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# Research Submission

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## Feasibility Assessment of Telephone-Administered Behavioral Treatment for Adolescent Migraine

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**Objectives.**—To examine the feasibility of administering behavioral migraine management training by telephone (TAT) and the acceptability of TAT to adolescents with episodic migraine.

**Methods.**—34 adolescents (M = 14 years) with migraine (M = 3.6 migraines/month; M = 29.2 hours duration) were randomly assigned to a two-month telephone administered behavioral migraine management program (TAT) or to a standard Triptan Treatment (TT). Outcome was assessed at three- and eight-month evaluations. Participants completed a daily migraine diary that yielded information about number, duration and severity of migraines and migraine-related disability, as well as the Migraine Specific Quality of Life Questionnaire - Adolescent. In addition, TAT participants evaluated key aspects of the TAT program using 5-point Likert-like rating scales. Lastly, the ability of adolescents to demonstrate specific headache management skills following TAT was assessed.

**Results.**—All fifteen adolescents who entered TAT successfully demonstrated either full or partial mastery of two or more skills and nearly half demonstrated at least partial mastery of all four skills evaluated. Ninety three percent of the TAT participants reported having a positive relationship with their phone counselor. They also reported a preference for the telephone-based treatment over in-clinic visits and rated the manual and tapes as helpful. Treatment effects (in terms of percent improvement) ranged from consistently large across both evaluations for improvement in number of migraines (54% and 71%), disability equivalent hours (80% and 63%) and quality of life (44% and 48%), to moderate or variable for migraine duration (35% and 23%) and severity (30% and 34%). The TT group also showed clinically meaningful reductions in headache parameters and improvements in quality of life.

**Conclusions.**—Completion rates for TAT were high; adolescents evaluated their experience with TAT positively and were able to exhibit key behavioral headache management skills following treatment. While clinically significant improvements in migraine and migraine-related disability/quality of life were observed with both TAT and treatment as usual (triptan therapy), the small study size and the absence of a control group do not permit conclusions about the effectiveness of either treatment. Nonetheless these results indicate TAT may be a promising treatment format for improving access to behavioral treatments for underserved adolescents and justifies further evaluation of TAT both alone and in combination with drug therapy.

**Key words:** migraine, quality of life, behavior, treatment, adolescent, headache

**Abbreviations:** TAT Telephone-Administered Treatment, TT triptan treatment, MSQI-A Migraine Specific Quality of Life-Adolescent

(Headache \*\*;\*\*\*:\*\*\_\*\*\*)

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Of the almost 28 million Americans reported to suffer the disabling effects of migraine headaches, it has been estimated that 10% are adolescents.<sup>1-4</sup> Migraine is among the most common maladies experienced by adolescents, with prevalence estimates ranging from 3% to 14%.<sup>5,6</sup> Beyond the pain and discomfort headaches produce approximately 1 million missed school days each year.<sup>7</sup> Adolescent migraines may remit, but often continue or reoccur in adulthood<sup>2,8,9</sup> and, in some individuals, progress to chronic forms of the disorder.<sup>10-12</sup> Effective management of episodic migraine in adolescents thus has the potential to reduce the long-term burden of migraine and prevent disease progression.

Relaxation training, thermal (hand-warming) biofeedback, and cognitive-behavioral stress-management therapy appear effective in managing adolescent migraine, though efficacy data are limited to small trials so the generality of findings has yet to be established.<sup>13-18</sup> Behavioral interventions teach adolescents brief relaxation, hand-warming, and/or stress management skills that they can integrate into everyday routines to prevent migraines. Adolescents also use these skills in situations identified as "high migraine risk," when prodromal symptoms or other "early migraine warning signs" are identified as well as when coping with migraines that do occur. Coping skills may also be useful in other areas of the adolescent's life facilitating overall adjustment.

Behavioral therapies require access to a behaviorally trained clinician and a number of clinic visits over several months. Unfortunately, access to behaviorally trained clinicians may be limited, and time demands, teens' school, and activity schedules, access to transportation, and cost limit access to behavioral treatments for many teens. Because the telephone is available in 95% of households<sup>19</sup> and telephone contact may be particularly appealing to adolescents, telephone-administered treatment (TAT) has the potential to circumvent many of these barriers, dramatically increasing access to behavioral treatment.

