



# Effects of a Classroom-based Asthma Education Curriculum on Asthma Knowledge, Attitudes, Self-efficacy, Quality of Life, and Self-management Behaviors among Adolescents

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## ABSTRACT

*Asthma education interventions primarily target young children and adults, and a few target adolescents. Several constructs of the social cognitive theory were used to design a classroom-based high school asthma education curriculum and to determine if the curriculum would improve asthma knowledge and attitudes among 10<sup>th</sup> grade students, as well as improve the quality of life, self-efficacy, and self-management behaviors among asthmatic students. Using a nonequivalent control group design with delayed intervention (three-week delay) in one group, we surveyed a sample of 122 10<sup>th</sup> grade health academy students. Twenty-four students (20%) reported having doctor-diagnosed asthma. Statistical data analysis determined that asthma knowledge mean scores and self-efficacy mean scores significantly improved for students who received the curriculum. Most students held favorable attitudes towards asthmatics before the intervention, with a slight decrease in positive attitudes after the intervention. There were also slight, insignificant improvements in quality of life among asthmatic students. This study demonstrated that the asthma curriculum improved knowledge among asthmatic and nonasthmatic students and self-efficacy among the asthmatic students. Asthma education, based on a theoretical framework, can be effectively incorporated into a traditional high school curriculum.*

## INTRODUCTION

Asthma is the leading chronic illness among children in the United States, affecting approximately 5 million under the age of 18.<sup>1</sup> Furthermore, asthma is now the leading cause of school absenteeism and emergency room admission among children. Among adolescents aged 12-17, 136,000 in California missed one or more days of school per month due to asthma symptoms.<sup>2</sup> Asthma among adolescents is also underdiagnosed,<sup>3</sup> and the acceptance of diagnosis and compliance is poor.<sup>4</sup> Consequently, some authors considered adolescent asthmatics to be a high-risk population.<sup>5,6</sup>

In a cross-sectional logistic regression analysis of the Healthcare Cost and Utilization Project's dataset called Nationwide

Inpatient Sample (NIS), adolescents 13 to 18 years of age were 1.22 times (95% CI= 1.05-1.43) more likely to have high-severity asthma than younger children 5 to 12 years of age, controlling for gender, geographic region, hospital location, bed size and season.<sup>7</sup>

Based on the literature, researchers are moving in the direction of implementing adolescent asthma health education in schools and determining what aspects of these interventions are effective. Schools, rather than hospitals, are prime settings for asthma health education for children and adolescents due to practicality and familiarity with the environment.<sup>8-10</sup>

Several asthma health education programs have been developed to change

behaviors, such as avoiding allergens or regularly taking preventive medications, necessary for long-term control of asthma,<sup>11-13</sup>

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however, a majority of these programs targeted adult or child patients with asthma. Furthermore, the theme of most asthma education programs focused on increasing knowledge and improving attitudes to increase self-management behaviors. Clark and Nothwehr<sup>14</sup> called for a need to go beyond improving knowledge and attitudes by examining other constructs, such as self-efficacy, social support or coping skills, that can influence self-management of asthma. The significance of this research was that an asthma education curriculum, entitled *First Aid for Asthma*, was developed and incorporated into a traditional school curriculum, targeting both asthmatic and nonasthmatic students to address the acceptance of asthmatics among adolescents.

Using several constructs of Bandura's Social Cognitive Theory (SCT),<sup>15</sup> this research provided a basis for long-term behavioral changes in adolescent asthmatics, such as increasing compliance to self-management skills and improving the quality of life, by targeting the intermediate variable of self-efficacy. A variety of asthma interventions have used SCT to improve asthma management.<sup>12,13,16-20</sup> Similar to the learning activities in these interventions, components of SCT such as performance accomplishments, vicarious experience, verbal persuasion and emotional arousal were incorporated into the asthma education curriculum in our study to enhance the self-efficacy of adolescent asthmatic students. Performance accomplishments included role playing to inform students of what to do when someone is having an asthma attack, simulations of an asthma attack, and conducting risk assessments of potential asthma triggers in their homes as a take-home assignment. Students also experienced and practiced how to use peak flow meters. Vicarious experience included an observation of an asthma educator using a peak flow meter, emphasizing the importance of regular peak flow monitoring. The asthma educator also used verbal persuasion by promoting the involvement of students in asthma prevention programs and encouraging asthmatic students to comply

with asthma treatment plans. Lastly, emotional arousal involved students by performing stress management techniques such as pursed-lip breathing.

