

# Reliability and Validity of the Migraine Therapy Assessment Questionnaire

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**Objective.**—To determine the reliability and validity of the Migraine Therapy Assessment Questionnaire (MTAQ).

**Design/Methods.**—Eligible patients between ages 18 and 65 with at least one migraine per month, a physician visit in the preceding 6 months, and a migraine diagnosis were recruited from physician offices in the Philadelphia area. Participants completed the MTAQ, Short Form-36 (SF-36), the Migraine Disability Assessment Score (MIDAS), the Beck Depression Inventory, a demographic questionnaire, and a medication use survey. The first 100 participants completed a second MTAQ approximately 2 weeks later. The test-retest reliability, construct, and predictive validity of the MTAQ were assessed.

**Results.**—Two hundred fifty-one patients were recruited; 243 patients were assessable. All MTAQ questions had a kappa statistic of .5 or higher and an agreement of at least 76%. There was a significant level of agreement (.71) for the MTAQ summary score. MTAQ items regarding control, frequency, work loss, resource use, and satisfaction were associated with significant differences in SF-36 scores. MTAQ items related to work loss, emergency department use, headache frequency, and control were associated with days missed from work and degree of disability as measured by MIDAS. Suboptimal migraine management was significantly associated with MTAQ items indicating three or more headaches per month, missing time from work or school, taking daily medication for headaches, and having an emergency department visit in the last 6 months.

**Conclusion.**—MTAQ is a reliable and valid questionnaire to identify migraineurs whose migraine management may be suboptimal in a primary care setting.

**Key words:** migraine, disease management, validity, reliability, MTAQ

**Abbreviations:** MTAQ Migraine Therapy Assessment Questionnaire, SF-36 Short Form-36, MIDAS Migraine Disability Assessment Score, BDI Beck Depression Inventory, HRQoL health-related quality of life, ROC receiver operator characteristic

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## INTRODUCTION

The economic burden of migraine is significant, both in terms of the direct costs for medical care and the indirect costs associated with migraineurs' lost productivity at work.<sup>1-4</sup> For the patient, migraines result in debilitation and impaired quality of life during a migraine attack and impairment in physical, social, and mental health between attacks.<sup>1,2,5</sup> The extent of the quality of life impairment is significant, as shown by migraineurs having poorer quality of life than patients with diabetes, hypertension, or depression.<sup>6</sup>

Migraine management, especially in severe cases, can be complex. Many migraine-specific treatments effective in decreasing medical costs<sup>7-10</sup> and lost work time<sup>8,11-13</sup> associated with migraines are available. These treatments also improve the quality of life of migraineurs.<sup>7,8,11,14-18</sup>

The US Headache Consortium Evidence-Based Treatment guidelines were created to assist practitioners in migraine management.<sup>19</sup> These guidelines provide an extensive review of the efficacy and safety of available medications and behavioral therapies for headache treatment. They are intended to help physicians select patients who are likely to benefit from prevention and treatment strategies by providing information about organized pharmacological and non-pharmacological approaches.

Despite the availability of effective therapies and practice guidelines for the treatment of migraines, many patients are not receiving optimal therapy due to misdiagnosis,<sup>20</sup> undertreatment,<sup>21</sup> or misconceptions regarding the appropriate use of both prescription and nonprescription medications. In an effort to identify barriers to optimal migraine management and improve patient outcomes, a brief migraine-management screening tool, the Migraine Therapy Assessment Questionnaire (MTAQ), was created. This nine-item patient-completed questionnaire was developed as a disease management tool to identify individuals whose migraine management may be sub-optimal (Appendix). By identifying patients' specific management issues, the MTAQ may improve communication between health care providers and patients, decrease inappropriate migraine-related health care resource use, decrease lost productivity, and improve patient satisfaction and quality of life. Similar questionnaires have been developed for other disease states, such as the Asthma Therapy Assessment Questionnaire.<sup>22</sup>

For the MTAQ to be useful as a screening questionnaire, its reliability and construct and predictive validity must be established. The purpose of our study was to determine whether the MTAQ is a reliable and valid survey, which can assist clinicians and managed care organizations in improving the quality of care by identifying those individuals with possible migraine management issues.

