Published in final edited form as:

Int J Behav Med. 2017 February ; 24(1): 136–143. doi:10.1007/s12529-016-9587-2.

Headache-specific locus of control and migraine-related quality of life: understanding the role of anxiety

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Abstract

Purpose—This study examined the relationship between headache-specific locus of control (HSLC) and migraine-related quality of life, and anxiety as a mediator of this relationship.

Methods—Two hundred and thirty-two people with severe migraine participated in the Treatment of Severe Migraine trial. At baseline, participants completed self-report questionnaires of headache-specific locus of control (HSLC; subscales = Internal, Chance, and Medical Professionals), anxiety, and migraine-related quality of life. Correlations examined relationships between HSLC, anxiety, and migraine-related quality of life; ordinary least squares regression evaluated anxiety as a mediator of the relationship between HSLC and migraine-related quality of life.

Results—Higher internal HSLC was related to higher overall migraine-related quality of life ($p < .05$) and emotion function impairments ($p = .012$). Anxiety mediated the relationship between internal HSLC and all measures of migraine-specific quality of life ($p < .05$). Higher external (medical professionals and chance) HSLC was related to higher migraine-related quality of life impairments (all $p < .001$).

Conclusions—All HSLC beliefs are associated with higher migraine-related quality of life impairments. Anxiety mediates the relationship between internal HSLC and migraine-related quality of life.

Keywords

Migraine; Locus of control; Anxiety; Quality of Life

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Compliance with Ethical Standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required

Informed consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: Ms. Grinberg has no conflicts to report.

Migraine is a headache disorder in which individuals experience moderate to severe unilateral pulsating head pain, which lasts from 4 to 72 hours [1]. Associated symptoms include nausea, vomiting, photophobia and phonophobia [1]. Migraine prevalence rates, in adults in the United States, range from 11.7% to 22.7% [2]. The Global Burden of Disease Survey, 2010 ranked migraine as the seventh highest specific cause of disability worldwide [3]. Migraine has been linked to significant burden, including impaired social and occupational functioning and decreased quality of life [4]. Understanding what factors are associated with poor quality of life will aid treatment planning to ameliorate the negative impact of migraine.

In the Cognitive Behavioral Therapy model [5] of migraine, beliefs influence affective (emotional) and behavioral responses to migraine [6, 5], which in turn influence quality of life. Headache Specific Locus of Control (HSLC) refers to an individual's belief that the development and progression of headache symptoms are a consequence of their own behavior (internal HSLC) or something external to themselves, including chance (chance HSLC) or their medical professional's actions (medical professionals HSLC) [7]. External (chance and medical professionals) HSLC has demonstrated associations with impaired headache-related quality of life [7–9] in a handful of older studies examining college students [7] or outpatients [7] with migraine and/or tension-type headache. None of these studies evaluated the differential impact of chance and medical professionals HSLC on the role functioning and emotional functioning aspects of headache-related quality of life. Further, these three studies included participants with heterogeneous headache diagnoses; no study has examined the impact of HSLC on headache-related quality of life in a homogenous sample of people with migraine.

Anxiety disorders are comorbid with migraine [10, 11] and are associated with poorer migraine-related quality of life within people with migraine [12, 10]. Anxiety is a potent affective response characterized as “a state of helplessness, because of a perceived inability to predict, control, or obtain desired results or outcomes [13]” (p 1249). Thus anxiety is intrinsically related to beliefs regarding control [14] and may be implicated in the relationship between HSLC and migraine-related quality of life. Interestingly, one study has demonstrated that higher anxiety is associated with both higher internal and chance HSLC, even though internal and chance HSLC are negatively related to each other [9]. Thus, it is possible that the mechanism of anxiety operates differently for internal and chance HSLC. To date, no studies have examined anxiety as a mediator of the relationship between HSLC and migraine-related quality of life. This knowledge will allow us to enhance cognitive behavioral treatment targets to improve migraine-related quality of life.

The present study aims to: 1) Examine the relationship between HSLC and migraine-related quality of life, including both role and emotional impairment, and 2) Evaluate anxiety as a mediator of the relationships between HSLC and migraine-related quality of life in patients with severe migraine recruited from outpatient settings.

Method

Treatment of Severe Migraine Trial

The current study is a secondary analysis of baseline data from a larger 16-month randomized controlled treatment trial evaluating whether the addition of behavioral migraine management, preventive medication, or their combination to optimized acute therapy improved migraine symptoms and migraine-related quality of life among people with severe migraine (Treatment of Severe Migraine trial) [15]. The primary analysis demonstrated that the combination of behavioral migraine management and preventive medication produced the largest decrease in migraine symptoms and migraine-related quality of life [15].

