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Asthma Knowledge and Asthma Management Behavior in Urban Elementary School Teachers

Lynne H. Unikel, Ph.D.,

Graduate Program in Psychology, La Salle University

David Evans, Ph.D.,

Pediatric Pulmonary Division, Columbia University College of Physicians & Surgeons and Joseph L. Mailman School of Public Health

Lea Bornstein, B.A.,

Child and Adolescent Psychiatry, NYU School of Medicine

Katherine Surrence, B.A., and

Department of Psychology, University of Wisconsin-Madison

Robert B. Mellins, M.D.

Pediatric Pulmonary Division, Columbia University College of Physicians & Surgeons

Abstract

BACKGROUND—While schools are an important setting for asthma care in youth, teachers' asthma knowledge and symptom management is poor. This study investigated the knowledge, prevention and management behaviors, and communication regarding asthma of teachers of low income ethnic minority students. It was hypothesized that relative to colleagues whose students did not have active asthma (i.e., did not have symptoms during the day), teachers of students with active asthma would have better asthma knowledge and that more would take asthma prevention steps and communicate with parents and school nurses.

METHODS—Drawing from 25 elementary schools in NYC, 320 Pre-Kindergarten through 5th grade classroom teachers with at least one student with asthma completed measures assessing their asthma knowledge, steps taken to manage asthma, communication with the school nurse or parents, information they received about asthma and whether or not they had at least one student in their class experience asthma symptoms. T-test and chi-square were used to test hypotheses.

RESULTS—Asthma knowledge varied among teachers. Most could identify potential triggers, yet few knew that medication taken prior to exercise could prevent symptoms and that students with asthma need not avoid exercise. Communication between teachers and school nurses and between teachers and parents was lacking. Relative to colleagues whose students did not have active asthma, teachers whose students had active asthma had better asthma knowledge; more took

Corresponding Author: Jean-Marie Bruzzese, Ph.D., Assistant Professor of Child and Adolescent Psychiatry, Child and Adolescent Psychiatry, NYU School of Medicine, 215 Lexington Avenue, 13th Floor, New York, N.Y.10016, Phone: (212) 263-3667, Fax: (212) 263-3690, Jean-Marie.Bruzzese@nyumc.org.

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steps to prevent students from having asthma symptoms, communicated with parents and initiated communication with the nurse.

CONCLUSIONS—Teacher knowledge about asthma and asthma management is limited, especially among those whose students did not have active asthma. Teachers respond reactively to students who have symptoms in class by increasing prevention steps and communications with parents and the school nurse. A more proactive approach to managing asthma in schools is warranted.

Keywords

asthma knowledge; management; health communication; teachers; school nurses

Asthma, a chronic inflammatory disorder of the airways, affects 6.8 million children in the United States (1). Children of lower socioeconomic status and ethnic minority backgrounds bear a disproportionate share of the burden of asthma (2-4), and despite an overall decrease in asthma morbidity, these disparities continue to increase (5).

Asthma has been shown to have an impact on the physical, psychological, and social functioning of youth (6). It also may have a negative impact on children's education. Children with asthma miss more days of school than asymptomatic children (7, 8), and uncontrolled asthma is associated with diminished school performance (9, 10). When children stay home from school, parents often miss work to care for them, and the combined costs of lost school days, lost parent productivity, and medical expenses for school-aged children with asthma in the U.S. have been estimated to be almost two billion dollars per year (11).

Schools are an important environment for asthma care. During the academic year, children spend about a third of their waking hours in school each weekday. Furthermore, schools are significant sources of exposure to asthma-triggering allergens (12, 13), and the rates of asthma diagnosis among students have been found to be associated with the presence of allergens in the school environment (14). Thus, children and school personnel, including teachers, school administrators, nurses and custodial/environmental staff face all the issues of asthma management that the family faces at home. To provide a seamless blanket of care for children with asthma, school personnel need to be educated about asthma, to take steps to prevent asthma exacerbations, and to communicate with parents, medical providers and each other to coordinate care for students with asthma during the school day (15).

