Headache
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ISSN 0017-8748
doi: 10.1111/head.13471
Published by Wiley Periodicals, Inc.

Research Submission

Optimism, Pessimism, and Migraine: A Cross-Sectional, Population-Based Study

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Background.—Optimism and pessimism are related to several mental health and brain disorders, are significant predictors of physical and psychological health outcomes, and implicated as psychosocial determinants of the pain experience. Despite this promising evidence, limited information is available on optimism and pessimism in headache disorders.

Objective.—To evaluate the influence of optimism and pessimism in meeting criteria for migraine and related disability in a population-based sample.

Methods.—This is an observational, cross-sectional study. The sample population was selected through a stratified, multi-stage area probability sample of households, as used by the last Brazilian Census. A validated questionnaire eliciting data on demographics, headache features, migraine-related disability, depression (PHQ-9), anxiety (GAD-7), optimism, and pessimism (life orientation test – revised) was administered to people with migraine and headache-free control participants from the general population in São Paulo, Brazil via trained interviewers. Six hundred individuals were contacted. The odds for having migraine/no headache diagnosis were calculated by binary logistic regression, and ordinal regression was performed to check associations between migraine-related disability and optimism.

Results.—A total of 302 individuals (mean ± SD age: 39.7 ± 12.7; BMI: 26.5 ± 5.9) met inclusion criteria and were included, 140 controls (with no history of headache disorders) and 162 people meeting criteria for migraine (29 with chronic migraine, that is, 15 or more headache days/month). People with migraine were less optimistic and more pessimistic than controls, and endorsed higher levels of anxious and depressive symptoms. Pessimism (OR 95% CI = 1.16 [1.05–1.28], $P = .005$) and anxiety (OR 95% CI = 1.19 [1.10–1.29], $P < .001$) were predictors of meeting criteria for migraine, while optimism (β 95% CI = −0.915 [−1.643, −0.188], $P = .01$) was inversely associated with migraine-related disability.

Conclusions.—Optimism and pessimism are associated with migraine and migraine-related disability. These concepts should be further explored in people with migraine with regard to their potential influences on clinical research outcomes and treatments.

Key words: migraine, optimism, pessimism, anxiety, depression, headache-related disability

(*Headache* 2019;59:205-214)

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Accepted for publication October 28, 2018.

INTRODUCTION

Migraine is a chronic neurological disease characterized by episodic attacks comprising head pain with a host of prodromal/accompanying symptoms,[1] and constitutes a leading cause of disability worldwide.[2] Migraine is associated with several psychophysiological factors,[1,3] personality traits,[4] and is comorbid with many psychiatric disorders,[5-7] indicating that

Conflict of Interest: None.

Funding: This study was funded by Natura Innovation and Technology of Prducts.

this disease affects behavioral and neurophysiological functioning. In this regard, several constructs have been applied to determine specific psychological characteristics of individuals with migraine, and their implications in terms of management and treatment approaches.[3,4,8,9]

Limited information is available regarding the association between optimism and pessimism and migraine. Dispositional optimism and pessimism, which refer to one's expectations in favorable or unfavorable generalized life events, respectively, constitute cognitive constructs of personality traits associated with a variety of physical and mental health outcomes.[10-12] These constructs have been implicated as psychosocial modulators of function in several pain-related conditions,[13] the perception of pain,[14] and may be predictors of the placebo response in clinical trials.[15-17] Overall, greater optimism correlates to better health-related behavior, better coping with stress and pain, reduced disease complications (re-hospitalization), and lower mortality, while increased pessimism is associated with worse disease prognosis.[12]

Therefore, we aimed to investigate this personality trait in individuals with migraine using the validated "Life Orientation Test" questionnaire, a measure of the traits of optimism and pessimism. We performed exploratory analyses to test the alternative hypothesis, assuming that optimism and pessimism would be predictors of meeting criteria for migraine and migraine-related disability. We hypothesized that optimism would be related to a lower risk of meeting criteria for migraine and lower migraine-related disability, while pessimism would be associated with an increased risk for meeting criteria for migraine and greater migraine-related disability.

