Migraine disability, healthcare utilization, and expenditures following treatment in a tertiary headache center

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Headache is among the most common disabling pain complaints. While many patients are managed in primary care or referral neurology practices, some patients have refractive situations that necessitate referral to a tertiary headache center. Increasing frequency of headache is strongly associated with increasing disability and workplace absenteeism as well as increased healthcare utilization. Previous studies have demonstrated that headache care in a dedicated tertiary center is associated with a decrease in headache frequency and improvement in other characteristics that persist over extended periods of time. Previous studies have not examined the impact of this treatment on subsequent healthcare utilization and associated expenditures. In this study we examined the changes in healthcare utilization and expenditures as well as the impact on disability and workplace productivity with treatment in a tertiary headache care center that used initial treatment settings of inpatient and outpatient care and considered the difference between those with episodic migraine and those with chronic migraine and its complications. Tertiary care was found to produce positive reductions in disability, healthcare utilization, and expenditures. These results suggest that earlier tertiary-level intervention may avoid the complications of migraine that occur in some patients and the increasing costs and utilization of care associated with higher disability.

Inpatient dedicated programs for headache were developed to care for patients with difficult-to-resolve headaches. Patients treated in dedicated headache treatment centers have been shown to realize more robust outcomes. These programs seek to provide comprehensive assessment and treatment for patients and address the lifestyle, behavior, and physical factors that contribute to disease management. A variety of outcomes may be considered for headache management, including pain severity, headache frequency, amount of medication taken, quality of life, disability, productivity, healthcare costs, and absenteeism and “presenteeism,” which describes patients’ limited functioning from headache at work. Existing outcome studies of headache treatment have focused almost exclusively on measures of headache attributes, with results reported in the US Headache Consortium Inpatient Treatment guidelines (1). These studies have noted significant reduction in the frequency and severity of headaches over both short-term and long-term assessments when headaches were treated in an integrated inpatient program. Disability or healthcare costs have largely gone unstudied

(1), and few studies have evaluated the outcomes of treatment for patients in tertiary headache centers in which hospitalization has not been a component of the treatment program. Some research has evaluated the effects of migraine on quality of life. The Migraine Disability Assessment Score (MIDAS[®]) was developed in 1997 to assess the impact of periodic migraine on lost time and productivity at work, at home, and in family activities (2–4) in patients with episodic headache. Episodic headache has been defined as headache that occurs on 14 or fewer days per month, whereas chronic headache has been defined as occurring on 15 or more days a month for at least 3 months (5). The MIDAS was not developed for use in patients with daily or nearly daily headache. Mathew and colleagues (6) examined the MIDAS tool in patients with very frequent headaches in a tertiary setting and found that even among these patients, treatment outcomes could be assessed with the MIDAS. In an earlier study (7), we found a correlation between higher MIDAS scores and greater healthcare expenditures and utilization and found that greater reductions in MIDAS scores correlated with greater reductions in healthcare utilization. In recent years, increasing interest has focused on utilization of healthcare resources and corresponding costs of care (8–10). Given both the findings and limits of studies to date that look at the various impacts of migraine, the current research was conducted to assess the following variables before and after treatment in a specialized tertiary headache treatment center: 1) changes in episodic and chronic migraine headache attributes; 2) changes in quality of life as measured by patient MIDAS scores; 3) changes in healthcare utilization and costs; and 4) changes in patient absenteeism and presenteeism at work and in family and community functions.

METHODS

Participants were treated at a tertiary headache center at a large teaching hospital. The inpatient program as well as the

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connected outpatient program provide comprehensive multidisciplinary assessment and treatment. The patient's diagnosis was determined by the treating physician, without necessarily aligning with the International Classification of Headache, while treatment setting and specific treatments were determined by the clinician with the patient. Diagnoses included in this study were episodic migraine and chronic migraine, with and without medication overuse. Specific medical therapies were not evaluated separately.

Patients selected for outpatient treatment were provided with acute and preventive medications for their headaches. They were instructed in lifestyle modification and were offered a variety of nonpharmacologic strategies as part of comprehensive treatment. Not all patients treated on an outpatient basis were provided with a full array of nonpharmacologic strategies due to limited access to care for some of these services. Patients treated as inpatients not only received acute and preventive medications, but also were discontinued from other acute medications that had been causing medication overuse headache. This discontinuation has been demonstrated to play a significant role in treatment outcome (11–13). Inpatients were treated with intravenous dihydroergotamine and given additional adjunctive intravenous medications based on their clinical situation in order to break their headache cycle. In addition to receiving the educational component as did the outpatient group, inpatients were evaluated by psychological services, underwent counseling, and received behavioral interventions including biofeedback, physical therapy, and dietary education. Many of these services were provided during their hospitalization, and some were continued following the patient's discharge to the outpatient setting.