Despite this, studies consistently show that teachers from U.S. rural areas (16) and other countries (17-19) have limited knowledge of asthma, with scores on both investigator-written and standardized measures ranging from a low of 46% to a high of 69% correct. They often inadvertently interfere with appropriate management of symptoms and guidelines for physical activity (20). Even more troubling, delayed response or hesitancy of school staff to provide medical assistance may have contributed to some deaths from asthma in schools (21).

Furthermore, communication between school personnel and parents is poor, which hampers efforts to manage asthma in schools. School nurses consider lack of communication with parents a major obstacle to managing students' asthma (22-24). Sometimes no one at school, including the school nurse, is aware that a given student is diagnosed with asthma (25, 26). Students often do not have asthma management plans on file at school (23, 27).

Although several studies have examined staff knowledge and management behaviors, few have focused on staff who serve low-income, urban, ethnic minority students (26, 28), the population that is most vulnerable to asthma and most in need of comprehensive asthma management in schools. The goal of this preliminary study is two-fold: (1) to add to the existing literature on elementary school teachers' (a) knowledge about asthma, (b) strategies to prevent the occurrence of symptoms, and (c) strategies to manage symptoms when they occur at school in this understudied population; and (2) to explore whether there are differences in asthma knowledge, prevention behaviors, and communication with the school nurse and with parents among teachers who report having students who experience asthma symptoms in school (i.e., have active asthma) compared to teachers whose students do not have active asthma. We hypothesized that relative to colleagues whose students did not exhibit asthma symptoms during the school day, elementary school teachers whose students did exhibit symptoms (a) would have greater asthma knowledge, (b) would be more likely to take steps to prevent asthma symptoms in their students and (c) would be more likely to communicate with parents and school nurses.

METHODS

Participants

Participants were 320 Pre-Kindergarten through 5th grade classroom teachers who had at least one student with asthma in their class. An additional 51 classroom teachers completed the survey, but were excluded from analyses because they indicated that they had no students diagnosed with asthma in their classroom. Teachers taught in 25 elementary schools located within the five boroughs of New York City. In each school more than half of the students received free lunch and more than two-thirds were ethnic minorities. Each school had a full-time nurse who was employed by the New York City Department of Health and Mental Hygiene (NYC DOHMH). All schools offered *Open Airways for Schools* (OAS) (29), an education intervention for 3rd to 5th grade students with asthma.

Data for this study were obtained from baseline measures of a larger, randomized control trial (RCT) testing the efficacy of a comprehensive school-based asthma program in which school nurses were trained to facilitate the establishment of a preventive network of care for children with asthma by coordinating communications and fostering relationships between families, primary care practitioners (PCPs), and school personnel (30). The RCT enrolled students with asthma and their parents through an informed consent process. School principals and staff were not enrolled in the study as participants; rather, they agreed to adopt the proposed intervention activities for the duration of the trial and to engage in program evaluation activities, including the surveys completed by the teachers. Teachers were informed of the study and asked to complete surveys via letters placed in their mailboxes which were signed by the principal investigator. Baseline surveys were included

with the letters and were redistributed once to increase response rates. Teachers were not compensated for completing surveys. The study was approved by the Institutional Review Boards of Columbia University College of Physicians and Surgeons, the NYC Department of Education (DOE), the NYC DOHMH, the Medical and Health Research Association of NYC, Inc. (MHRA), and the New England Research Institute (NERI).

Measures

Students' with Asthma—Teachers specified the number of students who had asthma in their classroom and indicated whether students exhibited symptoms during the school day (i.e., had active symptoms; yes/no). The number of students with active symptoms was not reported by teachers.

