Development and Evaluation of an Integrated Asthma Awareness Curriculum for the Elementary School Classroom

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ABSTRACT *Asthma is one of the most common causes of school absenteeism, and many children are affected by, or encounter, it in the school setting. An integrated curriculum that presents asthma as a real world example can raise all children's awareness and understanding of asthma, not just those with the condition. A 15-lesson, asthma-based curriculum was developed to integrate with and enhance the core subjects of math, science, and communication arts. A pilot test was performed in fourth- and fifth-grade classes to assess student asthma knowledge gain, teacher acceptance, and grade appropriateness of the curriculum. During the 2006–2007 school year, 15 teachers were recruited from the St. Louis, MO, USA area to assess the curriculum through teaching and administering pre- and post-unit tests and completing a teacher evaluation for each lesson taught. Four additional classrooms served as comparisons. Paired t tests were used for each lesson taught, to evaluate pre-/post-test and classroom differences, and focus groups were used for qualitative evaluation. There was an increase in asthma knowledge between pre- and post-tests in both grades, individually and combined ($p < 0.001$). Intervention post-test scores were higher than comparison classroom scores ($p < 0.001$). Teacher feedback indicated that the lessons enhanced previously learned skills and increased students' overall understanding of asthma. Offering asthma education in the classroom can provide an opportunity for all students to gain asthma knowledge and build health literacy about a leading chronic disease in school-aged children.*

KEYWORDS *Asthma, Integrated curriculum, Elementary school, Interdisciplinary curriculum*

INTRODUCTION

Asthma is one of the most common causes of school absenteeism among chronic diseases.^{1–3} Consequently, many children are likely to be affected by, or encounter, asthma in the school setting. The need to provide asthma self-management education to children with asthma is recognized. However, school administrators have indicated that removing children from the classroom or budgeting for after-school activities for this purpose is difficult, if not impossible. An alternative or additional approach is an integrated curriculum that presents asthma as a real-world example in order to raise all children's awareness and understanding of asthma, not just those with the condition. The approach avoids taking children with asthma out of the classroom or activities to provide

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asthma education. The approach avoids taking children with asthma out of the classroom or activities to provide asthma education. The Asthma 411 Initiative, the school component of the Controlling Asthma in American Cities/Controlling Asthma in St. Louis (CASL) Project, developed a pilot evaluation of this interdisciplinary curriculum. Titled “Explore. Define. Measure: An Integrated Curriculum for the Elementary Classroom,”⁴ it can be used by classroom teachers, can be offered to all students, and meets federal and state education standards. At the time of development, few asthma curricula meeting these criteria existed or had been evaluated.

METHODS

An integrated, or interdisciplinary, curriculum is often defined as one that “combines several school subjects into one active project since this is how children encounter subjects in the real world—combined in one activity.”⁵ *Explore. Define. Measure: An Integrated Curriculum for the Elementary Classroom*⁴ was designed to enhance the core content areas of mathematics, science, and communication arts, while improving knowledge and awareness of asthma. Lesson plans were aligned with federal and Missouri education standards and grade-level expectations (GLEs). Curriculum development involved the following steps: (1) the adoption and adaptation of existing materials, (2) a feasibility study, and (3) the development and evaluation of the curriculum unit. This project was approved by the Saint Louis University Institutional Review Board.

The feasibility study was conducted in 4 classrooms in 1 school district during the 2004–2005 school year and used materials adapted from a curriculum developed in Minnesota.⁶ A brief 5-question pre-/post-test was used to assess gains in students’ asthma knowledge, and focus group meetings with teachers evaluated the feasibility of developing a complete asthma curriculum. Teacher feedback indicated that the lesson plans reinforced core learning concepts, that aligning lessons to GLEs enhanced teachers’ ability to incorporate the lessons into standard curriculum planning, and that all students, not only those with asthma, benefited from the asthma information presented.