The purpose of this study was to assess whether *First Aid for Asthma* would improve knowledge and attitudes among asthmatic and nonasthmatic 10<sup>th</sup> grade health academy students and, as a result, improve self-efficacy, quality of life and self-management behaviors among asthmatic students.

## METHOD

### *Participants and Design*

Two public high schools (School One and School Two), with equivalent socioeconomic status and ethnic makeup were selected to participate in the study. Neither school had any formal contact with the other and both offered health academies for 10<sup>th</sup> through 12<sup>th</sup> grade students. Health academies were health-oriented programs that not only included traditional high school curricula, such as math, science, social studies and English, but also medical or allied health classes, laboratory investigations, and job shadowing. We implemented *First Aid for Asthma* as an adjunct to the respiratory system component of the existing science curriculum, which is only taught in the 10<sup>th</sup> grade. With parent and student consent, a total of 122 10<sup>th</sup> grade health academy students participated in the study (65 students from School One and 57 students from School Two) March 12, 2001 through December 13, 2001. Institutional Review Board approval was granted prior to study implementation.

We used a nonequivalent control group design with delayed intervention in one group. Thus, School One received the asthma curriculum first, and School Two received the asthma curriculum three weeks later. We collected measurements one week prior to the implementation of the curriculum and at one week, three weeks and six weeks post-intervention. Due to mandatory state testing during Week 6, students in School Two completed their assessment at four weeks post-intervention rather than at three weeks as planned. The study was con-

ducted in two phases to acquire a large sample size and to accommodate for attrition. Phase One occurred during the Spring Quarter (March to June) and Phase Two during Fall Quarter of the next school year (September to December) for both schools. The duration of each phase was 13 weeks.

## INTERVENTION

*First Aid for Asthma* met the California Department of Health Services' objective: to promote school-based asthma education.<sup>21</sup> It was designed as a nine-module curriculum, addressing the epidemiology and physiology of asthma, triggers of asthma and how to control these triggers, types of asthma medications, asthma management, and exercise and asthma. Modules included Microsoft PowerPoint® lectures (equipped with speaker's notes and formatted on zip disks), activity handouts, discussion dialogues, exams with answer keys, case studies, a resource list and a prospective guest speakers list. The intended duration of each module was 2 hours. Modules were shortened for convenience to one class period, approximately 50 minutes. One module was implemented per school day for approximately two weeks. The health academy teacher at each participating high school taught the curriculum. Prior to class instruction, the teachers were trained by the project coordinator on how to use the curriculum in a two-hour training course. Teachers were given the same *First Aid for Asthma* Lesson Plan to follow and were instructed step-by-step on how to implement the curriculum modules. During the study, teachers were given evaluation forms upon completion of each module to assess whether the objectives were met and to provide an opportunity for the teachers to submit suggestions and comments. Teachers also kept logs of day-to-day activities that might have influenced the intervention.

### *Measures*

We developed a self-administered asthma questionnaire, using items and scales from validated questionnaires as well as newly developed items, to measure five outcome variables: (1) asthma knowledge,



(2) attitude towards asthmatics, (3) quality of life, (4) self-efficacy, and (5) self-management behaviors. All validated questionnaires were also tested for reliability. The first part of the questionnaire contained asthma screening items, adapted from a validated pediatric asthma screening survey,<sup>22</sup> asthma knowledge items and asthma attitude items. We categorized students who had been diagnosed with asthma or who reported symptoms of asthma as asthmatics to verify that those who answered the asthma portion of the questionnaire were indeed asthmatic. School records confirmed asthma status. If students reported having asthma and no records were found, we contacted parents who returned response cards, indicating their teen's asthma status.

To assess asthma knowledge, students completed a 27-item asthma knowledge questionnaire.<sup>23</sup> The authors of the questionnaire reported a reliability coefficient of 0.94. Correlations with parent knowledge confirmed face validity and content validity, as well as concurrent validity.<sup>24</sup> The knowledge questionnaire was also validated in an adolescent asthma education intervention.<sup>13</sup> There were six items requiring a short answer response and 25 items with a response option of "true," "false" or "unsure." One evaluator, the project coordinator, evaluated short answer responses. The original questionnaire contained 31 items; however, most students (97%) did not complete four out of the six short answer items, regarding asthma medications and ways to prevent an asthma attack during exercise. We deleted these items from the computation of the total knowledge score. Actual points scored were divided by the total possible points to calculate the total knowledge score.

