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Feasibility of a Self-Management Intervention in Adolescents with Headache (SMI-AH)

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Abstract

Purpose: This study assessed the acceptability and limited efficacy of a self-management intervention to improve lifestyle behaviors and headache outcomes among rural adolescents with recurrent headache.

Design and Methods: Participants were randomly assigned to a self-management intervention for adolescent headache (SMI-AH, $n=13$) or standard care group ($n=17$). The SMI-AH group participated in goal-setting, self-monitoring, and information processing to modify lifestyle behaviors (missed meals, caffeine intake, and poor sleep). Independent samples t test was used to compare the means of outcomes at baseline and 6-week follow-up between the treatment group and control group. Linear mixed model (LMM) was used to examine the intervention effects over time.

Results: The mean age was 14.8 years ($sd=1.6$, range, 12–17); with female participants accounting for 80% of the sample ($n=24$) and persons reporting white race were 97% ($n=29$). The SMI-AH group demonstrated a greater magnitude of change in lifestyle behaviors, including increased days of eating breakfast and lunch. The multivariate LMM showed significant intervention effect of lunch intake ($p=0.042$ with Cohen's $d=0.42$) and borderline significant effect

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of breakfast intake ($p=0.064$ with Cohen's $d=0.38$). Participants reported the intervention was easy to use and helpful to monitor behaviors.

Conclusions: Among rural adolescents, a self-management intervention is a feasible approach for engaging youth. The SMI-AH provides an opportunity for the adolescents to talk about their behaviors and participate in goal setting as well as the plan of care with the provider. Challenges identified in this study are manageable and a full study is feasible with modifications.

Keywords

adolescent headache; lifestyle behaviors; self-management; rural health; quality-of-life; mixed model

Introduction

Adolescent headache is influenced in large part by unhealthy lifestyle behaviors including missed meals, caffeine use and poor sleep. These behaviors have been reported among rural adolescents which puts this population at risk for recurrent headache.^{1, 2} Unhealthy lifestyle behaviors are amenable to change through self-management. Limited research has explored the use of self-management and modification of unhealthy lifestyle behaviors in adolescent headache.³ Adolescents with headache do demonstrate self-managing behaviors; however, they do not demonstrate a good understanding of which behaviors lead to improved headache outcomes.⁴ Rural adolescents typically prefer talking about problems and adolescence is a time when children begin to show independence and communicate reasons for their choices.^{5, 6} It is important to identify effective developmentally appropriate interventions for adolescent headache that can be integrated into rural practice settings which are practical and involve an individualized self-management approach.⁷ The purpose of this feasibility study was to evaluate the acceptability and limited efficacy of a Self-Management Intervention for Adolescent Headache (SMI-AH) in terms of headache and lifestyle behavior outcomes in rural adolescents.

Conceptual Framework

Based upon an integration of the theoretical concepts of the Symptom Management Theory (SMT) and the Principles of Self-Management, the SMI-AH is proposed for the treatment of recurrent headache in a rural adolescent population.

Symptom Management Theory

SMT addresses the role of the patient in self-care and proposes explicit and testable relationships between the concepts of symptom experience, symptom management strategies, and symptom status outcomes.⁸ Symptom experience refers to the perception, evaluation, and change (i.e. frequency) in the symptom experience. Symptom management strategies refer to efforts used to “avert, delay or minimize” the symptom experience.⁸ Symptom status outcomes are measureable outcomes assessed following the implementation of an intervention. *Principles of Self-Management*

Three Principles of Self-Management, as proposed by Creer and Holroyd (1997), include goal setting, self-monitoring, and information processing. Goal setting involves patient education on the management of the chronic health condition which sets the foundation for a collaborative interaction between the adolescent and provider to establish individualized goals to improve lifestyle behaviors.⁹ To effectively follow through on the goals set for self-management, individuals need to self-monitor (i.e. record) behaviors and outcomes to evaluate the progress of self-managing behaviors.⁹ Information processing requires the individuals to evaluate what may or may not have contributed to a behavior change and the consequences of these actions.⁹

Methods

Design

This feasibility study used a pre-test, post-test design. A convenience sample was recruited and adolescents were randomly assigned to a standard care or intervention (SMI-AH) group.