Asthma Knowledge—Teachers completed self-administered surveys with 21 investigator written questions assessing asthma knowledge; the scale demonstrated good internal consistency (Cronbach's $\alpha = .75$). Nine questions assessed knowledge about asthma symptoms and warning signs, ways to prevent symptoms, and triggers; response options were True/False/Not Sure. Sample items included "Children with asthma should avoid strenuous exercise" (false) and "Having a 'tight' feeling in the chest is a symptom of asthma" (true). Additionally, using a list of 12 potential asthma triggers, teachers checked the items they thought were triggers. Sample items of correct triggers included cockroaches, laughing, and changes in weather; incorrect triggers included overeating and cuts or injuries. A total percent correct score was computed (potential range = 0 to 100%).

Asthma Prevention Steps—Teachers indicated (yes/no) if they took steps to prevent their students from developing asthma symptoms, and if yes, what they did. The steps taken were coded into one of the following seven categories: (1) trigger avoidance (e.g., reduce chalk dust; reduce pets from the classroom); (2) activity limitation (e.g., encourage moderate play; limit amount of time in the cold); (3) relaxation exercises (e.g., allow students to rest; child was permitted to get a drink of water); (4) education for students (e.g., advised on maintaining a clean home; informed them about breathing exercises); (5) monitor children (e.g., watched children carefully for signs of an attack; checked the children to see how they felt); (6) coordinate medical care (e.g., have inhalers on hand for trips); and (7) unscorable (e.g., yard/hot weather; access to air). Limited detail in some teachers' responses precluded scoring the potential effectiveness of the preventive steps.

Asthma Management—Teachers who indicated that they had students in their classroom who exhibited symptoms during the school day (i.e., had active symptoms; yes/no) also reported what they did when this occurred. Responses were categorized into one of 8 possible management steps: (1) contacting the nurse for medication (e.g., sent to nurse for pump); (2) contacting the nurse, reason not specified; (3) helped or reminded student to take medication (e.g., I gave them their inhaler); (4) permitted use of medication in class (e.g., child knew how to use his inhaler; he would go to the bathroom to use his inhaler); (5) assist student to relax (e.g., help calm down; reassured him); (6) relaxation, not specified if assisted student (e.g., they could also stay in the room and relax); (7) notify parents; (8) unscorable (e.g., I was not in school at the time). As with prevention steps, determining the

potential effectiveness of management steps was not possible due to limited detail provided by some teachers.

Asthma Communication—Four questions evaluated communication about students' asthma between teachers, the school nurse, and parents. Teachers indicated (yes/no) whether they initiated communication with the school nurse, whether the nurse initiated communication with them, whether they spoke to the parents/guardians of their students, and whether they received information about asthma from the school nurse or other sources.

For the three questions regarding communication with the nurse and parents, if teachers indicated there was communication with the nurse or parents, they also provided information on the nature of the conversation. Responses regarding teacher initiated communication with the nurse were coded into one of 10 categories. Five categories involved the teacher requesting information about (1) medication (e.g., we needed to discuss medication and its application in school); (2) asthma management (e.g., what to do if they have an attack – what she has to help them); (3) student activity limitations at school (e.g., discussed what activities the children could partake in); (4) asthma symptoms (e.g., signs of asthma); and (5) about other topics (e.g., what to tell the parent). The remaining categories were (6) informing the nurse about asthma cases, (7) informing the nurse about the occurrence of symptoms and other asthma-related morbidities, (8) passing medical information or paperwork to the nurse from the parent, (9) school absences due to asthma, and (10) the asthma education program *Open Airways*.

Communication initiated by the school nurse was coded into one of 10 categories. Six categories involved the nurse providing information about (1) medication (e.g., she explained the use of an asthma pump), (2) symptoms (e.g., she made me aware of...signs of asthma), (3) case identification, (4) activity limitation (e.g., during cold days and weather changing periods some asthmatic children should stay inside), (5) asthma management (e.g., I was told what to do in an emergency situation), and (6) other (e.g., the nurse told me of the student's past history); four additional categories were: (7) medical paperwork, (8) asthma education program offered by nurse (i.e. *Open Airways*), (9) requests to communicate with parents (e.g., she asked me to give information to the parent of the child in my class); and (10) school absences due to asthma.

