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A Pilot Study to Enhance Preventive Asthma Care among Urban Adolescents with Asthma

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Abstract

Background—Low-income, minority teens have disproportionately high rates of asthma morbidity and are at high-risk for non-adherence to preventive medications.

Objective—To assess the feasibility and preliminary effectiveness of an innovative school-based asthma program to enhance the delivery of preventive care for 12–15 year olds with persistent asthma. We hypothesized that this intervention would; 1) be feasible and acceptable among this population, and 2) yield reduced asthma morbidity.

Subjects/Setting: Teens with persistent asthma and a current preventive medication prescription in Rochester, NY.

Design: Single group pre-post pilot study during the 2009–10 school year.

Intervention: Teens visited the school nurse daily for 6–8 weeks at the start of the school year to receive directly observed therapy (DOT) of preventive asthma medications; 2–4 weeks following DOT initiation, they received 3 counseling sessions (1 in-home and 2 via telephone) using motivational interviewing (MI) to explore attitudes about asthma management, build motivation for medication adherence, and support transition to independent preventive medication use.

Primary Outcome: Number of symptom-free days (SFDs)/2 weeks; outcome data were collected 2 months after baseline and at the end of school year.

Results—We enrolled 30 teens; 28 participated in the intervention. All teens initiated a trial of school-based DOT. All in-home MI visits were completed successfully, and 89% completed both follow-up sessions. Teens experienced an overall reduction of symptoms with more SFDs/2 weeks from baseline to 2-month and final (end of school year) assessments (8.71 vs. 10.79 vs. 12.89, respectively, $p=.046$ and $.004$). Teens also reported fewer days with symptoms, less activity limitation, and less rescue medication use (all $p<.05$). Exhaled nitric oxide levels decreased ($p=.012$), suggesting less airway inflammation. At the final assessment, teens reported significantly higher motivation to take their preventive medication every day ($p=.043$). At the end of the study, 79% of teens stated that they were better at managing asthma on their own, and 93% said they would participate in a similar program again.

Conclusions—This pilot study provides preliminary evidence of the feasibility and effectiveness of a novel school-based intervention to promote independence in asthma management and improve asthma outcomes in urban teens.

Background

Asthma is one of the most common chronic illnesses of childhood, and is associated with substantial morbidity and cost.¹ Low-income, minority teenagers have disproportionately

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high rates of asthma morbidity, including excess risk of emergency department care, hospitalization, and death from asthma, compared to white adolescents.^{2, 3} National data demonstrate that the adolescent age group remains at high risk for asthma morbidity, with death rates similar to those among very young children.³

Preventive medicines for asthma, if used properly, reduce symptoms⁴ and prevent asthma hospitalizations.⁵ National guidelines specifically recommend the use of daily preventive anti-inflammatory medications for all children and adults with persistent asthma.⁶ However, many individuals who should receive these medications are not receiving them.⁷ Poor and minority children are the least likely group to receive adequate preventive therapy, and this gap in care plays a significant contributing role in asthma morbidity. Inner-city adolescents with asthma are at particular risk of non-adherence with daily preventive medications.⁸ Thus, there is a substantial amount of suffering among this population that could be prevented with improvements in care.

While many studies examine strategies to improve pediatric asthma outcomes, few specifically focus on promoting adherence to asthma medications,^{9–13} and a limited number target adolescents for intervention.^{9, 13–19} Through a long-standing partnership with the Rochester City School District (RCSD) and the school nurse program in Rochester, NY, we previously developed, implemented, and evaluated a large school-based trial (the School-Based Asthma Therapy Trial – SBAT) for young urban children, aged 3 to 10 years old, with asthma.²⁰ The current paper examines the effectiveness of a new adaptation of this intervention, specifically designed for the adolescent age group. The prior intervention included directly observed therapy of daily preventive asthma medications from the school nurse, to assure adherence to these medications on the days the child attended school. We found that children receiving their medication in school had fewer symptoms, missed fewer days of school due to asthma, and had reduced asthma exacerbations compared to a usual care control group.²¹ The adapted intervention for teens includes two key components; directly observed therapy (DOT) of preventive asthma medications to assure that the teen receives guideline based preventive medications, and motivational interviewing to promote medication adherence, administered in a developmentally appropriate manner (e.g, focusing on transition to taking medication independently).