## METHODS

This was a cross-sectional study conducted in primary care physician offices in the Metropolitan Philadelphia area. The main study site was Jefferson Family Medicine Associates, a large academic family medicine physician practice located in center city Philadelphia. Jefferson Family Medicine Associates has 20 full-time physicians and residents working under the professional and academic auspices of Thomas Jefferson University Hospital. In addition, patients were recruited from 28 JeffCARE family and internal medicine physician practices. JeffCARE, a nonprofit organization, is the Jefferson Health System's affiliated physician hospital organization, which consists of physician practices located in suburban Philadelphia and Southern New Jersey. The study protocol was approved by the Thomas Jefferson University Institutional Review Board.

Patients of one of the above clinical sites with a diagnosis of migraine were identified through the sites' respective computer systems used for scheduling and billing. The study coordinator contacted, by letter and/or telephone, the patients' respective physician to obtain permission to contact them for participation in the study. Once permission was obtained, patients were invited by letter to participate in the study. Patients who agreed to participate were screened by the study coordinator for eligibility criteria.

Eligible patients were between 18 and 65 years of age, having on average at least one migraine each month, a visit to their primary care physician in the preceding 6 months, and meeting the International Headache Society's criteria for the diagnosis of migraine with or without aura.<sup>23</sup> Patients who met the inclusion criteria and completed a written informed consent form were enrolled in the study. Eligible patients were given a \$25.00 incentive for participation.

The study coordinator asked each participant to self-complete a battery of questionnaires. The battery consisted of the MTAQ, the Short Form-36® (SF-36), the Migraine Disability Assessment Score (MIDAS), the Beck Depression Inventory (BDI), a demographic survey, and a medication use sheet. The MTAQ and medication use sheet were completed as paper surveys, whereas the other questionnaires were completed using a computer touch-screen system (version

6.2, Assist Technologies, Scottsdale, AZ, USA). The first 100 enrolled participants were asked to complete two MTAQ questionnaires approximately 2 weeks apart to evaluate test-retest reliability. Participants received an additional \$25.00 incentive for completion of this second questionnaire.

**Questionnaires.**—The MTAQ is a brief survey designed to identify possible management issues for patients with migraine. The MTAQ consists of nine dichotomously scaled questions that focus on migraine control, frequency of attacks, knowledge and behavioral barriers, economic burden, and treatment satisfaction. Each MTAQ item receives a score based on the response categories (yes = 1 or no = 0). Questions 1, 2, 5, and 9 are reversed coded (yes = 0, no = 1), and questions 3 and 4 are scored together. (If questions 3 and 4 are yes responses, then together their score is 0. If question 3 has a no response and question 4 has either a yes or no response, the combined score will also be 0. If question 3 has a yes response and question 4 has a no response, then their combined score will be 1.) This yields a total MTAQ score ranging from 0 to 8, with a higher score indicating a greater number of migraine management issues. The individual MTAQ questions can be combined to form three broader domains: migraine control, knowledge/behavior/treatment satisfaction, and economic burden. The MTAQ was developed based on previous work in other disease states,<sup>22</sup> patient focus groups, and expert opinion. The MTAQ is appropriate for use with individuals having a reading level of fifth grade or higher.

Health-related quality of life (HRQoL) was measured using the SF-36, which has previously been used in migraine patients.<sup>2,15-17</sup> The SF-36 survey measures patients' HRQoL in eight domains: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health.<sup>24</sup> Two summary scores (physical and mental) can be derived from the SF-36. The SF-36 was scored according to guidelines published by the Medical Outcomes Trust (Boston, MA, USA).<sup>24</sup>

The MIDAS, a five-item questionnaire, has been shown to be a reliable instrument for measuring disability in patients with migraine.<sup>25</sup> Patients answer questions reporting the number of days of work,

household duties, and leisure activities lost over a 3-month period due to migraine. The overall score is categorized to yield four grades of increasing disability.