METHODS

This is an observational, cross-sectional door-to-door study carried out in the city of São Paulo, Brazil, from March to May, 2015. The study was approved by the institutional review board of the Albert Einstein Hospital, Brazil. All participants signed a consent form.

Eligibility Criteria.—We included in the study men and women aged between 18 and 65 years who showed sound comprehension of questions. Episodic and chronic migraine were diagnosed according to the diagnostic criteria of the International Classification of Headache Disorders – 3rd edition (ICHD-3).[18] Participants with other headaches subtypes were excluded.

Procedures.—Six hundred potential participants were selected from the general population of the city of São Paulo, Brazil. The sample population was selected through a stratified, multistage area probability sample of households. In each household one individual per dwelling was selected via a Kish grid. Sampling units were 2000 count areas defined by the last Brazilian Census.[19] Door-to-door interviews were conducted by trained lay interviewers with extensive experience in marketing interviews. All interviewers attended a 2-day training session, and random supervised interviews were performed during the data collection to ensure accuracy. Respondents were interviewed only after obtained written consent. Eligible respondents were aged 18–65, Portuguese-speaking, without any disability impairing their ability to answer the questionnaire.

Instruments.—The interview had an average duration of 30 minutes. Participants answered demographic questions (Table 1) and questionnaires assessing the following variables:

Optimism and Pessimism: The Life Orientation Test – revised (LOT-R) was used to assess the traits of optimism and pessimism.[20] This questionnaire has been translated and validated into Portuguese.[21] This questionnaire evaluates optimism and pessimism and contains 3 self-report items for optimism, 3 for pessimism, and 4 filler items. It is rated on a 5-point scale from 0 (strongly disagree) to 4 (strongly agree). Optimism (LOT_{Pos}) and Pessimism (LOT_{Neg}) scale scores were analyzed independently, as well as a combined total score (LOT_{Total}).

Headache and Migraine: In order to assess the prevalence and characteristics of headache disorders, an initial question "Have you had any headache during the past year?" was used. If the subject responded positively to this question, a questionnaire was administered that included headache diagnostic criteria, associated symptoms, and disability. Data from this questionnaire were used to assign primary headache diagnoses, previously validated in Portuguese language.[18,22] Participants we re also asked about average headache pain intensity (0 [no pain] to 10 [pain as bad as you can imagine]), treated headache duration (hours), and headache

Table 1.—Participants' Anthropometric, Clinical, and Psychometric Data

	Groups	
	Migraine (N = 162)	No Headache (N = 140)
Age (yrs)	36.2 ± 9.5	43.6 ± 14.6‡
BMI (kg/m^2)	26.6 ± 5.7	26.3 ± 6.1
Sex (n/%)		
Female	141/87.1	68/48.5
Male	21/12.9	72/51.5
Frequency (/month)	8.4 ± 7.2	0
Intensity (0–10)	6.1 ± 1.9	0
Disability (n/%)		
MIDAS-I	43/26.5	0
MIDAS-II	15/9.3	0
MIDAS-III	37/22.8	0
MIDAS-IV	67/41.4	0
LOT_{Pos}	8.4 ± 2.5	9.2 ± 2.4†
LOT_{Neg}	4.8 ± 2.7	3.4 ± 2.6‡
LOT_{Total}	15.6 ± 4.3	17.8 ± 3.9‡
PHQ-9	10.5 ± 6.1	6.1 ± 6.1‡
GAD-7	10 ± 5.5	5 ± 4.7‡

†$P < .01$, ‡$P < .001$; 2-tailed *t*-test.

frequency (mean number of headache days in the past 3 months) considered for the most bothersome headache experienced.