Participants

Two hundred and thirty-two participants were recruited for the Treatment of Severe Migraine trial from July 2001 to November 2005, in two outpatient settings in Ohio. Inclusion criteria were: 1) individuals aged 18 to 65 with an International Classification of Headache Disorders – I diagnosis of migraine (with or without aura) [16] by two evaluations in the clinic (2) at least three migraines with reported disability in a 30 day diary monitoring period. Exclusion criteria were: 1) International Classification of Headache Disorders-I diagnosis of probable medication overuse headache, 2) an additional primary pain disorder, 3) 20 or more headache days over a 30 day period, 4) contraindication to study medications or current use of preventive medications, 5) receiving current psychological treatment, 6) inability to read and understand study documents, and 7) female participants who are pregnant or breastfeeding or plan to become pregnant or breastfeed.

Table 1 presents participants' demographic data. Two hundred and thirty-two males (N= 48, 20.7%), and females (N = 184, 79.3%) participated in the study. Their ages ranged from 18 to 62 years (M = 38.6, SD = 10). The majority of the participants were married (N = 134, 59.3%), not of Hispanic origin (N = 194, 83.6%), and held a high school/ GED degree (N = 83, 37.1%) or a BA/BS degree (N = 62, 27.7%).

Procedure

At baseline, participants were given a structured interview pertaining to their headache and psychosocial history, in addition to receiving a medical examination by a neurologist. Participants completed electronic self-report questionnaires pertaining to headache related cognitions (HSLC), migraine-related quality of life, and psychiatric symptoms (anxiety). The current study utilizes baseline data.

Materials

Demographics—Participants answered self-report demographic questions relating to their age, gender, ethnicity, the highest degree completed, household income, marital status, and employment status.

Headache Specific Locus of Control—(HSLC) [7] is a 33 item self-report measure pertaining to an individuals' belief that the development and progression of headache symptoms are a consequence of their own behavior, their medical professional's actions, or

due to chance. Items are rated on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Three subscale scores were utilized: Internal HSLC, chance HSLC, and health care professionals HSLC. Items include, “When I drive myself too hard I get headaches” (internal), “When I have a headache, there is nothing I can do to affect its course” (chance), and “Health professionals keep me from getting headache” (medical professionals). In the original validation study, the HSLC demonstrated good internal consistency ($\alpha = 0.84 - 0.88$), and adequate test-retest reliability over a three-week period ($r = 0.72$ to 0.78).

Headache Disability Inventory—(HDI) [17] is a 25 item self-report measure pertaining to the impact of headaches in terms of emotion “I feel desperate because of my headaches” and on daily functioning “I restrict my recreational activities (e.g. sports, hobbies) because of my headaches.” Individuals respond to items indicating *yes, sometimes or no*. The HDI demonstrated good internal consistency ($r = 0.94$), and good sixty-day test-retest reliability ($r = 0.83$) in the original validation study. Within our sample, emotion and functioning subscales did not emerge as distinct factors, thus only the total score is utilized in the current analysis.

Migraine Specific Quality of Life Questionnaire—(MSQL) [18] is a 16 item self-report measure pertaining to an individual’s migraine-related quality of life impairments over the past 4 weeks. Items are rated on a 6-point Likert scale (1 = *none of the time* to 6 = *all of the time*). There are three subscales: Role Function-Restrictive, Role Function-Preventive, and Emotional Function. Items include, “In the past 4 weeks, how often have migraines interrupted your leisure time activities, such as reading or exercising?” (Role Function-Restrictive), “In the past 4 weeks, how often have you had to cancel work or daily activities because you had a migraine?” (Role Function-Preventative), and “In the past 4 weeks how often have you felt like you were a burden on others because of your migraines?” (Emotional Function). Higher scores on the MSQL indicate higher levels of disability. The MSQL demonstrated good internal consistency for all three subscales ($\alpha = 0.70-0.85$) in the original validation study.

Beck Anxiety Inventory—(BAI) [19] is a 21 item self report measure pertaining to an individual’s anxiety related symptoms. Items are rated on a 4-point Likert (0 = *not at all* to 4 = *severely - it bothered me a lot*). Items include “unable to relax,” “fear of losing control” and “numbness or tingling.” Higher scores on the BAI indicate higher levels of anxiety. In the original validation study, the BAI demonstrated high internal consistency ($\alpha = .92$).