The BDI has been used for depression screening in normal populations. Total scores of 17 to 20 on the BDI may suggest dysphoria, whereas total scores of 21 and above may be indicative of depression.<sup>26</sup>

**Analysis.**—All analyses were conducted using Statistical Analysis Software (version 6.12, SAS, Cary, NC, USA) with  $\alpha$  set at .05. Patient demographic characteristics were described using descriptive statistics. Test-retest reliability of the individual MTAQ questions was assessed using Cohen's kappa and Pearson's/Kendall statistics; the summary score was assessed as an inpatient correlation using repeated measures analysis of variance. Statistically significant differences in kappa were determined using the two sample Z-test. A kappa statistic of .75 or greater represents excellent agreement, .40 to .75 represents intermediate to good agreement, and below .40 represents poor agreement.<sup>27</sup> To determine whether time between administrations, race, gender, and number of migraines per month had an impact on MTAQ reliability, subgroup analyses were performed.

To assess the construct validity of the MTAQ, the association between participant responses to individual MTAQ questions and instruments related conceptually to the MTAQ questions was determined. A Student's *t*-test was used to test for significance between participants who answered yes or no to each MTAQ question for the eight SF-36 domains and two component scores, days missed from work, days worked with symptoms due to migraine, MIDAS score, satisfaction with migraine care, and health care resource use.

The days missed from work and days worked with migraine symptoms were collected from questions 1 and 2, respectively, of the MIDAS questionnaire. Satisfaction with migraine care was assessed with question 9 of the MTAQ, whereas health care resource use (emergency or urgent care for a migraine in the past 6 months) was assessed with question 8 of the MTAQ. To determine whether there were differences in MTAQ responses, based on age and gender, chi-square tests were used to determine significant differences.

The predictive validity of the MTAQ summary score was assessed by logistic regression using migraine management as the dependent variable. Two migraine management categories were used in the analysis: optimal migraine management and suboptimal migraine management. Optimal migraine management was defined as less than three migraines per month as reported by participants on the demographic survey and a MIDAS score indicative of no or mild disability (MIDAS score  $\leq 10$ ). Suboptimal management of migraine was defined as equal to or greater than three migraines per month as reported by participants on the demographic survey and a MIDAS score indicative of moderate or severe disability (MIDAS score  $> 10$ ). Once a logistic regression model was identified, a receiver operator charac-

teristic (ROC) curve was constructed to evaluate its sensitivity-specificity characteristics and to determine a threshold score to identify patients in need of further follow-up.

## RESULTS

Two hundred fifty-one patients were recruited from the clinical sites. Eight patients did not have assessable MTAQ questionnaires, so 243 patients were available for data analysis. Patient demographics for the subset of 100 patients completing the two MTAQ surveys for the reliability analysis were similar to the entire study population (Table 1). The average age of the study participants was 40. Ninety-one percent were women, which would be expected based on the prevalence of migraine in the general population.

**Table 1.—Patient Demographics**

Characteristic	Test-Retest Population*	Entire Study Population†
Race‡		
African American	38 (39)	74 (31)
White	53 (54)	150 (63)
Asian American/Indian/Hispanic	7 (7)	15 (6)
Age (yr)§	40 (18-63)	40 (18-63)
Gender, female‡	90 (92)	219 (91)
Marital status‡		
Never married	30 (33)	66 (27)
Married	48 (52)	136 (56)
Separated or divorced	13 (14)	34 (14)
Widowed	1 (1)	4 (2)
Last year of school completed‡		
Some high school	5 (5)	13 (5)
Completed high school	25 (27)	61 (25)
Technical school/associates degree	8 (9)	19 (8)
Some college or currently enrolled	20 (22)	53 (22)
College degree	17 (19)	54 (22)
Some graduate school or currently enrolled	8 (9)	18 (7)
Graduate degree	9 (10)	24 (10)
Work status‡		
Work full-time (35 hours or more a week)	54 (59)	156 (65)
Work part-time (less than 35 hours a week)	9 (10)	25 (10)
Not currently working at paid job	17 (19)	41 (17)
Retired	2 (2)	3 (1)
On disability	10 (11)	17 (7)

\*N = 100; however, number of missing values varies with each characteristic.

†N = 243; however, number of missing values varies with each characteristic.

‡Values are number of cases, with percents in parentheses.

§Values are means, with ranges in parentheses.