To evaluate attitudes and tolerance toward asthmatics, six items of a validated asthma attitude questionnaire, based on a six-point Likert-type scale, assessed attitudes towards asthmatics.<sup>23</sup> The questionnaire was tested for construct validity and found to be useful in assessing adolescent attitudes towards the test subjects' asthmatic peers.<sup>13</sup> The reliability of the questionnaire

was assessed in our research study with a reliability coefficient of 0.61.

The remainder of the asthma questionnaire, completed only by asthmatics, contained items regarding self-efficacy, quality of life and self-management behaviors. There were some missing values possibly due to inadvertently skipping the question or voluntary refusal to answer the question. Therefore, the series mean within both schools combined replaced these missing values to retain the sample size. For self-efficacy, we used the validated 14-item Child Asthma Self-Efficacy questionnaire with a five-point Likert-type scale.<sup>25</sup> Mean scores were calculated for overall self-efficacy. The reliability coefficient for the self-efficacy questionnaire was 0.82 and was tested for construct validity. For quality of life, we used the validated 23-item Standardized Pediatric Asthma Quality of Life Questionnaire (SPAQLQ),<sup>26</sup> targeting children 7 to 17 years of age. The SPAQLQ had a reliability coefficient of 0.84 and was tested for cross-sectional and longitudinal construct validity. Items included degree of impairment and frequency of asthma-related events. A seven-point Likert-type scale was employed. Mean scores were calculated for overall quality of life. Finally, for self-management behaviors we measured self-efficacy, compliance to asthma prevention and self-management behaviors developed for this study. For example, if students expressed self-efficacy in regularly going to the doctor, a question addressed if they actually went to the doctor. Other questions included whether they used asthma medications, avoided allergens or whether they followed an asthma treatment plan. These 12 self-management behavior items were not validated or reliability tested. These items were used for information gathering purposes only.

We conducted paired *t*-tests, using SPSS software, version 10.0 (Chicago, Illinois), to compare baseline values for asthma knowledge, attitudes, self-efficacy and quality of life with post-intervention values collapsing across groups, School One and School Two. The groups were collapsed to compen-

sate for diminishing sample sizes after baseline collection and to determine the effect of the intervention. Total student number was used for mean measurements.

## RESULTS

### *Demographic data*

Participating students were predominantly female (77%). The prevalence of asthma among the participating students was 20% (24 students confirmed via school records and parent verification): 15 students from School One and nine students from School Two, but this difference was not significant. Of the 24 asthmatic students, only 19 students (13 from School One and six from School Two) completed the asthma portion of the questionnaire. There were only 11 asthmatic cases at follow-up three (six weeks post-intervention) because the School One teacher was unable to administer questionnaires during Phase One due to school testing. We mailed 27 letters to students who did not have doctor-diagnosed asthma, but reported possible asthma symptoms, as well as to their parents, to follow-up with their primary care providers. Tracking these students to verify asthma status was beyond the scope of the study. Furthermore, there was no significant difference between students tested during Phase One and students tested in the next school year for Phase Two.

### *Baseline Measurements—Comparisons between School One and School Two*

#### *Asthma knowledge*

Baseline asthma knowledge scores were poor for both asthmatics and non-asthmatics. Out of a possible score of 100%, School One and School Two had mean baseline scores of 43.96 (SD=14.21) and 39.86 (SD=17.08), respectively. Students indicated some knowledge of asthma symptoms and asthma triggers. School One showed significant improvement in mean asthma knowledge scores following the intervention at the first follow-up, 62.23 (SD=12.84;  $p=0.001$ ). School Two, which received no intervention during the same period, showed no significant difference in



mean knowledge score from baseline, 39.15 (SD=13.73). Thus, School One students were able to retain what they learned from the asthma education curriculum and had higher follow-up scores than baseline scores.

#### **Asthma attitudes**

Baseline results showed positive attitudes, or tolerance towards asthmatics, for both schools. School One showed a significant ( $p=0.02$ ) but slight decrease in mean attitude scores, from 4.44 (SD=0.68) at baseline to 4.23 (SD=0.66) at first follow-up. Mean attitude scores for School Two fell insignificantly from 4.49 (SD=0.82) at baseline to 4.31 (SD=0.84) at first follow-up. Based on a six-point Likert-type scale, an attitude score of "4" represented a somewhat favorable attitude toward students with asthma.