Setting and sample

Approval for this study was obtained from the Institutional Review Board (IRB) as expedited. Adolescents receiving care in a Pediatric Neurology clinic that is part of an academic medical center in rural North central West Virginia were recruited for this study. Adolescents reporting four or more headache days (i.e. migraine, tension type, chronic daily headache) per month with a diagnosis of primary headache based on classification standards¹⁰ were invited to participate in the study. Inclusion criteria were as follows: (a) aged 12–17 years; (b) visiting a rural adolescent academic headache clinic for the first time; (c) requiring medication intervention (standard treatment)¹¹; and (d) access to internet. Fifty-nine patients were screened, twenty-four did not meet inclusion criteria and five declined participation with no specific reason provided. This resulted in a sample size of n=30 (treatment group, n=13 and standard care, n=17).

Measures

Limited efficacy was evaluated at baseline and follow-up using headache and lifestyle behaviors as the two primary outcome variables. Headache frequency was measured with a researcher-constructed Headache Questionnaire (HAQ). This measure asked participants if they had headaches daily, weekly or monthly, and if weekly or monthly, how many times per week or per month. Headache frequency was then reported as average number of headache days per month. To measure lifestyle behaviors, a researcher constructed Lifestyle Behaviors Questionnaire (LBQ) was used. The LBQ is a six-item instrument that measures frequency of meals, sleep, and caffeine use behaviors. Meals were measured using three subscales in which participants reported their average weekly intake of breakfast, lunch and dinner. Breakfast, lunch and dinner intake were reported as number of days per week each was consumed. Hours of sleep were calculated based upon self-report of the time which the adolescent falls asleep on a school night and time which the adolescent awakens on a school day. Finally, participants were asked to report how much caffeine was consumed in a day (number of glasses per day).

In addition to the primary outcome variables, baseline measures included demographics (gender, age and race). Also, due to the confounding nature of co-morbidities associated with adolescent headache, additional baseline measures were obtained on depression and anxiety. For depression, the Center for Epidemiological Studies Depression Scale for Children (CES-D) was used.¹² The CES-D is a 20 item likert-type self-report inventory of depression symptoms in children and adolescents. For anxiety, the Multidimensional Anxiety Scale for Children (MASC2) was used.¹³ The MASC2 is a 50-item likert type self-report measure of anxiety symptoms in youth ages 8 to 19 years. The Cronbach's alpha in this sample was 0.90 and 0.91 for the CES-D and MASC2 respectively, which all fall within the range of Cronbach's alpha of previous study reports using these instruments.^{14, 15} Strong correlations were also found within CES-D and MASC2, ($r=.60$, $p=.01$).

Acceptability was assessed using open-ended questions and an exit survey. The exit survey questionnaire asked the following: Was the intervention helpful to you? If yes, how was it helpful? If no, why was it not helpful?; Describe any challenges you had with the weekly writings and Describe any challenges you had with using the software Qualtrics™. Responses obtained from the exit survey were analyzed for content.

Procedures

Adolescents that met inclusion criteria were identified, and assent and consent were obtained. Using a random number generator, participants were then assigned to either the intervention (SMI-AH) group, or to the control (standard care) group.

Self-Management Intervention for Adolescent Headache (SMI-AH)

The SMI-AH is a six-week intervention developed to teach self-management strategies to adolescents with recurrent headache. The intervention includes three strategies: goal setting for changes in lifestyle behaviors, self-monitoring of lifestyle behaviors over time, and information processing through expressive writings about managing positive lifestyle changes. Lifestyle behaviors for this study were based on those behaviors determined to be predictors of adolescent headache in the literature.^{16, 17} The lifestyle behaviors include eating three meals a day, sleeping at least eight hours/night, and caffeine avoidance.

The SMI-AH began with the first guided expressive writing. The participant was given a topic and asked to write for 20 minutes. Expressive writing was used as a tool to develop a better understanding of the life event and improve self-awareness.^{18, 19} The guided expressive writings for this study were structured to promote an understanding of behaviors as questions guide the adolescent to begin thinking about the following: what was most troubling about headache, how goals were met, how the headache will change and what advice the participant would give to other adolescents with headache (see Table 1).

