

## PEDIATRIC ASTHMA

# An Intervention to Increase Caregiver Support for Asthma Management in Middle School-Aged Youth

JENNIFER L. TERPSTRA, M.PH., PH.D.,<sup>1</sup> LAURA J. CHAVEZ, M.PH.,<sup>2,3</sup> AND GUADALUPE X. AYALA, PH.D., M.PH.<sup>4,\*</sup>

<sup>1</sup>*Centre of Excellence in Intervention and Prevention Science, Carlton, VIC, Australia.*

<sup>2</sup>*Northwest Center of Excellence for Health Services Research & Development, Veterans Affairs Puget Sound Health Care System, Seattle, WA, USA.*

<sup>3</sup>*Department of Health Services, University of Washington, Seattle, WA, USA.*

<sup>4</sup>*Graduate School of Public Health and Institute for Behavioral & Community Health, San Diego State University, San Diego, CA, USA.*

**Objective.** Asthma control requires adherence to a treatment regimen. Caregiver involvement is a key determinant of adolescent asthma control, but the involvement must recognize the youth's developmental stage and need for autonomy. This article describes the evaluation of a pilot asthma management intervention for middle school-aged youth and their adult network members, including caregivers, based on caregiver findings. **Methods.** Following approval from San Diego State University's Institutional Review Board and school district authorization, two middle schools were randomized into one of two conditions: 6-weekly group-based skills training for the adolescents followed by 6-weekly targeted newsletters for caregivers and others (Group 1) versus group-based skills training for adolescents only (Group 2). Outcome evaluation examined pre–post changes by study condition. **Results.** Caregivers in both groups reported improvements in quality of life (QOL) and access to asthma care resources among their adolescents. Caregiver self-efficacy increased significantly among Group 1 versus Group 2 caregivers, while Group 2 caregivers (those who did not receive newsletters) reported that their adolescents had more responsibility for their asthma care compared with Group 2 caregivers. **Conclusions.** The adolescent-only intervention resulted in improvements in caregivers' QOL and parenting behaviors that promoted the adolescent's access to asthma resources. When caregivers were directed with intervention materials, their self-efficacy increased. Those who did not receive materials reported that their adolescents had more responsibility for their asthma care. The latter finding may reflect an unintended consequence of an adolescent-only intervention as it may communicate to caregivers to assume less responsibility for their child's asthma care.

**Keywords** adolescents, asthma control, caregiver, quality of life, self-efficacy, self-management

## INTRODUCTION

Asthma affects an estimated 8.9% of US children under 17 years old and continues to be one of the most common childhood chronic illnesses (1). Nighttime awakenings from asthma have been linked to school absences, lower school performance, and parents' lost workdays (2). Having a child with asthma negatively impacts a parent's quality of life (QOL) (3) and this impact may be even greater with adolescents given more frequent exacerbations due to poorer adherence to treatment guidelines compared with children (4). This supports the need for interventions targeting the caregivers of adolescents with asthma.

The National Heart, Lung, and Blood Institute guidelines provide recommendations for proper asthma management that range from pharmacologic therapy to environmental trigger control (5). Given decreases in adherence as children age (4), these guidelines emphasize that providers should involve adolescents in the development of an asthma management plan to ensure compliance. The guidelines recognize the need to consider the developmental stage of the adolescent and his/her emerging need for independence

from parental control (6). Unfortunately, studies have found that less than half of parents have ever received education about their child's asthma (7, 8). Lack of knowledge about proper asthma management strategies can have severe consequences: a study found that most hospitalizations for asthma attacks could have been prevented had medications been taken regularly and known asthma triggers avoided (9). Further, when adolescents' asthma goes unmanaged, parent's QOL suffers (3). Such findings highlight the need for interventions to promote adherence to treatment guidelines, including both parent and adolescent training on proper asthma management.