Data Analysis

Descriptive statistics characterized the data. Correlations examined relationships between HSLC and migraine-related quality of life. Hayes’ PROCESS analysis examined anxiety as a mediator of the relationship between HSLC and migraine-related quality of life. PROCESS analysis calculates two discrete pathways: 1) where the predictor variable (HSLC) directly influences the outcome variable (migraine-related quality of life) (direct effect) and 2) where the predictor variable (HSLC) influences the outcome variable (migraine-related quality of life) through the mediator variable (anxiety) (indirect effect) (see Figure 1). A significant indirect effect represents a significant mediation model [20, 21].

PROCESS utilizes bootstrapping to obtain the indirect effect estimate, which is robust to non-normal distributions [21]. Alpha was set at .05. All analyses were two-tailed. Analyses were completed in SPSS version 22.0.

Results

Relationships between HSLC and migraine-related quality of life

Table 2 presents correlations among the variables. Higher internal HSLC was related to higher overall migraine-related quality of life impairments for only one of the two scales (HDI total, $r = .21$, $p = .002$). However, higher internal HSLC was associated with higher impairment on the emotion function subscale of the MSQ ($r = .17$, $p = .012$). Internal HSLC was not significantly associated with MSQ role restriction ($r = 0.08$, $p = .26$), and MSQ role prevention ($r = .03$, $p = .62$).

Higher chance HSLC was related to higher overall migraine-related quality of life impairments (MSQ total, $r = .23$, $p < .001$, HDI total, $r = .24$, $p < .001$). Higher Chance HSLC was also associated with all three MSQ subscales, role restriction, $r = .17$, $p = .009$, role prevention, $r = 0.21$, $p = .001$, and emotion function MQoL impairments, $r = .27$, $p < .001$. Higher medical professionals HSLC was related to higher levels of overall migraine-related quality of life impairments (MSQ total, $r = .29$, $p < .001$; HDI total, $r = .28$, $p < .001$), and all three subscales of the MSQ (role restriction: $r = .25$, $p < .001$; role prevention: $r = .27$, $p < .001$); and emotion function: $r = .29$, $p < .001$).

Anxiety as a Mediator between HSLC and migraine-related quality of life

Higher internal HSLC was associated with higher anxiety ($r = .18$, $p = .007$). Neither chance HSLC, $r = .07$, $p = .30$, nor medical professionals HSLC, $r = .08$, $p = .24$, was significantly associated with anxiety.

Anxiety mediated the relationship between internal HSLC and all measures of migraine-specific quality of life (see Table 3). There was a significant indirect effect of internal HSLC on MQoL (HDI total) through anxiety, $ab = 0.20$, 95% CI [0.08, 0.37], $R^2 = 27\%$ (see Figure 2). There was a significant indirect effect of internal HSLC on migraine-related quality of life (MSQ total) through anxiety, $ab = 0.09$, 95% CI [0.03, 0.17], $R^2 = 13\%$ (see Figure 3). This result was comparable for each MSQ subtest $ps < .05$.

There were no significant indirect effects of chance HSLC or medical professionals HSLC on any measures of migraine-related quality of life through anxiety, $ps > .05$.

Discussion

The present study aimed to: 1) Examine the relationship between HSLC and migraine-related quality of life, including both role and emotional impairment, and 2) Evaluate anxiety as a mediator of the relationships between HSLC and migraine-related quality of life in patients with severe migraine recruited from outpatient settings. Results indicate that higher internal HSLC demonstrated a direct negative impact on the emotional aspects of migraine-related quality of life. Thus, the belief that the development and progression of

headache symptoms is due to the patients' own actions may be maladaptive in certain circumstances, particularly when evaluating emotional quality of life. The relationship between internal HSLC and anxiety appears to at least partly explain this relationship. In this study, as in previous studies, higher internal HSLC was related to higher anxiety symptoms [9, 14]. Further, this study demonstrated that anxiety mediated relationships between internal HSLC and all measures of migraine-related quality of life. This accounts for at least part of the maladaptive nature of internal HSLC among people with migraine. Current findings provided novel information regarding anxiety as a mediator between internal HSLC and migraine-related quality of life. To our knowledge, this is the first study to evaluate the interrelationships between HSLC, anxiety and migraine-related quality of life in people with migraine.