All new patients to the center were invited to participate in the study. These patients came to the tertiary headache center from a range of geographic locales around the United States. Those who expressed interest in participating provided written informed consent using a form approved by the hospital institutional review board. Five hundred consecutive new patients to the clinic were included in this evaluation process. Enrollment occurred on a continuing basis over a period of approximately 6 months. Of the 500 patients approached to participate in this study, 371 completed the first phase of the data collection and 294 completed the follow-up phase of the data collection (Figure 1).

The first phase of data collection consisted of a series of self-reported questionnaires regarding headache traits, prior treatments, use of healthcare resources related to headaches and general health, and associated expenses incurred, including both out-of-pocket and insurance-reimbursed expenses. In addition, participants were required to complete a MIDAS survey for the prior 3 months before their first visit, and their resulting score was used to assess their headache frequency. The data from the healthcare utilization questionnaires examined the 6 months prior to their first visit to the tertiary headache center. In addition they were informed that they would be asked to complete a similar assessment following their initial assessment and treatment at the center. The second phase was

conducted at least 3 months and less than 6 months after completion of the patient's first treatment program at the clinic and/or in the inpatient treatment unit. The final collection of data occurred approximately 1 year after the first patient was enrolled.

Patient data were blinded to the physician reviewer through a numeric code assigned to each patient. An administrator of the center maintained the log of the patients, their contact information, and their assigned numeric codes. All data were entered into an Excel spreadsheet by the center administrator and provided to the physician reviewer.

RESULTS

The total population that provided complete data consisted of 294 patients; 94 of these patients had episodic migraine diagnoses, 153 had chronic migraine diagnoses, and 47 had other headache diagnoses, such as tension-type headache, cluster headache, and posttraumatic headache, representing a heterogeneous group that provided too few patients with any one diagnosis to provide meaningful assessment. Their data, while included in the data set comparing inpatient versus outpatient treatment groups (Table 1), were not further examined as a separate group in this study.

Patients' initial data demonstrated that they had headaches on more days than not and had MIDAS scores far in excess of the MIDAS score range used to describe patients as significantly disabled. Patients were seen by their prior treating physician an average of once per month. Emergency department utilization averaged at least one visit every 6 months, and an inpatient treatment in the patient's home locale had occurred an average of once every 2 years. Estimated healthcare expenditures averaged more than \$10,000 per year. Following treatment at the tertiary level, significant reduction in

Figure 1. Subject enrollment outcomes.

healthcare utilization occurred broadly and robustly in both the inpatient group and outpatient group, aside from the finding that inpatient readmission occurred more frequently in those who were initially treated at the tertiary care center as inpatients (*Table 1*).

The migraine population of patients in the study represented a group with more significant frequency of migraines—an average of 17 days per month—compared to the US population, with its average of approximately 2 headache days per month. Even the episodic migraine group treated at the tertiary headache center on an outpatient basis averaged 23.2 headache days for the 3 months prior to their first visit to the center, roughly half the average number of headache days experienced by a typical new patient to the center who was admitted for inpatient treatment of episodic migraine. The episodic migraine group overall was somewhat younger on average and less prone to comorbid diseases, with a shorter headache history of 12.5 years compared with 15.3 years for the chronic migraine population. During the 90 days prior to initial treatment at the tertiary center, the outpatient episodic migraine group not only experienced 50% fewer headache days than the inpatient migraine group, but also had approximately 50% lower MIDAS scores, one third the emergency department visits, and one fifth the prior hospital admissions compared with the group treated by the center as inpatients. Following initial treatment, the inpatient migraine group realized more robust reductions in healthcare costs (−47%), physician visits (−73%), emergency department visits (−80%), and subsequent inpatient care (−88%) than the outpatient treatment group (−22%, −6%, −12%, and +510%, respectively). The mean length of initial hospitalization was 7.4 days, and its costs were included in the posttreatment assessment. Subsequent hospital admissions increased substantially in the outpatient group (*Table 2*).