Motivational interviewing (MI) is a patient-focused method of motivating behavior change, centered on enhancing intrinsic motivation and resolving ambivalence about change.²² Through MI, persons are guided to make self-care decisions based on their personal goals and values. In combination, the 2 components of this study, DOT and MI, aim to first provide teens with experience adhering to an asthma treatment plan and then to help guide the teens to continue to adhere and manage their asthma independently. We felt the incorporation of MI into the DOT intervention to support the teen's independence with medication taking was particularly appropriate for this age group, since one of their key developmental tasks is to establish autonomy.

We hypothesized that this new intervention would; 1) be feasible and acceptable among this population and among school nurses, and 2) yield reduced asthma morbidity (symptom-free days and improved quality of life).

Methods

Participants

The University of Rochester Institutional Review Board approved the study protocol. We used school-based screening to identify a convenience sample of 30 eligible teens for the pilot study. Teens were identified through school “medical-alert” forms that indicate if the

student has an asthma diagnosis, and their caregivers were contacted to complete a brief telephone survey to determine eligibility. Eligible teens had physician-diagnosed asthma (based on self-report with validation from the teen's physician), persistent asthma based on national guidelines,⁶ and a current preventive medication prescription. Additionally, eligible teens were between the ages of 12 and 15 years old at the time of screening, and were attending school in the Rochester City School District. All caregivers provided written consent and teens provided assent for participation in the study. Each teen's primary health care provider (PCP) was contacted to confirm the teen's prescription for a daily inhaled corticosteroid and also to provide written authorization for its delivery in school.

Intervention

The intervention consisted of school nurse assisted preventive medication use (directly observed therapy; DOT) and a guided self-management program using motivational interviewing. Following completion of the baseline assessment, we provided each teen with a start-up inhaler of preventive medication, as authorized and prescribed by their PCP, and taught them proper administration technique. A second canister was delivered to the school nurse, and participants received directly observed therapy from the school nurse for one daily dose of their preventive medication, with the goal of each teen completing approximately a 6–8 week trial of daily preventive medication therapy at school. The aim of the DOT component of the intervention was to allow teens to establish a partnership with the school nurse, learn proper medication technique, and begin to experience the health benefits and value of daily preventive therapy.

The second component of the intervention (motivational interviewing) began 2–4 weeks after the beginning of the DOT period and was adapted from previous research.^{13, 23, 24} One of two trained counselors (research nurses) conducted three counseling sessions with each teen, focusing on adherence to evidence-based preventive care guidelines for asthma medication. The counseling included one in-home 40 minute session followed by two 20 minute follow-up sessions (2 and 6 weeks later) completed by telephone.

The goal of this component of the intervention was to build on the positive experiences gained from taking medication consistently during the DOT period (e.g., more stamina to play sports, fewer symptoms), thus increasing motivation to take medication independently. During the MI counseling sessions, asthma education was provided in a non-directive, non-prescriptive manner, using open-ended questions and reflections to help explore the teen's thoughts about adhering to an asthma medication regimen. The research nurse also fostered motivation to adhere by discussing what was most important to the teen (values, goals), and how not taking their medication compromises goal attainability. In MI, building a discrepancy between behavior (non-adherence) and personal values (e.g., playing basketball) is theorized to motivate movement toward change.

While the sessions were primarily targeted towards the teen, the primary caregiver was also encouraged to participate at the end of the counseling sessions. Using MI-compatible strategies, the nurse explored with both the caregiver and teen the role the caregiver plays in supporting or hindering the teen's asthma self-management.

The two follow-up counseling telephone calls focused on providing continued support for medication adherence, discussing barriers to implementation of independent adherence, and reflecting on what, if any, benefits had been accrued by adhering to preventive asthma care. If the teen was not using medications, the nurse continued to explore his/her ambivalence about taking medication, and continued to develop a discrepancy between the current behavior and the teen's desired goals and values. To ensure consistency in approach, more

than 20% of the counseling sessions were reviewed by an expert in MI counseling (B. Borrelli) for assurance of treatment fidelity.

Outcome Assessment

Research associates performed baseline assessments in participant's homes between November-January, which included an assessment of asthma symptoms, family and health history variables, and questions regarding environmental exposures. They collected outcome data by structured telephone interview two months after the baseline visit (January-mid March), following the targeted DOT phase of the intervention and initial MI session. Therefore the first follow-up occurred prior to the completion of all MI counseling sessions. Research associates also collected outcome data at a home visit at the end of the school year (approximately six to seven months after enrollment; between May-June), following completion of all MI counseling sessions. At this final assessment, we also conducted semi-structured interviews with each teen to assess program satisfaction and acceptability. After all final assessments were completed and the study school year ended, school nurses completed anonymous written surveys regarding program satisfaction and feasibility.

