Examining the Consulting Physician Model to Enhance the School Nurse Role for Children With Asthma

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ABSTRACT

BACKGROUND: The Centers for Disease Control and Prevention's *Strategies for Addressing Asthma Within a Coordinated School Health Program* recommends a consulting physician for schools to help manage asthma. The literature examines the effects when a school nurse is present, but the addition of a consulting physician is not well understood. The purpose of this study is to assess the effect of having a consulting physician on school absenteeism and children sent home due to health reasons for children with asthma and all children pooled together.

METHODS: A 2-year preimplementation group cohort and 1-year implementation group cohort of grades K-6 in an urban school district were used to determine the impact of a consulting physician on school absenteeism for children with asthma and all children pooled together.

RESULTS: A consulting physician was significantly associated with reduced missed school days for children with asthma and all children as a group. All children pooled together were 44% more likely (OR = 1.44, 95% CI = 1.31-1.58) to be sent home without the consulting physician. There was a reduction from 13.8% to 12.6% of sent home events in children with asthma.

CONCLUSIONS: Having consulting physicians in school districts appears to be associated with fewer days of school absence. The results provide additional evidence and suggest that more research is required to determine if this association is valid and to better understand the cause of such an association.

Keywords: chronic diseases; school health services; child and adolescent health.

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The Centers for Disease Control and Prevention's (CDC) *Strategies for Addressing Asthma Through a Coordinated School Health Program* recommends a consulting physician for every school to help address asthma in the school setting.[1] This recommendation, however, is based on expert opinion.[2] While the literature documents the benefits of providing a school nurse for children with asthma,[3-5] the addition of a consulting physician to enhance this role for children with asthma is not well documented. The purpose of this study is to understand the effect of adding a consulting physician on school absenteeism and children being sent home due to asthma symptoms for children with asthma. Additionally, all children are pooled together to understand, from a school district's perspective, the total effect on school absenteeism and children sent home for health reasons.

Asthma is a significant public health issue in the United States in terms of the numbers of people affected (especially children), morbidity, and resulting economic burden.[6-11] Asthma is one of the most common chronic childhood illnesses,[12] the most prevalent cause of childhood disability,[3,13] and a common reason for the use of school health services.[14,15] Asthma contributes to almost 15 million lost school days a year, and the number continues to increase.[15,16] In Missouri, the average prevalence of current childhood asthma is 8.6%.[16] In St. Louis, 5-18% of the students in each school are reported to have asthma, contributing to over 30,000 missed school days a year.[17] In a study, approximately 33% of the school absences in children with asthma were caused specifically by asthma symptoms.[18]

The CDC's *Strategies* document was first published in 2002 and then revised in 2006.[1] This article provides empirical information on a consulting physician model that is designed around the CDC recommendation. In the most recent School Health Policies and Programs Study 2006 conducted by the CDC, only 10.5% of school districts nationwide reported having an arrangement with a physician, and 14.9% reported some type of arrangement with a local community health center.[19] It is difficult to ascertain what types of services constitute this type of arrangement, but with the analysis of a consulting physician model, we hope to provide empirical evidence that suggests that a consulting physician model is both feasible and effective for school districts. Adding evidence to the CDC *Strategies* recommendation will aid in further dissemination and adoption of these recommendations.

Two research questions were explored. Does the addition of a consulting physician model decrease school absenteeism for children with asthma, and if all children are pooled together, is the effect still observed? The purpose for pooling all children together is for the purpose of those making decisions to incorporate consulting physician services. These types of services are not only reserved for children with asthma but also applied to all children in terms of potential policies and costs. The second research question focuses on children being sent home due to health reasons. Does the consulting physician model reduce the number of all children sent home for health reasons and children with asthma sent home for asthma symptoms?

METHODS

Subjects

The group cohorts are from a school district with urban characteristics (Table 1). Key variables were measured in both group cohort years to assure measurement of like groups from 1 year to the next.

All children in grades K-6 in all elementary schools (n = 9) were included in the analysis. Children were coded as having asthma or not having asthma. Diagnostic confirmation or screening of undiagnosed asthma was not performed. If a school nurse identified a child with asthma at any point throughout the school year, they were included in the analysis as having asthma. Every school had a school nurse.