Headache-related disability was captured with the Migraine Disability Assessment Scale (MIDAS),[23] a 5-question scale assessing headache-related disability by quantifying the number of headache days in the past 3 months of missed or reduced productivity at work, school, and in family and leisure time due to headache. The total sum score is graded as follows: grade I (0–5), indicative of little or no disability; grade II (6–10), mild disability; grade III (11–20), moderate disability; and grade IV (≥21), severe disability. The MIDAS questionnaire has been validated and translated into Brazilian Portuguese.[24]

Anxiety: We used the 7-item Generalized Anxiety Disorder scale (GAD-7) to assess anxiety Symptomology.[25] It assesses the 7 diagnostic criteria for generalized anxiety disorder from the Diagnostic and Statistical Manual of Mental Disorders – 5th edition (DSM-5) over the preceding 2-week period. Symptoms include: (1) Feeling nervous, anxious, or on edge; (2) Not being able to stop or control worrying; worrying too much about different things; (3) Trouble relaxing; (4) Being so restless that is hard to sit still; (5) becoming easily annoyed or irritable; (6) Feeling afraid as if something awful might happen. Four alternatives are offered: 1 – "Not at all," 2 – "Several days," 3 – "More than half the days," and 4 – "Nearly every day." Sum scores can range from 0 to 21, data were analyzed continuously. The scale has been validated to Brazilian Portuguese.[26]

Depression: Depression was assessed using the 9-item Patient Health Questionnaire (PHQ-9),[25] which has been validated and translated into Portuguese.[27] It assesses the 9 diagnostic criteria for major depressive disorder from the DSM-5 over the preceding 2-week period including: (1) anhedonia; (2) depressed mood; (3) trouble sleeping; (4) feeling tired; (5) change in appetite; (6) guilt, self-blame, or worthlessness; (7) trouble concentrating; (8) feeling slowed down or restless; and (9) thoughts of being better off dead or hurting oneself (16). Symptoms are rated using a 4-point scale (0 – never; 1 – several days; 2 – more than half the time; and 3 – nearly every day) regarding the past 2 weeks experienced. Total sum scores ranged from 0 to 27; data were analyzed continuously.

STATISTICAL ANALYSIS

In order to detect a medium effect size ($f = 0.25$) for between-group differences (no headache and migraine subgroups by MIDAS) for optimism or pessimism scores (fixed effects of one-way ANOVA), with $\alpha < 0.05$, and study power = 80%, it was necessary to include a total of 200 participants. Comparisons between the migraine and no headache groups for anthropometric and psychometric variables were performed by two-tailed independent *t*-test. All variables were tested for the assumption of normal distribution (Shapiro-Wilk's test). Subgroup analyses for comparisons of psychometric and clinical variables among people with migraine by MIDAS categories (I–IV) were performed by one-way ANOVA with Bonferroni's adjustments of confidence intervals. The assumptions of homogeneity in these analyses were verified through Levene's test.

We computed the odds for having migraine or no headache diagnosis through a binary logistic regression model. Predictors were included using the forced

entry method. Predictor variables in this model were age, sex, BMI, LOT-R scores (LOT_{Pos}, LOT_{Neg}, and LOT_{Total}), GAD-7, and PHQ-9. In order to explore the relationship between LOT-R scores and migraine-related disability, we ran an ordinal regression model using the logit link function method. In this model, we only included the migraine cohort, and aimed at calculating the associations of LOT-R scores as possible predictors of migraine-related disability (MIDAS categories), controlling for the effects of psychometric (GAD-7 and PHQ-9 scores) and clinical variables (headache days per month and average headache pain intensity). The MIDAS-I (none plus mild migraine-related disability) group was set as the reference group. The LOT-R scores (total and subscales) were ordered as "above"/"below" the migraine cohort's median (below median set as reference group). A P value < .05 was considered statistically significant. Analyses were run using SPSS software (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY, USA).

