

Loneliness and Migraine Self-Management: A Cross-Sectional Assessment

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Abstract

Background: Chronic illness is often comorbid with the psychological state of loneliness. Models of care for patients who experience chronic migraines may often lack an understanding of psychosocial influences of the illness. Addressing the effects of loneliness on the health behaviors of chronic migraine patients may further elucidate gaps in care that exist beyond the biomedical approach to migraine treatment. The primary aim of this study was to assess the relationship between loneliness and behavioral health decisions in chronic migraine patients, specifically patient ability to self-manage, and effectiveness of treatments. **Methods:** We conducted a cross-sectional survey among patients ($n = 500$) with migraine and assessed for the experience of loneliness by using the University of California, Los Angeles–Revised (UCLA-R) Three-item Loneliness Scale and the extent of migraine-related disability via the Migraine Disability Assessment (MIDAS). Furthermore, we evaluated patients for their ability to self-manage their migraines, and perceived effectiveness of treatment. **Results:** Nearly half of our population reported at least one measure of loneliness (230/500, 46.0%). Patients experiencing chronic migraine were statistically more likely to report feeling lonely when compared to patients with episodic migraines ($P < .001$). Patients who report loneliness had lower odds of feeling “very satisfied” with their ability to self-manage their migraine symptoms (aOR = 0.34, 95% CI 0.14–0.81) and had lower odds of feeling “very satisfied” with their ability to avoid conditions that cause their headache (aOR = 0.39, 95% CI 0.16–0.91). **Conclusions:** Loneliness has significant effects on the illness experience of patients with chronic migraines, including their ability to self-manage or be satisfied with their current state of care. Psychosocial models of care that address loneliness among patients with chronic migraine may help improve health outcomes and management.

Keywords

migraine, social support, loneliness, surveys, migraine self-management

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Background

According to the National Health Interview Study (NHIS) of 2015, nearly 1 in 6 Americans over the age of 18 reported having migraine or severe headache over a period of 3 months, making migraine and severe headache among the leading causes of outpatient and emergency department visits.¹ The World Health Organization (WHO) has labelled migraines a public health hazard due to the deleterious effects on daily life.² Migraines pose a significant physical and financial burden on patients, impairing psychosocial functioning and compromising well-being.

The interplay between loneliness, social support, and self-efficacy has implications on chronic health states.³ Loneliness can be defined as a “distressing discrepancy

between desired and actual levels of social contact.”⁴ Loneliness has been observed to be associated with pro-inflammatory states, cardiovascular disease, neurodegenerative disorders,⁵ and an increased risk for premature mortality.^{6,7} The WHO lists a social support network as a “determinant of health.”⁸ Among patients with migraine, specifically, the prevalence of headaches increases in people with fewer confidants and intimate relationships.⁹ Migraines

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have been associated with poor social functioning.¹⁰ Previous studies in patients with chronic migraine and other neurological disorders have identified self-efficacy, a subjective estimation of a patient's overall well-being, and perceived social support as part of the successful management of migraine symptoms and improved quality of life.^{11,12}

There is a scarcity of research that explores loneliness and disability among patients with chronic migraines. To our knowledge, no studies have evaluated the effects of loneliness on the perceptions of treatment efficacy or patient confidence in self-management of migraine symptoms. Furthering our understanding of health behaviors and perceptions among patients with migraine who experience loneliness may provide insight on how to improve models of care for patients with migraine, and how to incorporate components of social support into disease and symptom management for those who suffer from migraine.

We conducted a cross-sectional survey of 500 adult patients with migraine in a primary care setting with 2 major aims. We sought to explore the effects of loneliness and perceptions of patient-perceived effectiveness on migraine treatment, and on patient-reported ability to self-manage their headaches.