We collected both teen and caregiver reports of asthma symptoms over the prior 14 days using questions adapted from the recommendations of the 2007 National Heart Lung and Blood Institute Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma.⁶ Our primary outcome measure was symptom-free days at the two-month assessment. This outcome measure is consistent with the symptom monitoring suggested by the national guidelines for asthma care and has been suggested as an appropriate surrogate marker for asthma control.²⁵ The two-month assessment also aligned with the peak of the asthma season in Rochester, NY. Teens were asked to report the number of days they experienced *no* symptoms of asthma (defined as a 24-hour period with no coughing, wheezing, chest tightness, or shortness of breath, and no need for rescue medications) over the past two weeks. We also measured the number of days with symptoms, days needing to slow down from usual activities, and days with rescue medication use over the past two weeks. Teens were referred to symptom diaries (distributed at baseline, for use during the entire school year) to assist with recollection of symptoms.

To objectively measure airway inflammation, we used a portable NIOX MINO[®] machine to measure exhaled nitric oxide (FeNO) for each teen at baseline and both follow-up assessments. FeNo is elevated in inflammatory diseases and decreases with inhaled steroid treatment.²⁶ Measurements may range from 5-300ppb, with the lowest detection limit of 5 ppb.

Both adolescent and caregiver quality of life were measured using two previously validated scales; the Pediatric Asthma Quality of Life Questionnaire (PAQLQ)^{27, 28} and the Pediatric Asthma Caregiver's Quality of Life Questionnaire (PACQLQ).²⁹ The PAQLQ consists of 23 questions, and asks about symptoms, activities, and emotions related to asthma. Each item is scored on a 7-point scale and is averaged for a total mean score, with higher scores indicating better asthma related quality of life for the teen.²⁸ Similarly, the PACQLQ consists of 13 questions and asks about the caregiver's emotional function and activities related to their child's asthma. Each item is scored on a 7-point scale and is averaged for a total mean score, with higher scores indicating better asthma related quality of life for the caregiver.²⁹

To measure confidence to adhere to preventive medications, teens were asked "on a scale from 1 to 10, how sure are you that you can take your controller medication every day as prescribed?" where 1 is "not at all sure" and 10 is "completely sure." Teens were also asked to use this 1 to 10 rating scale to evaluate their perception of value of controller medication

(“not at all important” to “extremely important”) and their motivation to take their medication (“don’t want to take it” to “really want to take it”).¹³ We used the stages of change item from the Asthma Readiness to Change Questionnaire (RTC) to assess the teen’s readiness to make changes in their adherence behavior.³⁰ The RTC is based on the transtheoretical model of behavior change,³¹ and asks teens to rate their readiness to change adherence behavior on a scale from 1 to 5. A score of 1 indicates a precontemplation stage (“I have not been taking my asthma medications as prescribed in the past month and do not plan to use them in the next month”) and a score of 5 indicates a maintenance stage (“I have been taking my asthma medications as prescribed in the past month, and I plan to take them in the next month”).³⁰

Demographic variables were also collected. These included the teen’s age, gender, race and ethnicity, as well as caregiver education, marital status and relationship to teen.

Analysis

We compared outcomes for individual teens before and after their participation in the study using paired t-tests for continuous variables and the McNemar test for dichotomous outcomes. All analyses were performed using SPSS version 17.0. A two-sided p-value less than .05 was considered statistically significant.

Results

We performed telephone screening for study eligibility with 347 families; of these 53 were eligible. The primary reasons for ineligibility were either not having a prescription for a preventive asthma medication (36.7%), or having no asthma diagnosis or mild asthma (32.5%). Thirty teens were enrolled (57%) between October and January 2010, and 28 participated in the intervention; we stopped screening subjects when our enrollment goals were met. Two teens withdrew from the study for personal reasons shortly after enrollment. Table 1 presents the demographic characteristics of the teens and their caregivers. The mean age of teens was 13.6 years and 57% were male. The majority of the teens, 53%, identified themselves as Black and 33% reported Hispanic ethnicity. Ninety percent of caregivers were the teen’s mothers, 63% reported marital status of single, and 23% had less than a high school diploma. Teens attended a total of 14 different secondary schools in the city school district, with a range of 1–4 teens per school.

All teens initiated a trial of DOT, and 18 of 28 received the majority of their possible in-school doses before their 2 month follow-up assessment. For the MI component of the intervention, all in-home MI counseling visits were completed successfully with participating teens, and 89% completed both of the follow-up telephone MI sessions.

