

The Journal of School Nursing

<http://jsn.sagepub.com/>

School Asthma Screening and Case Management: Attendance and Learning Outcomes

Michelle L. Moricca, Merry A. Grasska, Marcia BMarthaler, Tricia Morphew, Penny C. Weismuller and Stanley P. Galant

The Journal of School Nursing published online 13 July 2012

DOI: 10.1177/1059840512452668

The online version of this article can be found at:

<http://jsn.sagepub.com/content/early/2012/07/13/1059840512452668>

Published by:



<http://www.sagepublications.com>

On behalf of:



National Association of School Nurses

National Association of School Nurses

Additional services and information for *The Journal of School Nursing* can be found at:

Email Alerts: <http://jsn.sagepub.com/cgi/alerts>

Subscriptions: <http://jsn.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

>> [OnlineFirst Version of Record](#) - Jul 13, 2012

[What is This?](#)

School Asthma Screening and Case Management: Attendance and Learning Outcomes

The Journal of School Nursing
00(0) 1-9
© The Author(s) 2012
Reprints and permission:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/1059840512452668
<http://jsn.sagepub.com>



**Michelle L. Moricca, BSN, RN¹,
Merry A. Grasska, MPH, RN, NP-C¹,
Marcia BMarthaler, BSN, RN¹, Tricia Morphew, MSc²,
Penny C. Weismuller, DrPH, RN³, and Stanley P. Galant, MD⁴**

Abstract

Asthma is related to school absenteeism and underperformance in elementary students. This pilot study assessed whether school nurse case management (CM) in children identified with asthma impacts academic performance and school absenteeism in one school. A validated questionnaire was used to identify children at risk for asthma and CM was provided to link these students to medical care and assure asthma action plans at school. In the 40 children with confirmed diagnosis who received CM, academic performance on standardized testing postintervention was similar to the 76 children who were low risk for asthma. Average days absent due to illness in the CM group were reduced from 5.8 to 3.7 days in the postintervention school year. School nurse screening, CM, and collaboration with a medical provider resulted in early identification, referral, and subsequent treatment of students at risk for asthma and may have contributed to reduced illness absences.

Keywords

asthma, academic achievement/attendance, screening/risk identification, case management, quantitative research, elementary

Introduction

Asthma is a common chronic disease that affects 7.0 million children in the United States (Bloom, Cohen, & Freeman, 2010). It is one of the leading causes of emergency room visits, hospitalizations, school absenteeism, and school underperformance. When students stay home because of asthma symptoms, they miss instructional school time putting them at risk for academic problems as well as health complications. Children spend 7 to 10 hr a day in school; therefore, a school-based intervention could be beneficial to the children and families it serves. An integrated approach including school and community resources is effective in addressing the health status of children with asthma and these children's attendance and participation at school (Centers for Disease Control and Prevention [CDC], 2006; Erickson, Splett, Mullett, Jensen, & Belseth, 2006; Levy, Heffner, Stewart, & Beeman, 2006; Taras, Wright, Brennan, Campana, & Lofgren, 2004; Wilson, Moonie, Sterling, Gillespie, & Kura, 2009). The school nurse is frequently the first source of health care for children at school. As such, the school nurse is in a unique position not only to help identify students that may be at risk for asthma but also to link these students to medical care.

Although primary asthma case identification is best done by a pediatric asthma/allergy specialist, not all children have

convenient access to a doctor. School-based screenings can increase access to medical care, specifically for asthma when the school nurse is knowledgeable and available and medical care is accessible (Yawn, Wollan, Scanlon, & Kurland, 2003). The school nurse can serve as a valued team member providing asthma case identification as is done with other common screenings at school such as screening for vision, hearing, scoliosis, or oral health status (Council on School Health, 2008).

Previous studies have shown that identifying a health problem is not enough and follow-up by a patient is less likely if assistance is not offered to connect the patient to a qualified health care provider (Gerald et al., 2007). The purpose of this pilot study was to determine whether school

¹ Newport-Mesa Unified School District, Costa Mesa, CA, USA

² Asthma and Allergy Foundation of America, California Chapter, Los Angeles, CA, USA

³ California State University, Fullerton, CA, USA

⁴ Children's Hospital of Orange County (CHOC), Orange, CA, USA

Corresponding Author:

Michelle L. Moricca, Newport-Mesa Unified School District, 2469 N Northumberland Rd, Orange, CA 92865, USA
Email: mmoricca@nmsud.us

