Published in final edited form as:

Cephalalgia. 2007 October ; 27(10): 1156–1165.

Impaired functioning and quality of life in severe migraine: the role of catastrophizing and associated symptoms

KA Holroyd, JB Drew, CK Cottrell, KM Romanek, and V Heh

Department of Psychology, Ohio University, Athens, OH, USA

Abstract

Migraine characteristics are associated with impaired functioning and quality of life (Fn/QoL), but the impact of other factors on Fn/QoL in headache patients is largely unexplored. We examined catastrophizing, comorbid anxiety/depression and migraine characteristics as related to Fn/QoL, and explored the consistency of these relationships across five Fn/QoL measures. We evaluated 232 frequent migraine sufferers for comorbid psychiatric diagnosis, and they completed anxiety, depression and catastrophizing measures, recorded migraine characteristics in a diary and completed five Fn/QoL measures (four self-report questionnaires, one diary disability measure). Backward regression revealed catastrophizing and severity of associated symptoms (photophobia, phonophobia, nausea) independently predicted Fn/QoL across all five measures (β weights 0.16–0.50, all $P < 0.01$). This is the first demonstration that a psychological response to migraines (catastrophizing) is associated with impaired Fn/QoL independent of migraine characteristics and other demographic and psychological variables. Severity of associated symptoms also emerged as an important contributor to Fn/QoL.

Keywords

Associated symptoms; catastrophizing; disability; migraine; quality of life

Introduction

Migraines negatively impact daily functioning and overall quality of life (1–3). However, identification of factors contributing to migraine-related impairments in quality of life have been confined primarily to migraine characteristics, such as frequency or intensity, and to mood and anxiety disorders, which are comorbid with migraine (4,5). The role of other psychological variables that might contribute to migraine-related disability has been largely ignored.

Catastrophizing, a psychological response to pain or anticipation of pain, is characterized by rumination, magnification and helplessness, and has been associated with impaired functioning and quality of life across a variety of chronic pain disorders (6–10). Catastrophizing magnifies the possible negative impacts of pain and exaggerates helplessness in response to pain, undermining efforts to involve patients in the active management of their pain disorder. In a review of the catastrophizing–pain link, Sullivan and colleagues have concluded that, across pain disorders, catastrophizing is consistently associated with greater pain, disability, pain behaviour, use of healthcare services and longer hospital stays (11). It has yet to be determined if catastrophizing similarly impacts functioning and quality of life in migraine.

Kenneth A. Holroyd, PhD, 225 Porter Hall, Athens, OH 45701, USA. Tel. + 1 740 593 1085, fax + 1 740 593 0579, e-mail holroyd@ohio.edu.

Competing interests
None declared.

Catastrophizing may be elevated in individuals with mood and anxiety disorders, raising the possibility that catastrophizing is simply a proxy for the depression or anxiety (12,13) prevalent in pain disorders, including migraine. However, recent research that has addressed this issue indicates that catastrophizing and depression are distinct (14–16). Nevertheless, it is important to differentiate the role of catastrophizing from mood or anxiety disorders when assessing the functioning and quality of life (Fn/QoL) impairments observed in migraine.

Studies examining the impact of migraine characteristics on Fn/QoL have yielded variable results. Population studies (17,18) and retrospective clinic-based studies (19,20) have confirmed that increasing migraine frequency is associated with greater impairments to quality of life, but clinic-based studies using headache diaries have sometimes found headache frequency to be unrelated to impairments in QoL (21,22). Discrepant findings may reflect differences in subject samples (e.g. population vs. clinic), measures of migraine characteristics (e.g. headache diary vs. retrospective report) or differences in the QoL measure employed. Assessment of Fn/QoL by multiple measures within a single sample would allow the consistency of findings across commonly used measures of Fn/QoL to be evaluated.

When examining the impact of migraine characteristics on Fn/QoL, associated symptoms, such as phono- and photophobia, have rarely been examined, yet patients often report that these symptoms, particularly nausea, can be especially impairing. Although some data support this clinical observation (23), associated symptoms deserve greater attention in efforts to understand the impact of migraine on Fn/QoL.