Methods

Practice Setting

Mayo Clinic in Rochester, MN has a community-based practice that serves the primary care needs of the 155 000 individuals residing in Olmsted county and adjacent communities. The community-based primary care practice is staffed with physicians and advanced practice professionals specializing in primary care internal medicine and family medicine. The community-based practice in Rochester, MN deploys an integrated community specialist model, embedding specialties such as cardiology, behavioral health, and neurology into primary care.¹³ The integrated community neurology (ICN) team collaborates with primary care specialists to care for patients with migraine within our local community.

Survey Population

Patients receiving care at our Mayo Clinic, Rochester, MN campus who were ≥ 18 years of age and billed for an International Classification of Diseases–9th Revision (ICD-9) or ICD-10 code for migraine between June 1, 2014 and April 1, 2017 were included within our target population. We derived a random sample of 1804 patients from 5239 identified migraine patients based on an anticipated response rate of 25% to 30% from our experience in this population. Sampled individuals were invited to participate with our paper-based survey tool via United States postal

mail. If no response was received within 1 month, a second survey was mailed. The hypotheses and analyses presented here were a secondary aim of a larger study to redesign community-based migraine care based on patient type.¹⁴ The Mayo Clinic Institutional Review Board reviewed the project and determined that it does not constitute research as defined under 45 CFR 46.102.

Measures

Demographic Information. Before survey sampling was performed, we collected demographic information from administrative data sources for each potential participant. Information collected included age, gender, marital status, race, and ethnicity.

Patient-Reported Information. To assess for loneliness, we deployed the University of California Los Angeles–Revised (UCLA-R) Loneliness 3-item scale.¹⁵ Each item of the UCLA-R is scored from 1 to 3 for a total possible score of 3 to 9. Internal consistency of the UCLA-R scale was assessed using Cronbach's alpha. High internal consistency (Cronbach $\alpha \geq .5$) would allow us to collapse our loneliness scale into a single measure. If the participant scored a 4 or higher, they were classified as "lonely" whereas 3 or below were "not lonely." This is consistent with other reports on this scale.^{15,16} Returned surveys with 2 or more missing responses to any of the 3 UCLA-R loneliness questions were excluded from further analysis ($n = 2$ respondents). To assess for headache-related disability, we included the Migraine Disability Assessment (MIDAS).^{17,18} The MIDAS is a commonly deployed measure of headache-related disability among patients with migraine.^{19,20} The questionnaire evaluates characteristics of headache symptoms over a period of 3 months, including the frequency and severity of headaches, as well as the consequences of headache symptoms on daily activities (household chores, work, school, etc) and productivity. Survey responders are classified according to their scores as little or no disability (MIDAS score 0-5), mild disability (MIDAS score 6-10), moderate disability (MIDAS score 11-20), or severe disability (MIDAS score >21). We also assessed for the chronicity of migraines among our study population. To be classified as experiencing chronic migraines, respondents averaged more than 2 days of migraines per week for the past 3 months and have a migraine every day or greater than half of the days each month.

To understand patient perception of his/her ability to self-manage their migraines, we asked patients their overall ability to self-manage their migraine symptoms, ability to avoid conditions that cause headache, and confidence in using over-the-counter medications in self-treatment. To assess how patients viewed the effectiveness of their current treatment, we asked a series of questions related to overall

effectiveness of current treatment, effectiveness in preventing, reducing the frequency, and reducing the severity of headaches. Each of these questions was asked on a 5-point Likert-type scale for satisfaction (very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, very dissatisfied).

A copy of our survey tool is included as an additional file (Supplementary Material 1).