Primary Outcomes

The primary outcomes for this study were based on teen report of symptoms and are shown in Table 2. Teens experienced an overall reduction of asthma symptoms with the mean number of symptom-free days over two weeks significantly increasing at both the two-month time point as well as at the final assessment, compared to baseline (mean(sd); 8.71(4.66.) vs. 10.79(3.74) vs. 12.89(1.62) for baseline, two-month and final assessments, respectively, $p=.046$ and $.004$. At the two-month assessment, teens also reported fewer days where they had to slow down or stop their normal activity due to asthma ($p=.01$). In addition, at the final assessment (at the end of the school year), teens reported fewer symptom days ($p=.002$) and fewer days using a rescue medication to relieve asthma symptoms ($p=.015$) compared to baseline. Primary outcome data were also collected from

the caregiver of each teen, and caregiver report of the teens' symptoms was congruent with the teen report and indicated significant improvements over time (data not shown).

We also found that exhaled nitric oxide (FeNO) levels significantly decreased from baseline to the two-month assessment (mean (sd); 28.71ppb(32.04) vs. 25.61ppb(45.98), $p=.012$), representing a reduction in airway inflammation after the start of the intervention. Teen quality of life significantly improved at both the two-month follow-up and final assessments, with teens showing the least impairment at the final follow-up (mean (sd); 4.80(1.30), 5.68(0.86), 6.19(0.46), for baseline, two-month, and final assessment, respectively, $p=.001$, .004). Caregiver quality of life did not show a statistically significant change, but a trend toward improvement from baseline to two-month follow-up, as well as from baseline to the final assessment was seen.

Adherence and Readiness to Change

In addition to symptom improvement, teens showed positive change in measures of medication adherence confidence, importance, and motivation (Table 3). At the two-month time point, teens reported significantly greater confidence in their ability to take their preventive asthma medication every day as prescribed (mean(sd); 6.17(1.95) vs. 6.98(1.77) $p=.048$), reported greater perceived importance of taking preventive medications for asthma control (mean(sd); 8.01(1.85) vs. 9.04(1.08) $p=.012$), and were more motivated to take their medication daily (mean(sd); 6.11(2.83) vs. 7.37(2.16), $p=.043$) compared to baseline self-reports. Motivation to take daily controller medication was also significantly improved at the final assessment compared to baseline values. Lastly, there was a statistically significant improvement in asthma readiness to change scores. In fact, at the end of the study, 82% of teens indicated being in either an action ("I am taking my asthma medications as prescribed") or maintenance stage ("I have been taking my asthma medications as prescribed in the past month and plan to use them in the next month") with regard to their medication use.

Acceptability

At the final assessment, 96% of teens and 89% of caregivers reported that the teen's asthma was better than it was during the previous school year (prior to the program). Teens also reported that after participating in the program, they were better at managing their asthma on their own and felt more confident in their ability to care for their asthma by themselves. Almost all participating teens (93%) and their caregivers (96%) said that they would be willing to participate in a similar program if offered to them again (Table 4).

Semi-structured interviews with the teens at the end of the study revealed an overall general satisfaction with the program. Suggestions from the teens included using in-person meetings whenever possible (rather than telephone) for counseling sessions and providing more reminders to take medications. Additionally, while many teens had no difficulty getting to the nurse's office for their medication, a few stated that it was sometimes hard to get there each day, especially without reminders. The majority of teens expressed feelings of growth and accomplishment from the program and provided positive feedback on the DOT and MI counseling components. Commenting on how the two intervention components worked together and explaining his opinion of what teens need to take care of their asthma, one teen said,

They need an understanding person ...need someone to - coach them along-, how the study did, where you had to go to the nurse, then eventually after they see that you can go to the nurse everyday and take it, then you can start taking it on your own at home.

Another teen, reflecting on his experience with the DOT portion of the study, said,

Once you start it's hard to stop. So once you remember once, you're consistent with taking it, then it's hard to... not (keep) taking (it). I'm starting to notice if I take it, say 5 times, the other 2 times will just be like by nature.

School nurses also expressed positive reactions to the program. In anonymous program feedback surveys collected at the end of the school year, several of the participating nurses relayed that they felt that the program was very beneficial to their students. Commenting on the benefits of the program, one nurse said,

Students are more controlled. It helped the students have more knowledge of their asthma and their triggers. (It) helped them be more responsible for their own health care and management.