We examined the relative contributions of migraine characteristics (including associated symptoms), comorbid anxiety and depression, and catastrophizing on impairments in Fn/QoL. Migraine characteristics were assessed by daily electronic diary; psychiatric diagnosis was obtained by structured clinical interview and supplemented by self-report measures of anxiety and depression. Five commonly used measures of Fn/QoL, including diary and self-report measures, were obtained to examine consistency of findings across measures.

Methods

Subjects

Participants were 232 frequent migraine sufferers (79% female; average age 38 years; 84% White; average migraine days/month 8.5; average years of problem headaches 15). Participants were recruited from the general population in Columbus, Ohio and surrounding suburban areas and in rural southern Ohio and western West Virginia and were evaluated at sites in Columbus or Athens, Ohio. The study was approved by the Ohio University Institutional Review Board and informed consent was obtained from all subjects. Inclusion criteria were: age 18–65 years; International Headache Society (IHS) diagnosis by a study neurologist of migraine headache with or without aura (24–27); and electronic diary confirmation of at least three migraine episodes within a 30-day period that were associated with impaired functioning. Exclusion criteria included: IHS diagnosis of medication overuse headache or frequent tension-type headache (24–27); current use of prophylactic medication for migraine or tension-type headache; >20 headache days per month; and primary pain disorder (e.g. fibromyalgia, arthritis) other than migraine.

Procedure

During their initial visit, participants were evaluated and diagnosed by the study neurologists, provided demographic information and completed computer-administered self-report measures of anxiety, depression and catastrophizing in response to headaches. In addition, the Primary Care Evaluation for Mental Disorders (PRIME-MD (28)) interview was completed

and participants were instructed how to use the handheld electronic diary to complete headache recordings.

During the following 5 weeks, participants treated their migraines with acute therapy that included triptan, anti-nausea, and analgesic medications, and recorded migraine characteristics and migraine-related impairment using a daily (Palm OS) electronic diary. At the conclusion of the 5-week period, participants returned to the study site to turn in their electronic diaries (from which one of the five Fn/QoL measures was derived) and to complete questionnaires. At this visit, Fn/QoL over the previous 5-week period was assessed with four self-report computer-administered measures.

Measures

The following measures were examined as determinants of Fn/QoL and assessed at visit 1.

Pain catastrophizing scale—Catastrophizing about headache pain was measured by a modified version of the Pain Catastrophizing Scale (PCS) (29). This 13-item measure assesses rumination, magnification and helplessness as essential elements of catastrophizing and has demonstrated good reliability ($\alpha = 0.87$) and construct validity (29). For the current study, the word ‘headache’ replaced the word ‘pain’ in the items (e.g. ‘I keep thinking about how badly I want the *headache* to stop’). All items follow a lead-in of ‘When I have a headache...’ and include statements such as ‘I feel I can’t go on’, ‘I become afraid that the headache will get worse’ or ‘there’s nothing I can do to reduce the intensity of the headache’. Items are rated on a five-point scale from 0 to 4 and summed for a total score ranging from 0 to 52, with higher scores reflecting a greater tendency to engage in catastrophizing. Mean PCS score for this sample was 19.1 (SD = 10.36).

Primary Care Evaluation for Mental Disorders—Participants were diagnosed regarding mood or anxiety disorders at their initial baseline visit using the PRIME-MD (28), designed to facilitate the diagnosis of psychiatric disorders commonly seen in medical settings. This clinician-administered structured interview provides a subset of diagnoses included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV (30)). Diagnoses of mood and/or anxiety disorder [major depressive disorder, dysthymia, minor depressive disorder, panic disorder, generalized anxiety disorder, anxiety disorder not otherwise specified (NOS)] were made by clinical psychologists using the Prime MD Mood and Anxiety modules in combination with clinical judgement. For the purposes of this study, this variable was coded dichotomously such that participants either had an anxiety and/or mood disorder diagnosis (25.4% of sample) or had neither.