During early adolescence, roles and responsibilities shift from parental control to adolescent control (10, 11). Adolescents often voice their desire for more autonomy, including more control over their asthma care (12). However, a power struggle can ensue when parents worry that medications might be forgotten without their direct supervision (8). Educating parents can prepare them for the challenges that this transitional period presents and ensure their encouragement of asthma management behaviors that will serve adolescents well into the future. Ongoing parental support is critical to optimal asthma management during adolescence (13, 14), but cannot be effective if they themselves do not have the necessary skills and knowledge.

\*Corresponding author: Guadalupe X. Ayala, Ph.D., M.PH., Graduate School of Public Health and Institute for Behavioral & Community Health, San Diego State University, 9245 Sky Park Court, Suite 220, San Diego, CA 92123, USA; Tel: 619-594-6686; Fax: 619-594-2998; E-mail: ayala@mail.sdsu.edu

Individual education, group sessions, and case management for parents and children improve asthma knowledge and self-efficacy as well as reduce asthma morbidity and health-care utilization (15). Interventions targeting improvements in children's asthma management and asthma outcomes have targeted the child only, the parent only, or both the parent and child (15). The latter studies, however, differ on individual involvement in the intervention. For example, an intervention for elementary school-aged children with asthma involved separate parent- and child-focused workshops (16), with a similar approach used in a feasibility study conducted with adolescents (17). In a study involving parents of elementary school-aged children with asthma, written materials and homework assignments that parents and children worked on together were found to be an effective education tool (18). Another intervention targeted intervention activities to the adolescents only with the expectation that they would share written materials with their parents (19). The extent to which these varied types of interventions meet the unique needs of middle-school-aged adolescents and their parents is not yet known. Further, the effectiveness of less resource-intense approaches, such as targeted written materials, has not been fully explored. Although parents may improve management of their child's asthma indirectly through their child's participation in a self-management program, they may experience even greater benefits from health messages directed and delivered to them through mailed targeted newsletters.

This study tested the benefits of mailed targeted newsletters on caregiver outcomes compared with no targeted newsletters within the context of a school-based adolescent-focused intervention. Two schools were randomized into one of two conditions: (1) 6-weekly group-based skills training for the adolescents followed by 6-weekly newsletters for the adult network members of these adolescents, including caregivers (Group 1) or (2) 6-weekly group-based skills training for the adolescents only (Group 2). We hypothesized that Group 1 caregivers, through the receipt of targeted asthma management newsletters, would experience greater increases in self-efficacy for preventing and managing attacks, greater positive outcome expectations for their child's asthma, greater caregiver-reported adolescent access to asthma care resources, and greater transfer of responsibility for care to the adolescent compared with caregivers in Group 2. Given the less proximal nature of these variables to the intervention approach, exploratory analyses examined whether Group 1 versus Group 2 caregivers experienced greater improvements in QOL and greater reductions in the impact of illness on family (IIF).

## METHODS

### *Design*

This pilot study, a quasi-experimental, non-equivalent comparison group study, was designed to improve caregiver outcomes among middle school students living in

Southern California, USA. Human subjects' approval was provided by the San Diego State University Institutional Review Board and school district approval was required prior to study implementation at the participating middle schools.

### *Subjects*

This pilot study recruited 58 adolescents and their caregivers from 2 middle schools (grades 6–8) in Southern California. The principal investigator (PI) (last author) contacted the district nurse to identify eligible, interested schools from among eight schools, and two schools were selected to participate given funding limitations. Participation was conditional on the school's ability to prepare a list of students who had asthma, send out recruitment letters to parents, and agree to be randomized to one of the two conditions.

Recruitment of the adolescents and caregivers occurred via two strategies: (1) school nurses identified students via the school registry system and mailed an information packet to the caregivers and (2) research members staffed an information booth for students during lunch/open periods and provided students with an information packet to bring home to their caregivers (see Figure 1). The information packet contained both English and Spanish recruitment letters, caregiver consent forms, caregiver denial forms, and a self-addressed stamped envelope. Upon receipt of caregiver consent, the adolescents were screened for eligibility, which included an expressed plan to remain in the area for the study duration, physician-diagnosed asthma, and adolescent's ability to read and speak English (group meetings were in English only). All interested adolescents who met the inclusion criteria were asked to sign an assent form.