Responses regarding communication with parents were coded into one of 10 categories: (1) medication (e.g., I asked about the use of the asthma pump the child brought to school); (2) asthma management (e.g., how to handle an episode should it occur); (3) symptoms (e.g., I asked her to describe the symptoms and severity of the asthma); (4) triggers (e.g., I asked if they knew what triggered their child's attacks); (5) student absences due to asthma; (6) activity limitations (e.g., The mom told me... if he needed to sit out in dance, let him); (7) case identification; (8) medical paperwork, (9) other (e.g., anything needed to know, how the child was doing, etc); and (10) unscorable (e.g., parent told me about her concerns).

Coding of Open-Ended Questions—Research assistants, with input from the first author, developed the response categories for each of the five open-ended questions regarding prevention steps taken, management steps taken, teacher initiated communication

with the nurse, nurse initiated communication with the teacher and teacher-parent communication. A pediatric pulmonologist reviewed and confirmed the appropriateness of each response category as well as sample items for each category. Responses to each question were coded by two independent raters. Kappa values indicated good initial agreement among raters (range = .74 to .98). All discrepancies were reviewed and resolved by the raters and two other researchers with input from the pediatric pulmonologist.

Data Analysis—Descriptive statistics were calculated to provide an overview of the teachers' knowledge, the prevention and management steps they took, and their communication with school nurses and parents. To test the hypotheses, teachers with a student with active asthma (i.e., student experienced symptoms in school) were compared to teachers without a student with active asthma (the independent variable). A two sample Student t-test was computed with knowledge as the dependent variable; chi-square analyses were computed for the following categorical dependent variables: teacher took prevention steps (yes/no); teacher communicated with parents (yes/no); teacher initiated communication with the nurse (yes/no); the nurse initiated communication with the teacher (yes/no); and the teacher received information about asthma (yes/no).

RESULTS

Descriptive Statistics

Students with Asthma—The number of students with asthma per classroom ranged from one to 26, with an average of 3.1 (SD = 2.7). The vast majority of teachers (85.6%; 274/320) had up to five students with asthma, 7.8% (25/320) had 6 to 10 students with asthma, and 1.6% (5/320) had 11 or more students. Five percent (16/320) did not know the exact number of students with asthma in their classrooms; they either provided a range (e.g., “1 or 2”; n=11) or wrote in answers such as “few” or “a lot” (n=5). Slightly less than half (42.9%; 137/319) of the teachers had students with active asthma.

Asthma Knowledge—Knowledge scores spanned the full range of potential scores; the average total correct score was 68.9% (SD = 16.7). Table 1 presents the percent of teachers answering each knowledge question correctly. When considering the list of triggers, the majority of teachers correctly identified potential triggers, with the exception of cockroaches and laughing where only 49.2% (157/319) and 32.9% (105/319) of teachers correctly identified these as triggers, respectively. Among teachers who correctly identified exercise as a trigger, only 26% (55/222) knew students with asthma should not avoid exercise and only 36% (79/222) knew medication should be taken prior to exercise to prevent symptoms.

Prevention Steps—Nearly half of the teachers (49.0%; 154/314) reported taking steps to prevent asthma symptoms in their students. Among those who reported taking prevention steps, the average number of steps taken was 1.6 (SD = 0.9). The range was 1 to 6, with most teachers (59.7%; 92/154) reporting taking one step and few taking three or more steps (13.0%; 20/154). Table 2 provides a breakdown of the percentage of teachers reporting taking each type of prevention step. Most teachers (54.5%; 84/154) took steps related to

trigger avoidance, and few took steps to coordinate medical care (5.2%; 8/154) or to monitor the children (7.1%; 11/154).