It should be noted that previous studies have found that higher internal HSLC is associated with higher levels of adaptive headache-related beliefs (self-efficacy [9]). Further, behavioral treatments that increase internal HSLC have demonstrated efficacy for reducing migraine-related quality of life [22]. Thus it appears that internal HSLC is multifaceted: on the one hand, it is related to anxiety, and is associated with poorer emotional migraine-related quality of life in cross-sectional studies; on the other hand, it is related to adaptive headache-related beliefs, and improves during effective treatment of migraine. It is possible that internal HSLC is multi-factorial; perhaps internal HSLC is adaptive in relation to headache-related phenomena that are indeed controllable by the individual (e.g., stress management, migraine medication-taking behaviors), whereas, internal HSLC is less adaptive in relation to phenomena which the individual may exert little influence (e.g., the presence of migraine). Future research should continue evaluate the multiple roles of internal HSLC in migraine-related quality of life, and in the behavioral treatment of migraine.

Higher beliefs that the development and progression of headache symptoms are predominantly due to chance, or a consequence of medical professional's actions, were associated with poorer MQoL across all measures. These findings are consistent with previous research [7–9]. Certainly the belief that only chance or fate can influence the onset and course of migraines is fatalistic and maladaptive, and could lead to skepticism about treatment recommendations and discontinuing adaptive migraine management efforts. However, it is less immediately clear how higher medical professionals HSLC is necessarily maladaptive. Higher medical professionals HSLC may indicate an overreliance on the actions of one's headache provider, to the exclusion of self-management behaviors necessary for successful treatment of a complex chronic disorder such as migraine. On the other hand, many lifestyle recommendations for migraine include dietary and lifestyle restriction to avoid migraine triggers; perhaps high medical professionals HSLC leads to excessive restriction of adaptive pleasurable activities for fear that they may induce migraine. People with migraine may thus benefit from clarity from their physicians regarding their ability to partake in a variety of activities.

Taken together with the prior literature, findings from this study suggest that higher external (medical professionals and chance) HSLC is consistently associated with poorer migraine-related quality of life. Higher Internal HSLC is associated with poorer emotional migraine-related quality of life; further, internal HSLC is associated with higher anxiety, which

mediates relationships between internal HSLC and migraine-related quality of life. Future research should use these findings to guide evaluation of different clinical techniques for different HSLC beliefs. For example, people with migraine and high internal HSLC may benefit specifically from techniques that focus on reducing anxiety and the emotional burden of migraine. Further, this study suggests that although effective behavioral treatments increase internal HSLC, higher internal HSLC in the absence of migraine management tools taught during behavioral treatment may be maladaptive. Thus, within clinical practice, the use of a HSLC measure may help guide the types of treatments offered, with the ultimate goal of reducing migraine-related quality of life impairments.

Limitations

The current study evaluates baseline data from a randomized controlled trial. Consequently, all participants were seeking further treatment, and may therefore not be satisfied with their current health care. Future research would benefit from examining participants who are not enrolled in a trial, where participants might be more satisfied with their health care. Additional information pertaining to provider characteristics, such as patient's satisfaction with their medical provider, and length of relationship with their medical provider would also be beneficial, as this may impact individuals' HSLC beliefs. Further, addressing whether migraine-related quality of life differs between patients who are satisfied with their treatment in comparison with those who are not will be useful.

Due to the cross-sectional nature of the study, we were unable to examine temporal relationships between the variables. Further, all measures utilized in this study comprised of self-report data, which is reliant on participant recall and is subject to bias. All of the participants experienced migraines, thus it is possible that their reported headache-related quality of life may differ from those who are diagnosed with other headache disorders. Findings may therefore not generalize to other types of headache disorders, though this is currently unknown. Since migraine is the most disabling of the headache disorders, first examining associations between HSLC, anxiety and migraine-related quality of life in patients with migraine are helpful. Future research should examine whether differences in HSLC beliefs and headache-related quality of life impairments prevail in patients with other types of headaches.

Conclusion

This study found that people with migraine who believe that the development and progression of their headache symptoms are due to internal factors experience emotion-related migraine-related quality of life impairments. Moreover, the relationship between internal HSLC and migraine-related quality of life is mediated by anxiety. Individuals who believe that the development and progression of their headache symptoms are due to external factors experience migraine-related quality of life impairments in terms of both role and emotional impairments. Future studies should further examine the utility of HSLC beliefs in guiding treatments for people with migraine.

Acknowledgments

We would like to acknowledge the contributions of the principal investigator of the TSM trial, Kenneth A. Holroyd, for his invaluable mentorship. We would also like to acknowledge the members of the TSM trial team; Constance Cottrell, Francis O'Donnell, Gary Cordingley, Carol Nogrady, Kimberly Hill, Victor Heh, Suzanne Smith, Bernadette Devantes Heckman, Brenda Pinkerman, Gregg Tkachuk, Sharon Waller, Donna Shiels, Kathleen Darchuk, Yi Chen, Timur Skeini, Manish Singla, Swati Dalmai, Lorie Arnott and Lina Himawan.