### *Instruments*

At both pre- and post-intervention, caregivers completed a 30- to 45-minute structured telephone interview with a trained data collector in English or Spanish. Pre-intervention caregiver interviews were conducted immediately following completion of the adolescent assessments at school and prior to randomization. For both groups, the post-intervention interviews were conducted immediately after the last newsletter had been distributed to Group 1 adult network members. The data collectors remained blinded to treatment condition to minimize bias. Caregivers received a \$10.00 gift certificate for each assessment completed.

Interview item selection was based on formative research (12, 20), as well as the theoretical frameworks guiding our intervention. The intervention was developed based on adaptations of social cognitive theory (SCT; 21) as well as previous experience applying SCT to interventions for the target population (22–24). Most scales were previously validated, although the majority required translation and back-translation to maximize conceptual and linguistic equivalence (25).

Among the most important variables on which to intervene are self-efficacy and outcome expectations (OE) (26).

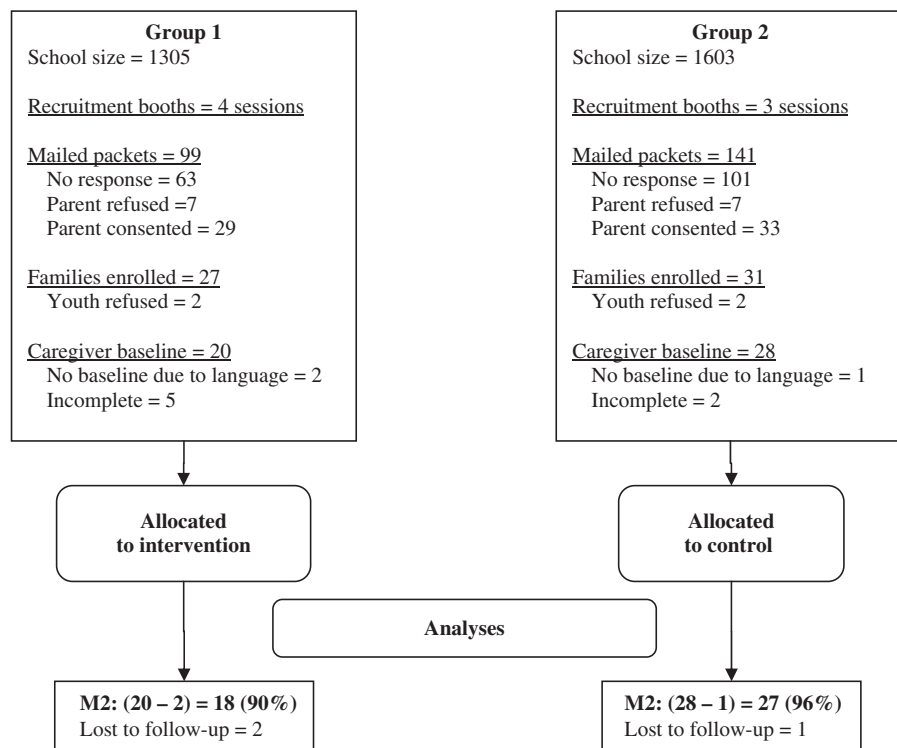


FIGURE 1.—Consort figure.

*Self-efficacy for asthma care* was measured by adding two new items to a previously validated 13-item scale (27) (see Table 1). The new items were added to the “confidence in preventing attacks” subscale and assessed how sure the caregiver was in recognizing early signs of an asthma attack in the adolescent and helping the adolescent avoid triggers that could cause an asthma attack. The prevalidated *OE* scale was adapted slightly by removing the last item from the original scale because numerous caregivers reported no access to a peak flow meter (28).