Beck Anxiety Inventory—Anxiety was measured by the Beck Anxiety Inventory (BAI (31)), a 21-item measure designed to assess severity of anxiety while also reliably discriminating between anxiety and depression. This measure has demonstrated good reliability ($\alpha = 0.92$) and can differentiate anxiety-related diagnostic groups from non-anxious groups. The self-report measure asks participants to rate how much they have been bothered by anxiety symptoms (e.g. nervous, fear of losing control, fear of dying, numbness or tingling, heart pounding/racing) over the past week on a four-point scale ranging from 0 to 3. The item responses are summed (total score range is 0–63) with higher scores indicating greater anxiety symptoms. The mean BAI score for this sample was 5.4 (SD = 5.1). BAI anxiety scores for the 33 participants who received an anxiety disorder diagnosis were in the mild range for 21 (64%) participants and in the moderate to severe range for four (12%) participants. The remaining eight (24%) participants scored in the minimal anxiety range and thus revealed more problems with anxiety in the Prime MD interview than on the BAI questionnaire.

Beck Depression Inventory-II—The Beck Depression Inventory-II (BDI-II) (32) is a 21-item measure assessing the intensity of depressive symptoms. Each item includes four statements presented in increasing severity regarding a specific symptom of depression. A total score between 0 and 13 is considered within normal limits; 14–19 suggests mild depression; 20–28 is interpreted as a moderate depression; ≥ 29 suggests a severe level of depressive symptomatology. The mean BDI score in this sample was 6.4 (SD = 6.7), placing the sample as a whole within the normal range of depressive symptomatology. The BDI-II has good reliability ($\alpha = 0.92$) and correlates with scores of other measures of negative affect (32).

BDI depression scores for the 42 participants who received a mood disorder diagnosis were in the mild range for 15 (36%) participants and in the moderate to severe range for eight (19%) participants. The remaining 19 (45%) participants reported subclinical levels of depression on the BDI, and thus revealed more severe problems with depression in the Prime MD interview than on the BDI questionnaire.

Migraine characteristics

The following migraine characteristics were obtained from the electronic diary (33): (i) migraines (number of migraine episodes separated by a 24-h pain-free period); (ii) migraine days (number of recorded days of migraine); (iii) migraine severity [migraine days $\times$ average severity, which ranged from 1 (mild) to 3 (severe)]; and (iv), severity of associated symptoms [SAS; sum of the three severity ratings (ranging from 0 = none to 3 = severe) provided for nausea, photophobia and phonophobia for each migraine, summed across all migraines]. To examine the impact of migraine characteristics over a 30-day period, values were normalized for 30 days.

Migraine-related impairments in Fn/QoL were assessed with the following four self-report measures at visit 2.

Migraine-Specific Quality of Life (Version 2.1)—The Migraine-Specific Quality of Life (MSQ), Version 2.1 (34) is a 14-item self-report measure that assesses the impact of migraine on quality of life and yields three factorally derived subscales: role restriction (seven items), which assesses the degree to which migraine limits performance of routine activities; role prevention (four items), which assesses the degree to which migraine interrupts the performance of routine activities; and emotional impact (three items), which measures the emotional impact of migraine. The MSQ, Version 2.1 has demonstrated internal consistency ($\alpha = 0.86$ – 0.96 across the three dimensions) and evidence of construct validity (34). The total score ranges from 14 to 84; in the current study the measure was scored so that higher scores reflect greater impairment in quality of life; the mean for this sample was 34 (SD = 10.3).

Headache Disability Inventory—The Headache Disability Inventory (HDI) is a 25-item measure that assesses the impact of headache on daily living (35). The scale, which consists of two subscales assessing functional and emotional impact of disability, has strong test–retest reliability at 2 months ($r = 0.83$) and has demonstrated validity via generally congruent spouse/patient perceptions of the patient's headache disability (36). Scores range from 0 to 100, with higher scores indicating greater disability. The mean for this sample was 39.6 (SD = 19.8).

Medical Outcomes Study General Health Survey—The Medical Outcomes Study General Health Survey (MOS-SF36) is a 36-item measure assessing general health-related quality of life across eight domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional functioning, and mental health and is reported to have acceptable reliability (generally, internal consistency and test–retest reliability for each domain are >0.70 ; most have exceeded 0.80) and validity as reviewed by Ware and

Gandek (37). Subscale scores are standardized and range from 0 to 100, with higher scores indicating better quality of life in the domain being measured, and a score of 100 indicating an absence of impairment. For this study, a subscale average across the eight domains was generated; the mean for this sample was 59.67 (SD = 13.47).