Explaining how the benefits of the program outweigh the additional work asked of school nurses, another nurse commented,

The key to me is consistency. If taking the inhaler in school benefits the student because he/she is taking the med(ication) consistently, it is well worth it. It is not a burden.

Discussion

This pilot study provides preliminary data to support both the feasibility and effectiveness of a novel intervention for urban teens with asthma that combines directly observed therapy with motivational interviewing to motivate asthma medication adherence and support transition to independent medication use. We found improved outcomes over time for our teen participants, including an increased number of symptom-free days, reduced need for rescue medications, fewer days where slowing down or stopping was necessary due to symptoms, and improved quality of life. Further, the decrease in FeNO measurements suggests reduced airway inflammation. Importantly, teens also reported improved confidence, motivation, and a heightened sense that it was important to adhere to their asthma care regimen.

The program was found to be both feasible and acceptable among urban teens with asthma and their caregivers. The vast majority of participants followed the program through to the end of the study, completing all aspects of enrollment, intervention, and follow-up. Teens expressed general satisfaction with the program, and the majority stated that they thought their ability for asthma self-management had improved. Additionally, the majority of both teens and caregivers reported that they would participate in a similar program again.

During early adolescence, parents typically grant their child increased independence and responsibility for illness management.³² Unfortunately, this transition in responsibility is often marked by decreased adherence and worsening symptoms.³³ However, a limited number of studies have explored efforts to improve asthma outcomes among urban adolescents. Many of these studies have focused on asthma education,^{14, 19, 34–36} and only a few have targeted adherence to preventive medications. van Es et al. tested a nurse-led program based on the attitude-social influence—self-efficacy (ASE) model to improve adherence, but did not find a significant effect.⁹ One study, conducted by Riekert et al., used motivational interviewing to improve self-management in inner-city adolescents and found positive changes in motivation and readiness to change.¹³ In addition, there are a limited number of school-based programs that show promise for management of children with asthma including teens.^{18, 34, 37–39} For example, Bruzzese et al. developed an in-school asthma education program for middle school students that promoted self-management skills and improved outcomes.¹⁷ Overall, studies targeting this population have shown mixed

results, with some indicating improvement in clinical measures,^{17–19} while others found change primarily in non-clinical measures such as motivation, quality of life, or knowledge.^{13–16, 35, 36} Further exploration of novel approaches to asthma management and outcomes for this population is needed.

This study's strengths lie in its success using evidence-based methods, incorporated into the existing system of care, to innovatively target an underserved group. The two intervention components used in this study, DOT of preventive asthma medications and MI counseling, have both demonstrated effectiveness in prior studies, but have not been tested in combination. The DOT model of care was previously utilized in our school-based asthma trial for young children and was effective in improving asthma outcomes.²¹ For this study, the purpose of the DOT component was to allow the teen to establish a partnership with the school nurse and learn proper medication technique. Through DOT, the teen also had the opportunity to experience benefits and value from preventive therapy, ideally fostering an association between adherence and asthma control along with an enhanced sense of competence in decision-making about asthma care.

Since it is developmentally appropriate to transition teens to independent use of preventive medications when they are ready, we also included an MI counseling intervention. Motivational interviewing is particularly appropriate for teens because MI aims to promote autonomous decision making. Through MI, persons are guided to make individualized and independent decisions and take greater personal control of their behaviors. Motivational interviewing is strongly rooted in behavioral science literature and has been successfully used to approach various health problems in adolescents,^{40–42} including other chronic illnesses like diabetes.⁴³

In combination, the MI and DOT components work together to first give teens a trial of proper medication use and then the opportunity to reflect upon and utilize this experience to establish concrete and attainable goals for their asthma care. The two components were relatively easily incorporated into the teen's current system of care with minimal strain on existing structures. Since schools already routinely provide daily medications for other conditions such as attention deficit disorder, the provision of daily asthma preventive medications represents a relatively simple system change to improve adherence. The MI counselor is conceptualized as an adjunct to the school nurse, providing enhanced support to move the teen towards independence with his/her self-care. While this study is a small effectiveness trial and further investigation is needed, we believe this program could ultimately be expanded to reach many adolescents in urban settings.

There are also some limitations to this study. This study consisted of a single group design based on a convenience sample of teens, and lacked a control group to validate the findings from the study. Our final sample included 28 teens which limits our statistical power. Our before and after symptom assessment could have been influenced by the seasonal variation of asthma or other factors, and our outcome assessment was limited to three different time-points. Additionally, due to funding limitations, we did not objectively measure adherence for this study. A larger trial with adequate power will be needed to fully understand the impact of this novel intervention and its cost-effectiveness in asthma management and outcomes for urban adolescents.