Management Steps—Teachers with a student with active asthma reported taking between one and five steps to manage their students' symptoms, with most taking only one step (72%; 96/133; mean = 1.4; SD = 0.7). The percentage taking each of the eight management steps is detailed in Table 2. Most reported contacting or sending the child with symptoms to the school nurse (65.4%; 87/133), with only 8.1% (7/87) of these teachers specifying the student was sent to the nurse for medication. An additional 16.5% (22/133) of the teachers reported that symptoms were managed with medication; these teachers either actively reminded or encouraged students to use their medication (50%; 11/22) or passively allowed medication use in class when necessary (50%; 11/22). Few reported relaxation as a management step (21.8%; 29/133) with 8.3% (11/29) indicating they helped calm or comforted students. Only 18% (24/33) notified parents when students had symptoms in school.

Communication—Almost half the teachers (46.7%; 148/317) reported initiating communication with the school nurse regarding asthma; of these 95.3% (141/148) described the nature of the communication. Although teachers reported discussing between one and three topics, the vast majority (81.6% 115/141) initiated discussion on only one topic (mean = 1.2; SD = 0.4). Table 3 presents the percentage of teachers initiating communication with the nurse for each topic. Teachers initiated contact with the nurse in order to inform the nurse about the health of their students (35.5%; 50/141), including identification of asthma cases (54.0%; 27/50), the occurrence of active asthma symptoms or other asthma-related morbidities (40.0%; 20/50), or both (6.0%; 3/50). A slightly larger, but still relatively small, percentage (39.0%; 55/141), approached the nurse to request information about asthma, with the majority (78.2%; 43/55) asking for information on only one topic. Just over half of these requests were in regard to asthma medication (50.9% 28/55). Teachers also requested information on symptom management (27.3% 15/55), activity limitations (21.8% 12/55) and asthma symptoms (16.4% 9/55).

With respect to nurse initiated communication with the teachers, only a third of the teachers (38.6%; 122/316) indicated the nurse initiated communication; of those who provided details on the nature of the discussion, the vast majority, 94.8% (110/116) reported only one topic being discussed. Table 3 details the type of communication. Just under half of the nurse-initiated discussions (43.1%; 50/116) involved the nurse informing teachers about asthma topics, including medication (24.0%; 12/50), symptoms (20.0%; 10/50), case identification (18.0%; 9/50), activity limitation (12.0%; 6/50), and management practices (10.0%; 5/50). The remainder of nurse-initiated communication was largely administrative. For example, nurses alerted teachers that students would be participating in *Open Airways* (27.6%; 32/116) and discussed medical paperwork (6%; 7/116).

Most teachers (60.2%; 192/319) reported communicating with their students' parents or guardians. Eighty-eight percent (169/192) described these conversations. While not specifically asked, teacher responses indicated that discussions were initiated by both parents and by teachers. Typically only one topic was discussed with parents (75.7%;

128/169; mean = 1.3; SD = .56; range 1 to 4). As detailed in Table 3, medication was the most frequently reported topic of conversation with parents (27.8% 47/169), followed by symptom management (20.1%; 34/169). Parents and teachers also focused on asthma symptoms (17.2%; 29/169). Few spoke to parents about medical paperwork (4.1%; 7/169).

Nearly half of the teachers indicated they received asthma information from the nurse (41.4%; 127/307). In contrast, few reported receiving asthma information from sources other than the nurse (29.8%; 93/312).

Hypothesis Testing: Differences among Teachers with and without Students who Experience Asthma Symptoms at School

Asthma Knowledge—Teachers who reported having a student with active symptoms had significantly higher asthma knowledge scores than their colleagues whose students did not have active symptoms ($t_{(317)} = 2.15, p < .05$; 71.4% correct versus 67.5%, respectively).

