophylaxis agent(s) currently used*							
· Antidepressant	32 (14.2)	9 (16.4)	17 (15.6)	17 (15.9)	15 (13.4)	11 (17.5)	
· Antiepileptic	13 (5.7)	4 (7.3)	6 (5.5)	3 (2.8)	1 (0.9)	2 (3.2)	
· Beta blocker	8 (3.5)	4 (7.3)	11 (10.1)	10 (9.3)	18 (16.1)	3 (4.8)	
· Calcium channel blocker	4 (1.8)	0 (0)	2 (1.8)	2 (1.9)	3 (2.7)	1 (1.6)	N/A
Number of migraine abortive agents ever tried							
· ≤ 3	108 (47.8)	30 (54.5)	40 (36.7)	43 (40.2)	60 (53.6)	23 (36.5)	
· >3	118 (52.2)	25 (45.4)	69 (63.3)	64 (59.8)	52 (46.4)	40 (63.5)	0.036
Type of abortive migraine agent(s) currently used*							
· Prescription	106 (42.9)	24 (43.6)	68 (62.4)	76 (71.0)	68 (60.7)	35 (55.6)	
· OTC	192 (85.0)	53 (96.4)	81 (74.3)	78 (72.9)	82 (73.2)	54 (85.7)	N/A

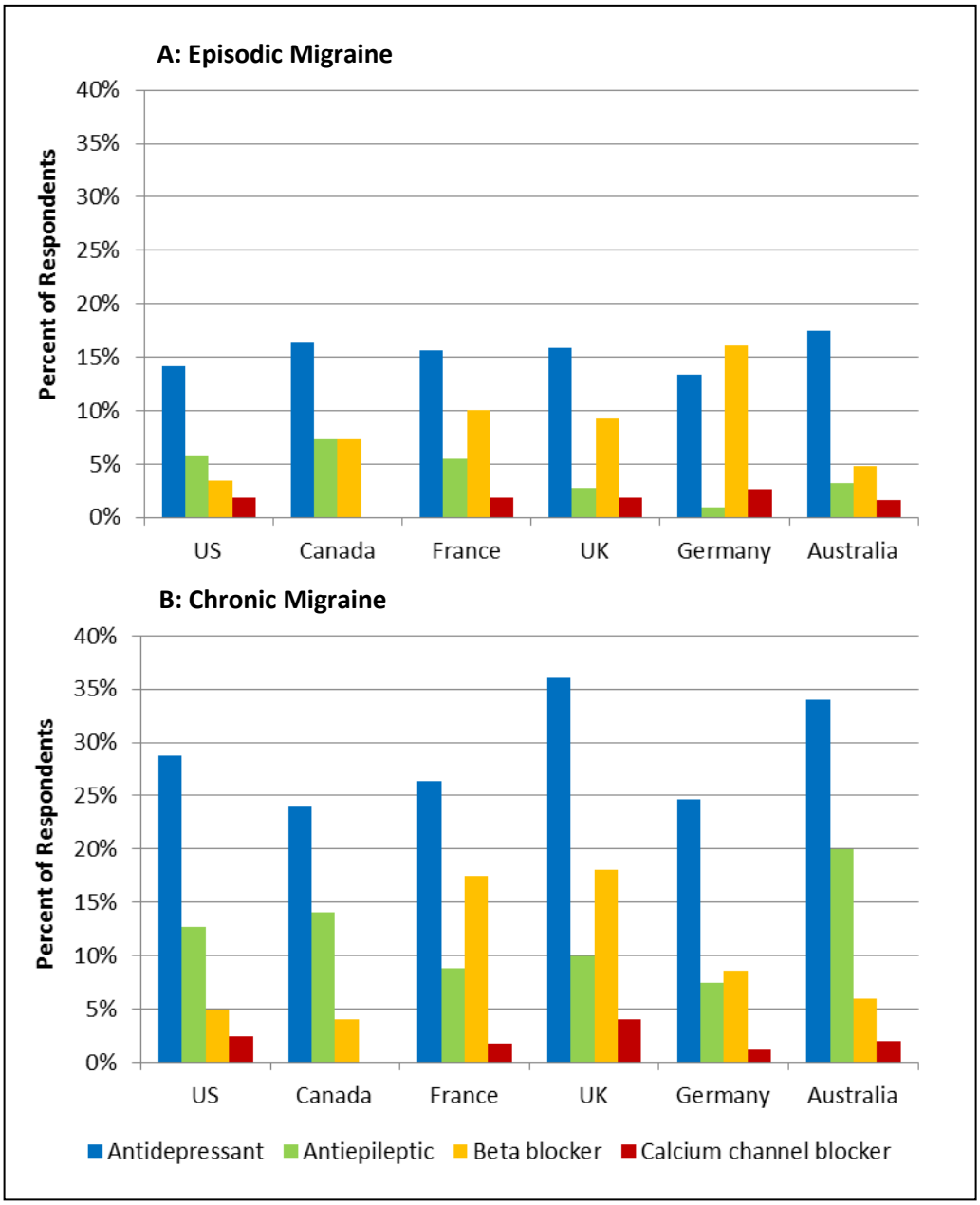
*Subjects may be using more than one agent, HA: headache, N/A: not available (some respondents taking more than one agent), p values from χ^2 tests