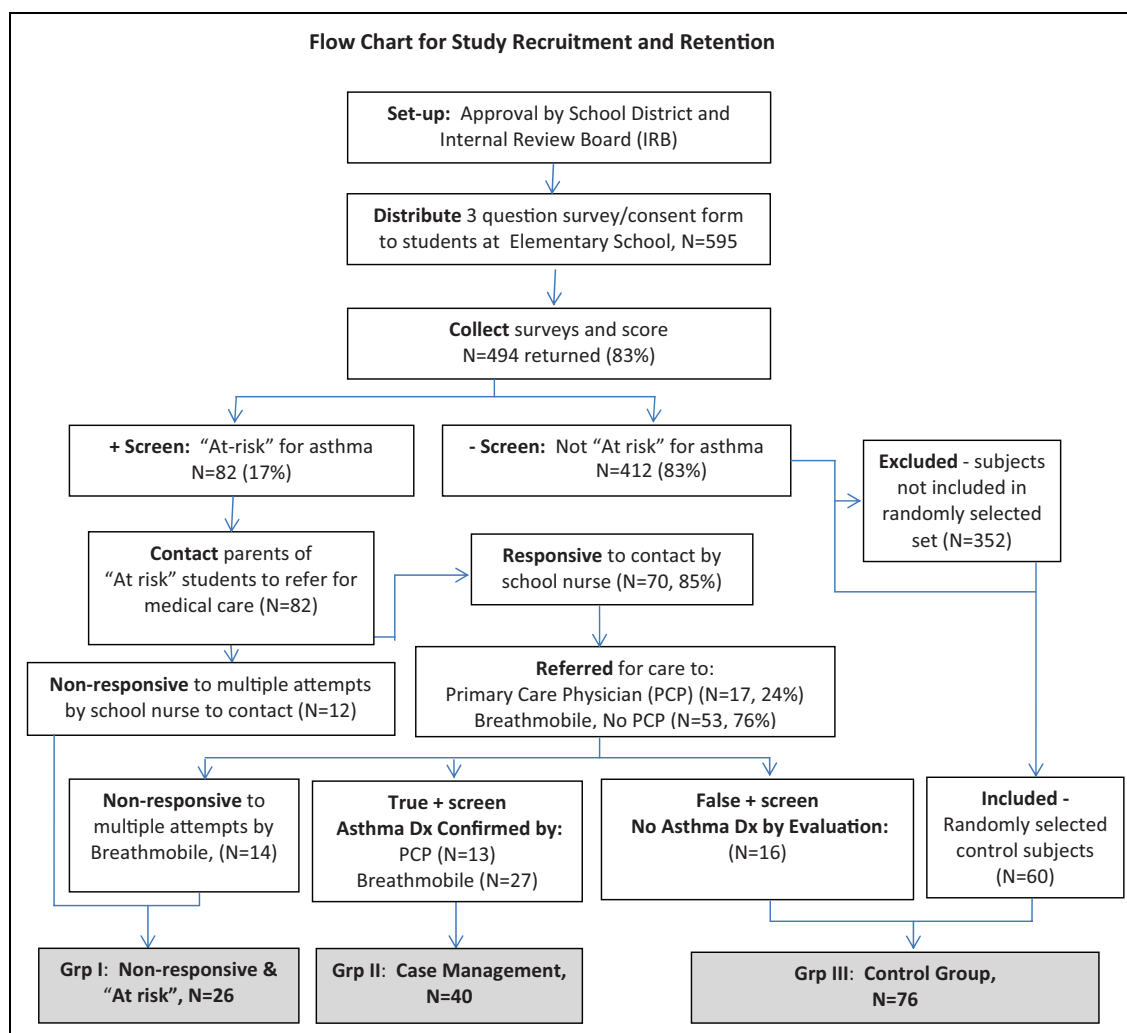


Figure 1. Study diagram showing flow from setup through group delineation.

nurse case management (CM) in children identified with asthma impacts academic performance and school absenteeism. Specifically we wanted to know whether children identified with asthma, when case managed by the school nurse and referred to asthma care, were able to perform at least as well as children without asthma in the study school. Asthma care providers in this study were the Breathmobile[®], an asthma disease management program, or the children's private health providers.

Method

Once the project was approved by the school district and the collaborating hospital's Institutional Review Board, the school nurse met with the school principal to outline the project. She then teamed with the Breathmobile physician and nurse to provide asthma education to the school principal and teachers. The school nurse and the Breathmobile team provided a short "lunch and learn" for 21 teachers. The school nurse discussed the impact of asthma on student

health and academic performance and explained the details of the research project. The teacher's role in the study was to distribute and collect back the questionnaires from the students. Figure 1 displays the flow chart for recruitment and retention used for this pre- and postintervention study, using a convenience sample of students from an elementary school located in a low socioeconomic neighborhood.