Statistical Analysis

Descriptive statistics were calculated for all survey respondents based on dichotomized loneliness scale. Proportions were calculated as total answering an individual response category over the total respondents per question, excluding patients who did not respond. Patients were grouped based on scored responses to the 3-item loneliness scale for comparison of report by loneliness by demographic characteristics. Wald Chi-square test was used to compare lonely versus nonlonely migraine patients. To assess for the potential for confounding, we assessed all demographic factors from 3 perspectives: (1) could the factor be associated with our outcomes of interest (effectiveness of current treatment, perceptions of self-management of migraine); (2) could each factor be associated with our main exposure (loneliness); and (3) could each factor serve as an intermediary on the relationship of loneliness with patient perception of the effectiveness of his/her current treatment and his/her ability to self-manage their migraine. Based on these assessments, we found that migraine type (acute vs chronic) and headache-related disability (measured via the MIDAS scale) could be significant confounders within our study. However, these patient assessments demonstrated a high degree of collinearity. A priori information indicates that disability is strongly associated with report of loneliness.^{10,21} We thereby chose to perform all subsequent analyses to adjust for headache-related disability (MIDAS). Logistic regression models were created, and both unadjusted and adjusted odds ratios with associated 95% confidence intervals were calculated. Internal consistency of the UCLA-3 item Loneliness scale was performed by calculating Cronbach's alpha. Assessment for nonresponse bias was performed by comparing demographic characteristics of survey responders versus nonresponders and assessing for differences. All data management and statistical analyses were performed using Statistical Analysis Software (SAS) Version 9.3, 2-tailed hypothesis testing was performed and statistical significance was considered at the value of .05.

Results

Twenty-eight percent of contacted patients completed and returned their survey over the 2 distribution waves (27.7%; 500/1,804). Demographic characteristics and headache-related disability status (MIDAS scores) are summarized by

lonely versus nonlonely groups in Table 1. The average age of survey respondents was 47 years, and the majority of our respondents were female, married, white race, and non-Hispanic or Latino ethnicity, and experiencing episodic versus chronic migraines. Based on the 3-point potential score for each item of the UCLA-3 item Loneliness scale, respondents had an average score of 1.5 (SD = 0.81) of "lacking companionship," an average score of 1.6 (SD = 0.85) of "feeling isolated," and an average score of 1.6 (SD = 0.87) of "feeling left out." Internal consistency across these measures was acceptable (Cronbach α = .81) allowing us to collapse our loneliness scale. Patients with chronic migraines ($P < .001$), greater amounts of headache-related disability according to the MIDAS score ($P < .001$) and who were married ($P < .001$) were more likely to report being lonely. Loneliness was not significantly associated with gender ($P = .652$).

Assessment for nonresponse bias within our respondent population did indicate that there were significant differences in age, gender, marital status, race, and ethnicity ($P < .05$) between those who responded to our survey and those who did not (Supplementary Material 2).

Effectiveness of Current Treatment for Migraine

The majority of patients felt "somewhat satisfied" or "very satisfied" in the effectiveness of their current treatment for migraine, in the effectiveness of their current preventive treatment for migraine, and in the effectiveness of their current treatment on migraine severity (Table 2). No differences in patient-reported effectiveness of current treatment were observed by patient loneliness. In our tabular analysis, survey respondents differed by reported loneliness on their level of satisfaction with their current treatment effectiveness on migraine frequency, but this finding was no longer apparent when controlling for headache-related disability (MIDAS) in our adjusted models.

Self-Management of Migraine Symptoms

Migraine patients significantly varied in their reported ability to self-manage their migraine symptoms and in their ability to avoid conditions which cause their headache symptoms by reported loneliness in our tabular, unadjusted, and adjusted models (Table 3). When adjusting for headache-related disability (MIDAS), the odds of feeling "very satisfied" with one's ability to self-manage headache symptoms were 66% lower for those who were lonely when compared to those who were not (adjusted odds ratio [aOR] = 0.34, 95% CI 0.14-0.81). Similarly, migraine patients also had lower odds of reporting the highest ability to avoid conditions causing their headache symptoms, when controlling for headache-related disability (aOR = 0.39, 95% CI 0.16-0.91). We did not observe

Table 1. Demographic Characteristics of Patients With Migraine in a Primary Care Population (n = 500).