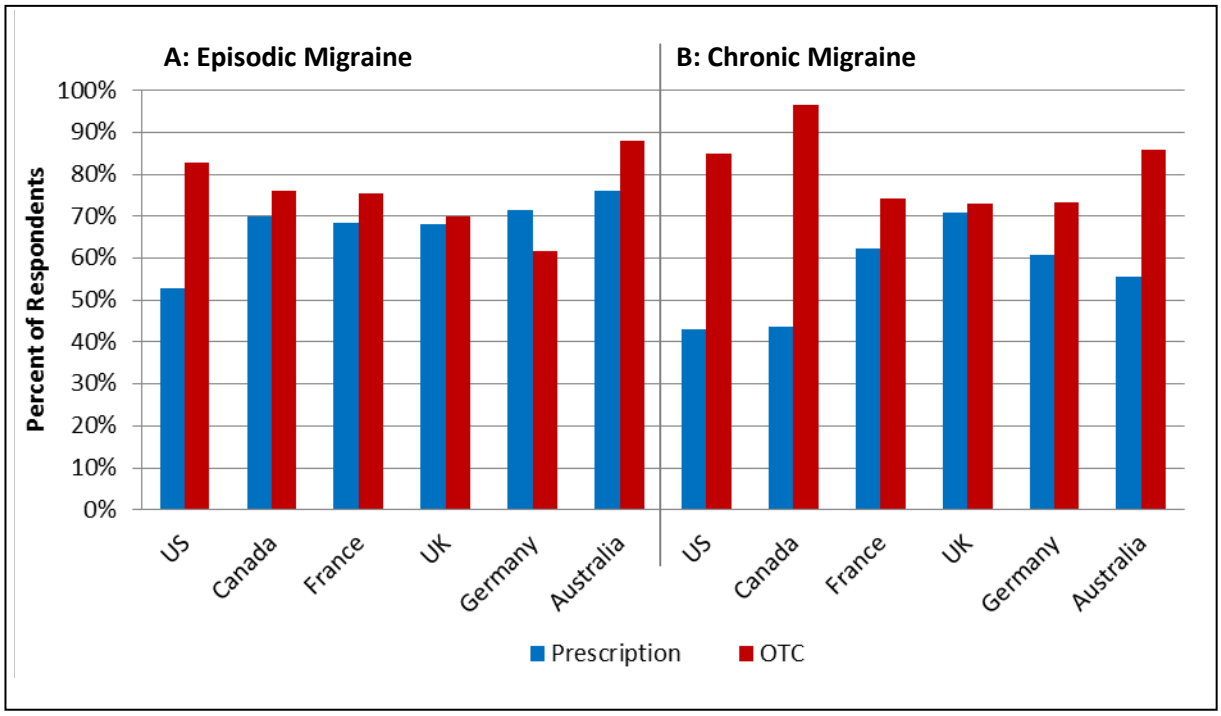
Figures 1A and 1B. Number of migraine prophylaxis therapies ever used by country



Figures 2A and 2B. Number of migraine prophylaxis therapies currently used by country



Figures 3A and 3B. Type of migraine prophylaxis therapies currently used by country



Figures 4A and 4B. Type of migraine abortive therapies currently used by country

Tables 5 and 6 and Figure 5 present the type of provider respondents reported typically visiting for headache care, by country. Primary care providers were the most commonly reported provider of headache care in all countries and migraine types. For both CM and EM, the UK had the highest proportion of respondents who reported typically visiting a primary care provider for headache care (CM 64.0%, EM 69.2%), and Germany had the lowest (CM 35.8%, EM 45.5%). Neurologists were the second most commonly reported provider type visited in all countries. However, the distribution of provider types differed significantly by country in both CM and EM.