Prevention Steps and Communication—Chi-square tests revealed significant differences between teachers who reported students had active asthma symptoms and those who reported inactive asthma on prevention steps ($\chi^2_{(1)} = 18.34, p < .001$), communication with parents ($\chi^2_{(1)} = 20.39, p < .001$) and initiation of communication with the school nurse ($\chi^2_{(1)} = 15.85, p < .001$). Among those who reported active asthma symptoms in students, 65% took steps to prevent asthma symptoms, 75% communicated with parents, and 60% initiated communication with the nurse, where as only 41%, 50%, and 37% of teachers who students did not have active symptoms took these steps, respectively. There were no differences on communication initiated by the nurse or receiving information about asthma from the nurse or from other sources.

DISCUSSION

This preliminary study sought to assess knowledge and management behaviors among teachers in a large, urban school district, using sites that predominantly serve low-income, ethnic minorities. Teacher knowledge, while equal to or higher than knowledge levels reported in previous studies (16-19, 31, 32), was still somewhat limited in some areas. The vast majority knew that dust, airborne irritants, changes in weather, animals with fur, colds and the flu, and mold were asthma triggers, and recognized that wheeze and shortness of breath were symptoms of asthma. However, only half of the teachers correctly identified three other important signs and symptoms of asthma that may occur independently of wheeze: tight chest, persistent cough without wheeze and hunched shoulders. It is recommended that teachers be taught about these signs and symptoms as way of realizing early on a student may be in need of medical assistance. Furthermore, consistent with prior research (18, 33), teachers did not understand the relationship between exercise and medication. Among those who knew exercise triggered asthma, few knew that medication taken prior to exercise prevents symptoms and under these circumstances students with asthma need not avoid exercise. To facilitate student participation in physical activities in a safe manner while at school, it is recommended that teachers be educated about the relationship between exercise and asthma.

This research also examined steps teachers take to prevent asthma symptoms in their students. Among the steps teachers reported taking to prevent asthma, trigger avoidance was the most common followed by activity limitation. Helping teachers identify and eliminate allergens that may trigger asthma (e.g., removing rugs and furry pets from classrooms and limiting exposure to chalk dust) may assist in minimizing students' exposure to allergens throughout the school environment (12, 13).

Less than half the teachers with a student with asthma obtained information about asthma from the nurse or communicated in other ways with the school nurse or with parents. Communication was worse between teachers and the school nurse than between teachers and parents. Interestingly, when nurses and teachers did communicate, regardless of who initiated the communication, the topics of their conversations were similar.

Another goal of the study was to examine differences in knowledge and asthma prevention behaviors among teachers who had a student with active asthma and those who did not. Teachers who had a student with active asthma were more likely to become involved in the asthma management of their students than colleagues who did not have a student exhibit asthma symptoms. Specifically, they were more likely to take prevention steps, communicate with parents, and initiate communication with the school nurse. They also had higher knowledge scores.

These results suggest that teachers may cope with asthma reactively, waiting until students exhibit symptoms before learning how to assist them. School and district policies may be partially responsible for this reactive behavior. Snow et al assessed the asthma management policies of NYC schools, the school district used in this study, and found that 51% of their participants (administrators, teachers, counselors, and school nurses) learned that a student had asthma through informal conversations with the student or parent (26). Only 10% learned of a student's having asthma through district protocols. They concluded that limited knowledge of the asthma status of students may create a barrier to effectively managing asthma in schools. Additionally, for a variety of reasons, including limited knowledge of district policies or school-based health resources, range of symptom severity, or the episodic nature of asthma, families in the current study may not have reported students' asthma to the nurse and/or teacher or may not have sought school-based support. Also, while some teachers may have learned about a student having asthma because the student participated in OAS, this would have been limited to only 3rd to 5th graders. Thus, in the current study, despite potential opportunities to learn about a student's asthma status, it is plausible that teachers became aware of students' asthma status once students experienced symptoms in class. This may then lead to a reactive rather than a preventive style of asthma management aimed at all students with asthma.