Table 1. **Demographics of an Urban School District in St. Louis, MO, K-6 Grade**

	2003-2004		2004-2005		p^*
School Year	**n**	**%**	**n**	**%**	**.802**
Gender					
Female	2430	47.7	2458	48.0	
Male	2664	52.3	2668	52.0	
Total	5094	100	5126	100.0	
Students with asthma					.822
No	4418	86.7	4438	86.6	
Yes	676	13.3	688	13.4	
Total	5094	100	5126	100.0	
Race					.055
African American	4841	95.0	4912	95.8	
Caucasian	233	4.6	187	3.6	
Hispanic	16	0.3	20	0.4	
Asian	4	0.1	7	0.1	
Total	5094	100	5126	100.0	
Grade					.023
Kindergarten	714	14.0	668	13.0	
1	674	13.2	728	14.2	
2	669	13.1	717	14.0	
3	681	13.4	664	13.0	
4	771	15.1	713	13.9	
5	831	16.3	786	15.3	
6	754	14.8	850	16.6	
Total	5094	100	5126	100.0	
Free/reduced or full lunch					.399
Full pay lunch	934	18.3	907	17.7	
Free or reduced lunch	4160	81.7	4219	82.3	
Total	5094	100.0	5126	100.0	

*$p \leq .01$.

Instruments and Data Sources

School absenteeism data were electronically sent from the school district to a secure data site within the study center with assigned student identification numbers that did not provide specific individual information but did provide individual-level data. Identification of children with and without asthma was similarly linked with the electronic absenteeism records. The data used for calculating the odds ratios for children sent home were tracked through school nurse logs and collected and entered by trained research staff into a secure database. All data were managed using Microsoft Access (Microsoft Redmond, WA) software.

Procedures

Overview of Consulting Physician and School Nurse Activities. This analysis builds on a published descriptive analysis of providing consulting physician services through the Asthma 411 program.[20] The consulting physician group that provided the services to the school districts was a *family practice* not-for-profit physician group with school health experience. The family practice group contracted for approximately 0.5 day per week per school and district to provide (a) educational consulting for each school nurse and case-by-case consultation when needed, especially for determining whether or not to send a child home, (b) health policy/procedure review and development, (c) standing medication orders including asthma medication (albuterol) to treat episodes at school for any child presenting with asthma symptoms when no medication was available, and (d) services to act as a liaison with a child's primary care provider when necessary. None of these activities were present prior to implementation of this model in our study. Prior to implementation, the only option for children without medications at school was to send the child home or to the emergency department. With the consulting physician model, the school nurse had enhanced knowledge of when to take appropriate action, including keeping or sending the child home.

The school nurse activities included (a) participating in asthma education and one-on-one education with the consulting physician group, (b) securing current provider written asthma action plans, (c) implementing and acting upon standing orders that included the administration of albuterol for asthma episodes if no medication was present at school, (d) acting as a liaison with the child's health care provider in partnership with the consulting physician, (e) resolving asthma episodes at school using professional judgment and appropriate action in conjunction with the consulting physician and parents/caregivers, and (f) identifying children with asthma through existing documentation and tracking these children throughout the school year. Documented asthma was defined as reported in the school health record, by the parent, or asthma medication required at school. The 3 school nurse activities that were exclusive to the model and Asthma 411 program were the consulting physician one-on-one consultation/education, the partnership liaison to the primary health care provider, and the administration of standing medication orders. To a much lesser extent, all other school nurse activities occurred prior to the consulting physician implementation. More information and an in-depth description of the Asthma 411 program can be found in *Journal of School Health*'s special issue on asthma, ''Managing Asthma in Schools—What Have We Learned?''.[21] All aspects of this study were approved by the Saint Louis University Human Subjects Institutional Review Board.

The study design was a preimplementation group and 1-year implementation group cohort design. The 2 cohorts thus include some children who were continuously enrolled for the 2 academic years and some who were not due to age and movement into and out of the district. This design was used to determine the statistical significance of the addition of a consulting physician to enhance the school nurse role for all children and specifically for children with asthma. The group cohort, as described by Cook and Campbell, is a common study design used in observational designs when cyclical patterns are anticipated and consistent from year to year, as with a school. It is important that the contiguous groups be similar in background characteristics and history as the previous group.[22]

Data Analysis

Descriptive statistics were conducted to assess whether the 2 group cohorts were similar in characteristics. Chi-square tests were performed to check for significant differences in proportions among demographic variables between years (Table 1). Statistical analysis was performed using SPSS 14.0 (SPSS, Inc, Chicago, IL) for descriptive analysis and linear regression. Odds ratios for children sent home were calculated with EpiInfo Version 3.3 (CDC, Bethesda, MD).

The statistical significance of the addition of a consulting physician to enhance the school nurse role for reducing absenteeism for all children pooled together and specifically for children with asthma was determined. A blocked entry linear regression analysis method was used. The dependent variable was weighted school absenteeism. The independent block variables in order of entry were: (a) model 1 demographics, (b) model 2 demographics and school-level variables, and (c) model 3 demographics, school-level variable, and the consulting physician pre-/postvariable. The addition of the consulting physician variable was entered last as this was the variable of interest. Blocked entry linear regression analysis was used

because of the interest in determining the effect of adding a consulting physician as the variable of interest. It was desired to understand the impact of any added effect after controlling for known individual-level demographic variables and the 1 school-level variable. In entering the demographic variables as the first block, and the school-level variable as the second block, the effect of adding the consulting physician variable could be assessed. All appropriate linear regression diagnostic assumptions were tested to screen for violations of normality and produce the best linear unbiased estimates. Two potential violations were identified in the normality of the data and with outlying cases. The dependent variable was found to be nonnormal, and the analysis was run with both a log-transformed dependent variable as well as original dependent variable. The results were substantially similar, so the analysis was completed using the nontransformed variable. Outlier cases were assessed for their effect on the model fit, and although present, they remained in the analysis as they did not change the results.