Developmental theory applied to the management of chronic diseases informed the concept of assessing responsibility for care (29). The *responsibility for asthma care* (*ResCar*) scale was also adapted by removing the last item from the original scale due to the lack of access to a peak flow meter. Caregiver and family functioning were assessed given their association with asthma control (3, 31). Both the *caregiver QOL* scale (30) and the *IIF* scale (31) were used in their original form. Formative research indicated the importance of the adolescent’s *access to asthma resources* (*AAR*; 20), which was measured by asking the caregivers if the adolescent had access to the following six items: (1) regular nurse or doctor, (2) asthma medications when needed, (3) a spacer, (4) an asthma diary, (5) an asthma action plan, and (6) a peak flow meter.

Lastly, *caregiver-reported demographics* included age (continuous), gender (dichotomous), ethnicity (Hispanic vs. non-Hispanic), marital status (married or living together vs. not married), education (continuous), income (retained in \$10,000 ranges), insurance status (private health insurance vs. none), and employment (working full time or part time vs. not working, student, or unable to work).

### Procedure

Adolescents in both schools received a 6-week skills training program developed by the project investigators based on extensive formative research (12, 20). The skills training program addressed topics in a developmentally appropriate way (see Table 2). For example, cooperative learning (e.g., teaching each other) was used to teach adolescents how to use a peak flow meter, which they were given to take home. A variety of other teaching methods were used including role-playing, question and answer, and knowledge-testing games. The adolescents followed as per their manuals and participated in hands-on skills training. Occasionally, there were homework assignments for the adolescents to complete before the following week’s class, including explaining asthma to someone, monitoring and recording peak flow for a week, and examining their home environment for triggers.

Two research staff, consisting of one Master of Public Health-level lead educator and one Bachelor of Arts-level assistant, received a 1-day training led by the PI on curriculum delivery. Both were new to the topic of asthma but were trained in health promotion. The lead educator completed post-session facilitator notes and discussed these notes with the PI within 2 days of each session. Any reported fidelity concerns for the educator’s intervention delivery were discussed and addressed.

The 6-week program was delivered during the school lunch period and involved between 10 and 18 adolescents per group. Given the structure of each school’s lunch schedule and other organizational elements, the group meetings were grade-homogeneous in the Group 1 school

TABLE 1.—Description of instruments used in the study.

| Construct                               | Instrument name                                                                         | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Study $\alpha$ | Published $\alpha$ |
|-----------------------------------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------------|
| Self-efficacy for asthma care (SE)      | Parent Asthma Self-Efficacy Scale (27)                                                  | <ul style="list-style-type: none"> <li>– Measures self-efficacy regarding attack prevention and attack management</li> <li>– 15-item, 5-point Likert scale</li> <li>– Responses range from “not at all sure” to “completely sure”</li> <li>– Higher mean score represents higher levels of self-efficacy</li> </ul>                                                                                                                                                                                             | 0.87           | 0.89               |
| Outcome expectations (OE)               | Holden’s Caretaker Expectations Regarding the Management of Pediatric Asthma Scale (28) | <ul style="list-style-type: none"> <li>– Expectations that caregiver management activities would help manage the child’s asthma</li> <li>– 7-item, 5-point Likert scale</li> <li>– Responses range from “not at all helpful” to “completely helpful”</li> <li>– Higher mean score represents more positive expectations</li> </ul>                                                                                                                                                                              | 0.85           | 0.72               |
| Responsibility for asthma care (ResCar) | Asthma Responsibility Questionnaire (29)                                                | <ul style="list-style-type: none"> <li>– Measures who takes responsibility for management tasks</li> <li>– 10-item, 5-point Likert scale</li> <li>– Responses range from “you the caregiver take ALL the responsibility” to “the child takes ALL the responsibility”</li> <li>– Higher mean score represents the child having more autonomy over asthma care</li> </ul>                                                                                                                                         | 0.74           | 0.87               |
| Access to asthma resources (AAR)        | NA (20)                                                                                 | <ul style="list-style-type: none"> <li>– Measures the adolescent’s access to asthma resources</li> <li>– 6 items, yes/no questions</li> <li>– Higher sum score represents greater access to resources</li> </ul>                                                                                                                                                                                                                                                                                                | NA             | NA                 |
| Caregiver quality of life (QOL)         | Paediatric Asthma Caregiver’s Quality of Life Questionnaire (30)                        | <ul style="list-style-type: none"> <li>– Subscale 1 measures limitation in caregiver and family activities</li> <li>– Subscale 2 measures emotional functioning in response to the adolescent’s asthma</li> <li>– 13-item, 7-point Likert scale</li> <li>– Responses for subscale 1 ranged from “all of the time” to “none of the time”</li> <li>– Responses for subscale 2 ranged from “very very worried” to “not at all worried”</li> <li>– Higher mean score represents a better quality of life</li> </ul> | 0.86           | 0.85               |
| Impact of illness on family (IIF)       | Impact-on-Family Scale (31)                                                             | <ul style="list-style-type: none"> <li>– Measures the impact of a child’s illness on family functioning</li> <li>– Four domains: financial, family/social, personal strain, and mastery</li> <li>– 24-item, 4-point Likert scale</li> <li>– Responses range from “strongly agree” to “strongly disagree”</li> <li>– Higher mean score represents a higher level of self-reported impact of the asthma on the family</li> </ul>                                                                                  | 0.94           | NA                 |