Study Population

The student population consisted of 595, second through sixth grade students, age 7–12 years. The school was comprised of 96.6% Hispanic students, of whom 77% were English learners. One hundred percent of the student population was eligible to receive the free or reduced lunch program.

Survey Instrument and Data Collection

The Asthma Case Identification Survey (Figure 2), abbreviated version, was distributed by teachers to parents of second to sixth grade students attending an elementary school in

Asthma Case Identification Survey

1. In the past two years, has your child had *repeated* episodes of asthma? ☐ Yes ☐ No
2. Does your child have episodes of cough, chest tightness, trouble breathing, or wheezing when they **play** or **exercise**? (Select the **one** best answer)

Never ☐	Rarely ☐	Sometimes ☐	Often ☐	Most of the time ☐
--	---	--	--	---
3. In the past 4 weeks, how often has your child had episodes of cough, chest tightness, trouble breathing or wheezing in the **morning** or **during the daytime**?

Never ☐	Less than 2 days a week ☐	2 or more days a week but not every day ☐	Everyday ☐	More than once a day on most days ☐
--	--	--	---	--

Scoring

A positive answer to question 1 **and/or** positive answers to **both question 2 and 3** indicates an “at-risk” status for having asthma.

A positive answer to question 1 is yes.

Positive answers to **both question 2 and 3** indicates “at-risk” status for having asthma.

A positive answer for question 2 was sometimes, often, or most of the time.

A positive answer for question 3 was two or more days, everyday and more than once a day.

Figure 2. Asthma Case Identification Survey and Scoring

Orange County, California, in September 2008. The abbreviated tool consists of three questions and has a sensitivity of 0.70 and a specificity of 0.84 (Berg, Morphew, Tichacek, Chowdhury, & Galant, 2009). The tool also has greater than 80% predictability in detecting children at risk for persistent asthma; it can be used in a large setting such as a school (Galant, Crawford, Morphew, Jones, & Bassin, 2004). Children were identified as at risk for asthma when their parent answered their child had repeated episodes of asthma in the past year or their child experienced exercise/play limitations *and* had persistent day symptoms in the past 4 weeks due to asthma-related symptoms (cough, chest tightness, trouble breathing, or wheezing).

Questionnaires, with an explanatory letter and consent, were sent home from school with the students. Teachers and students were offered an incentive to encourage students to return completed surveys. Classes who had a return rate of 85% or better received a gift card for school supplies and students were given a pencil as an incentive for return of the completed survey. The study team obtained student records of California Standardized Testing (CST) scores on the English Language Arts (ELA) and Math sections as well as absenteeism records from the school district in students who screened positive and 60 randomly selected students who screened negative for the following three school years: 2007–08 (preintervention year), 2008–09 (intervention), and 2009–10 (postintervention year). CST scores, absenteeism, grade level at the time of screening, and gender were documented. Corresponding survey identification number, asthma detection status, and treatment group were also recorded. Data did not include any identifiers to link back to an individual student. These de-identified data were utilized in the analyses to address study objectives. The Breathmobile care team provided patient information on disease severity and number of visits for patients who entered their care program. Additional information was not solicited from

students identified as at risk who opted to be seen by their primary care physician.

Nurse CM

The study intervention included not only screening for asthma risk status but also CM to ensure appropriate medical follow-up and school management of the students' asthma. Of the 82 students identified during screening as at risk for asthma, all received school nurse contact with the parents; these contacts included phone calls, letters home, or visits with parents at the school office. During these contacts, the school nurse explained screening findings, determined whether the student was receiving asthma care, and if not, discussed options for care and referred the family to their selected provider. Consent was obtained for the nurse to communicate with the Breathmobile or the private medical provider. At least six attempts were made in effort to contact the parent before identifying the family as nonresponsive. Assistance was given to parents if desired to set up appointments with the private provider or with the Breathmobile. The school nurse then communicated with the care provider to confirm whether the student had been seen. The school nurse also provided follow-up to ensure that these students had asthma action plans and needed medication and equipment available for use at the school site.