**Table 2.—Migraine Characteristics**

Characteristic	Test-Retest Population*	Entire Study Population†
Migraine headaches per month‡	5 (1-24)	5 (0-30)
Migraine headaches in last 3 months‡	11 (1-80)	12 (0-90)
Days since last migraine headache‡	8 (0-60)	9 (0-120)
Age when first migraine headache‡	20 (0-57)	20 (0-57)
Age when first diagnosed with migraine headache‡	26 (5-55)	26 (0-55)
Length of migraine in hours if do not take medication‡	30 (1-100)	34 (0-100)
Length of migraine in hours if do take medication‡	15 (0-72)	14 (0-100)
Nausea experienced§	77 (84)	207 (86)
Vomiting experienced§	51 (51)	131 (54)
Phonophobia§	86 (93)	221 (91)
Unilateral pain§	65 (71)	181 (75)
Vision changes§	65 (71)	168 (69)
Pulsating or throbbing pain§	89 (97)	233 (96)
Sensitive to odors§	62 (67)	167 (69)
Photophobia§	88 (96)	224 (93)

\*N = 100; however, number of missing values varies with each characteristic.

†N = 243; however, number of missing values varies with each characteristic.

‡Values are means, with ranges in parentheses.

§Values are number of cases, with percents in parentheses.

SF-36 scores followed a pattern seen in previous studies of migraineurs with lower scores than population norms in all eight domains, the mental component score, and physical component score. The average MIDAS score of 27.7 indicates that the study population is severely disabled from their migraine headaches. The average BDI score was 9.6, and 42 patients had BDI scores greater than 16. Forty-four percent of patients had greater than three migraines per month, and the entire study population suffered from an average of five migraines per month (Table 2).

Demographic information was also obtained for a portion of the patients who did not complete the study. There was a slightly greater percentage of white patients who completed the study (55% vs. 45%).

**Reliability.**—For the reliability analysis 100 patients completed two MTAQ questionnaires. All

MTAQ questions had a kappa statistic of .5 or higher and had a percent agreement of at least 76% (Table 3). There were only small variations in reliability coefficients for study participants' self-reporting more than three migraines per month and for participants who completed the second MTAQ more than 14 days after the first MTAQ.

**Validity.**—Table 4 shows the relationship between each MTAQ question and measures of HRQoL (SF-36), work loss, disability, satisfaction, and health care resource use. Responses to seven of the nine MTAQ questions were significantly associated with SF-36 scores. The exceptions were the two questions related to knowledge of migraine triggers (question 5) and timing of medication use (question 6).

Questions related to return to normal activities (question 2), attack frequency (question 3), missing school/work (question 7), and emergency department use (question 8) were significantly associated with the number of days missed from work and level of disability as measured by the total MIDAS score. The question regarding daily medication use (question 4) was only significantly associated with disability as measured by the total MIDAS score. Patients who took daily medications to reduce the frequency of migraines had a significantly higher level of disability.

Participant responses to five of the eight MTAQ questions were significantly associated with treatment satisfaction. Questions regarding daily medication use (question 4), timing of medication use (question 6), and emergency department use (question 8), were *not* associated with treatment satisfaction. Responses to MTAQ questions regarding attack frequency (question 3), knowledge of triggers (question 5), and missing work or school (question 7) were significantly associated with the use of health care resources.

Two hundred twenty-eight patients were assessable for the migraine management category. Sixty-five percent (149) of the patients were categorized as optimally managed. There was a significant ( $P < .05$ ) association between having greater than three migraines per month (question 3), taking a daily medication (question 4), missed work/school (question 7), visiting an emergency department in the last 6 months (question 8), and the management category.

**Table 3.—Test-Retest Reliability Results**

Statistic	MTAQ Question									Total MTAQ Score
	One	Two	Three	Four	Five	Six	Seven	Eight	Nine	
Kappa	.614	.683	.711	.635	.638	.517	.599	.702	.699	NA
Pearson Kendall	.614	.697	.713	.646	.638	.517	.599	.705	.699	.714
Percent Agreement ANOVA	81	84	89	84	82	76	81	91	85	.71

*N* = 100 patients.

NA, not appropriate to use kappa to determine overall MTAQ reliability; ANOVA, analysis of variance.