Table 5. Typical provider of headache care in chronic migraine

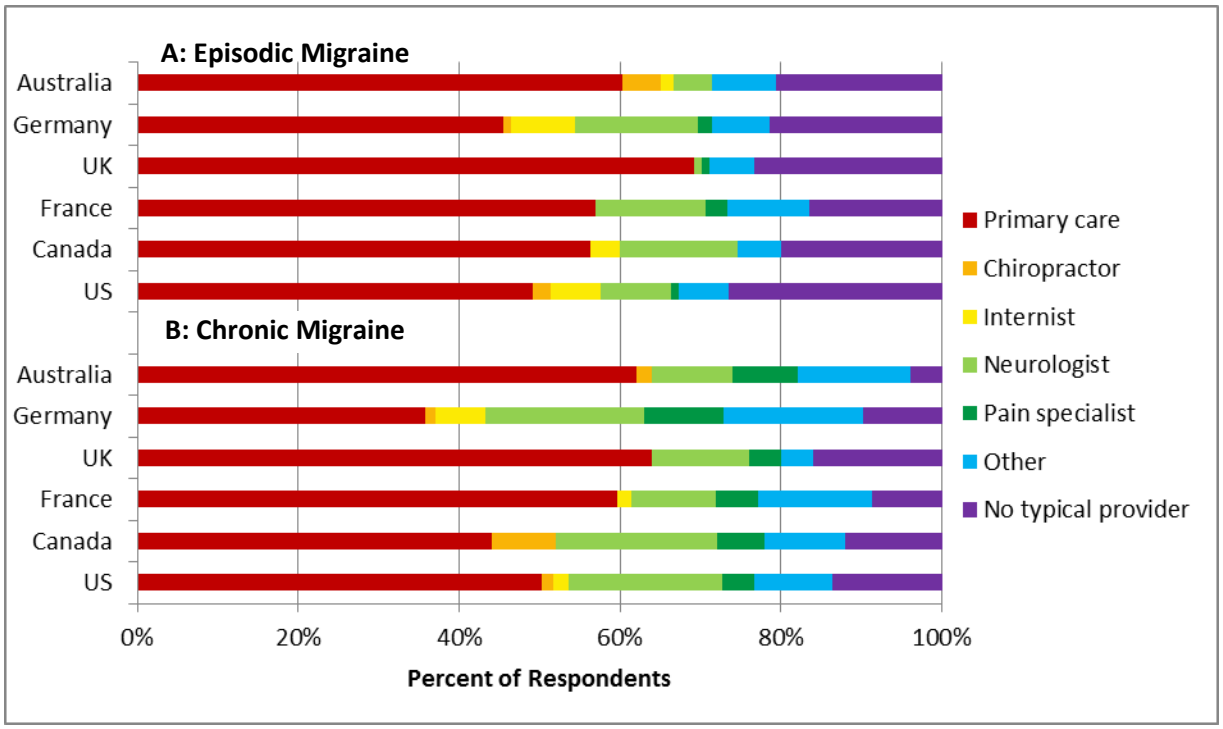
Provider type n (%)	US (n= 205)	Canada (n= 50)	France (n= 57)	UK (n= 50)	Germany (n= 81)	Australia (n= 50)	p
Primary care	103 (50.2)	22 (44.0)	34 (59.7)	32 (64.0)	29 (35.8)	31 (62.0)	
Chiropractor	3 (1.5)	4 (8.0)	0 (0)	0 (0)	1 (1.2)	1 (2.0)	
Internist	4 (1.9)	0 (0)	1 (1.7)	0 (0)	5 (6.2)	0 (0)	0.005
Neurologist	39 (19.0)	10 (20.0)	6 (10.5)	6 (12.0)	16 (19.7)	5 (10.0)	
Pain specialist	8 (3.9)	3 (5.3)	3 (5.3)	2 (4.0)	8 (10.0)	4 (8.0)	
Other*	20 (9.8)	5 (10.0)	8 (14.0)	2 (4.0)	14 (17.3)	7 (14.0)	
No typical provider	28 (13.7)	6 (12.0)	5 (8.8)	8 (16.0)	8 (10.0)	2 (4.0)	