Of the 82 students determined to be at risk for asthma, 70 students of responsive parents were referred for asthma diagnosis and care; 17 students (24%) were referred to their private medical provider and 53 students (76%) were referred to the Breathmobile. Fifteen students were seen by their private provider and 10 (66%) were diagnosed with asthma; 38 students were seen by the Breathmobile and 26 (68%) were diagnosed with asthma. Of the 36 students diagnosed as having asthma as a result of the screening and medical referral, 19 (52%) had asthma action plans and/or medication orders

Table 1. Distribution of Grade and Gender Overall and in Each Treatment Group

	Overall	Group I, nonresponsive and positive asthma screen	Group II, case management confirmed asthma diagnosis	Group III, control group no asthma diagnosis or negative asthma screen
Grade when screened	N = 142	N = 26	N = 40	N = 76
2nd–4th	25.4%	15.4%	22.5%	30.3%
5th–6th	74.6%	84.6%	77.5%	69.7%
Gender				
Female	47.2%	46.2%	45.0%	48.7%
Male	52.8%	53.8%	55.0%	51.3%

Note. $p > .05$ (no group differences in distribution of grade and gender detected by chi-square test).

established where there were none before the school nurse's intervention.

Study Groups

Students were divided into three groups for analyses (Figure 1). Group I ($N = 26$) comprised students at risk whose diagnosis could not be confirmed as their parents were unable to be reached after six attempts or their scheduled appointment was not kept; this group was identified as the nonresponsive group. Group II ($N = 40$) comprised students at risk with confirmed diagnosis who accepted nurse CM and were seen by either their primary care provider (PCP; $N = 13$) or by the Breathmobile ($N = 27$). Group III ($N = 76$) comprised 16 children who screened positive but did not have asthma upon evaluation by their PCP or the Breathmobile and 60 randomly selected students from the 412 students who screened negative.

Response rates were high across the three conditions and two time periods (Group I = 100%, Group II = 97.6%, and Group III = 100%), with only one student from Group II lost to follow-up at the postintervention period.

Statistical Analyses

Student grade and gender at the time of screening were compared across groups (I, II, and III) by means of the chi-square test statistic. The decision was made a priori to investigate students' CST scaled scores (ELA and Math) and absenteeism ("due to illness" and "total") in the pre- (2008) and post- (2010) intervention school years using a series of generalized estimating equations (for additional information on GEE techniques see Zerger, Liang, & Albert, 1988). GEE modeling was chosen in lieu of standard regression techniques because it is explicitly designed to handle longitudinal data, handles missing data in a more robust fashion than other repeated-measures regression techniques, and controls for correlations between the variables in the model. The multivariate GEE enabled examination of between-group differences in average post-year standardized scores and absenteeism after controlling for pre-year levels, grade, and gender.

Dependence of group effects on grade and gender (i.e., interaction effects) were investigated and found to be nonsignificant; however, these results should be viewed with caution due to the small sample size. All analyses were conducted using SPSS 18.0.

Results

The questionnaire was given to 595 elementary school students (Figure 1). Of 494 (83%) returned surveys, 82 (17%) students were found to be at risk for asthma. Seventy (84%) parents of at risk students were responsive to contact by the school nurse; 17 (24%) had a primary care physician while 53 (76%) had no PCP for their child and accepted a medical referral to the Breathmobile. In the Breathmobile referral group, 14 (26%) were nonresponsive to multiple attempts by staff to schedule an appointment. In the 39 (74%), who scheduled and showed for their appointment, asthma diagnosis was confirmed in 27 (69%), while in those with a PCP, asthma diagnosis was confirmed in 13 (76%) students. Sensitivity of the tool to detect asthma in this population was 71% (40 of 56). The majority of students in Groups II, III, and I were in fifth-sixth grade (74.6%) and male (52.8%; Table 1). There were no significant differences between groups for grade level or for gender. Scaled scores on both the CST-ELA and Math sections were normally distributed. Absenteeism was positively skewed with fewer students reporting a relatively large number of school days missed.

Academic Performance on CST-ELA

As shown in Table 2, no differences were detected between the groups after controlling for grade, year, gender, and the interaction of group and year ($p = .26$). Likewise, none of these covariates served as statistically significant predictors of CST-ELA scores ($p > .05$ for all).

Academic Performance on CST-Math

As with CST-ELA scores, no differences were detected between the groups' CST-Math scores after controlling for grade, year, gender, and the interaction of group and year

Table 2. Adjusted Analysis to Examine Performance Measures Overall and Across Groups, Pre- Versus Post-Year of Intervention (Adjusted for Grade (5–6 Vs. 2–4) and gender (Male Vs. Female))