Participants classified as receiving suboptimal management for migraine headache were more likely to have MTAQ responses indicating three or more headaches per month and missing time from work/school. Participants optimally managed for migraine headache were more likely to have MTAQ responses indicating that they did not take a daily medication for headaches and have not visited an emergency department in the last 6 months.

There was no association ( $P > .05$ ) between not receiving relief from migraine within 2 hours (question 1), not returning to activities (question 2), knowing what brings on a migraine (question 5), trying to use medication right away (question 6), satisfaction with migraine care (question 9), and the management category when evaluated using univariate Student's *t*-tests.

Logistic regression, using the total MTAQ score,

**Table 4.—Construct Validity Results**

MTAQ Question	Health-related Quality of Life	Work Loss	Disability	Satisfaction	Health Care Resource Use
Q1: Relief from symptoms within 2 hours of medication (No)	↓*	NS	NS	↓	NS
Q2: Get back to normal activities within 2 hours of medication (No)	↓†	↑	↑	↓	NS
Q3: Three or more migraines per month (Yes)	↓‡	↑	↑	↓	↑
Q4: Take daily medicine to reduce migraines (Yes)	↓§	NS	↑	NS	NS
Q5: Know triggers (Yes)	NS	NS	NS	↓	↑
Q6: Delay use of medication (Yes)	NS	NS	NS	NS	NS
Q7: Missed school, work, or other activity because of a migraine in the past month (Yes)	↓†	↑	↑	↓	↑
Q8: Emergency or urgent care for a migraine in the past 6 months (Yes)	↓†	↑	↑	NS	—
Q9: Satisfaction with migraine treatment (No)	↓¶	NS	NS	—	NS

\*BP, GH, MH, PF, SF, VT, MCS, PCS

†BP, GH, MH, PF, RE, RP, SF, VT, MCS, PCS

‡BP, GH, MH, PF, SF, VT, MCS, PCS

§PF, MH

¶BP, GH, MH, PF, RP, SF, VT, MCS, PCS

↓, significant decrease; ↑, significant increase; PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role emotional; MH, mental health; MCS, mental component score; PCS, physical component score.

**Table 5.—Sensitivity and Specificity for the Modified MTAQ Score**

MTAQ Score	Probability Level	Sensitivity	Specificity
0	.14	98.8	13.6
1	.19	92.6	13.6
2	.27	74.1	34.0
3	.36	48.1	51.7
4	.46	48.1	72.1
5	.57	7.4	87.8
6	.67	0	98.6

did not yield a model to predict suboptimal management. However, a modified MTAQ score calculated using only those questions on migraine control, frequency of attacks, disability, resource utilization, and treatment satisfaction (questions 1, 2, 3, 7, 8, and 9) as the predictor variable did yield a predictive model and ROC curve for suboptimal migraine management with an area under the curve of .669. From the ROC analysis Table 5 was constructed, providing the sensitivity and specificity of the modified MTAQ score to predict suboptimal migraine management at various MTAQ scores.

#### COMMENT

This study demonstrates that the MTAQ is a reliable and valid questionnaire to identify patients with migraine in a primary care setting who may benefit from additional care. This is the first study to develop a tool that may be used by clinicians and managed care organizations in a migraine disease management program to help identify patients with migraine management issues that need to be addressed. This tool is brief and self-administered, which decreases patient burden and allows them to complete the questionnaire while sitting in the physician's office or at home.

The MTAQ is reliable and, given the calculated reliability coefficients, may be used to screen a population of migraineurs for suboptimal management. However, the MTAQ does not demonstrate sufficient reliability such that it could be used *alone* in making decisions regarding individual migraine care.<sup>28</sup>

The MTAQ is also a valid questionnaire to screen patients for migraine management issues in a primary care setting. Seven of the nine MTAQ items were significantly associated with participants' quality of life, demonstrating construct validity. These strong associations are expected due to the relationship between quality of life and effective migraine treatment.<sup>7,8,11,15-19</sup> Significant associations between MTAQ questions and work loss, disability, satisfaction, and health care resource use provide additional information to support the construct validity of the MTAQ questions. These associations were also expected due to previous studies showing that effective migraine treatment results in significant improvements in work loss, disability, satisfaction, and health care resource use.<sup>7-13</sup>

For predictive validity the association between MTAQ questions and management category appear to be consistent. One would predict that a patient suboptimally managed would have MTAQ responses indicating greater than three headaches per month, missed time from work/school, and emergency department visits in the last 6 months. Interestingly, the questions that relate to patients' knowledge of migraine triggers, when they take acute migraine medication, and satisfaction with therapy did not appear to be associated with management category. This suggests that these factors, although perceived to be relevant to effective migraine management, are overshadowed by the larger issues of migraine frequency, disability, and resource use. However, this finding may simply be due to the definition of suboptimal management used in this study, because it relied exclusively on headache frequency and level of disability.