#### **Self-efficacy**

There was a significant improvement in mean self-efficacy scores, from baseline to first follow-up, in School One compared to School Two. The mean self-efficacy scores for School One were 4.20 (SD=0.47) at baseline and 4.43 (SD=0.30) at post-intervention ( $p=0.001$ ). School Two did not show a significant improvement in students' mean scores, 3.50 (SD=0.73) and 3.71

(SD=1.41), respectively. Asthmatic students from School One reported more confidence in managing their asthma than asthmatic students in School Two, and they became significantly more confident subsequent to what they had learned from the asthma education curriculum.

#### **Quality of life**

The mean quality of life scores for School One improved insignificantly from a mean of 5.47 (SD=1.31) at baseline to 5.91 (SD=1.06) at first follow-up. School Two also showed an insignificant improvement in mean quality of life scores, from 5.91 (SD=0.95) at baseline to 6.20 (SD=0.73) at first follow-up. Asthmatic students in both schools reported almost no impairment from having asthma at baseline, and their impairments did not change significantly following the intervention.

#### **Follow-up Measurements—School One and School Two Combined**

To assess the effect of the intervention over time, the two schools were collapsed during statistical analysis to compensate for the diminishing sample sizes after baseline data collection and the loss of an observation because of the staggered intervention design. (Table 1). There were significant

improvements in asthma knowledge from baseline for follow-up data after collapsing the two groups ( $p=0.001$ ). There was also a significant decrease in mean attitude scores from baseline to the first follow-up ( $p=0.02$ ), but no significant differences between baseline and the second and third follow-ups. Mean self-efficacy scores significantly improved between baseline and second follow-up ( $p=0.02$ ), but not for the first follow-up. Self-efficacy scores for the 11 asthmatic students at the third follow-up slightly increased, but were not significant. Mean quality of life scores were not significantly altered between baseline and subsequent follow-ups.

#### **Self-management behaviors**

A majority (74%) of the 19 asthmatic students stated that their asthma was worse at a certain time of the year. Asthma symptoms were more severe during the winter season for 53% of the asthmatic students. A little over half (58%) conveyed that they had physician-written instructions regarding asthma medications. Of those, 50% followed the instructions most of the time, 42% followed the instructions all of the time, and 9% did not follow the instructions at all. Asthmatic students also showed

**Table 1. Results for Baseline and Follow-up Measurements of School 1 and School 2 Combined**

Dependent Variable	Baseline		Follow-up One (One Week Post-intervention)		Follow-Up Two (Three Weeks Post-intervention)		Follow-Up Three (Six Weeks Post-intervention)	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Knowledge	115	41.51 (14.27)	115	57.20* (14.94)	111	59.76* (14.04)	83	55.47* (16.37)
Attitudes	105	4.38 (.77)	105	4.24** (.68)	102	4.30 (.76)	78	4.29 (.69)
Quality of Life	19	5.70 (1.19)	19	5.85 (.99)	19	5.82 (1.33)	11	6.15 (.95)
Self-Efficacy	19	4.05 (.87)	19	4.17 (.70)	19	4.47** (.41)	11	4.23 (.83)

\*  $p \leq .001$ . \*\*  $p < .05$



high self-efficacy scores regarding self-management behaviors (Table 2). They were fairly confident about performing behaviors, such as using medications or avoiding allergens, to manage their asthma.

## DISCUSSION

A primary limitation of our research was selection bias. Participants were health academy students who possibly had more extensive medical knowledge, may have received prior information about asthma management in other classes, already held favorable attitudes towards asthmatics, or might have been healthier than the general population.

Using different teachers to teach the curriculum rather than one teacher was another limitation in our study. The School One teacher may have had a more effective teaching style than the School Two teacher or possibly had a better rapport with the students to effect favorable attitudes or improvements in self-efficacy. To minimize Type III error, the project coordinator provided the two teachers a detailed lesson plan of the same asthma education curriculum. The project coordinator instructed the teachers step-by-step on how to use the curriculum in a two-hour training course and advised them to not make any changes to the curriculum, unless instructed by the project coordinator. Process evaluation, using evaluation forms and logs, was also conducted to determine fidelity to the modules.