Telephone contacts coupled with home study materials such as workbooks and audiotapes have successfully reduced but not eliminated the number of clinic contacts required for behavioral treatment,<sup>20-23</sup> indicating telephone contacts can successfully be sub-

stituted for at least some clinician contacts. Completely telephone-administered behavioral migraine management has also yielded promising results in 1 study.<sup>24</sup>

Additional information about the viability of completely telephone-administered treatment is needed before a clinical trial would be warranted. In particular, information is needed about problems encountered with TAT, treatment completion rates, and the magnitude of treatment effects that could be expected. We also wanted to determine if the telephone-administered behavioral migraine management treatment effect (if any) was of the same order of magnitude as that produced by our usual drug therapy for episodic migraine. If not, this would reduce the appeal of telephone-administered behavioral treatment in the form assessed here.

## METHODS

**Participants.**—Adolescents were recruited by neurologist (a headache specialist) referral and community advertisement. There were no significant differences in any of the target variables between neurologist-referred and community-recruited adolescents. All participants provided written informed child assent and parental consent according to procedures approved by the Ohio University Human Subjects Committee. Inclusion criteria included age 12 to 17 years, and diagnosis of migraine (with or without aura) by the project neurologist based on International Headache Society (IHS) criteria<sup>25</sup> adjusted for adolescents.<sup>26-29</sup> Participants were required to average between 2 and 6 migraines per month (based on self-report and baseline daily headache diary recordings) with average migraine duration of at least 4 hours to ensure that acute therapy was warranted. Exclusion criteria included current or planned pregnancy or breastfeeding, significant medical problem other than migraine, more than 8 tension or nonmigraine headaches per month, significant ECG abnormality, current or recent history of illicit drug use or alcohol abuse, current psychological treatment, and failure to complete a baseline headache diary. Participants were permitted to be on preventive migraine medication (preventive use among treated participants: TT = 4; TAT = 2); however, neither the

introduction of, nor dose adjustments to, preventive medications were to be made for the duration of the study.

Of the 47 participants who qualified for participation at the initial evaluation, 13 were excluded following the baseline assessment. Of the excluded subjects, 10 chose not to complete baseline diary recordings, 2 had a positive pregnancy test, and 1 recorded daily headaches during baseline. Thus, 34 adolescents were randomized to treatment (16 TT and 18 TAT). One adolescent became pregnant (TT group) and 3 adolescents (TAT) could not be reached by phone and hence could not be administered treatment. Thus, 30 adolescents (15 in each group) received treatment; all 30 adolescents were evaluated at month 3 of the study. At month 8, data from 28 adolescents (14 from each group) were available because 1 adolescent in each group initiated migraine preventive medication during the follow-up period. See Table 1 for demographic and clinical characteristics of participants at baseline.

**Procedure.**—All participants completed an initial assessment that included neurological evaluation and determination of their standing on the inclusion/exclusion criteria. Eligible participants were asked to complete 1 month of baseline headache recording. The TT protocol required clinic visits for the initiation of treatment (following baseline) and after using the medication for 1, 3, and 8 months. At these visits the project neurologist evaluated triptan use and side effects. The TAT protocol required only 1 clinic visit (aside from the initial assessment) at month 3 of the study during which the adolescent completed a questionnaire about the teen's experience with TAT treatment (anonymous from their counselor) and the teen's ability to perform specific migraine management skills taught in TAT was observed. Participants in both groups also received weekly phone calls for 8 weeks as described below. Participants were compensated financially for travel expenses for clinic visits and completion of study measures and diaries. Nine subjects in the TT group treated at least 1 migraine with a triptan medication during baseline. However, triptan-treated and nontriptan-treated migraines did not differ in severity ( $M = 2.2$  vs  $2.3$ , respectively,  $P = .84$ ) or duration ( $M = 5.2$  vs  $6.8$  hours, respectively,  $P = .22$ ). Thus, all migraines were included in the data analyses.