* OB/GYN, ophthalmologist, psychiatrist, other and unknown

Table 6. Typical provider of headache care in episodic migraine

Provider type n (%)	US (n= 226)	Canada (n= 55)	France (n= 109)	UK (n= 107)	Germany (n= 112)	Australia (n= 63)	p
Primary care	111 (49.1)	31 (56.4)	62 (56.9)	74 (69.2)	51 (45.5)	38 (60.3)	
Chiropractor	5 (2.2)	0 (0)	0 (0)	0 (0)	1 (0.9)	3 (4.8)	
Internist	14 (6.2)	2 (3.6)	0 (0)	0 (0)	9 (8.0)	1 (1.6)	0.001
Neurologist	20 (8.8)	8 (14.5)	15 (13.8)	1 (0.9)	17 (15.2)	3 (4.8)	
Pain specialist	2 (0.9)	0 (0)	3 (2.7)	1 (0.9)	2 (1.8)	0 (0)	
Other*	14 (6.2)	3 (5.5)	11 (10.1)	6 (5.6)	8 (7.1)	5 (7.9)	
No typical provider	60 (26.5)	11 (20.0)	18 (16.5)	25 (23.4)	24 (21.4)	13 (20.6)	

* OB/GYN, ophthalmologist, psychiatrist, other and unknown



Figures 5A and 5B. Typical provider of headache care by country

Table 7 presents the results from the multivariate analyses of resource utilization. All odds ratios are relative to the US and are adjusted for age, gender, income, ethnicity, region of residence, work status, BMI, migraine type and number of comorbid conditions. The odds of visiting a provider for headache in the three months prior to survey completion were higher in all countries relative to the US; this trend was significant for all countries except Germany. The odds of having a typical provider of headache care were also higher in all countries relative to the US, but this was only significant for France (OR 1.85, 95% CI 1.04, 3.32). Relative to the US,

the odds of having ever visited the emergency room for headache were significantly lower in France (OR 0.37, 95% CI 0.22, 0.62), the UK (0.25, 95% CI 0.14, 0.45) and Germany (OR 0.31, 95% CI 0.18, 0.53); Canada and Australia did not differ significantly from the US. The odds of having ever been admitted to the hospital for headache were significantly higher in Canada (OR 2.18, 95% CI 1.11, 4.27) and Australia (OR 2.16, 95% CI 1.14, 4.12) relative to the US. The odds of ever trying more than two prophylaxis agents and currently using more than one prophylaxis agent did not differ significantly by country, relative to the US. Respondents from Australia (OR 1.83, 95% CI 1.13, 2.96) and France (OR 1.51, 95% CI 1.00, 2.28) were more likely than those from the US to report ever trying more than three abortive agents. The odds of currently using a prescription abortive agent were significantly higher in France (OR 1.80, 95% CI 1.19, 2.74), the UK (OR 2.68, 95% CI 1.72, 4.17), Australia (OR 1.88, 95% CI 1.16, 3.03) and Germany (OR 2.10, 95% CI 1.37, 3.23) than in the US.

Table 7. Adjusted odds of utilizing resources by country, relative to the US.

OR (95% CI)*	US	Canada	France	UK	Germany	Australia
Have visited a provider for headache in the last 3 months	1.00	1.79 (1.07, 2.99)	1.61 (1.04, 2.48)	1.59 (1.02, 2.47)	1.43 (0.92, 2.22)	2.77 (1.71, 4.47)
Have a typical provider of headache care	1.00	1.64 (0.83, 3.26)	1.85 (1.04, 3.32)	1.03 (0.62, 1.73)	1.59 (0.90, 2.79)	1.93 (0.98, 3.79)
Have visited the emergency room for headache	1.00	1.32 (0.81, 2.18)	0.37 (0.22, 0.62)	0.25 (0.14, 0.45)	0.31 (0.18, 0.53)	0.89 (0.55, 1.45)
Have been admitted to the hospital for headache	1.00	2.18 (1.11, 4.27)	1.66 (0.90, 3.08)	0.56 (0.23, 1.32)	1.54 (0.81, 2.91)	2.16 (1.14, 4.12)
Have ever tried more than two prophylaxis agents	1.00	0.75 (0.39, 1.41)	1.05 (0.63, 1.76)	1.31 (0.78, 2.20)	1.03 (0.61, 1.72)	0.81 (0.44, 1.47)
Currently using more than one prophylaxis agent	1.00	0.51 (0.17, 1.55)	1.24 (0.58, 2.63)	1.63 (0.77, 3.44)	0.74 (0.33, 1.69)	1.10 (0.47, 2.58)
Ever tried more than 3 abortive agents	1.00	0.73 (0.45, 1.18)	1.51 (1.00, 2.28)	1.32 (0.88, 1.98)	0.91 (0.61, 1.37)	1.83 (1.13, 2.96)
Currently using a prescription abortive agent	1.00	1.14 (0.70, 1.86)	1.80 (1.19, 2.74)	2.68 (1.72, 4.17)	2.10 (1.37, 3.23)	1.88 (1.16, 3.03)