Migraine Disability Assessment—The Migraine Disability Assessment (MIDAS) (38) is a five-item measure that assesses the number of days affected by headache with regard to work/school, household chores and leisure activities. The measure asks both about days missed from such activities and about impaired days during which productivity was reduced by half or more. The MIDAS score is the sum of days missed from paid work, housework or non-work activities plus impaired days at paid work and in household activities during which productivity was reduced by at least half. The MIDAS has demonstrated test-retest reliability (approximately 0.8 (39,40)) and MIDAS scores have been strongly associated with clinical judgement of headache severity and need for medical care (38). A study assessing the validity of the MIDAS compared it with a daily diary measure of disability and found that the two measures were correlated in the low moderate range (0.63), with the MIDAS overestimating number of impaired days (40). In the current study, a MIDAS disability equivalent score was calculated [missed days + 0.5(impaired days)] (41) to account for the differential impact of a missed vs. an impaired day due to migraine. MIDAS scores were completed with reference to the previous 30 days (rather than the customary 90 days) to cover the same time frame as other measures used in this study, with this 30-day score multiplied by 3 to yield a score comparable to those typically reported in the literature. The mean MIDAS score for this sample was 29 (SD = 21.9).

Diary disability equivalent hours

During the 5-week observation period of this study, participants completed daily recordings of their headache activity using an electronic palm diary. These ratings included impact of migraine on daily functioning (missed and impaired hours of paid and unpaid work, as well as social/recreational activities, and missed sleep). Disability equivalent hours (DE hours) was calculated as [total number of hours missed + 0.5(hours impaired at least 50%)] (41). Mean DE hours in this sample was 31.1 per 30 days (SD = 27.9).

Results

Migraine impairment

Participants in this study reported an average of 8.5 migraine days (SD = 3.6) and 5.5 migraine episodes (SD = 1.9) per 30 days and, although treated, of moderate severity (Mean = 1.9, SD = 0.4). The migraine severity score averaged 10.6 (SD = 4); severity of associated symptoms mean score was 20.6 (SD = 14.2).

Correlations among predictor variables and among measures of Fn/QoL

Relatively few of the predictor variables were inter-correlated (Table 1); for the most part variables with significant correlations measured different aspects of the same construct (i.e. migraine characteristics or affective distress). However, catastrophizing and affective variables were modestly correlated (e.g. $r = 0.40$, $P < 0.001$ for PCS and BDI). Age and gender were negatively correlated, indicating that women in the study tended to be younger than male participants (mean age for women was 37; for men 42.5). Gender was also associated with severity of associated symptoms, indicating that women in this sample reported greater severity of symptoms than did men.

As would be expected, the five measures of Fn/QoL were correlated (Table 2). Although all five measures were significantly correlated, only the MSQ and the HDI shared more than

50% variance ($r = 0.72$). This probably reflects the differing item content of measures as well as their imperfect reliabilities.

Correlations between hypothesized predictor variables and measures of Fn/QoL

Two variables exhibited strong first-order correlations (all $P < 0.001$) with all five measures of Fn/QoL: catastrophizing and severity of associated symptoms (Table 3). Migraine severity also exhibited significant, although smaller, associations with the Fn/QoL measures. The BAI, BDI and PRIME-MD diagnoses were consistently related to impairment in Fn/QoL on measures that assessed the affective distress and worry about headache occurrence that migraines can engender (MSQ, HDI, MOS), but were unrelated, or less strongly related, to measures that assessed only impaired physical functioning (MIDAS or DE hours). Age and gender were unrelated to the Fn/QoL measures.

Multiple regression analyses were used to examine the independent effects of catastrophizing, migraine characteristics and affective distress on measures of migraine-related impairments in functioning and quality of life. In most cases, the migraine characteristics with the highest and most consistent first-order correlations across the five Fn/QoL variables (migraine days, severity of associated symptoms, migraine severity, catastrophizing, anxiety, depression, mood/anxiety diagnosis) were chosen as candidate predictor variables. However, because migraine days shared substantial variance with migraine severity and is actually a constituent element of this calculated variable (migraine severity = migraine days $\times$ average severity), it was excluded from the regression analyses to avoid multicollinearity. By including both migraine severity and severity of associated symptoms in the analyses, information is provided about the relative predictive ability of an overall migraine severity rating compared with the more specific severity of associated symptoms. Similarly, because a measure of self-reported depression symptoms (BDI) was highly correlated with both mood/anxiety diagnosis and self-reported anxiety symptoms (BAI), the BDI was excluded to avoid multicollinearity. A backward entry ($P > 0.10$ to remove) linear regression analysis was calculated for each of the five Fn/QoL measures. Seven variables (age, gender, severity of associated symptoms, migraine severity, BAI score, PCS score and PRIME-MD diagnosis) were entered for each equation.