	Not lonely (n = 270)	Lonely (n = 230)	Total (n = 500)	P
Age, years				.036
Mean (SD)	49 (16)	46 (15)	47 (16)	
Median	49	46	47	
Q1, Q3	37, 59	34, 57	36, 58	
Range	(18-88)	(18-89)	(18-89)	
Gender, n (%)				.652
Female	235 (87.0)	197 (85.7)	432 (86.4)	
Male	35 (13.0)	33 (14.3)	68 (13.6)	
Marital status, n (%)				<.001
Divorced	20 (7.4)	28 (12.2)	48 (9.6)	
Life partner	1 (0.4)	0 (0.0)	1 (0.2)	
Married	201 (74.4)	127 (55.2)	328 (65.6)	
Single	42 (15.6)	73 (31.7)	115 (23.0)	
Widowed	6 (2.2)	2 (0.9)	8 (1.6)	
Race, n (%)				.062
Missing	0	1	1	
Other	9 (3.3)	16 (7.0)	25 (5.0)	
White	261 (96.7)	213 (93.0)	474 (95.0)	
Ethnicity, n (%)				.326
Missing	1	3	4	
Not Hispanic or Latino	259 (96.3)	222 (97.8)	481 (97.0)	
Other	10 (3.7)	5 (2.2)	15 (3.0)	
Migraine type, n (%)				<.001
Chronic	42 (15.6)	67 (29.1)	109 (21.8)	
Episodic	228 (84.4)	163 (70.9)	391 (78.2)	
Headache-related disability (MIDAS score), n (%)				<.001
Missing	3	5	8	
Little/no disability	112 (41.9)	41 (18.2)	153 (31.1)	
Mild	38 (14.2)	40 (17.8)	78 (15.9)	
Moderate	60 (22.5)	37 (16.4)	97 (19.7)	
Severely disabled	57 (21.3)	107 (47.6)	164 (33.3)	

Abbreviation: MIDAS, Migraine Disability Assessment.

significant differences following adjustment in patient-reported confidence in their ability to care for migraine.

Discussion

We observed that patients with chronic migraine are more likely to be lonely than patients with episodic migraine. Patients with chronic migraine, greater amounts of headache-related disability according to the MIDAS score, who were married, and white were significantly more likely to report being lonely. We also observed that patients who are lonely are less likely to feel “very satisfied” in their ability to self-manage their migraine symptoms and to avoid conditions causing their headache symptoms, even after removing the effects of headache-related disability.

The finding that patients with chronic migraine are more likely to be lonely supports the current evidence associating loneliness with the occurrence of chronic disease and

severity of disability. According to our knowledge, studies of chronic diseases to date seem to exclude migraines, focusing mainly on the development of heart disease, hypertension, stroke, lung disease, and metabolic disorders.^{22,23} While there are certainly biomedical etiologies that link loneliness to inflammatory pathways, and ultimately the development of several chronic illnesses,⁵ this finding further reinforces the need to understand health as it relates to physical, social, and other structural circumstances.

We observed that patients meeting criteria for being lonely were less likely to be very satisfied with their ability to self-manage migraine symptoms and in their ability to avoid conditions causing headache symptoms, even after controlling for headache-related disability. These findings are consistent with current research which suggests that loneliness impairs self-management ability.^{9,11,12} Self-management includes tasks such as medical and emotional management, as well as deploying skills such as problem

Table 2. Patient-Perceived Effectiveness of Treatment for Migraine (n = 500).