About half of the patients with chronic migraine were diagnosed with concomitant medication overuse (*Table 3*), whether they initiated treatment in the outpatient or inpatient setting

at the tertiary headache center. Those with chronic migraine without medication overuse were treated at the center as outpatients approximately half as often as they were treated as inpatients. By contrast, those with medication overuse headache with chronic migraine were twice as likely to be treated as outpatients since many migraines with medication overuse are not toxic and outpatient bridge treatments can be effective for transition of this condition. All four groups were close in mean age and frequency of comorbid medical illnesses. Chronic migraine patients with medication overuse tended to have a longer history of disease than chronic migraine patients without medication overuse. Headache days per 3 months prior to the initial visit and MIDAS scores were highest in the population with medication overuse, regardless of treatment setting. These same patients had the greatest reduction in these same parameters over the evaluation period. Physician and emergency department visits declined by roughly the same level of magnitude in all treatment groups. Hospital admissions decreased by roughly 50% in those with chronic migraine without medication overuse headache who were treated as outpatients and in those with medication overuse who were treated as inpatients. Conversely, a significant increase in readmissions occurred in the other two chronic migraine groups.

Healthcare costs changed to only a limited degree in patients with chronic migraine, with the exception of those chronic migraine patients with medication overuse who were treated in a multidisciplinary inpatient unit. For this group, post-inpatient treatment costs declined by one third from pretreatment costs. Overall, healthcare costs were 2 to 3 times higher in patients with medication overuse as compared to the non-medication overuse chronic migraine population.

DISCUSSION

The burden of migraine and chronic migraine has been demonstrated in the American Migraine Prevalence and Prevention Study. Despite this result, these disorders receive little in the way

Table 1. Patient characteristics and outcome data for migraine treatment for all patients, treated in both inpatient and outpatient settings

Parameter	All inpatient initial treatment			All outpatient initial treatment		
Number of patients	116			178		
Age (mean in years)	48.9			49.3		
Number of comorbid medical illnesses	2.54			1.48		
Headache disease duration (years)	14.2			14.6		
	Pretreatment	Posttreatment	Change	Pretreatment	Posttreatment	Change
Cost/6-month period	\$6698	\$4384	−34.5%	\$5484	\$4290	−21.8%
Number of headache days/3 months	56.6	42.4	−25.1%	47.2	35.7	−24.4%
MIDAS	83.4	27.1	−67.5%	77.1	14.9	−80.7%
Number of MD visits for headache/6 months	6.58	1.36	−79.3%	6.18	1.31	−78.8%
Number of ED visits for headache/6 months	1.65	.53	−67.9%	1	.73	−27%
Number of inpatient admissions/6 months	0.29	.37	+27.6%	.26	.18	−30.7%

MIDAS indicates Migraine Disability Assessment Score; MD, physician; ED, emergency department.

Table 2. Patient characteristics and outcome data for patients with episodic migraine, treated in both inpatient and outpatient settings

Parameter	Inpatient initial treatment			Outpatient initial treatment		
Number of patients	25			69		
Age (mean in years)	46			47		
Number of comorbid medical illnesses	2.2			2.1		
Disease duration (years)	9.9			13.5		
	Pretreatment	Posttreatment	Change	Pretreatment	Posttreatment	Change
Cost/6 months	\$4787	\$2531	−47%	\$2468	\$1928	−21.8%
Number of headache days/3 months	47.2	43	−8.9%	23.2	19.9	−14.2%
MIDAS	82.1	42.8	−47.9%	43.8	8.9	−79.7%
Number of MD visits/6 months	8.8	2.42	−72.5%	3.5	3.3	−5.7%
Number of ED visits/6 months	1.68	.33	−80.3%	.59	.52	−11.8%
Number of inpatient admissions/6 months	.48	.06	−87.5%	.1	.61	+510%

MIDAS indicates Migraine Disability Assessment Score; MD, physician; ED, emergency department.

Table 3. Patient characteristics and outcome data for patients with chronic migraine, with or without medication overuse headache, treated in both inpatient and outpatient settings