Note: NA, not applicable.

TABLE 2.—Group session and newsletter topics and their associated evaluation components.

| Group session topics                                                                        | Newsletter content                                                     | Evaluation components                                      |
|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------|
| 1 What is asthma and how did I get it?                                                      | Introduction to the program                                            | Responsibility for care (RC)                               |
| 2 Holler. Stop. Six-pack. Chill: signs and symptoms of an attack and knowing how to respond | What is asthma, including from the perspective of an adolescent        | Outcome expectations (OE)                                  |
| 3 How do medicines prevent attacks?                                                         | Preventing attacks by identifying triggers and using a peak flow meter | Self-efficacy through preventing and managing attacks (SE) |
| 4 Stopping asthma before it stops you: action planning and using a peak flow meter          | Controlling asthma via medication management                           | SE                                                         |
| 5 How can I avoid triggers and asthma attacks?                                              | Improving communication with others                                    | SE                                                         |
| 6 Getting the help you need: how to talk to parents, friends, doctors, and school personnel | Maintaining changes through reinforcement                              | OE, RC, impact of illness on family                        |

and were held in an empty classroom, the nurses’ office, and an empty cafeteria, while the Group 2 school’s intervention activities involved mixed grades and occurred in a private room within the library.

To maximize the dose received, reminder calls were placed the night before each group meeting and reminder school passes were distributed to the adolescents by the nurses’ office on the day of the group meeting. In addition, makeup sessions were held for adolescents who missed one or more sessions and one summary session was given to all adolescents with content derived from the two

sessions with the lowest attendance rates. All school personnel and adolescents were blinded to intervention condition until after the group-based skills training had been completed, and evaluation staff were blinded to treatment condition throughout the study.

After completion of the training program, adolescents in Group 1 were asked to identify up to three adults in their social network who they perceived as needing more information about how to support their asthma care. The adolescents were told to identify adults who facilitated self-management, as well as adults who may impede effective

asthma management, such as school personnel who accuse them of faking symptoms or a family member who smokes in the home (12). The adolescents provided the names and addresses of these adults and the six newsletters were mailed over the subsequent 6 weeks. To promote discussions between the adolescents and their identified network members, the adolescents also received these newsletters. In all but two cases, the participating caregiver received the newsletters. Overall, the recipients of the newsletters included 25 caregivers, 15 teachers/or adults at school, 2 friends, 1 school nurse, and 8 “others” (including other family members). Of these 51 newsletter recipients, the students chose to send the newsletters anonymously to 14 and chose to disclose their names to the other 37. A total of 78 newsletters were sent out including those for the students, 14 of which were in Spanish and the remaining 66 were in English.