	Not lonely, n (%)	Lonely, n (%)	Unadjusted model		Adjusted model ^a	
			Odds ratio	95% CI	Odds ratio	95% CI
Current treatment effectiveness						
Very satisfied	81 (33.8)	44 (19.8)	0.30	(0.13, 0.66)	0.55	(0.24, 1.30)
Somewhat satisfied	105 (43.8)	104 (46.8)	0.54	(0.25, 1.15)	0.74	(0.34, 1.64)
Neutral	25 (10.4)	23 (10.4)	0.50	(0.20, 1.24)	0.58	(0.23, 1.49)
Somewhat dissatisfied	17 (7.1)	29 (13.1)	0.93	(0.37, 2.34)	1.12	(0.43, 2.93)
Very dissatisfied	12 (5.0)	22 (9.9)			Reference	
Missing	30	8				
Current preventative treatment effectiveness						
Very satisfied	48 (26.8)	28 (15.9)	0.32	(0.15, 0.71)	0.65	(0.27, 1.56)
Somewhat satisfied	52 (29.1)	57 (32.4)	0.61	(0.29, 1.27)	0.71	(0.33, 1.55)
Neutral	38 (21.2)	39 (22.2)	0.57	(0.26, 1.24)	0.71	(0.31, 1.61)
Somewhat dissatisfied	26 (14.5)	25 (14.2)	0.53	(0.23, 1.23)	0.49	(0.21, 1.18)
Very dissatisfied	15 (8.4)	27 (15.3)			Reference	
Missing	91	54				
Current treatment effectiveness on frequency						
Very satisfied	56 (31.3)	34 (19.3)	0.39	(0.18, 0.83)	0.83	(0.36, 1.95)
Somewhat satisfied	45 (25.1)	47 (26.7)	0.67	(0.32, 1.41)	0.97	(0.43, 2.16)
Neutral	32 (17.9)	44 (25.0)	0.88	(0.41, 1.91)	1.07	(0.47, 2.46)
Somewhat dissatisfied	30 (16.8)	26 (14.8)	0.56	(0.25, 1.26)	0.57	(0.24, 1.35)
Very dissatisfied	16 (8.9)	25 (14.2)			Reference	
Missing	91	54				
Current treatment effectiveness on severity						
Very satisfied	78 (33.3)	43 (19.5)	0.23	(0.11, 0.49)	0.46	(0.20, 1.05)
Somewhat satisfied	91 (38.9)	86 (39.1)	0.39	(0.19, 0.82)	0.59	(0.27, 1.28)
Neutral	29 (12.4)	30 (13.6)	0.43	(0.18, 1.00)	0.64	(0.26, 1.54)
Somewhat dissatisfied	24 (10.3)	32 (14.5)	0.55	(0.24, 1.30)	0.71	(0.29, 1.72)
Very dissatisfied	12 (5.1)	29 (13.2)			Reference	
Missing	36	10				

^aAdjustment for headache-related disability (Migraine Disability Assessment [MIDAS]).

solving, decision making, resource utilization, goal setting, and self-tailoring, and accessing the relationship with their provider.²⁴ Self-efficacy and self-management ability have been shown to be associated with improved health outcomes and health-promoting lifestyles.²⁵⁻²⁷ Ability to self-manage disease and loneliness appear to be locked in a deadly cycle: Loneliness may be compromising migraine self-management, but also poor migraine self-management may be increasing loneliness. Currently, migraine self-management treatment strategies are limited to targeting the development of acute and preventive care methods that patients can implement and sustain independently at home.²⁸ For an illness that seems to have etiologies spanning all axes of the biopsychosocial model, our care continues to be disproportionately focused on neurochemical pathophysiology.²⁹ Our findings suggest that coaching patients on the use of migraine interventions may include the engagement of social connections to encourage or reinforce self-management strategies for migraine, and

involving social support systems in the treatment planning for patients with chronic migraine.

To effectively manage migraines, our study implies the importance of identifying patients who are experiencing loneliness and offering strategic interventions. Beyond the walls of the clinic, an effective method is partnering with local organizations with preexisting community rapport.³⁰ In a *Health Affairs* blog exploring cross-sector collaborations to address loneliness among older adults, the article provides the example of Meals on Wheels America, a meal delivery service where 60% of participants live alone with complex health needs, as a potential community partner for clinicians.³⁰ Within the clinic, other interventions involve screening for these factors in our patients through tools such as the Accountable Health Communities (AHC) Health-Related Social Needs Screening Tool,³¹ developed by the Centers for Medicare and Medicaid Services (CMS), or the Medicare Total Health Assessment Questionnaire,³² developed by Kaiser Permanente. These questionnaires have been used to identify significant social

Table 3. Patient-Perceived Ability to Self-Manage Migraine (n = 500).