Catastrophizing and severity of associated symptoms emerged as strong and consistent determinants of Fn/QoL across the five measures (Table 4). The remaining variables accounted for significant unique variance in, at most, two equations. (Our analysis statistically controlled both anxiety disorder diagnosis and BAI anxiety scores. To examine further the role of catastrophizing vs. anxiety, the analyses were rerun in the subset of participants with no anxiety disorder diagnosis ($N = 198$). The results for catastrophizing were unchanged.)

Discussion

This is the first demonstration that a specific psychological response to headache pain—catastrophizing—is associated with impaired Fn/QoL independent of both migraine characteristics and psychiatric comorbidity. Our findings also highlight the importance of migraine-associated symptoms (photophobia, phonophobia and nausea) in migraine-related impairments in Fn/QoL.

Catastrophizing and Fn/QoL

In this study, catastrophizing emerged as a robust predictor of Fn/QoL in migraine. The association between catastrophizing and Fn/QoL remained strong even after the effects of other variables (e.g. depression, anxiety, migraine characteristics) known to influence Fn/QoL in migraine were controlled. Further, catastrophizing predicted impairments in Fn/QoL across

five diverse measures of functioning or quality of life, including measures that assessed impact of headaches on both role and emotional functioning (HDI, MSQL), a daily diary and a self-report measure of migraine-related impairments in daily activities (DE hours, MIDAS), and a global measure of physical, role, and affective functioning (MOS). Despite differences in the item content of measures, catastrophizing was strongly related to impairments in Fn/QoL as assessed by each measure, emerging as an important component of quality of life in migraine.

Our findings also provide additional evidence that the effects of catastrophizing and comorbid depression on Fn/QoL can be distinguished. Consistent with previous findings, affective distress (e.g. reports of anxiety and depression symptoms, or mood/anxiety disorder diagnosis) was associated with impaired Fn/QoL (17,42). However, across all five Fn/QoL measures, catastrophizing proved an independent and stronger predictor of impaired Fn/QoL than affective variables, indicating that the deleterious effects of catastrophizing and of affective distress on quality of life can be distinguished.

Although unexamined in migraine, catastrophizing is a focus of study in other chronic pain disorders, and the chronic pain literature may provide insights into the role of catastrophizing in chronic headache disorders. Catastrophizing has been associated with elevated pain ratings (9,43–46), reduced pain tolerance (47), increased pain behaviours (verbal and non-verbal communication of pain) (50) and psychological symptoms (9,44–46,49), as well as with greater disability, irrespective of whether disability is assessed by self-report (43,46,50,51) or clinical evaluation (52) across multiple chronic pain disorders. Across chronic pain conditions, and in both laboratory (15) and clinical studies (7,48,50,51) it has been found that catastrophizing can be distinguished from affective distress. These findings, and the strong relationship between catastrophizing and migraine-related impairments in functioning and quality of life observed here, suggests that, at least for some individuals with migraine, catastrophizing plays an important role in migraine-related impairments in Fn/QoL.

The chronic pain literature also raises the possibility that catastrophizing is a risk factor for the progression from episodic to chronic headaches (43,53). For example, in the Dutch Musculoskeletal Complaint and Consequences study (43), a population-based longitudinal study, catastrophizing emerged as an important risk factor, both for the development of new back pain with disability and for the persistence or worsening of pre-existing back pain. Thus, high levels of catastrophizing predicted the development of new back pain with disability at a 6-month follow-up in individuals who were pain free at baseline [odds ratio (OR) 3.1, 95% confidence interval (CI) 1.1, 8.7] and also predicted back pain with disability in individuals with back pain at baseline (OR 3.0, 95% CI 1.7, 5.4), even when baseline pain severity and disability were controlled (OR 1.5, 95% CI 0.7, 2.9). Although similar findings are unavailable for headache, functional magnetic resonance imaging data raise the possibility that, even in individuals with no pain disorder, catastrophizing is associated with diminished activity in prefrontal cortical circuits involved in pain modulation (54). Preliminary evaluation of catastrophizing as a potential risk factor for headache progression seems warranted.