Each newsletter was centered on an important theme identified during formative research and paralleled content presented during the group meetings to reinforce knowledge and skills learned (see Table 2). The format was consistent across the six newsletters to facilitate the ease of use and included skill-building activities.

#### Data Analysis

The database was checked for errors, missing data, and outliers. No data imputation was done for missing data. Descriptive statistics for demographic and other variables were calculated and differences were examined using chi-squared tests and *t*-tests. Repeated measures ANOVA was used to test for group-by-time interactions, controlling for differences in health insurance status.

## RESULTS

#### Demographic Characteristics and Differences by Condition

Recruitment and retention rates are shown in Figure 1. There were no significant differences between Group 1 and Group 2 adolescents in terms of their current age, age of diagnosis, gender, or Latino ethnicity (see Table 3). The adolescents were on average 12 years of age, half were female, and the majority was Latino. The average age at diagnosis was 5 and 4 years for the intervention and control conditions, respectively.

There were no significant differences between Group 1 and Group 2 caregivers on most of the demographic variables, although Group 2 caregivers were more likely to have private health insurance ( $p \leq .05$ ). Most of the caregivers interviewed were female, on average 41 years of age, with 10 years of education, 46% were married/living together, 64% were Hispanic, and about 60% were employed. In addition, both samples reported a median annual income that ranged from \$10,000 to \$19,999.

TABLE 3.—Baseline adolescent and parent characteristics by condition.

| Variable                                   | Group 1<br>(group + newsletter) | Group 2<br>(group only) |
|--------------------------------------------|---------------------------------|-------------------------|
| Adolescent demographics                    | ( <i>n</i> = 27)                | ( <i>n</i> = 31)        |
| Mean age (SD)                              | 12.52 (1.09)                    | 12.10 (0.91)            |
| Mean age at diagnosis (SD)                 | 5.76 (3.81)                     | 4.09 (4.03)             |
| Percent female ( <i>n</i> )                | 45 (13)                         | 55 (16)                 |
| Percent Latino ( <i>n</i> )                | 44 (15)                         | 56 (19)                 |
| Caregiver demographics                     | ( <i>n</i> = 20)                | ( <i>n</i> = 28)        |
| Mean age (SD)                              | 42 (11)                         | 40 (8)                  |
| Percent female ( <i>n</i> )                | 80 (16)                         | 96 (27)                 |
| Percent Latino ( <i>n</i> )                | 60 (12)                         | 67 (18)                 |
| Percent married ( <i>n</i> )               | 45 (9)                          | 46 (13)                 |
| Mean years of education (SD)               | 10 (3)                          | 11 (3)                  |
| Median annual income                       | \$10,000–\$19,999               | \$10,000–\$19,999       |
| Percent private insurance ( <i>n</i> )     | 5 (1)                           | 29 (8) <sup>a</sup>     |
| Percent employed ( <i>n</i> )              | 60 (12)                         | 61 (17)                 |
| Percent non-parent caregivers ( <i>n</i> ) | 16 (3)                          | 7 (2)                   |

<sup>a</sup> $p \leq .05$

#### Baseline Psychosocial, Behavioral, and Caregiver/Family Functioning Characteristics

At baseline, caregivers in Group 2 reported feeling more efficacious at managing their adolescent's asthma compared with caregivers in Group 1 ( $p \leq .05$ ). Caregivers reported high levels of self-efficacy for managing their adolescent's asthma and were fairly positive that caregiver management behaviors would help their adolescent manage his/her asthma. Baseline responsibility for care scores indicated that caregivers felt that asthma management was a shared responsibility. However, the adolescents only had moderate access to asthma care resources. Finally, both the mean QOL score and the mean IIF score indicated that the adolescent's asthma had a moderate impact on the family's life.