	Not lonely, n (%)	Lonely, n (%)	Unadjusted model		Adjusted model ^a	
			Odds ratio	95% CI	Odds ratio	95% CI
Ability to self-manage headache symptoms						
Very satisfied	88 (34.5)	40 (17.7)	0.19	(0.08, 0.43)	0.34	(0.14, 0.81)
Somewhat satisfied	95 (37.3)	85 (37.6)	0.37	(0.17, 0.83)	0.49	(0.22, 1.12)
Neutral	44 (17.3)	45 (19.9)	0.43	(0.18, 0.99)	0.51	(0.22, 1.23)
Somewhat dissatisfied	18 (7.1)	32 (14.2)	0.74	(0.29, 1.89)	0.81	(0.31, 2.11)
Very dissatisfied	10 (3.9)	24 (10.6)			Reference	
Missing	15	4				
Ability to avoid conditions causing headache symptoms						
Very satisfied	47 (18.8)	20 (9.2)	0.25	(0.11, 0.55)	0.39	(0.16, 0.91)
Somewhat satisfied	61 (24.4)	57 (26.1)	0.55	(0.27, 1.10)	0.7	(0.33, 1.45)
Neutral	81 (32.4)	64 (29.4)	0.46	(0.23, 0.92)	0.54	(0.27, 1.10)
Somewhat dissatisfied	44 (17.6)	48 (22.0)	0.64	(0.31, 1.32)	0.7	(0.33, 1.49)
Very dissatisfied	17 (6.8)	29 (13.3)			Reference	
Missing	20	12				
Confidence in ability to care for migraines						
Strongly agree	51 (19.6)	31 (13.5)	0.59	(0.34, 1.02)	0.79	(0.44, 1.44)
Somewhat agree	68 (26.2)	50 (21.8)	0.72	(0.44, 1.16)	0.82	(0.49, 1.37)
Neither agree not disagree	32 (12.3)	31 (13.5)	0.94	(0.52, 1.70)	0.89	(0.47, 1.67)
Somewhat disagree	34 (13.1)	40 (17.5)	1.15	(0.66, 2.00)	1.03	(0.58, 1.86)
Strongly disagree	75 (28.9)	77 (33.6)			Reference	
Missing	76	72				

^aAdjustment for headache-related disability (Migraine Disability Assessment [MIDAS]).

determinants of health at play in an individual's life by assessing the frequency of feelings of loneliness in respondents. Screening tools can provide a basis for clinicians to refer patients to social work or community resources. They may also provide a baseline measure of loneliness that can be tracked at follow-up visits and used to contextualize the improvement or decline of other comorbidities. For example, a patient suffering from both chronic migraines and loneliness should be reassessed at follow-up with objective measures on both conditions using appropriate tools. However, a single question on screening tools should not be the ultimate evaluation of a patient's experience of loneliness. Nuances in the experience of loneliness should be discussed before recommending the appropriate resources. Furthermore, since many lonely individuals do not present to routine medical care due to reasons ranging from functional decline or lack of access to transportation, screening tools may not be a comprehensive intervention. Finally, public education efforts can help increase awareness of loneliness as a risk factor for adverse health outcomes. Initiatives such as the United Kingdom's Campaign to End Loneliness,³³ Denmark's Mary Foundation,³⁴ and the American Association of Retired Persons (AARP) Connect-2-Affect initiative³⁵ have all taken steps to increase awareness and reduce the stigma of loneliness. Despite the listed interventions above, further research is necessary to identify evidence-based strategies in addressing loneliness.