A ceiling effect could have occurred in

which the students generally had favorable attitudes towards asthmatics to begin with, and therefore, there was little room for improvement. Perhaps their health academy classes prepared them to be more tolerant towards others with chronic diseases, such as asthma.

Furthermore, follow-up may have been too short to effect improvements in quality of life. Typical follow-up periods as seen in other studies range from one month to as long as two years.<sup>12,19</sup> Most of these interventions, however, were conducted in a clinical setting and targeted elementary school children and adults rather than teens. The asthmatics in our research had significantly higher knowledge scores than their nonasthmatic peers and therefore possibly possessed sufficient knowledge to take care of themselves and felt less limited in daily activities. Furthermore, self-efficacy scores indicated that they were quite sure about how to manage their asthma. Therefore, this sample might be healthier than the general population of asthmatics, since the asthma severity was not assessed. The small sample size of asthmatics might also have affected the quality of life scores. Asthmatics lost to attrition might have differed in quality of life.

Attrition during each follow-up phase could also have affected the study results. Reasons for diminishing sample size from baseline included: 1) absent during data collection, 2) possible voluntary refusal to complete questionnaire, or 3) absent during intervention, therefore follow-up data are not

valid. Participants not part of the study may have had greater asthma knowledge, favorable attitudes or a healthier asthma status.

To assess whether the intervention had any effect on the outcome measures over time, we used total student number instead of number of schools for mean measurements. In our preliminary data analysis, prior to collapsing the data, there was no significant difference between School One and School Two in asthma knowledge, attitudes, self-efficacy and quality of life at each of the three follow-up observations; however, a larger sample size was needed to assess the permanence of the intervention. Also, School Two completed their assessment at four weeks post-intervention rather than at three weeks as planned because of state testing. Therefore, the two groups were collapsed upon statistical analysis to compensate for the lack of equivalent groups.

One strength of our research was that asthma knowledge and attitudes were assessed in both asthmatic and nonasthmatic high school students. In a 1998 study, asthma knowledge and attitudes among asthmatic and nonasthmatic students were assessed using the same knowledge and attitude questionnaires; however, the population was comprised of all girls, and investigators used a peer-led curriculum.<sup>13</sup> Similar to the 1998 study, our research showed poor asthma knowledge scores at baseline, but significantly improved scores post-intervention among asthmatic and nonasthmatic students.

Another strength was the use of a com-

**Table 2. Self-efficacy Scores and Self-management Behaviors of Asthmatic Students from Both Schools Combined**

Self-management behavior	n	Self-efficacy Score*	
		Mean	SD
Know which medication to use during a serious breathing problem and use quick relief inhalers	14	4.45	.57
Know which medications to use during a serious breathing problem and use long-term control inhalers	4	4.40	.51
Avoid allergens	15	4.08	.46
Go to next doctor's appointment	9	4.49	.67
Know when to go to emergency room during a serious breathing problem	18	4.47	.63

\* Total n = 19. Possible score range = 1-5.



parison group, School Two, controlling for the confounding effect of history bias. Significant improvements in knowledge and self-efficacy scores in School One were not likely due to an outside event, such as media or asthma-related experiences, since School Two showed no improvements.

Our research was also the first we were aware of that notified students who were not diagnosed with asthma by a physician, yet reported possible asthma symptoms, to follow up with their physicians. Long-term follow-up was beyond the scope of the study. The prevalence of asthma in this adolescent sample, 20%, was higher than that reported in the literature, 11%.<sup>13</sup> Still, 22% of the total study participants reported possible asthma symptoms and might be undiagnosed asthmatics. These possible cases might underestimate the true asthma prevalence rates in this study. Future research is needed to follow up on those who report possible asthma symptoms and determine their asthma status as well as refer them to their primary care providers for asthma management.

## CONCLUSION

This research confirms that this classroom-based asthma education intervention is feasible and may be an adolescent asthma management strategy worthy of further development in other populations, such as inner-city adolescents or adolescents in other grade levels. Furthermore, this curriculum can be enhanced with the resources and involvement of school nurses, physicians and community organizations. School nurses can participate in curriculum activities in order to develop a rapport with the students, addressing their needs and updating school records. Physicians can administer lung function tests or periodic peak flow monitoring to assess asthma severity or compliance. Finally, community organizations can supplement the curriculum with asthma education materials and "hands-on" activities.

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