Once the guided expressive writing assignment was completed, a 30-minute educational and goal setting session was initiated (week 1). Education addressed the benefits of lifestyle modifications in improving headache outcomes. Specific content included guidelines and recommendations for obtaining appropriate sleep, decreasing caffeine intake, and eating three regular meals per day. The principle investigator and the participant worked together to

develop 3 individualized goals for lifestyle improvement that the participant can strive to achieve over the 6-week intervention period. After the goal setting session, the goals were documented in the participant's medical record and a copy of the goals were given to the participant.

Following the baseline assessment and goal setting at the initial clinic visit, the self-management strategy of the SMI-AH consisted of at-home *lifestyle self-monitoring* and *information processing* through guided expressive writing (*weeks 2–5*).

At weeks 2–5, the adolescent recorded headache frequency over the past week, as well as lifestyle behaviors, including time to bed, time awakening, breakfast, lunch and dinner and daily caffeine intake (*lifestyle self-monitoring*). Data collected during weeks 2–5 were for self-monitoring purposes only and were not included as outcome data. The intervention group was also asked to write for 20 minutes once per week for Weeks 2–5 of the intervention period (*information processing*). The at home self-monitoring and expressive writings were documented by the participant via an electronic survey consisting of multiple choice and open ended questions.

During Week 6 of the intervention period, participants in the SMI-AH group returned to the clinic for a follow-up visit and completed the HAQ and LBQ to record post-test data on headache and lifestyle behavior outcomes. Finally, to assist in determining acceptability of the SMI-AH, adolescents completed the exit survey questionnaire.

Control Group

At Week 1, the control group received standard routine care. Standard of care for adolescent headache occurring 4 or more times a month includes medication intervention and discussion of importance of healthy lifestyle behaviors.¹¹ There was no discussion of goal setting, self-managing or self-monitoring of behaviors. These participants completed the HAQ and LBQ at only the initial clinic visit and the 6-week follow-up visit.

Data Analysis

At home data were collected using Qualtrics™ and extracted into Microsoft Excel™. Data analyses were performed using SAS, version 9.4. Data from paper-based surveys (HAQ, LBQ, CES-D, MASC2) were entered into Microsoft Excel™ by a doctoral student experienced in data coding and entry procedures. Demographic characteristics were summarized at baseline for all 30 participants. Acceptability was assessed using open-ended questions and responses were analyzed for content. Independent samples *t* test was used accordingly to examine statistical significance of outcomes at baseline and 6-week follow-up between the treatment group and control group. Linear mixed model (LMM) was used to examine intervention effects over time. Change of least squares means based on the LMM was used to evaluate the effect of intervention on the outcome variables from baseline to 6-week follow-up. To assess limited efficacy, Cohen's *d* was used to evaluate the magnitude of differences from the LMM between the treatment and control groups in the primary outcome variable of headache frequency and lifestyle behaviors.²⁰ We considered *d* values for 0.2, 0.5, and 0.8 as small, medium and large effects, respectively. Results were considered statistically significant when $p < 0.05$ and borderline significant when $p < 0.10$.

Results

The mean age of the participants ($n=30$) was 14.8 years ($sd=1.6$, range, 12–17), 24 (80%) were female and 29 (97%) were white. There were no statistically significant baseline differences between the treatment and control groups, at baseline, regarding headache frequency, lifestyle behaviors, depression or anxiety scores. Of the 13 participants in the SMI-AH group, 7 participants completed all 6 assignments; 3 participants completed 5 assignments; 2 participants completed 4 assignments, and 1 participant completed 3 assignments. Although all participants in the SMI-AH group completed baseline data and completed all or part of the at-home questionnaires, two were lost to follow-up at 6 weeks. Of the 17 participants in the control group, one was lost to follow up and another participant refused to complete the questionnaire at 6 weeks. Thus, Week 6 HAQ and LBQ follow-up data were not obtained for 4 participants and outcomes were calculated for a sample size at $n=26$ (SMI-AH=11; control=15).