Once the experience of loneliness is identified in patients with chronic migraines, care models seeking to improve care of migraine patients can incorporate appropriate interventions. This may be especially important for patients with chronic migraine and those with concurrent medication overuse headache.³⁶ In systems with electronic health records (EHRs), a number of promising tools that may enhance provider-patient connectedness include online patient messaging and development of headache management smartphone applications that interface with the EHR.³⁷ Provider-led education of groups of migraine patients is one strategy that is associated with reduced emergency department utilization and improved patient satisfaction with care.³⁸ Employing migraine-trained nurses to provide support and education is another promising intervention.³⁹ Scheduling more frequent care team interactions, including video and phone, may be an effective strategy particularly for patients who score high on loneliness screening tools. Assessing patients for loneliness may help identify patients that would benefit most from use of additional care resources. Another survey to better understand how patients with loneliness may prefer to interact with a migraine care team is suggested. Migraine is known to be a disabling, frustrating condition that may not respond to the best evidence-based care.⁴⁰ Developing care plans that include follow-up alternatives, especially ones void of stigmatizing migraine language, are suggested as well.

Our study has several strengths. First, our study included a random selection of community migraine patients from a well-defined population. Second, we deployed several validated survey measures (UCLA-R, MIDAS) to assess the main components of our analysis, which allows for comparison of our findings to studies which included the same tools. Our study also had several limitations. The cross-sectional nature of our study does not allow for an understanding of causation, but only for observing associations within our population. Additionally, our community sample from our single organization may not be generalizable to all populations. Survey-based research in general struggles from issues of recall and non-response bias, which may be affecting our findings as well. Our assessment for nonresponse bias did indicate that our study suffered from nonresponse based on age, gender, marital status, race, and ethnicity. We are unable to assess whether our respondents differed based on our main exposure, loneliness. The non-response bias found in our study along with the observational nature of our study design does not allow us to assess for causality between loneliness and patient perceived effectiveness of treatment and ability to self-manage their migraine symptoms. Our study also suffered from low response (27.7%; 500/1804). Our response rate does not differ from other paper- and electronic-based surveys among our community population.⁴¹ Our study experienced lower response to our mail-based surveys among those of younger ages, which has been noted in the literature.⁴² Mechanisms for enhanced response rates may include using a multimodal approach (a mix of paper- and electronic-based surveys) and follow-up phone calls to nonresponders. Further investigation into our observed effects is needed. Our study may also suffer from uncontrolled confounding. Research related to the psychosocial concerns of individuals with migraine indicates that additional factors that may be confounding our observed effects could include mental health and emotional function (anxiety, depression), and fatigue/energy and internal drive.¹⁰ Current literature also recognizes the association between loneliness and mood symptoms severity,^{43,44} as well as the bidirectional association between psychiatric comorbidities such as panic disorder and major depression with migraine.⁴⁵ We did control for a well-recognized measure of headache-related disability (MIDAS), which may correlate with these factors if assessed. This lack of exploration of the interplay between loneliness, mental health and emotional function, and migraines warrants further investigation. Due to our limited sample size, we did dichotomize the UCLA 3-item loneliness scale, which limits the variability in our responses.

Conclusions

Loneliness may be an important predictor or determinate of migraine headache outcomes. Lonely patients are more likely to be those with chronic migraine and report

reduced satisfaction with self-management of migraine. Headache care models should identify lonely patients and develop strategies to connect with these patients in patient centered methods they prefer. Doing so may improve the ability of patients to self-manage migraine and improve migraine care outcomes with less health care utilization.

Author Contributions

Author contributions included study design and conceptualization (NPY, JOE, LMP), analysis and interpretation of results (JZL, NPY, JKR, LMP), and the writing of the manuscript (JZP, NPY, JOE, JKR, LMP).

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Supplemental Material

Supplemental material for this article is available online.

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