Given the results of our study, modification to the MTAQ scoring system is recommended. Based on the logistic regression and ROC analysis, questions 1 through 3 and 7 through 9 should be used to derive a total score. This modified total score would then be used to determine which patients are in need of additional follow-up. Even though questions 4 through 6 are not scored, they may be used as a means to assess a patient's knowledge of their migraines and to provide an opportunity for dialogue and teaching between patient and health care provider.

Based on the sensitivity and specificity of the modified total MTAQ score to predict suboptimal

management, a score of 2 is recommended as a cut-off point for additional follow-up. This allows for a reasonably high level of sensitivity (detection of those migraineurs who are suboptimally managed), preventing few patients in need of follow-up from being missed. However, this cut-off value has a low level of specificity, indicating patients who are appropriately managed but whose MTAQ score would indicate the need for follow-up. This threshold score for follow-up is sensible given that the cost of follow-up is low and the comparative cost of mismanagement is relatively high.

In addition to its strengths, it is important to recognize the limitations of this study as well. There is concern regarding the generalizability of the study population to other primary care populations. The population recruited for this study experienced an average of five migraines per month and were severely disabled as measured by the MIDAS score. This may be due to the inclusion criteria, which included those patients who had seen their physician within the preceding 6 months for migraine headache, because patients seeking medical care for migraine may have more severe disease. However, ceiling effects have been associated with the MIDAS that may account for the high average MIDAS score in this population.<sup>29</sup> As with any newly developed questionnaire, additional analyses are needed to confirm the MTAQ's psychometric properties in larger and diverse patient populations, improving the questionnaire's generalizability.

The definition of suboptimal management used in this study was developed from clinical expertise and standard of care. This conservative definition may have led to the underestimation of the number of patients within each management category because some patients with management issues may not have been identified and therefore may have been excluded.

Despite these limitations the study demonstrates that the MTAQ is a reliable and valid instrument that may be used to assist clinicians in identifying a population of patients with migraine who have potential inappropriate management issues. The MTAQ may help to stimulate conversation between physicians and migraineurs leading to increased communication. This may eventually lead to improved health care delivery

and improve patients' quality of life, decreasing health care resource use and decreasing lost productivity.

In conclusion, the MTAQ is a reliable and valid questionnaire to identify migraineurs whose migraine management is suboptimal in a primary care setting. This questionnaire may be valuable in population-based migraine disease management programs, although further evaluation should be conducted in a managed care setting.

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**Appendix—Migraine Therapy Assessment Questionnaire (MTAQ®)**


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YES

NO

- |                          |                          |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Most times, I get relief from my migraine symptoms within 2 hours after I take my migraine medicine. |
| <input type="checkbox"/> | <input type="checkbox"/> | Most times, I can get back to what I was doing within 2 hours after I take my migraine medicine.     |
| <input type="checkbox"/> | <input type="checkbox"/> | Most months, I get 3 or more migraines.  |
| <input type="checkbox"/> | <input type="checkbox"/> | I take daily medicine to reduce how often I get migraines.   |
| <input type="checkbox"/> | <input type="checkbox"/> | I know what may bring on my migraines.   |
| <input type="checkbox"/> | <input type="checkbox"/> | Most times, I try <i>not</i> to use my migraine medicines right away.                                |
| <input type="checkbox"/> | <input type="checkbox"/> | In the past month, I missed some school, work, or other activity because of a migraine.              |
| <input type="checkbox"/> | <input type="checkbox"/> | In the past 6 months, I had to go to an emergency or urgent care center for a migraine.              |
| <input type="checkbox"/> | <input type="checkbox"/> | I am satisfied with my migraine treatment.   |
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