Catastrophizing, with its helpless and pessimistic thinking and associated pain behaviours (55), may also undermine development of the collaborative physician–patient relationship essential to the management of recurrent headache disorders. The 13-item Pain Catastrophizing Scale may be helpful in identifying this psychological response to headaches. The catastrophizing patient may respond best to empathetic statements that acknowledge the patient's feelings of helplessness and affective distress, while also highlighting the ways the patient can play an active role in management of their headaches. In addition, behavioural interventions have been shown to reduce catastrophizing in chronic pain disorders (7,56–58), and, in individuals with frequent migraines, behavioural migraine management appears more

effective in reducing catastrophizing than (acute or preventive) medication (K.A.H., unpublished data).

Severity of associated symptoms and Fn/QoL

Severity of associated symptoms also emerged as an important contributor to migraine-related impairments in Fn/QoL. Even controlling for migraine severity, the severity of associated symptoms predicted impairments in Fn/QoL across all five Fn/QoL measures. Although migraine frequency and severity of headache pain have been associated with impairments in Fn/QoL in a number of studies (3,17,19,20,59,60), little information is available about the impact of migraine-associated symptoms (nausea, vomiting, photophobia, phonophobia) on Fn/QoL. The limited available data indicate patient ratings of pain intensity and severity of associated symptoms are highly correlated (61), but one small study with adolescents ($N = 37$) found that severity of nausea explained impairments in Fn/QoL (23) that were not explained by headache intensity alone. Our findings in a large sample of adults confirm that migraine-associated symptoms and migraine severity are independently associated with migraine-related deficits in Fn/QoL.

Assessment of Fn/QoL

A number of instruments that often differ in assessment method, item content and psychometric properties are available to assess the impact of migraine on functioning or, more broadly, quality of life (62). Although we found catastrophizing and severity of associated symptoms independently associated with decrements in Fn/QoL across all five measures examined, differences in sensitivity of Fn/QoL measures were also evident. Self-report and diary measures that primarily assess the impact of migraine on functioning (e.g. hours or days of impairment), such as the MIDAS and electronic diary recordings of DE hours, were relatively insensitive to the impact of psychiatric comorbidity on functioning in this patient sample (see Table 3).

Strengths/limitations

Strengths of this study include the use of electronic daily diary recordings of migraine activity and associated symptoms, the inclusion of structured interviews for psychiatric diagnosis, and the use of multiple Fn/QoL measures. Limitations include a subject sample with frequent disabling episodic migraines that may limit the generalization of results to less frequent or more frequent (chronic) migraine, and the correlational nature of the data which limits causal inferences. Our findings require replication in frequent migraine and other patient and population samples to determine reliability and generalizability.

Summary

Catastrophizing and associated symptoms, two variables whose impact on migraine has received limited or no attention in the literature, proved to be consistently associated with migraine-related impairments in Fn/QoL. Recognizing the roles of psychological responses to migraine and the multiple symptoms that may precede, accompany and follow migraine episodes has the potential to improve our understanding of the impact of migraine on peoples' lives and possibly to improve treatment and reduce headache progression.

Acknowledgement

Support for this project was provided by NIH (NS32374).

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Table 1

Correlations within hypothesized determinants of Fn/QoL

Variable	Gender [†]	Migraine days	Migraine episodes	Severity of associated symptoms [‡]	Migraine severity [§]	Catastrophizing (PCS)	Anxiety (BAI)	Depression (BDI)	Mood or anxiety diagnosis
Age									
Gender [†]	−0.22***	−0.02	0.07	−0.03	−0.04	−0.04	−0.10	−0.03	−0.05
Migraine days		−0.02	−0.11***	0.17***	0.02	−0.00	−0.02	0.02	0.10
Migraine episodes			0.72***	0.58***	0.90***	0.03	0.10	0.06	−0.04
Severity of assoc. symptoms [‡]				0.46	0.57***	0.03	0.10	0.05	−0.03
Migraine severity [§]					0.65***	0.15*	0.10	0.12	0.01
Catastrophizing (PCS)						0.04		−0.03	−0.03
Anxiety (BAI)							0.04	0.40***	0.18***
Depression (BDI)							0.33***	0.61***	0.47***

All Ns = 232.