All children sent home for health reasons and children sent home for asthma symptoms were tracked by school nurses for 1-year preimplementation and throughout the 1-year implementation. Odds ratios with 95% confidence intervals were constructed, and a chi-square test of significance was calculated determining the odds that a group of children may be sent home due to health reasons and children sent home due to asthma symptoms. The odds ratios were calculated using a 2×2 table with group exposure defined as the consulting physician and the group event defined as children being sent home. We were only able to track events and not events linked to a specific child. School nurses reported total numbers of events of children being sent home due to health reasons and for asthma symptoms. Three of the 9 schools were excluded from the analysis as they had provided less than 75% of completed logs on children sent home.

RESULTS

School Absenteeism

Characteristics of the group cohort are presented in Table 1. Approximately 13% of students had documented asthma in both school years. The district was predominantly African American (95%), and 82% of the students were eligible for the free/reduced lunch program. All schools in the analysis had 1 school nurse per school and met the recommended 1 nurse to 750 students ratio with very similar nurse to student ratios in each school. All demographics were assessed in the 2 group cohorts to determine that the groups were similar. For these 2 group cohorts, the postyear cohort had a slightly different grade composition, but it was determined that this difference was not meaningful or likely to affect the analysis. There were slightly more children in total in the group cohort in the implementation year than in the preimplementation year, accounting for the difference in the grade variable.

Controlling for demographics and school variability, there was a statistically significant increase in the R^2 change when the consulting physician variable was added. Statistical significance was set at $p \leq .05$. For all children (n = 9748), each blocked entry model demonstrated statistical significance (model 1 partial F = 37.861*, R^2 change = .015*, overall F = 37.861*, adjusted R^2 = .015; model 2 partial F = 6.771*, R^2 change = .005, overall F = 17.194*, adjusted R^2 = .020; model 3 partial F = 24.806, R^2 change = .002, overall F = 17.819*, adjusted R^2=.022).

For children with asthma (n = 1293), each blocked entry model demonstrated statistical significance (model 1 partial F = 6.938*, R^2 change = .018*, overall F = 6.938*, adjusted R^2 = .018; model 2 partial F = 1.877, R^2 change = .011, overall F = 3.576, adjusted R^2 = .023; model 3 partial F = 11.890*, R^2 change = .009, overall F = 4.244*, adjusted R^2 = .032), but the school variables entered in block 2 were not statistically significant. Although the adjusted R^2 was very small for all children, and children with asthma, this was anticipated as there are many variables that impact school absenteeism beyond health reasons. The variability within schools was also noted with certain schools demonstrating significance within the models and others not. Again, there is no data on the specific schools to explain these differences, only the ability to account for the differences in the analysis.

Examining total weighted missed school days provides additional information on the impact for the school districts. Total missed school days for all children in the preintervention year was 36,529 (7.1 missed school days per student) and 32,899 missed school days after 1 year of implementation), (6.4 missed school days per student) for a savings of 3630 days. Even taking into account the increasing total population, the number of absent days decreased. For children with asthma, the total missed school days preintervention (n = 676) was 6001 (8.9 missed school days per student), and after 1 year of implementation (n = 688), it was 5172 (7.5 missed school days per student) for a savings of 829 days.

Children Sent Home

The odds ratios and confidence intervals for all children sent home for health reasons and children sent home due to asthma symptoms are presented in Table 2.

The odds ratio was statistically significant for all children being sent home when not exposed to the consulting physician model (OR = 1.44, 95% CI = 1.31-1.58).

Table 2. **Children Sent Home for Health Reasons During the 2003-2004 and 2004-2005 School Years**

	n	Preconsulting Physician	Postconsulting Physician	Percent Change	OR	95% CI
All children	8215					
Children with asthma	1364					
Events of all children sent home		1423	1109	−7.70	1.44	1.31-1.58*
Events of children with asthma sent home due to asthma symptoms		93	87	−1.20	1.10	0.80-1.53

*$p \leq 05$.

Without the implementation of the consulting physician model, the group was 44% more likely to be sent home due to health reasons. For the analysis of children sent home due to asthma symptoms, the sample size was smaller resulting in wide confidence intervals and reduced ability to demonstrate statistical significance. The odds were not statistically significant, yet the trend reflects a reduced number of sent home days due to asthma symptoms when the consulting physician model was implemented, reducing children sent home due to asthma symptom events from 13.8% prior to consulting physician implementation to 12.6% after 1 year of implementation.