RESULTS

Six hundred individuals were contacted, 468 agreed to participate, 166 did not meet inclusion criteria (not meeting study criteria for either group: migraine or control group (no headache). Three hundred and two individuals (Migraine: N = 162; No headache: N = 140) were analyzed. There were 29 respondents with chronic or probable migraine. Descriptive statistics are expressed as mean ± standard deviation, or percentage of the group's sum. There were no missing data in the following analyses. Anthropometric, psychological, and clinical characteristics of the migraine and no headache groups are shown in Table 1. The migraine group was younger and had higher scores of LOT_{Neg}, GAD-7, and PHQ-9, and lower LOT_{Pos} and LOT_{Tot} scores compared to the no headache group. Subgroup analyses intended to compare differences in psychometric parameters between no headache group and migraine subgroups of MIDAS scores are shown in Figure 1. In these analyses, as for the subsequent regression analysis, MIDAS-II and MIDAS-III subgroups were pooled together because the number of participants in the MIDAS-II subgroup was disproportionately lower than the other subgroups, and thus, would violate the prerequisites of the statistical tests. MIDAS-IV subgroup showed lower scores of LOT_{Pos} than no headache, MIDAS-I, and

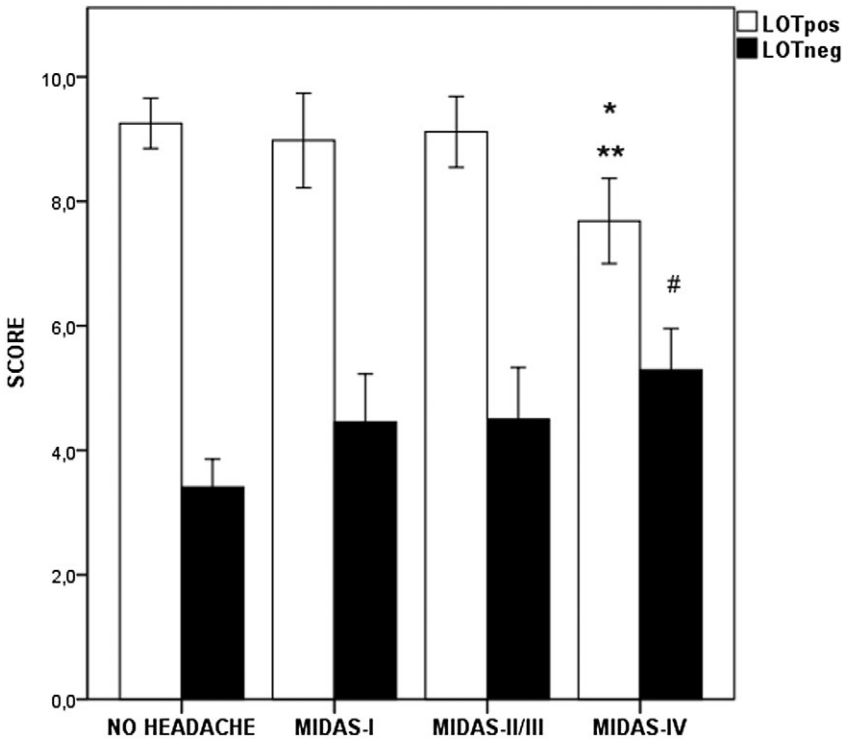

Fig. 1.—Life orientation test scores. Data are shown as mean ± CI 95%. *P < .05, vs MIDAS-II/III; **P < .01 vs NO HEADACHE and MIDAS-II/III; #P < .05 vs NO HEADACHE. ANOVA test with Bonferroni's adjustments of confidence intervals.

MIDAS-II/III groups, and higher scores of LOT_{Neg} than no headache group.

Binary logistic regression analysis was employed to predict the probability that a participant would meet criteria for migraine (Table 3). The predictor variables were participant's age, sex, BMI, LOT-R scores (LOT_{Pos}, LOT_{Neg}, and LOT_{Total}), GAD-7, and PHQ-9. A test of the full model vs a model with intercept only was statistically significant, $\chi^2(7, N = 302) = 136.5$, $P < .001$. The model was able to correctly classify 82.7% of those who were diagnosed with migraine and 79.1% of those who were not, with an overall success rate of 81.1%. Age, sex, LOT_{Neg}, and GAD-7 were significant predictors of meeting criteria for migraine (Table 2).