Based on this positive feedback, the project staff developed a full curriculum that enhanced the core content areas. The curriculum contained 15 lesson plans created or adapted from various existing sources^{6–10} and aligned with Missouri’s Show Me Standards,¹¹ as well as GLEs in communication arts, science, mathematics, and health, and were grouped into 9 major asthma concept areas (see Table 1). For instance, one group of lessons used students’ measurements of their peak flow readings to reinforce math concepts. Concepts, such as range, mode, median, as well as graphing and charting of individual and group level data, are applied to the peak flow meter readings. In another example, teachers reinforced math and science concepts when students measured out and mixed ingredients to make mucus and learn about its function in the lungs—specifically how mucus affects people with asthma. Elementary school teachers reviewed the curriculum, and project staff developed assessment methods in consultation with faculty and graduate students from the Saint Louis University education department. These included a unit assessment, individual lesson assessments, and scoring rubrics.

Curriculum evaluation occurred between January and May of 2007. Using a convenience sample (e.g., personal contacts, teacher referrals, school administrator designations), Asthma 411 staff recruited and trained 15 fourth- and fifth-grade teachers from 5 school districts to work with intervention classrooms. Four

TABLE 1 Mapping of major asthma concept areas with lesson plans

Concept area	Lesson plan
Defining asthma as a condition that causes difficulty with breathing	1, 2
Explaining that children with asthma can be active and healthy	1, 6
Explaining that asthma is not a contagious disease	1
Identifying signs and symptoms of an asthma episode	1, 2
Identifying common asthma triggers	3, 10
Identifying steps to assist a peer who is having difficulty with asthma	3, 5
Identifying components of the respiratory system	1, 7, 8
Understanding the role of mucus in asthma	9
Understanding the purpose and use of a peak flow meter	4, 11–15

additional fourth- and fifth-grade teachers from the same school districts were similarly recruited to work in comparison classrooms. None of the recruited teachers or classrooms had participated in the feasibility study.

Intervention classroom teachers were asked to teach 7 of the 15 lesson plans, including 3 specific lesson plans chosen by the investigators (1, 3, and 4). The remaining 4 lesson plans were self-selected by the teacher from the following groupings: plans 7 and 8; 2, 5, 6 and 9; 10; and 11–15. The lesson plans were grouped into 9 major asthma concept areas (see Table 1) to give teachers flexibility to integrate as much material as time allowed, yet still ensure basic information was covered. The 3 required lessons plus the self-selected lessons covered all 9-concept areas and provided the basis for an 18-question unit assessment test, which was based on these concept areas. Intervention teachers assessed students’ knowledge gain of these key concepts by administering the unit assessment before and after teaching all 7 lessons. Individual lesson assessments were also available and part of the curriculum unit, but were not tracked as part of this evaluation.

Intervention classroom teachers reported the pre-/post-unit assessment student scores; completed a teacher evaluation survey, which included open-ended and Likert-scale questions; provided copies of the assessment test performed; and participated in a post-unit evaluation focus group. Other than a requirement to perform the unit assessment test just before the first lesson and immediately after the last lesson, timing of the lessons was at the teacher’s discretion. During the focus group, the teachers were asked about curriculum content, format, and delivery to inform curriculum changes or improvements. Intervention classroom teachers received a \$100 debit card to purchase supplies to teach their self-selected lesson plans, or for other activities. All supplies for the three required lessons were provided. However, each lesson plan included a list of all supplies necessary and suggested sources for obtaining the less common supplies, such as peak flow meters. Comparison classroom teachers administered the unit assessment test once during the pilot testing period at a convenient time in their teaching schedules and received \$20 department store gift cards for their participation. Paired *t* tests were used to evaluate score differences between student pre- and post-tests and independent *t* tests between intervention and comparison classrooms.