#### Repeated Measures ANOVA

Assumptions for the repeated measures ANOVA were met including a nonsignificant Mauchly's test for all ANOVAs. Group-by-time interactions were observed in two of the three psychosocial variables (see Table 4). The addition of the targeted newsletters was effective at increasing caregiver self-efficacy ( $p \leq .05$ ), yet did little to change the caregiver's sense of responsibility for asthma care. On the other hand, not receiving the targeted newsletters was associated with caregivers reporting greater adolescent responsibility for asthma care ( $p \leq .01$ ). The effect size of both group-by-time interactions was moderate. No changes were observed in OE.

Two main effects for time were also observed. Caregivers in Groups 1 and 2 reported better QOL and greater AAR among their children between pre- and post-intervention ( $p \leq .01$  and  $p \leq .05$ , respectively). The effect sizes for both main effects of time were moderate. No changes were observed on the IIF scale.

TABLE 4.—Group-by-time interactions on outcome variables.

|                                                    | Group 1<br>(group + newsletter) |             | Group 2<br>(group only) |             | Group-by-time inter-<br>action and effect size | Main effects of time<br>only and effect size |
|----------------------------------------------------|---------------------------------|-------------|-------------------------|-------------|------------------------------------------------|----------------------------------------------|
|                                                    | Pre                             | Post        | Pre                     | Post        |                                                |                                              |
| Psychosocial variables                             |                                 |             |                         |             |                                                |                                              |
| Mean self-efficacy (SD) <sup>a</sup>               | 3.63 (0.76)                     | 4.01 (0.84) | 4.10 (0.61)             | 4.18 (0.53) | $p \leq .05$ ; 0.52                            | —                                            |
| Mean outcome expectations (SD) <sup>b</sup>        | 4.30 (0.52)                     | 4.54 (0.49) | 4.48 (0.41)             | 4.50 (0.53) | NS                                             | NS                                           |
| Mean responsibility for care (SD) <sup>c</sup>     | 2.64 (0.73)                     | 2.61 (0.73) | 2.24 (0.67)             | 2.66 (0.62) | $p \leq .01$ ; 0.73                            | —                                            |
| Caregiver behaviors                                |                                 |             |                         |             |                                                |                                              |
| Mean access to resources (SD) <sup>d</sup>         | 2.79 (1.36)                     | 3.26 (1.33) | 2.93 (1.21)             | 3.30 (1.10) | NS                                             | $p \leq .05$ ; 0.56                          |
| Caregiver/family functioning                       |                                 |             |                         |             |                                                |                                              |
| Mean quality of life (SD) <sup>e</sup>             | 5.73 (1.01)                     | 6.35 (1.02) | 5.66 (1.03)             | 5.89 (1.00) | NS                                             | $p \leq .01$ ; 0.77                          |
| Mean impact of illness on family (SD) <sup>f</sup> | 2.95 (0.54)                     | 3.04 (0.66) | 2.85 (0.34)             | 2.89 (0.44) | NS                                             | NS                                           |

Notes: NS, not significant.

<sup>a</sup>Self-efficacy used a 5-point scale with higher scores representing higher levels of self-efficacy for preventing and managing asthma attacks in the child.

<sup>b</sup>Outcome expectations used a 5-point scale with higher scores representing more positive caregiver expectations of asthma care.

<sup>c</sup>Responsibility for asthma care used a 5-point scale with higher scores representing greater adolescent autonomy for asthma care.

<sup>d</sup>Access to asthma resources was the sum of the following resources available to the adolescent: (1) regular nurse/doctor, (2) access to medications when needed, (3) spacer, (4) asthma diary, (5) asthma action plan, and (6) peak flow meter.

<sup>e</sup>Quality of life was measured with the 13-item Juniper quality of life scale with higher scores representing a better quality of life.