**Treatments.**—*Telephone-Administered Treatment.*—The goal of TAT was to teach the effective use of specific migraine management skills. Treatment was guided by a counselor in 8 weekly telephone calls that reviewed the learning tasks and addressed any problems encountered by the adolescent. TAT subjects received the STOP Migraines treatment manual that included sections addressing each of the 8 weekly learning tasks, plus 2 chapters for parents or caregivers (see Table 2). Two relaxation tapes also were provided. The TAT manual was adapted from McGrath and colleagues<sup>13</sup> manual for pain management and was modified to more specifically address migraine headache management skills (eg, thermal biofeedback training). See Table 2 for an outline of the behavioral treatment program. Telephone calls lasted approximately 30 minutes and focused on reviewing material presented in the manual, providing instruction (eg, relaxation training, thermal biofeedback), and assigning homework related to that week's topic. As participants progressed through the program more focus was placed on the application of behavior skills to "high migraine risk" situations, when promontory symptoms or other "early migraine warning signs" were identified, as well as on coping with migraines that did occur. During the first 2 calls, the counselor also spoke to a parent or caregiver to clarify the study protocol, increase parental awareness of the adolescent's responsibilities in the study and explain how caregiver(s) could best support the child's efforts at migraine management.

*Triptan Treatment.*—For adolescents with episodic migraine who have not been responsive to NSAIDs and analgesics the medication preference of parents in our setting is typically for an alternate oral acute therapy option, with preventive drug therapy instituted only if triptan therapy fails to adequately control migraines and restore functioning, or is not tolerated or cost-effective.

Of the 15 participants treated with triptans, 13 were prescribed 5-mg Rizatriptan<sup>®</sup> and 2 were prescribed 2.5-mg Zolmitriptan<sup>®</sup> based on each participant's past experience and the judgment of the neurologist. Adolescents were asked to treat their migraine headaches within 30 minutes after the headache became moderate to severe in pain intensity. (At the time

**Table 1.—Demographic and Clinical Characteristics of Participants at Baseline\***

	Total Group (n = 30)	Telephone-Administered Treatment (n = 15)	Triptan Treatment (n = 15)	P Value <sup>†</sup>
Demographics				
Age	14.1 (1.91)	13.9 (2.0)	14.3 (1.8)	.58
Female	15 (50)	8 (53)	7 (47)	.72
White	26 (86.7)	13 (86.7)	13 (86.7)	1.0
Migraine characteristics				
Migraine with aura	6 (20)	3 (20)	3 (20)	1.0
Migraines/month	3.5 (1.8)	3.7 (2.3)	3.4 (1.4)	.56
Disability equivalent <sup>‡</sup> hours/month	10.2 (12.9)	10.5 (11.9)	9.8 (14.2)	.89
Average duration (hours)/migraine	7.8 (7.1)	9.5 (9.2)	6.0 (3.6)	.19
Average severity	2.3 (0.5)	2.3 (.5)	2.2 (.5)	.47
Migraine specific quality of life questionnaire	39.1 (12.3)	40.8 (12.7)	37.5 (11.9)	.47

\*Values are presented as number (percentage for dichotomous variables and mean (standard deviation) for continuous variables.

<sup>†</sup>Results from  $\chi^2$  analyses on discrete variables and *t*-tests for continuous variables.

<sup>‡</sup>Disability equivalent hours = hours disabled + .5 (hours impaired) from daily diary.

this study was designed [2002], information about the relative effectiveness of different triptans, early treatment, and different routes of administration was lacking.)

**Measures.—Participant Feedback.**—The teens provided information about their experience with TAT on a 16-item questionnaire. A 5-point ratings scale (Strongly Agree to Strongly Disagree) was used