*OR (relative to US) are adjusted for age, gender, income, ethnicity, region of residence, work status, BMI, migraine type, and number of comorbid conditions.

Discussion

The objective of this research was to describe migraine-specific health resource and medication utilization amongst chronic and episodic migraineurs in the US, Canada, the UK, Germany, France and Australia.

Migraineurs differed significantly across countries in their demographic and clinical characteristics. However, general patterns were similar to those found for migraineurs in previous studies: (1) respondents were predominantly Caucasian and female, and (2) CM respondents were slightly older, reported lower household income, were less likely to be currently employed, reported more comorbid conditions and had higher MIDAS scores, signifying more severe disability.[11, 12] EM respondents were more diverse across countries demographically and clinically than CM respondents. Because chronic migraineurs are the most debilitated subset of the migraine population, it would not be surprising that they represent a distinct clinical group with more shared characteristics.

Resource utilization also differed significantly across countries. Respondents from other countries were more likely than those from the US to report visiting a healthcare provider for headache in the prior three months, in both unadjusted and adjusted analyses. For example, only 37% of CM subjects from the US reported visiting a provider for headache in the prior three months, compared to 64% in Australia. Similarly, US respondents were less likely to report having a typical provider of headache care, though adjusted results were only statistically significant in the comparison with France. The reasons for these differences are unclear. However, findings suggest that, relative to other countries, US migraineurs have less access to preventive services. A number of factors may limit access in the US, including factors related to the healthcare system, such as the lack of universal coverage of preventative care or the presence of insurance deductibles for preventative services. In general, less access to preventative care services could shift health resource utilization to emergency services. Consistent with this idea, US respondents were more likely to report previously visiting the emergency room for headache than respondents from France, the UK and Germany, in both

unadjusted and adjusted analyses. For example, 42% of CM subjects from the US reported a prior ER visit for headache, compared to 14% of CM subjects from the UK. However, this is clearly a multifactorial issue. Canada actually had the highest percent of CM subjects that reported visiting the ER (52%). This aligns with the results of a recent study, which found that, out of 11 countries surveyed, Canada had the highest percent of subjects that had visited the ER in the prior 2 years.[7] Our results also indicate that Canadian and Australian respondents were more likely to report ever being admitted to the hospital for migraine than US respondents. Again, the reason for this difference in hospitalization-rates is unknown and is likely multifactorial. Australia and Canada have longer average wait times to see specialists compared to the US. The same study mentioned above also reported that 41% of Canadian respondents and 28% of Australian respondents waited two months or more to visit a specialist, compared to 9% of US respondents.[7] Whether this impacts hospitalization rates of migraineurs is unknown. Further research into the impact of healthcare system design on access to and use of primary care, tertiary care and emergency services in the migraine population is warranted.

Percent of respondents who reported ever using migraine prophylaxis therapy ranged from about 50% to 76% in CM and from about 33% to 45% in EM, depending on the country. Ever use of prophylaxis therapy for EM respondents in the US was similar to ever use in respondents from the American Migraine Prevalence and Prevention (AMPP) study (IBMS-II 38.5%, AMPP 38.7%).[13] AMPP is a longitudinal population-based survey study of US migraineurs. Though AMPP results were not stratified by migraine type, reported prevalence rates in this population-based study would be weighted towards EM respondents; the prevalence of migraine in the US is about 12%, while the prevalence of CM (a subset of all migraine) is only about 2%.[4,14] Current or ever use of prophylaxis medications did not differ significantly by country in unadjusted or adjusted analyses. This suggests that the proportion of migraineurs who eventually receive prophylaxis therapy is similar across countries, despite differences in frequency of outpatient and inpatient visits. Due to the cross-sectional nature of this study, the results include prevalent cases of migraine. Treatment patterns for incident migraine cannot be compared across countries using these results. Also, time to treatment and duration of treatment cannot be