Acceptability of the SMI-AH

The acceptability of the SMI-AH was evaluated through guided writings and an exit survey questionnaire. Written responses were summarized and described the SMI-AH as helpful in the following ways: the SMI-AH helped in terms of talking about feelings, understanding lifestyle behaviors, and the weekly self-monitoring helped in terms of keeping track of sleep, caffeine use and headache frequency. Two responses included: “it [the SMI-AH] helped me realize some things that I do that I don’t notice I do” and “it [the SMI-AH] taught me what to avoid and keep doing to help with my headaches”. At home questionnaires asked the adolescents to write about goals for overcoming headache and responses indicated that they improved upon the behaviors discussed in the individual education and goal setting sessions: “go to bed”; “no electronics after 7 PM”; “better sleep schedule”; drinking right”; “drink less caffeine”; “[eat] three meals a day” and “stop drinking pop”.

During follow-up, the participants were asked to describe any challenges they had with weekly documentation and writings. Eight of the 11 participants reported no challenges. Participants responses about challenges included: “*I couldn’t think of good things [to write] for your topic*”; and “*I didn’t have any [challenges] except when I would forget about them [weekly documentation and writings]*”. Participants did not report any challenges in using the software Qualtrics™ for weekly documentation.

Limited efficacy of the SMI-AH

Results from an independent sample t test (Table 2) show that there were no significant baseline differences in 6 outcomes between treatment group and control group, except for borderline difference for dinner intake ($p=0.0941$). At 6-week follow-up, the treatment group demonstrated a statistically significant increase in lunches ($p=0.012$) and a borderline significant increase in breakfasts ($p=0.086$) as compared to the control group (see Table 2).

The results based on LMM analyses are presented in Table 3. The number of lunches significantly increased in the SMI-AH group compared with the control group ($p=0.02$ with Cohen’s $d=-0.49$, 95% CI= -0.89 , -0.08 in the crude analysis). Even after adjusting for age

and sex, the multivariate LMM showed that the number of lunches increased significantly in the SMI-AH group ($p=0.042$ with Cohen's $d=-0.42$, 95%CI=-0.82, -0.02). The multivariate LMM showed borderline significant effect for breakfast intake ($p=0.064$ with Cohen's $d=-0.38$, 95%CI=-0.78, 0.03). Additionally, the SMI-AH group revealed decreased headache frequency and number of glasses of caffeinated beverages and increased sleep hours and number of dinners; however, such changes did not reach at least borderline significant level ($p<0.1$).

Limitations

A primary limitation of this study was the sample size. However, a demonstration of significant improvement in lunch days in the SMI-AH group, along with borderline significant improvement in breakfast is clinically important since adolescents are more likely to skip breakfast and lunch as opposed to dinner and significant associations have been found between missed meals and headache.²¹ Borderline significant p values for breakfast may have reached statistical significance if the sample size were large enough. This finding can serve as a guide and support the need for further research using a larger sample size.²² The 6-week follow-up may be considered as a limitation since this time-frame may not give a true indication of long-term behavior change as a result of the SMI-AH. Changes in a lifestyle behavior may take over two months of daily repetition before it becomes a habit.²³ A truer indication of the outcome of the SMI-AH may occur with a larger dose of the intervention to detect changes in behavior, headache outcomes, as well as changes in the depression and anxiety scores. Also, when extending information processing and expressive writing over a longer period in a larger sample size, themes may be identified that further delineate the adolescent experience of headache and the acceptability of the SMI-AH.

Implications for further research

The SMI-AH offered a well-received developmentally appropriate approach for the treatment of adolescent headache in a rural population. Findings from this study support the need for further research that includes multi-site clinical settings using a larger sample size with observations extending over a longer period.

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Table 1:**Guided Expressive Writings**

Week 1) Please write about your deepest thoughts and feelings about what troubles you most about your headache.   Week 2) Please write about your goals for overcoming headache and what is in the way of meeting these goals.   Week 3) Lots of people are troubled with bad headaches and they do get better. Write about your thoughts and feelings about how your headache will change.   Week 4) Please write about how your headache has changed over the past weeks.   Week 5) Please write about what advice you would give to someone about what has helped you most with your headaches.