	Overall	Grp I, nonresponsive and at risk	Grp II, case management confirmed asthma Dx	Grp III, control group no asthma Dx or -screen	Tests of model effects based on Wald chi-square test
Outcomes	N = 142	N = 26, mean SE (95% CI)	N = 40, mean SE (95% CI)	N = 76, mean SE (95% CI)	Effects and corresponding (p value)
Absences due to Illness:					
Pre-year	4.9 SE = 0.46 [4.0, 5.8]	4.5 SE = 0.80 [3.0, 6.1]	5.8 SE = 0.81 [4.2, 7.4]	4.2 SE = 0.37 [3.5, 4.9]	Group: $p = .347$
Post-year	3.7 SE = 0.44 [2.9, 4.6]	3.9 SE = 0.91 [2.1, 5.7]	3.7 SE = 0.55 [2.7, 4.8]	3.6 SE = 0.40 [2.8, 4.4]	Year: $p = .003$ Group $\times$ Year: $p = .193$ Gender: $p = .638$ Grade: $p = .007$
Absences total					
Pre-year	5.9 SE = 0.053 (4.9, 7.0)	6.0 SE = 1.02 [4.0, 8.0]	6.8 SE = 0.91 [5.0, 8.6]	5.0 SE = 0.44 [4.2, 5.9]	Group: $p = .774$
Post-year	6.3 SE = 0.59 [5.1, 7.5]	6.4 SE = 1.21 [4.1, 8.8]	5.9 SE = 0.78 [4.4, 7.4]	6.6 SE = 0.68 [5.2, 7.9]	Year: $p = .462$ Group $\times$ Year: $p = .083$ Gender: $p = .642$ Grade: $p = .019$
CST-Math scaled score					
Pre-year	357 SE = 6 [345, 370]	348 SE = 12 [325, 370]	363 SE = 11 [342, 385]	361 SE = 8 [345, 377]	Group: $p = .082$
Post-year	353 SE = 6 [342, 365]	331 SE = 10 [311, 351]	360 SE = 11 [339, 380]	369 SE = 7 [355, 383]	Year: $p = .365$ Group $\times$ Year: $p = .068$ Gender: $p = .538$ Grade: $p < .001$
CST-ELA scaled score					
Pre-year	335 SE = 5 [326, 344]	327 SE = 9 [308, 345]	349 SE = 7 [335, 364]	330 SE = 5 [320, 341]	Group: $p = .259$
Post-year	342 SE = 5 [332, 353]	337 SE = 12 [314, 360]	349 SE = 9 [331, 367]	341 SE = 6 [329, 353]	Year: $p = .070$ Group $\times$ Year: $p = .288$ Gender: $p = .098$ Grade: $p = .307$

Note. Estimated marginal means (95% CI) based on generalized estimating equation analysis. Absences: Removed two outliers reporting ≥ 25 days. CST = California Standardized Testing; ELA = English Language Arts; SE = standard error.

($p = .08$). Likewise, year, gender, and the interaction effect failed to serve as statistically significant predictors of CST-Math scores ($p > .05$ for each). Grade did emerge as a statistically significant predictor of students' CST-Math scores with fifth to sixth grade students outperforming second to fourth grade students ($p < .001$).

Postintervention Absenteeism (Total)

Overall, no differences were detected between the groups' postintervention absenteeism after controlling for grade, year, gender, and the interaction of group and year ($p = .08$). While year, gender, and the interaction of Group and Year failed to serve as statistically significant predictors of postintervention absenteeism ($p > .05$ for each), younger children (Grades 2–4) missed approximately 2 more days per year than older children (Grades 5–6) 7.1 days ($SE = 0.85$) versus 5.1 days ($SE = 0.42$), $p = .019$.

Postintervention Absenteeism Due to Illness

On average, students missed one less day of school due to illness in the postintervention period (4.9 vs. 3.7 days, respectively, $p = .003$; Figure 2). Students with asthma in the CM group had a reduction in absenteeism of slightly over two days due to illness in the post-intervention period (5.8–3.7 days) compared to a reduction of approximately two thirds of a school day missed due to illness in both the nonresponsive (4.5–3.8 days) and control groups (4.2–3.6 days). Grade and gender did not alter these findings, although younger children missed approximately 2 more days per year than older children 5.2 days ($SE = 0.70$) versus 3.4 days ($SE = 0.29$), $p = .007$.

Discussion

This is the first study of which we are aware that investigated both academic performance by standardized testing and attendance outcomes in a study of school interventions for asthma. In this pilot study of predominately underserved Hispanic children attending an elementary school located in a low socioeconomic neighborhood, findings suggest that school nurse screening, CM, and collaboration with a medical provider resulted in early identification, referral, and subsequent treatment of students at risk for asthma and may have contributed to reduced absences. We were unable to determine an impact on student learning outcomes in this small study but believe that including learning outcomes is important in evaluating the impact of nursing interventions.