In the second regression model (ordinal), LOT_{Pos}, LOT_{Neg}, and LOT_{Total}) were set as predictors of MIDAS score, controlling for the effects of GAD-7, PHQ-9, days with headaches, and pain intensity (Table 3). A test of the full model vs a model with intercept only was statistically significant, $\chi^2(7, N = 162) = 17.3$, $P = .005$. Pearson's chi-square statistic for this model did not reject the null hypothesis that assumes that the observed data are consistent with the fitted model ($\chi^2 = 331.2$, $P = .254$). Only above median LOT_{Pos} and PHQ-9 were predictors of MIDAS score (Table 3). The negative signals of the B values indicate an inverse association. In this model, 11.6% (Negelkerke's R^2 statistics) of variance of the MIDAS scores was explained by the predictors variables. For both logistic and ordinal regression models, multicolinearity tests were performed in order to check errors of prediction. Because tolerance and VIF tests are calculated only in linear regression models (continuous instead categorical dependent variables), we ran a set of linear regression models testing all possible combinations between independent variables (predictors). All predictors' variables were selected each time as dependent variable, and the categorical variables were dummy transformed to enter the models. These tests showed that both logistic and ordinal regression models were statistically robust,

Table 2.—Binary Logistic Regression for Predictors of Migraine Diagnosis

Predictors	B	S.E.	Wald	df	*P* Value	OR (CI 95%)
Sex[†]	2.2	0.35	39.1	1	<.001	9.35 (4.6–18.8)
BMI	0.01	0.02	0.19	1	.661	1.0 (0.96–1.06)
Age	−0.06	0.01	24.2	1	<.001	0.93 (0.91−0.96)
LOT_{Pos}	−0.04	0.05	0.5	1	.461	0.95 (0.85–1.07)
LOT_{Neg}	0.15	0.05	8.4	1	.005	1.16 (1.05–1.28)
PHQ-9	−0.00	0.03	0.01	1	.892	0.99 (.93–1.06)
GAD-7	0.18	0.04	19.9	1	<.001	1.19 (1.10–1.29)

LOT_{Total} did not enter the model.
[†]Female.

Table 3.—Ordinal Logistic Regression Model of Predictors of Migraine-Related Disability in the Migraine Cohort (n = 162) Controlling for the Effects of Psychiatric and Clinical Variables[†]

Predictors	B (CI 95%)	S.E.	Wald	df	OR (CI 95%)	*P* Value
PHQ-9	−0.092 (−0.161, −0.022)	0.036	6.637	1	0.912 (0.978, 0.851)	.01
GAD-7	0.072 (−0.007, 0.151)	0.040	3.200	1	1.075 (1.163, 0.993)	.074
Frequency	−0.005 (−0.046, 0.037)	0.021	0.045	1	0.995 (1.038, 0.955)	.833
Intensity	0.049 (−0.107, 0.206)	0.080	0.381	1	1.050 (1.229, 0.899)	.537
LOT_{Pos}[‡]	−0.915 (−1.643, −0.188)	0.371	6.090	1	0.401 (0.829, 0.193)	.014
LOT_{Neg}[‡]	0.146 (−0.670, 0.962)	0.416	0.123	1	1.157 (2.617, 0.512)	.726
LOT_{Total}[‡]	−0.280 (−1.144, .584)	0.441	0.403	1	0.756 (1793, 0.319)	.525

[†]Reference group: "MIDAS-IV."
[‡]Above-median category.

with no predictors' combination yielding tolerance values <0.3, or VIF > 3.