RESULTS

Of the 15 recruited teachers, 10 (67%) completed the teaching requirements and turned in all evaluation materials. Five teachers were excluded from the analysis. Although they performed the lesson plans, they did not return all of the requested

materials or did not complete the data collection forms correctly. In the 10 intervention classrooms included (6 fourth grade and 4 fifth grade), 167 students completed the pre- and post-unit assessments. All of the 4 comparison classrooms returned student-completed ($n=69$) unit assessments. Intervention and comparison classroom demographics did not differ significantly ($p>0.05$). However, the comparison group had a higher percentage of African-American students and a slightly higher percentage of students who qualified for free or reduced lunch (Table 2).

Increases in asthma knowledge occurred between pre- and post-test mean scores among intervention classrooms (Table 3). In fourth- and fifth-grade classrooms, mean test scores increased 27% and 39%, respectively, from pre-test to post-test ($p<0.001$). When fourth- and 5th-grade scores were combined, a 33% increase was observed ($p<0.001$). Intervention classroom pre-test mean scores and comparison classroom test scores did not differ. Scores following the intervention post-test were overall 21% higher than comparison classroom test scores ($p<0.001$; Table 4).

Teachers indicated strong acceptance of the lesson plans. Based on 5-point Likert-scale responses, teachers agreed or strongly agreed that they would continue to incorporate the lessons into future teaching, the lessons were age appropriate and addressed specified grade-level expectations, and students were actively engaged in the lessons and increased their understanding of asthma (Table 5). In both the focus groups and the open-ended survey questions, teachers indicated that they appreciated and needed a cross-curricular unit on health, that the option and flexibility of which lessons to teach was helpful, and that the curriculum’s alignment with state GLEs was a deciding factor for choosing to teach the lessons or even for participating in the pilot study at all.

DISCUSSION

The evaluation had several limitations. To simulate regular classroom teaching more realistically and obtain teacher buy-in for participation, intervention classrooms did not have a prescribed time frame for completing the lessons. Despite the varied intervals of lesson completion and test administration, overall increases in asthma knowledge, as measured through the assessment tests, occurred in all intervention classrooms, thus decreasing the likelihood that students gained asthma knowledge through other normal classroom activities. The location of classrooms in different schools and the variation in timing of lesson plans and assessment tests reduced the potential for contamination from intervention to comparison classrooms.

All intervention teachers were required to teach 3 specific lesson plans, but they were able to choose the remaining 4 lesson plans from groups of similarly themed

TABLE 2 Intervention and comparison classroom student demographics

	Intervention classroom students (%) N=167	Comparison classroom students (%) N=69
African-American	115 (69)	56 (81)
Other races	52 (31)	13 (19)
Free or reduced lunch	130 (78)	59 (86)

TABLE 3 Curriculum pre- and post-test mean scores among intervention classrooms

Grade	Number	Pre-test mean (95% CI)	Post-test mean (95% CI)	Mean percent difference	<i>p</i> value ^a
4th grade	87	12.4 (11.7, 13.1)	15.7 (15.2, 16.3)	26.6	<0.001
5th grade	80	11.7 (10.7, 12.6)	16.3 (15.6, 16.9)	39.3	<0.001
Total	167	12.0 (11.5, 12.6)	16.0 (15.6, 16.9)	33.3	<0.001

Unit assessment test—score out of possible 20 points

^aPaired *t* test

lessons. Most teachers chose the same lesson plans so not all lesson plans were tested during the evaluation of the curriculum. The selection of specific lessons plans was not evaluated. However, the groups of lesson plans often covered the same type of theme. Lesson plans were grouped to allow teachers the flexibility to incorporate as much material as time would allow while still ensuring that the basic asthma information of the unit was covered.

Basing teacher and classroom inclusion on a sample of convenience rather than random selection may limit the generalizability of results. However, inclusion of a comparison group improves the rigor, interpretation, and relevance. If contamination between classrooms occurred or students gained asthma knowledge through other classroom activities, as discussed above, true differences between intervention and comparison groups would have been even greater.