The finding that illness absences among students with asthma were reduced following asthma screening and referral for care mirrors the finding that when a consulting physician was used in a school asthma absence program, absence was reduced by 1 day annually (Wilson et al., 2009). The improvement in asthma action plans and medication at school for asthmatic children seen in this study is

similar to the findings of Taras, Wright, Brennan, Campana, and Lofgren, (2004), although their study did not demonstrate a reduction in absenteeism among these students. Levy, Heffner, Stewart, and Beeman (2006) found that intensive CM for asthma students including asthma education, absence of follow-up, and coordination of student's asthma care resulted in "... fewer school absences than their counterparts in usual care (mean 4.38 vs. 8.18 days, respectively) and experienced significantly fewer emergency department visits ($p < .0001$) and fewer hospital days ($p < .05$) than UC [*usual care*] students." (Italics added)

Though our survey numbers were small, the results of our survey revealed a number of students that had not been previously diagnosed with asthma as well as students that had a past diagnosis of asthma but were not currently under physician care for their asthma. It was interesting to note that while the mobile asthma clinic had been serving the school for several years, most of the identified at risk students had not been seen previously by the mobile clinic. This study demonstrated the use of a simple survey tool allows the school nurse to identify students that may be at risk for asthma thus setting the stage for early intervention. It is an opportunity for the school nurse to reach out and care for the school community. At school, the school nurse initiates a referral for asthma medical evaluation when the student presents in the health office with asthma symptoms. Commonly, by the time the student sees the school nurse, he or she has already had difficulty with attendance or school performance. The student may have experienced lost school days and/or reduction of physical activity due to asthma-related illness. Often there has been inappropriate health care utilization, such as emergency room visits. The ability to identify these students early before school and health complications surface would be beneficial for the student and potentially cost effective.

It has been difficult to show that screening certain populations is beneficial in preventing health problems. In 2005, the American Thoracic Society convened a panel of experts to determine whether screening programs were warranted (Gerald et al., 2007). The panel determined that wide-area screening is not beneficial and that limited case detection might be appropriate in populations where there is a high prevalence of asthma such as in younger children and where there is an appropriate health care resource. The panel also suggested that combining asthma screening with other mandated screenings or screening at a specific grade level in a school would be a simple, efficient approach. California, as well as other states, mandates that health screenings occur in public schools at periodic intervals. Screening at an elementary grade level may be most appropriate, as it would help identify those students at risk for asthma before they suffer the sequelae of undiagnosed and untreated asthma.

A successful school-based screening requires a simple, effective screening tool (Yawn, 2006). Several studies demonstrate that an individual, such as a school nurse, can

administer a survey program for asthma using a short, take-home, self-administered parental questionnaire (Jones et al., 2004). Screening a single grade level for asthma risk is something the school nurse could easily do during the school year, even when that nurse has several schools to manage. The important caveat is the availability of a reliable referral source to which to send the students who will need further evaluation. Screening and medical referral without an accessible resource to which to send identified students will only lead to failure and noncompliance. The accessible resource might be a private provider, a disease management program such as the Breathmobile or a school-based clinic (Council on School Health, 2012).

The school nurse is an important link in assisting the identified student at risk for asthma to a medical resource. The American Academy of Pediatrics (Council on School Health, 2008) and the CDC (CDC 2006) support having a full-time school nurse in every school to ensure a strong connection with each students' medical home and improve coordination of asthma care at the school site. Erickson, Splett, Mullet, Jensen, and Belseth (2006) found that professional school nursing and evaluation were key to success in the Healthy Learner initiative and resulted in fewer asthma visits to the health office and better attendance among students who received asthma care in the school health office. The most important point here and the value of this current study is that case identification in school leads to positive outcomes because of two factors, dedicated school nurse services *and* collaborative relationships between the nurse and accessible medical providers.

Limitations

While the school nurse was conducting the study, she also had to maintain other duties, which included monitoring health programs and student health at several schools as part of her regular assignment (caseload ~ 1:2,300). Having a large assignment with multiple schools made CM a difficult part of this study. Given that most of the students in the school were surveyed, many school nurses could not manage this screening effort, given their large caseloads. However, by limiting the use of this simple validated questionnaire to just one elementary grade level and, in addition, using the screening tool when students present with asthma symptoms to the health office, screening would be more manageable.

Family communication was very important because, even though the questionnaire was written at a sixth grade level, some of the parents needed assistance to complete it. The parents also needed help understanding the implications of the results and the importance of following up with a medical provider. Many of the parents worked, so it was difficult to contact families during school hours and many calls were made after the nurse's workday, in the late afternoons or evenings. The school nurse and ancillary staff, who provided language translation services, spent a large amount of time

with the families to obtain the best outcome for the student. Another obstacle was interacting with the individual student's PCP in the community. Many did not respond to the school nurse's initial attempts to contact them about the student to obtain assessment information and follow-up. Multiple contacts were required to elicit a response.