DISCUSSION

Here, we intended to calculate the odds ratio for having migraine depending on the personality trait optimism/pessimism as a single trait, and its association with migraine-related disability. Partly corroborating our hypotheses, the main findings of this study were that only pessimism, but not optimism, was a significant predictor of migraine. Additionally, replicating previous studies from this group and others,[5,28] anxiety was also associated with migraine, showing equivalent predictive value as pessimism. On the other hand, optimism was found to be a protective factor against migraine-related disability, even when controlling for the effects of anxiety scores. The association between migraine, sex (stronger associations with female), and age (lower associations with increased age) has been established in several other population-based studies, including with the Brazilian population.[29] Unexpectedly, depression scores were inversely related to MIDAS scores, implying that greater depression scores were related to lower MIDAS scores. One explanation for this contradictory finding is the higher depression scores in the lower category of MIDAS score, which was composed by the combination of MIDAS-I and MIDAS-II scoring groups in order to balance group sample sizes.

Previous studies have investigated optimism or pessimism among people with headache or migraine. Nodari et al compared the scores of optimism for 74 headache patients and 84 headache-free controls and found no differences between groups, which is in accordance with our results.[30] Another study by Blomkvist et al compared 24 female patients with cluster headache and 24 age-matched migraine patients with and without aura.[31] The authors found a significant difference in "anticipated activities in the future," with cluster headache patients showing to be more "optimistic" than the migraine patients.[31] However, these studies did not apply validated scales to assess optimism/pessimism as a personality trait,[30,31] such as LOT-R, which reduced the ability to make comparisons with our findings.

Evaluating the roles of pessimism and optimism in migraine is challenging, as these constructs are conceptually overlapping with other personality traits and psychological constructs. Personality traits commonly reported in people with migraine include neuroticism and harm avoidance (see Davis et al for review).[4] Significant psychological constructs in migraine include self-efficacy, locus of control, and pain catastrophizing.[3,9] Anxiety was the strongest predictor of migraine in a recent population-based survey conducted by our group.[6] The anxiety symptoms with the strongest association with migraine were rumination (ie, "Not being able to stop or control worrying") on a daily basis (OR [CI 95%]) 49.2 (13.6–178.2), "trouble relaxing" 25.7 (7.1–92.6), "Feeling nervous, anxious or on edge" on a daily basis 25.4 (6.8–93.8), and "worrying too much about different things" 24.4 (7.6–77.6). These symptoms of anxiety are associated with catastrophizing, which includes rumination (inability to stop or control anxious thoughts or worries), magnification (exaggerated worries), and helplessness. Pain catastrophizing has been associated with more frequent migraine as well as greater migraine-related disability.[9]

However, dispositional optimism and pessimism can be distinguished from others psychological constructs mostly due to their inherently cognitive aspect (future-oriented thoughts/expectancies),[10,32-34] rather than situational expectancies, such as fear avoidance, pain catastrophizing. As such, pessimism has been also dissociated from neuroticism, anxiety, and depression.[10,34,35] Yet, it has been recognized that optimism/pessimism can overlap with these other constructs, and can also be moderated by behavioral interventions, such as cognitive behavioral therapy.[32] Pessimistic behaviors are related to the beliefs that "something can go wrong," "good things rarely happen," and I "hardly ever expect things to go my way," while optimistic behaviors are related to the beliefs that I "usually expect the best," "am optimistic about the future" and "expect more good things to happen than bad." Also, optimism/pessimism have been either conceptualized as a bidimensional construct, operating independently of each other, or understood as a single construct operating dependently.[20,33] Our data suggest the latter assumption, as both regression model showed no multicolinearity between LOT_{Pos} and LOT_{Neg} variables.