**Table 2.—Schedule of Treatment for Telephone-Administered Treatment**

Week 1	Introduction to program goals, education regarding migraine and tension headache characteristics, discussion of headache triggers, and how to identify and avoid them. Parent/caregiver phone contact: how to best support the participant's effective use of the TAT program.*
Week 2	Introduction to recognizing and monitoring headache-related stress; correct and effective acute medication use. Parent/caregiver phone contact: recognizing effective and ineffective coping; rewarding effective rather than ineffective coping.
Week 3	Introduction to progressive muscle relaxation and relaxation imagery <sup>†</sup> ; instructed to practice relaxation 20 minutes per day.
Week 4	Introduction to relaxation by recall, deep breathing, additional relaxation imagery. <sup>†</sup> Introduce the application of relaxation skills to preventing, aborting and coping with headaches.
Week 5	Introduction to cue-controlled relaxation, partial relaxation and applied relaxation (integration of brief relaxation techniques into daily activities). <sup>†</sup> Solving problems encountered in participant's efforts to apply relaxation skills in preventing, aborting or coping with migraines. Thermal biofeedback training introduced. Practice biofeedback for 10 to 15 minutes per day.
Week 6	Stress management training (evaluation of stressful events including headaches; identification of and challenging "stress-generating" thoughts and beliefs, preparing for stressful events, problem solving stressors as appropriate). <sup>‡</sup> Solving problems in the application of relaxation, hand-warming and/or stress management skills to preventing, aborting and/or coping with headaches.
Week 7	Introduction to activity "overload" and importance of activity pacing; information on use of palliative treatments (heat, cold, pressure, massage); use of relaxation and stress management skills for coping with migraines that do occur.
Week 8	Identification of the most effective headache management skills for individual adolescent. Relapse prevention: coping with temporary setbacks and setting realistic expectations for long term migraine management.

\*See Methods.

<sup>†</sup>[30-32]

<sup>‡</sup>[13,33]

to evaluate the TAT program, including the TAT manual (3 items: readability, understandability, and helpfulness), relaxation tapes (1 item: effectiveness in inducing relaxation), home biofeedback equipment (1 item: ease of use), and telephone-based versus clinic treatment format (1 item: preference). The adolescents also provided information about their satisfaction with their use of migraine management skills to modify (1) physiological responses (relaxation, handwarming), (2) headache-related stress (cognitive-behavioral stress management), and (3) pain and distress when migraines do occur (eg, relaxation, imagery). Finally, each participant also rated the quality of their relationship with the telephone counselor on 5 items adapted from the Working Alliance Inventory<sup>34</sup> (eg, “The counselor *did not* understand my headache problems”; “The counselor and I worked effectively together.”)

**Migraine Management Skills.**—Four observable behavioral headache management skills (progressive muscle relaxation, partial relaxation, diaphragmatic breathing, and thermal biofeedback) were rated on pre-established performance criteria for each skill. Performance was rated on 11 criteria for progressive muscle relaxation and thermal biofeedback (see Table 3), 3 criteria for partial relaxation (back

straight, shoulders rounded, mouth open about 1 inch), and diaphragmatic breathing (abdomen moves out during inspiration, chest remain stationary, breaths are even, regular, and smooth). To assess partial relaxation (relaxation while engaged in activity), participants were asked to demonstrate relaxation skills while completing paperwork at a desk as they might do in a classroom setting. Adolescents were required to perform 50% to 75% of the specified criteria to achieve partial mastery of a particular skill and 76% to 100% to achieve full mastery. Achieving partial mastery was judged an adequate skill level for functional behavioral management—that is for using the skill successfully to manage migraines.

**Daily Diary.**—Diary data were gathered during a 1-month baseline, and for 4-week periods at months 3 and 8 of the study. Participants recorded headache information in a daily diary that included time headaches started and ended, type of headache (Migraine, Tension, Other), headache severity (1 = Mild, 2 = Moderate, 3 = Severe), and number of hours subject was totally disabled (unable to perform any activities) and partially disabled (at least 50% impaired functioning). Descriptions of the 3 headache types as well as guidelines for assessing headache severity were provided on the back of the diaries to aid the adolescent

**Table 3.—Criteria for Assessment of Progressive Muscle Relaxation and Hand-Warming Skills\***

Progressive Muscle Relaxation	Thermal Biofeedback (Handwarming)
Pull and hold both shoulders up toward ears in exaggerated shrug	Allow at least 60 seconds for temperature on thermister to stabilize, check and accurately record baseline room temperature
Pull and hold chin to chest	Connect sensor to end pad of index finger with tape
Purse lips into an exaggerated kissing position	Tape sensor to finger securely, maintains initial color of finger tip
Pull corners of mouth back toward ears, keeping mouth closed	Leave tip of sensor exposed (no tape over end of sensor)
Close eyes tightly, causing crinkles at corners	Keep sensor free of external pressure
Raise eyebrows and wrinkle forehead	Maintain gentle curve of fingers
Hold tension in each muscle group for 5 to 10 seconds.	Keep wrists and arms relaxed
Return each muscle group to resting position	Allow at least 60 seconds for temperature on thermister to stabilize, check and record baseline finger temperature
Release each muscle group suddenly	Practice thermal biofeedback for 3 minutes
Keep other muscles relaxed	Eyes closed, body relaxed
Tremors/shakiness absent	Check and record finger temperature