assessed. The findings regarding prophylaxis therapy utilization may have been affected by the decision to categorize or dichotomize the medication counts in order to use χ^2 and logistic regression analyses. This certainly loses some information, though it also improves interpretability. Statistical tests were not used to determine whether type of prophylactic agent differed by country; because many respondents were using more than one type of prophylaxis therapy, each agent would have to be tested separately, and the number of respondents using agents from some classes was too low to perform statistical tests. However, the use of prescription abortive agents was compared across countries using logistic regression; results indicated that respondents from France, the UK, Germany and Australia were significantly more likely than those from the US to be currently taking a prescription abortive agent. This too could be a sign of greater access to preventative services in other countries relative to the US, if access to headache care providers is a primary predictor of whether migraineurs use prescription abortive agents. Future studies could explore this possibility.

There are several possible explanations for the differences in resource utilization presented here. Though some possible interpretations are mentioned, the goal of this research was primarily to describe the differences that exist rather than to explain them. The study is limited in its ability to provide explanations for variability in resource utilization because country-level variables were not included in the dataset. For example, it is unclear whether having fewer recent provider visits in one country relative to another is an indication of poor access (e.g. because of affordability), better control of migraines or some other factor. Including migraine type and number of comorbid conditions in the multivariate analyses controls, at least in part, for the impact of disease severity, but there may be residual confounding.

Future research may provide a better understanding of the reasons for the variation in migraine-related resource utilization across countries. For example, a survey could be administered that asks migraineurs both about their utilization of headache-related health resources and about healthcare access, affordability, and other factors. A multilevel analysis could be conducted that includes both country-level and individual-level characteristics that may influence access and utilization. A longitudinal study may also be useful, as it could provide

rates of resource utilization over time and track patterns of pharmaceutical utilization. However, such a study would be difficult to conduct on a multinational level. A cross-sectional survey study, like the one employed here, is much more feasible on this scale.

Since this study was entirely survey-based, results depend upon respondent recall. Information gathered regarding utilization was not verified through external sources. However, any misclassification that occurred is likely to be nondifferential; there is no reason to believe that country is associated with recall of resource utilization. The survey also only collected medication information on the class level. Though it would be interesting to collect utilization information on the drug level, this information may not be reliable in a multinational study based upon self-report. Subject recall accuracy of the names and doses of medications used is generally considered to be poor.[15]

Generalizability may be limited in this study; respondents were selected from a pool of motivated individuals who elected to take web-based health-related surveys. Sociodemographic characteristics of US respondents are similar in many respects to those from AMPP.[11] For example, the ethnicity distribution was comparable in both EM (percent Caucasian: IBMS-II 87.6%, AMPP 87.3%) and CM (percent Caucasian: IBMS-II 90.0%, AMPP 90.7%). Also, gender distribution was similar in both EM (percent female: IBMS-II 80.1%, AMPP 80.0%) and CM (percent female: IBMS-II 78.0%, AMPP 78.6%). However, AMPP respondents were older on average in both EM (mean age: IBMS-II 43.7, AMPP 46.0) and CM (mean age: IBMS-II 44.3, AMPP 47.7). Also, more AMPP respondents reported currently working full or part time in both EM (IBMS-II 55.3%, AMPP 65.4%) and CM (IBMS-II 38.0%, AMPP 49.1%). The use of a web-based survey, rather than a mailed survey, which was used by AMPP, could cause this oversampling of younger, unemployed respondents, who presumably have more time, access and ability to complete online surveys. The impact of these factors on generalizability is unknown. Other sociodemographic factors seem representative, and both age and work status were included as covariates in the multivariate models. However, generalizability may still be limited.

Overall, the results presented here suggest that chronic and episodic migraineurs differ across countries demographically, clinically and in resources used. US migraineurs were generally less likely to report use of preventative services, such as recent provider visits and use of prescription abortive agents, and more likely to report emergency room visits, relative to migraineurs from the other countries studied. However, US migraineurs were also less likely to report ever being hospitalized for headache compared to migraineurs from Canada and Australia. Further research on the sources of this variability, including the influence of healthcare system design, supply and demand features, and the effects of this variability on outcomes in migraineurs is warranted.

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