In spite of these challenges, asthma risk screening is actually not as labor intensive as some of the other screening the school nurse is required to do each school year. For example, in a school district of 22,000 students, each year approximately 10,300 (46.8%) students are screened for vision problems with an estimated 900 (8.7%) of those students being referred to a health care provider. Approximately 300 (33.3%) of those students will see a provider and receive care. This study demonstrated that through an additional resource, such as the school nurse, dedicated to CM and an accessible medical provider, a higher percentage of students (73%) identified as at risk for asthma saw a provider than children identified with a vision problem in the study school district.

A few study limitations are important to note. The level of nursing and medical intervention in our case-intervention group was not controlled for in the evaluation of academic performance and absenteeism. Routine care (at least every 3 months) has been shown to contribute to maintenance of well-controlled disease (Scott et al., 2011). In 27 patients who enrolled in the Breathmobile Program during the 2008–09 school year, aggregate information provided to our study team indicated that 22% of patients had only one visit at the time of evaluation and the distribution of asthma severity was as follows: 37% intermittent, 48% mild persistent, and 15% moderate persistent. No students who enrolled in the Breathmobile program during the year of screening had severe persistent baseline disease. Level of intervention and baseline disease severity was unknown for students in the CM intervention group who had a PCP. However, as the majority had been previously diagnosed in a primary care setting that may suggest they had more severe baseline disease.

Generalizability of inferences are limited due to the small number of students in Groups I and II and nonrandom group allocation. It is also difficult to determine that the intervention itself is the cause of the effect seen, when there was a lengthy period between intervention and postintervention measurement. It would be beneficial to examine whether the positive directional change in illness absences observed for students who received CM intervention in our study population is replicable in other student populations. Further investigation is needed to determine whether the level and amount of nursing intervention, as well as the site of referral and the site of care, influence illness absence. These studies should also control for the severity of asthma at study entry and examine changes in asthma status over the study period.

Implications for School Nursing

The school nurse provides health screenings and referrals for students throughout the school year. The screenings include and are not limited to vision, hearing, and dental health. We recommend that asthma screening and CM be added to that list. Such screening can help by identifying students with undiagnosed or undertreated asthma early and assisting them to an appropriate medical resource. Based on the results of this study, screening and CM can play a role in improving student academic performance and decreasing the loss of school days from asthma-related health problems.

The school nurse is a liaison between the school, family, and community. As a case manager for students with health problems, the school nurse can facilitate effective communication and collaboration between all parties. Also by using the simple validated case identification-screening tool, the school nurse can make a significant impact in the lives of students. Asthma screening helps with early recognition of students at risk for asthma and linking them to care. The school nurse plays a pivotal role because she is at school and able to identify asthma risk that may affect a child's health, school attendance, and learning outcomes. Effective CM, which includes assessing needs and planning care in coordination with involved medical providers, should be provided not only for students with a positive asthma screen, but also for students ". . . with frequent school absences, school health office visits, emergency department visits, or hospitalizations due to asthma" (CDC, 2006).

Conclusion

Approximately 17% of predominately Hispanic children attending an elementary school in an underserved area of Orange County, CA, had repeated episodes of asthma in the past year or reported exercise/play limitations and persistent day symptoms of cough, chest tightness, trouble breathing, or wheezing. In the 40 children with confirmed diagnosis who received CM intervention, academic performance on the CST-ELA and Math in 2010 (postintervention) was similar to the 76 children who were considered low risk for asthma (negative screen or confirmed no asthma by medical provider), after adjustment for their 2008 (preintervention) scores ($p > .05$). On average, absenteeism due to illness was reduced by 2 days from 5.8 to 3.7 days in the postintervention school year in at risk students who received CM intervention compared to healthy controls and students at risk for asthma who did not receive intervention; illness absence in these groups was reduced by approximately two thirds of a day in the postintervention period.

An important lesson of this pilot study was the partnership between the school nurse and either an accessible disease management program, such as the Breathmobile, for students without care or private physicians for students with a medical home. To ensure success to a school health

program that includes asthma risk screening, it is paramount to establish a strong link with and commitment from a community-based medical provider who will work closely with the school nurse. This could be a local physician, a consulting school physician, or an accessible mobile clinic, such as the Breathmobile. Although limited by the small number of children included, the findings from this pilot study support the value of case identification in a school setting, particularly with dedicated school nurse CM and accessible, collaborative medical care. Further study, with a large, randomized sample, is required to document both attendance and learning outcomes of asthma screening and nurse CM within school settings.