Table 2.

Headache frequency and behavioral characteristics at baseline and 6-week follow-up

Variable	Control group		Treatment group		t_{baseline}	p_{baseline}	$t_{\text{week 6}}$	p_{week6}
	Baseline Mean (SD)	Week 6 Mean (SD)	Baseline Mean (SD)	Week 6 Mean (SD)				
Headache Frequency	20.33 (10.94)	13.03 (12.99)	14.45 (10.76)	10.91 (10.92)	1.36	0.186	0.44	0.664
Sleep hours	7.86 (0.86)	8.48 (1.11)	7.49 (1.22)	8.66 (1.57)	0.90	0.376	-0.34	0.734
Number of Breakfasts	4.53 (1.62)	5.13 (1.84)	5.18 (2.36)	6.36 (1.57)	-0.83	0.413	-1.79	0.086 ⁺
Number of Lunches	5.63 (1.89)	6.33 (0.90)	6.27 (1.68)	7.00 (0.00)	-0.89	0.382	-2.87	0.012 [*]
Number of Dinners	6.10 (1.70)	6.67 (1.29)	7.00 (0.00)	7.00 (0.00)	-1.74	0.094	-0.85	0.403
Number of glasses of caffeinated beverages	1.07 (0.88)	0.80 (0.94)	0.95 (1.39)	0.73 (0.90)	0.25	0.8032	0.20	0.8448

SD = Standard deviation.

Independent samples *t* test was used to compare the means for baseline and 6-week follow-up between the treatment group and control group.^{*}*p*-value 0.05.⁺*p*-value 0.10.

Table 3.

Mixed models analysis of group differences in headache frequency and behavioral characteristics from baseline to 6-week follow-up

Variable	Estimates of fixed effects (Crude)					Estimates of fixed effects (Adjusted) ^a				
	Control group	Treatment group	Between group			Control group	Treatment group	Between group		
	Mean (SE)	Mean (SE)	Mean (SE)	<i>P</i>	Cohen's <i>d</i> (95%CI)	Mean (SE)	Mean (SE)	Mean (SE)	<i>P</i>	Cohen's <i>d</i> (95%CI)
Headache Frequency	18.06 (2.71)	13.35 (3.17)	4.71 (4.17)	0.269	0.22 (-0.18, 0.63)	16.06 (3.50)	11.82(3.10)	4.24 (4.19)	0.322	0.20 (-0.21, 0.60)
Sleep hours	7.97 (0.26)	7.70 (0.30)	0.27 (0.40)	0.507	0.13 (-0.40, 0.53)	8.31 (0.37)	7.96 (0.33)	0.35 (0.43)	0.424	0.16 (-0.24, 0.56)
Number of Breakfasts	4.90 (0.40)	5.90 (0.46)	-1.00 (0.61)	0.114	-0.32 (-0.72, 0.08)	4.42 (0.52)	5.63 (0.46)	-1.22 (0.63)	0.064 ⁺	-0.38 (-0.78, 0.03)
Number of Lunches	6.28 (0.17)	6.94 (0.20)	-0.66 (0.27)	0.020 [*]	-0.49 (-0.89, -0.08)	6.04 (0.27)	6.65 (0.25)	-0.61 (0.28)	0.042 [*]	-0.42 (-0.82, -0.02)
Number of Dinners	6.66 (0.25)	7.00 (0.30)	-0.34 (0.39)	0.388	-0.17 (-0.58, 0.23)	6.49 (0.37)	6.83 (0.33)	-0.35 (0.44)	0.433	-0.16 (-0.56, 0.25)
Number of glasses of caffeinated beverages	0.86 (0.23)	0.78 (0.27)	0.08 (0.36)	0.820	0.05 (-0.36, 0.44)	1.24 (0.32)	0.94 (0.28)	0.29 (0.39)	0.464	0.15 (-0.26, 0.55)

^a Adjusted for age and gender.

Mean = Least squares mean based on linear mixed model, SE = Standard error Cohen's *d* was based on linear mixed model. CI= Confident interval.

^{*} p-value 0.05.

⁺ p-value 0.10.