\*See Methods for description of partial relaxation and deep breathing.

in making accurate assessments. Home diary data were transcribed into the database during weekly phone calls to the adolescent at each assessment period. The daily diary yielded 4 variables: the number of migraines per month, the average duration and severity of migraines, and disability equivalent hours (total disability hours + .5 partial disability hours/month).<sup>35</sup>

*Migraine Specific Quality of Life Questionnaire-Adolescent (MSQL-A).*—The MSQL-A<sup>36</sup> is a 14-item paper and pencil measure assessing impact of migraine on quality of life in adolescents. The MSQL-A yields the same 3 factorially derived subscale as the adult MSQL<sup>36,37</sup>: the role-restrictive dimension assesses the degree to which migraine limits the performance of normal activities; the role-preventive dimension assesses the degree to which migraine interrupts the performance of normal activities, and the emotional function dimension measures the emotional impact of migraine. Internal consistency alphas for the MSQL-A are comparable (.77 to .93) to those reported for the MSQL.<sup>36</sup> Items are summed to generate a composite quality of life score ranging from 14 to 84, with lower scores indicating higher quality of life (less impairment). Participants completed the MSQL-A questionnaire at the baseline and at the 3- and 8-month evaluation.

## RESULTS

**Acceptability.**—One hundred percent (15 of 15) of the participants who could be contacted by telephone completed the treatment program. Eighty percent (12 of 15) indicated that they were satisfied or very satisfied with the treatment program overall. Eighty percent (12 of 15) of adolescents also indicated that they preferred telephone-administered over clinic-administered behavioral treatment, with an additional 2 stating no preference and 1 indicating a preference for clinic-administered behavioral treatment.

**Program Components and Preferences.**—Within the TAT group, 67% (10 of 15) of adolescents reported they read all 8 chapters of the STOP Migraines home-based treatment manual and completed all homework assignments; all adolescents reported having read at least 6 chapters. Twelve (80%) of the 15 TAT participants either agreed or strongly agreed that the manual was easy to read and understand and that it was

helpful. Fifty-three percent (8 of 15) rated the tapes as effectively teaching relaxation skills and the same number indicated that the biofeedback monitor was easy to use.

The majority of teens (13 of 15 or 87%) indicated that they were most satisfied with program components teaching how to manage physical changes related to headaches through deep breathing, relaxation, thermal biofeedback, and mental imagery. Pain management strategies for use when a migraine occurs such as pain coping and pain transformation imagery were next in popularity, with over 70% of participants (11 of 15) indicating satisfaction with these skills. Stress-management (eg, positive self-statements, preparing for a stressful event) was the least preferred program treatment component with just over half (9 of 15 or 60%) of the TAT group reporting satisfaction with this treatment component. Of the 9 teens, 1 was “very satisfied” and 8 were “satisfied” with the stress management skills.

**Counselor Relationship.**—Fourteen of 15 (93%) adolescents in the TAT group rated their overall relationship with their counselor as good or very good, suggesting an effective collaborative counselor–teen relationship can be established over the phone. All 15 adolescents reported they perceived their counselor was concerned about and understood their headache problem and that their counselor was friendly and supportive. Thirteen (87%) reported that they worked well with their counselor and that their counselor was able to help them with their headache problem.

**Behavioral Skills.**—Adolescents were considered to have achieved full mastery of a particular skill if they were able to perform 76% to 100% of the pre-established criteria for any given behavioral skill. However, achieving partial mastery (50% to 75% of the criteria) was judged an adequate skill level for functional behavioral management—that is for using the skill successfully to manage migraines. At the 3-month evaluation, all 15 teens demonstrated at least partial mastery (7 partial; 8 mastery) of 2 of the 4 headache management skills taught in the program and 6 of 15 (40%) demonstrated at least functional mastery of all 4 skills evaluated. All 15 participants demonstrated at least partial mastery (8 mastery; 7 partial) of progressive muscle relaxation. Twelve of 15 demonstrated at

least partial mastery (9 mastery, 3 partial) of thermal biofeedback and increased finger temperature an average of 0.5° Fahrenheit. Seventy-three percent (11 of 15) demonstrated full or partial mastery of diaphragmatic breathing. The number of behavioral skills mastered was correlated with reductions in migraines at both 3-month ( $r = .45, P < .06$ ) and 8-month ( $r = .49, P < .05$ ) follow-up.