Funding: The TSM trial was funded by the National Institute of Neurological Disorders and Stroke (NS-32375; PI Holroyd). Merck Pharmaceuticals, Inc. and GlaxoSmithKline Pharmaceuticals donated triptans for acute migraine therapy, which was their only involvement.

Dr. Seng reports funding from the International Headache Academy.

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Figure 1.
Mediation model

Figure 2.

The mediating role of anxiety in the relationship between internal headache-specific locus of control and migraine-related quality of life (HDI total score). Note. All regression coefficients are unstandardized. Standard errors are in parentheses.

* $p < .05$, ** $p < .01$, *** $p < .001$

Figure 3.

The mediating role of anxiety in the relationship between internal headache-specific locus of control and migraine-related quality of life (MSQ total score). Note. All regression coefficients are unstandardized. Standard errors are in parentheses.

** $p < .01$, *** $p < .001$

Table 1**Demographic Characteristics**

Characteristic	N (%)
Age M (SD)	38.16 (10)
Gender	
Male	48 (20.7)
Female	184 (79.3)
Ethnicity	
White, not of Hispanic origin	194 (83.6)
Black, not of Hispanic origin	31 (13.4)
Asian or Pacific Islander	3 (1.3)
Hispanic	3 (1.3)
American Indian or Alaskan Native	1 (0.4)
Highest degree completed	
High school/GED	83 (37.1)
AD/Trade School	46 (20.5)
BA/BS	62 (27.7)
MA/MS	23 (10.3)
Ph.D./M.D./J.D./D.O.	7 (3.1)
Other	3 (1.3)
Income range	
\$1–\$20,000	29 (13.8)
\$20,001–\$40,000	46 (21.9)
\$40,001–\$60,000	47 (22.4)
\$60,001–\$80,000	35 (16.7)
80,001+	53 (25.2)
Marital status	
Single	53 (23.5)
Married	134 (59.3)
Living with significant other	12 (5.2)
Separated	4 (1.8)
Divorced	23 (10.2)
Employment status	
Not working for pay	38 (16.6)
Part-time	36 (15.7)
Full-time	155 (67.7)

Table 2

Correlations between headache-specific locus of control, anxiety, and migraine-related quality of life

	1	2	3	4	5	6	7	8
1. Medical Professional HSLC	-							
2. Chance HSLC	.21**	-						
3. Internal HSLC	.18**	.21***	-					
4. MSQOL Role Restrictive	.25***	.17**	.08	-				
5. MSQOL Role Preventive	.27***	.21**	.03	.81***	-			
6. MSQOL Emotion	.29***	.27***	.17*	.65***	.62***	-		
7. MSQOL Total	.29***	.23***	.10	.95***	.90***	.82***	-	
8. HDI Total	.28***	.24***	.21**	.64***	.53***	.71***	.70***	-
9. BAI Total	.08	.07	.18**	.37***	.23***	.40***	.38***	.52***

Note. HSLC Headache Specific Locus of Control, MSQOL Migraine Specific Quality of Life, HDI Headache Disability Inventory, BAI Beck Anxiety Inventory.

 $p < .05^*$, $p < .01^{**}$, $p < .001^{***}$.

Table 3
Mediation model of internal headache specific locus of control, anxiety and migraine-related quality of life

	MSQL Emotion	SE	95% CI	MSQL Role Restrictive	SE	95% CI	MSQL Role Preventive	SE	95% CI
<i>a</i>	.11	.04	0.03 – 0.18	.11	.04	0.03 – 0.18	.11	.04	0.03 – 0.18
<i>b</i>	.28	.05	0.19 – 0.37	.45	.08	0.29 – 0.61	.17	.05	0.07 – 0.27
<i>c'</i>	.04	.03	– 0.01 – 0.10	.01	.05	– 0.08 – 0.10	–.002	.03	– 0.6 – 0.06
<i>c</i>	.07	.03	0.02 – 0.13	.06	.05	– 0.04 – 0.16	.02	.03	– 0.5 – 0.08
<i>ab</i>	.03	.01	0.01 – 0.06	.05	.02	0.02 – 0.09	.02	.01	0.01 – 0.03
<i>R</i> ²	.16			.13			.05		

Note. MSQL Migraine Specific Quality of Life