School policy and administrators need to support teachers in proactively learning the asthma status of their students and working to prevent asthma; a communication network is essential to helping teachers accomplish this. Specifically, teachers need to be encouraged to observe students in order to determine if they are experiencing asthma symptoms while at school, to become astute at identifying students' early warning signs, to communicate with the nurse to learn how to assist students with asthma, and to learn about effective asthma prevention and

management steps, including the importance of medication plans. Home-school partnerships, including communication between the two, enhance school success and promote shared values between settings, creating a seamless environment for children (34). Such communication may also help teachers learn who has asthma and how to best help these students, ensuring children with asthma receive optimal care while at school. Additionally, such communication may benefit asthma management at home by allowing the parents to learn if the child experienced symptoms or needed medication while at school. As such, a continuous system of asthma care is created which enhances the likelihood that the same prevention and management strategies are implemented at home and school.

While teachers have many responsibilities and thus have limited time for non-academic tasks, interventions lasting only a few hours have greatly improved teacher knowledge (31, 32). Educating teachers about asthma may assist them to take prevention steps and may give them the confidence to react appropriately when symptoms occur. Elementary school teachers may feel protective of and responsible for their young students, which in turn may motivate them to want information about asthma and ways they can assist their students with active asthma. If they are educated about simple things they can incorporate into their classroom routines to assist their students, such as not spraying air fresheners or avoiding furry animals, they may comply.

This study was limited by the fact that teachers' qualitative responses were too vague for more in-depth analyses. When considering the correctness of prevention and management steps, it was difficult to assess whether or not they were appropriate because teachers often did not write in full sentences. For example, they may have written "limit physical activity," which is generally not an acceptable means of preventing asthma, but might be appropriate if the student was symptomatic. Future studies would benefit by assessing the efficacy of teachers' prevention and management efforts.

Another limitation was the definition of active asthma. Having a student with active asthma was defined by teacher report of having a student exhibit symptoms during the school day. This requires teachers to be knowledgeable about asthma symptoms and to attend to the child. Teachers may have erroneously indicated they had a student with active asthma because they thought something was an asthma symptom when it was not (e.g., a runny nose or congestion). Conversely, others may have indicated they did not have students with active asthma because they were not attending to the children in a way that would allow them to see the symptoms. Also, while teachers reported the number of students with asthma in their classroom, they were not asked to specify how many of those students had active asthma. Therefore, the association of teachers' prevention efforts and communication behaviors to the number of students with active asthma could not be determined. Moreover, teachers were not asked if they had students with active asthma in prior school years. It is plausible that teachers currently without a student with active asthma had students with active asthma in prior school years, and they learned appropriate prevention steps then. Future studies should use more objective measures of active asthma and should consider if teachers ever had students with active asthma in their classrooms as well as the number of students with active asthma.

Despite its limitations, this preliminary study was an important first step to begin understanding the knowledge and asthma management behaviors of classroom teachers serving low income, ethnic minority students, and to determine if there are differences among classroom teachers with and without students with active asthma. It is recommended that future research examine the knowledge and communication patterns of cluster teachers who, unlike classroom teachers, do not teach the same group of students throughout the day every day. As such, their response to asthma may be different than classroom teachers, and would be interesting in its own right as a topic for further study. Additionally, teacher's willingness to implement asthma management steps should also be considered, with careful attention to potential differences in schools with a school nurse or school-based clinic versus schools without such healthcare resources.

In summary, this study supports prior research concluding that teacher knowledge of asthma is limited and that communication between teachers and nurses and between teachers and parents is often lacking. It also found that teachers who have students with active asthma are more knowledgeable about asthma and do more to assist students in their class than teachers who do not have a student with active asthma. Nevertheless, their knowledge and skills are insufficient and additional education for teachers regarding asthma and ways to prevent symptoms in students is needed, as is increased communication regarding asthma between teachers and families and teachers and school nurses. A proactive, rather than a reactive, approach by teachers is essential to help them overcome the challenges of managing asthma in schools and to ensure students receive optimal asthma care while at school.