**Improvements.**—Improvement scores (with 95% confidence intervals) were calculated for each of the 5 variables. Means and standard deviations were used to calculate effect sizes (Cohen's  $d$ ). Results are presented in Table 4.

The TAT showed clinically meaningful reductions of 2 to 3 migraines per 30 days, or 54% reduction in migraines per 30 days at the 3-month evaluation and 79% reduction at the 8-month evaluation. Approximately 80% of adolescents in the TAT group showed clinically significant reductions ( $\geq 50\%$  reduction<sup>37</sup>) in the number of migraines at both the 3-month (12 of 15 adolescents or 80%) and 8-month (11 of 14 or 79%) evaluations. Meaningful reductions of 8 and 9 diary recorded Disability Equivalent Hours (reductions of 80% at 3 months and 84% at 8 months) and improve-

ments in Migraine Specific Quality of Life scores (44% and 48% improvement, respectively) also were observed with TAT. Treatment effects (in terms of effect size) ranged from consistently large ( $\geq 0.8$ ) in magnitude across both 3- and 8-month evaluations for improvements in migraines, disability equivalent hours and quality of life. However, reflecting the small pilot sample size, confidence intervals were large; for example, with available power we can only say (with 95% confidence) that reductions in migraines with TAT at month 8 are somewhere between 1 and 4.4 migraines per month (or 29% to 129% reduction in migraines). The TT group also showed clinically meaningful reductions in headache parameters and improvements in quality of life. The small sample size did not permit meaningful statistical comparisons of improvements in the 2 groups and, in fact, all CIs overlapped, indicating improvements with TT and TAT could not be distinguished.

## COMMENTS

This study examined the feasibility of a telephone-administered behavioral migraine management for adolescents with migraine. Telephone-administered

**Table 4.—Difference Scores (95% Confidence Interval), Effect Size and Percent Change From Baseline to 3 Month and 8 Month Evaluations**

	Improvement Scores*					
	Month 3 Evaluation			Month 8 Evaluation		
	Mean (95% CI)	Effect Size	Percent Change	Mean (95% CI)	Effect Size	Percent Change
Telephone-Administered Treatment						
Migraines/month	2.0 (0.5 to 3.5)	1.0	54	2.7 (1.0 to 4.4)	1.3	79
Disability equivalent hours/month <sup>†</sup>	8.4 (0.9 to 15.7)	0.9	80	9.4 (0.8 to 17.9)	0.8	84
Average duration (hours)	3.3 (−3.7 to 10.3)	0.4	35	2.1 (−8.9 to 13.3)	0.2	23
Average severity	0.7 (−0.1 to 1.5)	0.8	30	0.8 (−0.7 to 2.3)	0.5	34
Migraine specific quality of life	17.9 (10.6 to 25.3)	1.6	44	19.5 (11.9 to 27.1)	1.7	48
Triptan Treatment						
Migraines/month	1.7 (0.9 to 2.5)	1.2	54	1.6 (0.7 to 2.6)	1.2	52
Disability equivalent hours/month <sup>†</sup>	6.1 (1.7 to 10.5)	0.8	63	7.2 (2.1 to 12.2)	0.9	74
Average duration (hours)	4.9 (2.5 to 7.3)	1.5	65	3.5 (0.5 to 6.4)	0.8	46
Average severity	0.9 (0.2 to 1.8)	1.0	40	1.1 (0.4 to 1.8)	1.8	43
Migraine specific quality of life	6.7 (−1.8 to 15.3)	0.6	18	10.2 (2.6 to 17.9)	1.0	28

\*Positive numbers indicate change is improvement from baseline score.

<sup>†</sup>Disability equivalent = hours disabled + .5 (hours impaired) from daily diary.

treatment (TAT) was acceptable, even preferable to clinic-based treatment; adolescents collaborated effectively with their counselor by phone, learned behavioral migraine management skills, and effected significant improvement in their migraine. However, TAT was not without limitations.