Data were anonymous, so evaluating whether students with asthma showed differential increases in their asthma knowledge compared to students without asthma or by gender, race, and socioeconomic status was not possible. The curriculum’s intent was to increase asthma awareness, not asthma management skills. Although it may have also reinforced self-management information for children with asthma, this was not evaluated, and the curriculum is not a substitute for self-management education.

Of the 15 teachers initially recruited to participate in the pilot testing, all teachers completed the 3 required and additional 4 lesson plans. However, 5 teachers did not properly complete or return all the requested data collection instruments. Reasons included lack of time or misunderstanding the instructions. Although individual student demographics were not available, there were no demographic differences between the classrooms with complete data and those without.

Without the structure imposed by this study, the demands upon teachers and administrators to cover required material during the school year might be a barrier

TABLE 4 Comparison of post-test intervention group curriculum mean scores to comparison group mean scores

Grade	Comparison (<i>N</i> =69)	Intervention post-test (<i>N</i> =167)	Mean percent difference	<i>p</i> value ^a
	Mean (95% CI)	Mean (95% CI)		
4th grade	12.4 (11.1, 13.7)	15.7 (15.2, 16.3)	26.6	<0.001
5th grade	13.0 (11.7, 14.2)	16.3 (15.6, 16.9)	24.4	<0.001
Both grades	12.7 (11.8, 13.6)	16.0 (15.6, 16.4)	26.0	<0.001

Unit assessment test—score out of possible 20 points

^aIndependent *t* test

TABLE 5 Selected questions from teacher Likert-scale evaluation of curriculum lessons

Question	Mean (SD)—1 = strongly disagree to 5 = strongly agree	Percent agree or strongly agree
Lesson addressed specified GLE	4.6 (0.5)	97.2
Lessons were age appropriate	4.7 (0.5)	98.6
Students were actively engaged	4.6 (0.6)	94.5
All students increased their understanding of asthma	4.4 (0.8)	90.0
I will continue to incorporate this lesson into future teaching	4.2 (0.9)	80.5

to widespread dissemination of an optional curriculum. In addition, the cost of supplies, such as peak flow meters, may deter teachers from using related lesson plans. However, teacher feedback indicated that many of the supplies are common items that students can bring in from home. Teachers might also reduce costs by requesting donations from local health organizations, managed care plans, or hospitals. The most difficult item for teachers to obtain would be peak flow meters; potential sources are supplied within the lesson plans.

Overall, teachers indicated that the lessons' alignment with grade-level expectations was not only appreciated, but a deciding factor for participation. Feedback from teachers indicated that the lessons addressed Missouri GLEs for the core subjects while increasing students' understanding of asthma. The curriculum's cross-curricular nature and its capacity for modification gave teachers greater flexibility and utility for incorporating it into their classrooms. This flexibility might increase the likelihood of teacher advocacy for incorporating the curriculum into classrooms and schools. Because many state education standards are aligned with Federal standards, the unit could be used or adapted by schools in states other than Missouri.

CONCLUSION

Offering an interactive, integrated asthma awareness curriculum in the elementary classroom provides all students an opportunity to increase knowledge and develop health literacy about a leading chronic disease among school-aged children while enhancing core content areas. The development of this curriculum expands the availability of resources for teachers wanting to use an integrated approach to introduce real-world topics in their classrooms. Future work is needed to enhance potential for dissemination, including the development of integrated curricula that address other health topics. Next steps in the evaluation of the curriculum would be to assess knowledge gain in the non-asthma curriculum areas, to determine whether increased awareness and knowledge is associated with changes in attitudes or behaviors, and to check for the feasibility and acceptability of using the curriculum in diverse populations and non-urban schools. Limited quantities of this integrated curriculum are available on a CD from the St. Louis Regional Asthma Consortium.¹²

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DISCLAIMER

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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