<sup>f</sup>Impact of illness on family used a 4-point scale with higher scores representing greater impact of asthma on the family.

## DISCUSSION

This pilot study was designed to examine the addition of a low-cost intervention (targeted mailed newsletters) on caregiver outcomes. As hypothesized, caregivers who received the targeted newsletters reported improvements in self-efficacy for preventing and managing their child's asthma attacks compared with caregivers who did not receive the newsletters. This is important given that caregiver self-efficacy is positively associated with preparing adolescents for successful self-management of asthma (32).

A group-by-time interaction was observed for responsibility for care, but in the opposite direction. Caregivers who did not receive the newsletters reported more adolescent autonomy for asthma care than caregivers who received the newsletters. One explanation for this finding is that caregivers who were not themselves gaining asthma management skills, but who knew that their adolescent was, may assume that their adolescent's increasing skills warranted giving them more responsibility. It is also possible that the newsletter communicated the message to caregivers that they should stay involved in asthma care. This finding requires further study given that little is known about the optimal level of autonomy that an adolescent should have for effective asthma control.

Across both groups, improvements were observed in caregivers' QOL, as well as access to asthma care resources for their adolescents, which were identified as important for caregiver self-efficacy for managing asthma among middle school students (20). This suggests that either approach has the potential to positively impact the caregivers and their relationship with their child, both of which are important for effective chronic disease management (16).

Successful asthma management during adolescence may require continued caregiver involvement in asthma management (11). Larger and more rigorous evaluations of

such approaches to improving caregiver outcomes among adolescents with asthma are sorely needed.

## Limitations

This study has several limitations. First, study findings are limited to two schools and caregivers who agreed to participate based on a mailed recruitment packet or receipt of a consent form that his/her adolescent obtained from the information booth. Regarding the latter, the fact that 68% of mailed recruitment forms were never acknowledged demonstrates the significance of this limitation. Future studies should be conducted with more schools using a cluster-randomized design, and additional recruitment strategies and follow-up efforts should be implemented, such as phone contacts.

Second, adolescents selected a greater variety of network members to receive the intervention; however, our evaluation is limited to caregivers given funding limits. In addition, there were caregivers who were either unable or unwilling to complete the assessments despite having signed the consent form, which reduced the sample size for all analyses and thus our ability to find intervention effects. Two caregivers in Group 1 were not selected to receive the newsletters, further compounding our ability to find intervention effects.

Third, significant differences were observed in access to private health insurance, with a greater percentage of Group 2 participants reporting access to private health insurance compared with Group 1 participants. Although health insurance status was controlled for in the analyses, it is possible that the higher baseline self-efficacy scores observed in Group 2, for example, were as a result of greater access to care.

Fourth, data are limited to self-report and using measures that, in some cases, required translation into Spanish. Regarding the former, funding limits precluded our ability

to collect objective indicators of QOL, for example. Regarding the latter, although careful attention was paid to the translation process to maximize the conceptual and linguistic equivalence of the two language versions, additional strategies are warranted prior to concluding that they are psychometrically equivalent.

Finally, our study design posed an additional limitation in that assigning schools, as opposed to individuals, to conditions resulted in two groups that differed slightly at baseline. Despite these limitations, findings from this research have important implications for future efforts to improve asthma management in adolescents. Further, lessons learned from the limitations of this pilot effort can be applied to future, larger scale studies to help avoid potential sources of bias in the study design, as well as to inform recruitment and data collection efforts to maximize participation and minimize missing data.

### CONCLUSIONS/KEY FINDINGS

The study findings support the need for asthma management programs to engage both the caregivers and their children in the efforts (5). The program presented here represents an effective strategy for improving asthma management that requires minimal resources. Further, the use of the school environment is ideal given the opportunity to address social norms related to asthma management and the fact that asthma control needs to occur in this context given the direct relationship between asthma management, student attendance, and academic performance (2).

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### DECLARATION OF INTEREST

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