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Table 1

Percentage of Teachers (N=319) Correctly Answering Each Asthma Knowledge Question

True – False Questions	% (n)
Wheezing and shortness of breath are symptoms of asthma (true)	93.8 (300)
Tobacco smoke can bring on asthma symptoms (true)	88.8 (284)
Keeping classroom free of dust does not help asthma (false)	76.9 (246)
Having a tight feeling in chest is a symptom of asthma (true)	72.5 (232)
Cold dry weather increases the risk of having asthma symptoms (true)	53.4 (171)
Raised or hunched shoulders can be a sign that a child with asthma is having difficulty breathing (true)	52.2 (167)
Persistent cough without wheeze is not a symptom (false)	40.0 (128)
Children with asthma should avoid strenuous exercise (false)	33.8 (108)
Asthma medicine taken 10-15 before recess or gym may enable a child with asthma to exercise without wheeze or cough (true)	31.9 (102)
Trigger Questions (yes/no)	% (n)
Dust (yes)	93.1 (297)
Airborne irritants (yes)	92.5 (295)
Changes in weather (yes)	91.5 (292)
Animals with fur (yes)	89.0 (284)
Colds or the flu (yes)	87.8 (280)
Cuts or injuries (no)	86.8 (277)
Mold (yes)	80.9 (258)
Exercise (yes)	69.9 (222)
Not exercising (no)	67.4 (215)
Overeating (no)	66.7 (213)
Cockroaches (yes)	49.2 (157)
Laughing (yes)	32.9 (105)

Table 2

Percentage of Teachers Taking Each Prevention and Management Step

Type of Prevention Step (N=154)	% (n)
Trigger avoidance	54.5 (84)
Activity limitation	25.3 (39)
Relaxation exercises	14.9 (23)
Educate students	7.8 (12)
Monitor children	7.1 (11)
Coordinating medical care	5.2 (8)
Unscorable	14.9 (23)
Type of Management Step (N=133)	% (n)
Contact nurse for medication	5.3 (7)
Contact nurse – reason not specified	60.2 (80)
Medication – helped or reminded student to take	8.3 (11)
Medication – permitted use in class	8.3 (11)
Relaxation – assist student relax	8.3 (11)
Relaxation – not specified if assisted	13.5 (18)
Notify parents	18.0 (24)
Unscorable	15.7 (21)

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Table 3

Percentage of Teachers or Nurses Initiating Communication by Topic

Teacher Initiated Communication with the Nurse (N=141)	% (n)
Informed the nurse – case identification	21.3 (30)
Informed the nurse – occurrence of symptoms or other asthma-related morbidities	16.3 (23)
Request information – medication	19.9 (28)
Request information – asthma management	10.6 (15)
Request information – activity limitations	8.5 (12)
Request information – symptoms	6.4 (9)
Request information – other	2.1 (3)
Passing medical information or paperwork from parent	8.5 (12)
School absences	5.0 (7)
Asthma education program offered by nurse (i.e., <i>Open Airways</i>)	5.7 (8)
Nurse Initiated Communication with the Teacher (N=116)	% (n)
Provide information – medication	10.3 (12)
Provide information – symptoms	8.6 (10)
Provide information – case identification	7.8 (9)
Provide information – activity limitation	5.2 (6)
Provide information – asthma management	4.3 (5)
Provide information – other	10.3 (12)
Medical paperwork	6.0 (7)
Asthma education program offered by nurse (i.e., <i>Open Airways</i>)	27.6 (32)
Request to communicate with parents	3.4 (4)
School absences	1.7 (2)
Teacher Communication with Parents (N=169)	% (n)
Medication	27.8 (47)
Asthma management	20.1 (34)
Symptoms	17.2 (29)
Triggers	10.1 (17)
Student absences	10.1 (17)
Activity limitations	9.5 (26)
Case identification	7.7 (13)
Medical paperwork	4.1 (7)
Other	7.1 (12)
Unscorable	14.2 (24)