Conclusion

Adolescence is a key time to initiate changes in asthma care that may influence a teen's success in asthma management as they transition into adulthood. This pilot study suggests the potential for a novel school-based intervention that is developmentally sensitive to

improve asthma morbidity outcomes as well as positively impact motivation and readiness to change behaviors related to asthma self-care. This study serves as a foundation for future efforts aimed at improving asthma outcomes in a population that is in great need of attention to their asthma care.

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Table 1

Demographics

Characteristics N(%)	n=30
Teen Age mean (SD)	13.6 (1.1)
Teen Gender	
Male	17 (57%)
Teen Race	
Black	16 (53%)
White	0 (0%)
Other (including mixed race)	14 (47%)
Teen Ethnicity	
Hispanic	10 (33%)
Non- Hispanic	20 (67%)
Caregiver Race	
Black	16 (54%)
White	4 (13%)
Other (including mixed race)	10 (33%)
Caregiver Ethnicity	
Hispanic	8 (27%)
Non-Hispanic	22 (73%)
Caregiver Education	
< High School	7 (23%)
High School Graduate or GED (General education development equivalency test)	12 (40%)
>High School	11 (37%)
Caregiver Relationship to teen	
Mother	27 (90%)
Caregiver marital status	
Single	19 (63 %)

Table 2

Primary Outcomes from Teen Report

Mean (SD)	Baseline N=30	2 month N=28	Final N=28
Symptom free days ^{*†‡} (range 0–14 days)	8.71 (4.66)	10.79 (3.74)	12.89 (1.62)
Symptom days [†] (range 0–14 days)	3.33 (3.38)	1.82 (2.29)	1.00 (1.91)
Slow down or stop days ^{*†} (range 0–14 days)	2.93 (4.27)	.89 (1.60)	1.00 (1.66)
Rescue medication use days ^{† ‡} (range 0–14 days)	2.54 (4.02)	2.29 (3.82)	.50 (1.11)
FeNo [*] (parts per billion)	28.71 (32.04)	25.61 (45.98)	27.21 (32.56)
Teen Quality of Life ^{*† ‡} (Pediatric Asthma Quality of Life Questionnaire) (7 point scale; 1= all the time, 7=none of the time)	4.80 (1.30)	5.68 (0.86)	6.19 (0.46)
Parent Quality of Life (Pediatric Asthma Caregiver Quality of Life Questionnaire) (7 point scale; 1= all of the time, 7=none of the time)	6.07 (1.05)	6.31 (0.97)	6.27 (1.15)

* Baseline to 2 month values significant p<.05

[†] Baseline to final values significant p<.05

[‡] 2 month to final values significant p<.05

Table 3

Medication Adherence Confidence, Importance, and Motivation and Readiness to Change

Mean (SD)	Baseline N=30	2 month N=28	Final N=28
Medication adherence confidence [*] (10 point scale; 1= not at all sure, 10= completely sure)	6.17 (1.95)	6.98 (1.77)	6.63 (2.22)
Medication adherence importance [*] (10 point scale; 1= not at all important, 10= extremely important)	8.01 (1.85)	9.04 (1.08)	9.02 (2.01)
Medication adherence motivation ^{*†} (10 point scale; 1= really want to take preventive medication, 10= Don't want to take it at all)	6.11 (2.83)	7.37 (2.16)	7.81 (2.47)
Readiness to change (RTC) ^{*†} (Range 1–5; 1=precontemplation stage, 5=maintenance stage)	3.68 (1.39)	4.86 (0.36)	4.50 (1.04)

Mean (SD)

^{*} Baseline to 2 month values significant p<.05[†] Baseline to final values significant p<.05

Table 4

Feasibility and Acceptability

	Teens N (%)	Caregivers* N (%)
Asthma better now than a year ago (somewhat or much) †	27 (96.4)	25 (89.3)
Better at managing asthma on my own now †	22 (78.6)	26 (92.8)
Feel more confident in my ability to take care of my asthma by myself†	28 (100)	28 (100)
Would participate in a similar program if offered again	26 (92.8)	27 (96.4)

* Questions asked of caregivers about the teen's asthma. e.g. My child is better at managing his or her asthma on his own.

† Questions asked with last school year as a reference point. Teens and caregivers asked to compare the current school year in which they participated in the asthma program to the prior school year.