The associations found between optimism and migraine-related disability were controlled for the

effects of migraine frequency and intensity. Thus, regardless the increased negative affectivity related to situational expectancies toward migraine attacks, our data on the protective role for optimism on disability extend the psychological aspects of migraine by including a broader concept concerning the individual's worldview and its impact on the disease. For example, optimism and pessimism can be analyzed as how one interprets the current status in life, the well-known "half glass full/half glass empty" dilemma.[36] Applied to the pain coping process, if one tends to think the future will be better, one may experience pain with less distress and suffering, and may be more likely to redirect focus from suffering to a mental state of well-being. This explanation is corroborated by studies showing that optimism is associated with better adjustment and function with chronic pain, lower levels of postoperative pain, less perception of pain, and increased placebo analgesia.[13,14,36,37]

Locus of control is another cognitive construct involved in both optimism–pessimism literature, and migraine management and outcomes.[38] It is the psychological attribute indicating how people explain to themselves why a particular event was experienced, due to external, internal, or chance/fate causes. Three aspects should be considered: the "Personal aspect" (how one considers the bad event to be his or her fault or the good event to be because of his or her attitudes, qualities), the "Permanent aspect" (how stable or unstable the state is – for example, a stable or permanent belief would be "Things never go well for me" for the pessimist and "Things always turn out OK in the end" for the optimist) and the "Pervasive aspect" (global vs local or specific, for example, a global belief would be "All people are good at heart" for the optimist and "You can't trust anyone" for a pessimist).[39] In migraine management, locus of control is associated with the perceived control of the onset, course, and consequences of migraine attacks.[38] Thus, it impacts the behavioral responses such as coping strategies and adherence to treatments, as well as psychological and emotional consequences, and it is logically associated with the traits of optimism and pessimism.

As a neurological disease with a genetic component,[40] migraine may involve common neurobiological mechanisms sharing "optimistic/pessimistic" personality traits. Putative candidates could be the serotonin and endocannabinoid systems, since polymorphisms at some component (enzyme or receptors) of these neurotransmitter/neuromodulators signaling systems have been linked to migraine,[41-43] and could indeed be related to the overlap between migraine and negative emotionality, such as pessimism/anticipatory worry,[44] neuroticism,[45,46] and depression and anxiety.[47]

Future studies should be conducted in order to confirm optimism as a protective aspect and pessimism as a cause or worsening factor in migraine. The role of aura and migraine chronification, and headache disorders other than migraine are other important issues to be further investigated in their relationship with pessimism/optimism. Our data have a potential role on treatment approaches as well. In particular, we are interested on testing whether cognitive-behavioral treatments modifying optimism/pessimism could reduce the burden of migraine in terms of disability and function, or positively influence clinical responses to treatments.

The present study has some limitations. First, it has a cross-sectional design and, although a correlation has been found, no cause or consequence can be established. Second, this study adopted interviewer assessed, survey-based meeting criteria for migraine, which could have allowed for misdiagnosis. All data were based on subject self-report without any physician or health care record information or diary tracking. We did not track headache history in those meeting criteria for migraine. It is unknown whether participants with migraine with longer previous history of migraine could have potentially less optimism or more pessimism. Third, although we used a validated instrument to investigate pessimism and optimism, only 3 questions were used for each construct. In this regard, our regression models showed high sensitivity to correctly predict the associations between meeting criteria for migraine and pessimism. Lastly, our regression models were not controlled for socioeconomic factors, which have been associated with dispositional optimism.[48-50] These limitations impose obstacles to the generalizability of the findings in this study; therefore, optimism and pessimism merit more detailed measurement in future studies to determine the specific role of these constructs.

In conclusion, optimism and pessimism and anxiety are associated with meeting criteria for migraine and optimism protected from migraine-related disability. These concepts should be taken into account by health

care professionals caring for people with migraine due to their potential implications for migraine diagnosis, treatment, and outcomes. In addition, cognitive-behavioral interventions such as cognitive behavioral therapy, which target dysfunctional thinking styles, may reduce pessimism and increase optimism as well as foster an internal locus of control, improve self-efficacy, and reduce catastrophizing, may help improve function and well-being directly, and may also improve migraine management outcomes.

STATEMENT OF AUTHORSHIP

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