Acknowledgements

We thank and acknowledge Consuelo Carcel, BSN, RN, for her assistance at the CHOC Breathmobile[®] during this study and Nik Gorman, EdD, MPH, for additional statistical consultation.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

- Berg, J., Brecht, M. L., Morpew, T., Tichacek, M. J., Chowdhury, Y., & Galant, S. (2009). Identifying preschool children with asthma in Orange County. *Journal of Asthma*, 46, 460-464.
- Bloom, B., Cohen, R. A., & Freeman, G. (2010). Summary health statistics for U.S. children: National Health Interview Survey, 2009. National Center for Health Statistics. *Vital and Health Statistics* 10, 1-91.
- Centers for Disease Control and Prevention. (2006). *Strategies for Addressing Asthma within a Coordinated School Health Program, with Updated Resources*. Atlanta, Georgia: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. Retrieved from www.cdc.gov/HealthyYouth/asthma/pdf/strategies.pdf
- Council on School Health. (2008) Role of the school nurse in providing school health services. *Pediatrics*, 121, 1052-1056.
- Council on School Health. (2012). School-based health centers and pediatric practice. *Pediatrics*, 129, 387-393.
- Erickson, C. D., Splett, P. L., Mullett, S. S., Jensen, C., & Belseth, S. B. (2006). The Healthy Learner Model for student chronic condition management—Part II: The asthma initiative. *Journal of School Nursing*, 22, 319-329.
- Galant, S. P., Crawford, L. J. R., Morpew, T., Jones, C. A., & Bassin, S. (2004). Predictive value of a cross-culture asthma case-detection tool in an elementary school population. *Pediatrics*, 114, e307-e316.
- Gerald, L., Sockrider, M., Grad, R., Bender, G., Boss, L., Galant, S., . . . Yuksel, B. (2007). An official ATS workshop report: Issues

- in screening for asthma in children. *American Thoracic Society*, 4, 133–141.
- Jones, C., Morpew, T., Clement, L., Kimia, T., Dyer, M., Li, M., & Hanley-Lopez, J., (2004). A school-based case identification process for identifying inner city children with asthma: The Breathmobile program. *The American College of Chest Physicians*, 125, 1–17.
- Levy, M., Heffner, B., Stewart, T., & Beeman, G. (2006). The efficacy of asthma case management in an urban school district in reducing school absences and hospitalizations for asthma. *Journal of School Health*, 76, 320–324.
- Scott, L., Morpew, T., Bollinger, M. E., Samuelson, S., Galant, S., Clement, L., . . . & Jones, C. A. (2011). Achieving and maintaining asthma control in inner-city children. *Journal of Allergy and Clinical Immunology*, 128, 56–63.
- Taras, H., Wright, S., Brennan, J., Campana, J., & Lofgren, R. (2004). Impact of school nurse case management on students with asthma. *Journal of School Health*, 74, 213–219.
- Wilson, K. D., Moonie, S., Sterling, D. A., Gillespie, K. N., & Kura, R. S. (2009). Examining the consulting physician model to enhance the school nurse role for children with asthma. *Journal of School Health*, 79, 1–7.
- Yawn, B. P. (2006). Asthma screening, Case identification and treatment in school-based programs. *Current Opinion in Pulmonary Medicine*, 12, 23
- Yawn, B. P., Wollan, P., Scanlon, P. D., & Kurland, M. (2003). Outcome results of a school-based screening program for under-treated asthma. *Annals of Allergy, Asthma and Immunology*, 90, 508–515.
- Zerger, S. L., Liang, K. Y., & Albert, P. S. (1988). Models for longitudinal data: A generalized estimating equation approach. *Biometrics*, 44, 1049–1060.

Bios

Michelle L. Moricca, BSN, RN, is with Newport-Mesa Unified School District, Costa Mesa, CA, USA.

Merry A. Grasska, MPH, RN, NP-C, is with Newport-Mesa Unified School District, Costa Mesa, CA, USA.

Marcia BMarthaler, BSN, RN, is with Newport-Mesa Unified School District, Costa Mesa, CA, USA.

Tricia Morpew, MSc, Asthma and Allergy Foundation of America, California Chapter, Los Angeles, CA, USA

Penny C. Weismuller, DrPH, RN, California State University, Fullerton, CA, USA

Stanley P. Galant, MD, Children's Hospital of Orange County (CHOC), Orange, CA, USA.