Parameter	Chronic migraine <i>without</i> medication overuse						Chronic migraine <i>with</i> medication overuse					
	Outpatient treatment			Inpatient treatment			Outpatient treatment			Inpatient treatment		
Number of patients	27			46			57			23		
Age (years)	48			50			52			50		
Comorbid medical disorders	2.8			2.8			2.7			2.8		
Disease duration	14			14			15.9			18		
	Pre-treatment	Post-treatment	% Change	Pre-treatment	Post-treatment	% Change	Pre-treatment	Post-treatment	% Change	Pre-treatment	Post-treatment	% Change
Cost/6 months	2724	2646	−2.8%	3677	3518	−0.4%	7859	7529	−4.2%	6671	4502	−32.5%
Headache days/3 months	54.4	48.1	−11.5%	59.2	53.3	−9.9%	75.5	49	−35.1%	65	23	−64.6%
MIDAS	55.1	27.6	−49.9%	83	39.6	−53.4%	123.9	25.4	−79.5%	91	21.5	−76.4%
MD visits/6 months	5.18	.56	−89.2%	6.8	1.27	−81.3%	10	1.88	−81.2%	7.9	2.8	−64.5%
ED visits/6 months	1.27	.38	−70.3%	1.41	.63	−55.3%	1.79	.95	−46.9%	1.38	.4	−71%
Inpatient admissions/6 months	.42	.18	−57.1%	.26	.81	+211%	.51	.72	+41%	.48	.2	−58.3%

MIDAS indicates Migraine Disability Assessment Score; MD, physician; ED, emergency department.

of specific acute and appropriate levels of preventive care (14). The significance of this absent or insufficient care, even in the episodic migraine population, has been underrecognized. The direct costs for migraine are expected to exceed \$11 billion annually and be over \$2500 per person with migraine compared to matched controls (14). The Affordable Care Act will require delivery of quality care in a cost-effective manner. One issue that is rarely considered in this process is the burden on the employer and employee in lost time and productivity related to the disorder. Migraines cost employers \$2444 per year per patient for women in their peak productive years who have episodic migraine, and

over \$7100 per year for those with chronic migraine. In men, this increases to over \$4100 per year per patient with episodic migraine and almost \$13,000 per year for chronic migraine (15). As with many disorders, the greatest costs of treatment will be for a small percentage of patients who have frequent headache and poor response despite being provided with the best-evidence treatments. In the present study, we have demonstrated that there are patients who have realized substantial benefits from treatment in the tertiary setting. These improvements have been realized in parameters of headache frequency, disability, healthcare utilization, and the costs of that care.

This study suffers from issues that create some challenges in evaluation, including patients lost to follow-up and verifiable accuracy of financial reporting data. Second, the diagnoses assigned to the patients were clinically applied and hence did not necessarily meet the International Headache Classification criteria. Another issue relates to the nature of the comorbidities and the failure to secure behavioral or psychiatric diagnoses as part of these comorbidities. A study by Lafata and colleagues suggested that the diagnosis of depression as comorbidity to headache may be a driver of the costs of healthcare delivery in these patients (16). In addition, specific data regarding neuroradiological services were not collected. Lastly, while we have obtained an appreciation of the disease duration of headache and some of the issues that might impact response to treatment, we did not collect detailed data to assess for the extent and quality of care of patients prior to initiation of tertiary headache care.

Comprehensive programs for episodic migraine appear from our findings to be effective in positively impacting multiple headache parameters for patients. These patients as a whole, regardless of treatment setting, experienced significant reduction in healthcare utilization. A decrease in MIDAS score results in a substantial reduction in disability parameters. Regardless of the diagnosis or how refractive the patient's headache has been to previous treatments, it is likely that patients would benefit from tertiary care and realize decreased disability, fewer headache days, and lower healthcare utilization after treatment.

Patients initially treated as inpatients, while improving across the various parameters in similar levels of magnitude compared to the outpatient group, never "caught up" with the outpatient group over the time frame of evaluation. Rather, they had improvements that led them to resemble the baseline for the outpatient group.

The chronic migraine groups were on average older, with more comorbid medical disorders and a longer average duration of disease than that found in the episodic migraine groups. Those with medication overuse were again older and with longer disease duration than those without medication overuse. Patients with chronic migraine without medication overuse were more closely aligned with the episodic migraine groups, though again they had a tendency to have higher service utilization, MIDAS scores, and costs of care than the episodic group. With treatment, however, this group tended to resemble a composite of the episodic migraine groups. Those patients with chronic migraine with medication overuse and those with chronic migraine without medication overuse who were treated initially as inpatients tended to have headache days, MIDAS scores, healthcare utilization, and costs of healthcare higher than any of the other groups and to realize smaller declines in healthcare costs with tertiary treatment.

Factors such as patient compliance with the program over the extended course were not evaluated as part of this study, but have been shown to be a critical factor in the potential to reverse

the course of a chronic disorder such as high-frequency migraine (17). Ongoing assessment of treatment programs, patient selection, and evaluation of other therapeutic and diagnostic issues may afford greater clarity and guidance to the process of optimizing treatment outcomes in a cost-effective manner.

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