[†] Gender data were coded as 1 = male, 2 = female.

[‡] Severity of associated symptoms = severity scores for phonophobia, photophobia and nausea summed across headaches and normalized to 30 days.

[§] Migraine severity = average headache severity (1 = mild to 3 = severe) × migraine days.

* $P \leq 0.05$;

** $P \leq 0.01$;

*** $P \leq 0.001$.

Table 2
Zero-order correlations within measures of Fn/QoL

	HDI	DE hours [†]	MOS	MIDAS
MSQL	0.72 [*]	0.46 [*]	-0.58 [*]	0.53 [*]
HDI		0.36 [*]	-0.54 [*]	0.40 [*]
DE hours [†]			-0.29 [*]	0.59 [*]
MOS				-0.34 [*]

All *N*s = 230, except for DE hours, for which *N* = 232.

[†] DE hours = hours missed + 0.5(hours impaired at least 50%).

* *P* < 0.001.

Correlations between measures of Fn/QoL and hypothesized determinants of Fn/QoL

Table 3

Variable	Age	Gender	Migraine days	Migraine episodes	Severity of associated symptoms [†]	Migraine severity [§]	Catastrophizing (PCS)	Anxiety (BAI)	Depression (BDI)	Mood/anxiety diagnosis
MSQL, 2.1	-0.06	0.12	0.25***	0.80	0.39***	0.31***	0.43***	0.30***	0.31***	0.19***
HDI	-0.02	0.09	0.21**	0.17*	0.38***	0.23**	0.57***	0.35***	0.43***	0.28***
MOS SF-36	0.01	-0.10	-0.11	-0.04	-0.28***	-0.16*	-0.41***	-0.32***	-0.42***	-0.34***
MIDAS	0.00	0.12	0.35***	0.15*	0.48***	0.40***	0.24***	0.10	0.14*	0.06
DE hours [‡]	0.11	0.01	0.38***	0.21**	0.53***	0.45***	0.22***	0.14*	0.16*	0.04

All N = 232, except for MOS, HDI, MIDAS and MSQ, for which N = 230.

[†] DE hours (disability equivalent hours) = hours missed + 0.5(hours impaired at least 50%).

[‡] Severity of associated symptoms = severity scores for phonophobia, photophobia and nausea summed across headaches and normalized to 30 days.

[§] Migraine severity = average headache severity (1 = mild to 3 = severe) × migraine days.

* $P < 0.05$;

** $P < 0.01$;

*** $P < 0.001$.

Table 4
Summary of regression analyses for variables predicting Fn/QoL in frequent migraine patients

Predictor variables	MSQL β	HDI β	DE hours $\beta^{\dagger}$	MOS β	MIDAS β
Age	—	—	0.13*	—	—
Gender	—	—	—	—	—
Severity of associated symptoms [‡]	0.24**	0.30***	0.38***	-0.23***	0.35***
Migraine severity [§]	0.14**	—	0.20**	—	0.17*
Anxiety (BAI)	0.15***	—	—	—	—
Catastrophizing (PCS)	0.34***	0.50***	0.16**	-0.32***	0.18***
PRIME-MD diagnosis	—	0.18	—	-0.28***	—
Adjusted R^2	0.32***	0.44***	0.33***	0.28***	0.27***
F(d.f.)	27.44 (4, 225)	60.90 (3, 226)	28.84 (4, 227)	30.82 (3, 226)	29.08 (3, 226)

[†]DE hours (disability equivalent hours) = hours missed + 0.5(hours impaired at least 50%).

[‡]Severity of associated symptoms = severity scores for phonophobia, photophobia and nausea summed across headaches and normalized to 30 days.

[§]Migraine severity = average headache severity (1 = mild to 3 = severe) $\times$ migraine days.

* $P \leq 0.05$;

** $P \leq 0.01$;

*** $P \leq 0.001$.