All teens who could be contacted by phone (15 of 18 randomized to TAT) completed telephone-administered treatment, a completion rate that compares favorably to the 89% completion rate observed across behavioral treatments for pediatric/adolescent headache.<sup>18</sup> Consistent with this high completion rate, 80% (12 of 15) of teens reported they were not only satisfied with the telephone-administered treatment format but preferred TAT to clinic-based treatment. Despite the absence of face-to-face contact with their telephone counselor, about 90% of teens also felt they had an effective collaborative relationship with their counselor. These findings suggest that telephone-administered treatment was well accepted by teens. Yet 3 of 18 (17%) teens randomized to TAT could not be reached by phone and thus could not receive TAT, indicating telephone-administered treatment is no panacea. As with clinic-based treatment, telephone-administered treatment is not likely to be feasible for all teens.

Our results also suggest that adolescents can learn behavioral migraine management skills via telephoned-administered treatment. Observation was necessarily limited to “observable” behavioral migraine management skills (eg, excluding cognitive coping skills), but every participant in the TAT group was able to perform at least 2 of the 4 observed behavioral migraine management skills at an effective level, with almost half the participants able to perform all of the skills taught at an adequate (functional) level for use in managing migraines. It should be kept in mind that adolescents typically do not need or use all the migraine management skills that are taught, but are encouraged to “choose and use” just the skills that work best for them and fit into their daily routine. Although this finding is clearly limited by the lack of a baseline assessment of the selected behavioral migraine management skills, our experience is that untrained teens are unable to spontaneously produce the specific relaxation postures monitored, or to prop-

erly employ biofeedback equipment (see Methods and Table 3 for monitored behaviors). Nonetheless, future studies would benefit from a baseline assessment of adolescents’ ability to perform relevant skills in all treatment groups. In addition, it would be valuable to monitor the actual application of behavioral migraine management skills in daily life situations.

Telephone-administered behavioral treatment was associated with clinically significant improvements in migraine in our sample of adolescents experiencing approximately weekly headaches of notable intensity and duration. Using the standard criteria for clinically significant improvement of 50% or greater reduction in migraine activity, 80% (12 of 15) participants achieved significant clinical improvements in number of migraines per 30 days at 3 months, and 79% (11 of 14) at 8 months. Meaningful reductions were also observed in disability equivalent hours (6 to 8 hours/30 days). Improvements in migraine related quality of life (as measured by the MSQ-L-A) was notable with a 44% reduction in MSQ-L-A scores observed at 3 months and a 48% reduction at 8 months. Improvements with TAT were comparable in magnitude to improvements reported with clinic-based behavioral migraine management,<sup>15-18,38,39</sup> to the one previous report of telephone-administered treatment for adolescents<sup>13</sup> and of the same order of magnitude as those observed in the triptan treatment group.

Although TAT eliminates many barriers to treatment it also presents problems not encountered in clinic treatment sessions. Adolescents could occasionally be heard multi-tasking (eg, typing on a computer, listening to music, watching television, playing videogames, or “Instant Messaging” friends) during a phone session. A few adolescents were repeatedly absent from the home at scheduled telephone call times, a problem that might be eliminated with use of cellular phones increasingly available to teens. Although these problems proved manageable, telephone-administered treatment may require a family environment sufficiently organized that regularly scheduled phone calls are possible, or an adolescent who is sufficiently motivated to complete phone calls and homework on their own initiative. Of course, a family environment that is too disorganized to even allow regular phone contact is also unlikely to allow the

teen to keep regularly scheduled clinic visits as well. However, more information is needed about adolescent, family, and environmental variables that prevent teens from making effective use of TAT.

Information technology might be used to address some of the limitations of the telephone-administered treatment format that we observed. With telephone instruction, only about half of participants rated the audiotapes effective in teaching relaxation skills or the biofeedback equipment easy to use. Technological enhancements, such as the videophone, or supplemental CD, or Web-based video instruction have the potential to assist teens in learning and applying relaxation, hand-warming skills, and other migraine management skills,<sup>40-42</sup> as well make treatment more compelling for the adolescent, but require access to technology beyond the basic telephone.

Taken as a whole, the results of this study suggest that TAT may be a viable treatment approach for adolescents with episodic migraine, with the potential to circumvent commonly encountered barriers to behavioral treatments. Additional studies using larger samples and technologically enhanced versions of TAT appear warranted.

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