DISCUSSION

Providing evidence-based results to test the CDC's recommendation for a consulting physician is important in facilitating the dissemination of these recommendations. The addition of a consulting physician to enhance the school nurse role appears to provide additional benefits for all children and for children with asthma.

Of all the activities included with the consulting physician and enhanced school nurse role, the implementation of standing medication orders, specifically albuterol for children presenting with asthma symptoms but with no medication at school, seems to be key in affecting school absenteeism. According to the school nurses in the study, they also felt that working in partnership with the consulting physician provided additional confidence for the school nurse in making professional assessment and judgments as to the status of children when presenting with asthma symptoms. Although data were not gathered in this area, school nurses also surmised that parents may have felt more comfortable sending their child to school knowing that the ability to care for their children with asthma during the day was enhanced.

Children being sent home provides another useful measure for the nurse, the children, and the school, as it may take time to see a reduction in overall school absenteeism. Information obtained qualitatively from the school nurses reflects that it takes adjustment on their part in using the standing orders, particularly the asthma quick-relief medication, but also report having those orders as vital in addressing asthma symptoms in the schools since many children do not have medications at school to address an asthma episode. The results for all children when combined show that when the consulting physician model is implemented, the children are more likely to remain in school. For children with asthma experiencing asthma symptoms, the trend indicates fewer children being sent home. Tracking over a longer period of time with a larger sample size and improved confidence in using the standing orders by the nurses may lead to statistically significant results.

This is a study that has potential population-level impact. If, at a population level, absenteeism is being reduced by even 1-2%, translated over the entire population, these are significant improvements for the school district in terms of days of absenteeism saved.

The practical implication for the school district is the reduction of missed school days for all children not only for children with asthma. In Missouri, school district revenue is partially dependent on school attendance. The cost for a consulting physician group was approximately $16,000 per year. The number of days saved for children with asthma in this study was 829 days, and when all children were pooled together, the number of days saved was 3630. According to the study school district revenue information, each absent day costs the district an estimated $15/day/child in federal and state funds. Multiplying the cost for 1 day of absenteeism with the school days saved for all children pooled together, the cost of the consulting physician is recovered. These savings in school absenteeism translate to increased reimbursement obtained by the school district. A more thorough economic evaluation of using a consulting physician group is needed to better understand the economic impact for the school district. Additionally, by missing less school, the children remain more active in the learning process, thus potentially increasing academic performance.[21] In summary, children are missing less school due to a better and more systematic response by the schools to the health needs of the students, particularly children with asthma.

Limitations

This study has several limitations. Generalizability is difficult as the data are based on the experience of 1 school district. Normal absenteeism variance is not entirely known or accounted for in this analysis. Such conditions as weather patterns or influenza rates, for example, would want to be accounted for in larger studies to better understand the added effect of a consulting physician. A limitation in only examining the preintervention year and 1 year of implementation is that normal variance is harder to understand. Unfortunately in this study, prior absenteeism rates were not available. A longitudinal study design combined with prior absenteeism data could more accurately capture and account for the normal variance in school absenteeism. Additional research to understand the school-level variance and the effects in multiple school districts are also necessary.

Although health reasons do contribute to lost school days, many other reasons also contribute to school absenteeism. Clearly, more variables are needed in the model to more fully explain school absenteeism if understanding the variance of school absenteeism is a goal. It was not possible in this study to tease out overall school absenteeism due to health reasons, or due to asthma specifically, but rather accept school absenteeism as an overall population measure that has many factors contributing to its variability. The data on children sent home were also subject to bias as this is recorded and reported by the school nurse. We suspect, however, that the bias was toward the null or was nondifferentially being underreported. The sample size for children with asthma being sent home was small, resulting in wider confidence intervals and the inability to detect differences at the set statistical significance level. Disseminating this model to additional school districts will increase the sample size, thus increasing power to estimate the odds more precisely. In doing so, based on the trends in our existing data, we anticipate that the power to detect statistical significance for the odds of children being sent home due to asthma symptoms will be improved and allow one to more accurately assess the effect of the consulting physician among this subgroup.

It is suggested that future studies account for normal variance of school absenteeism through longitudinal study designs or randomized controlled designs. A better understanding of the impact of the physician education and the school nurse, in addition to the impact on the self-efficacy of the school nurse, would be helpful in understanding the impact of the consulting physician model.

CONCLUSIONS

This study provides additional evidence that providing noninvasive, low-cost health services in the form of consulting physician services may have benefits for children with asthma and all children in the school district. Having a consulting physician in school districts appears to be associated with fewer days of school absence. This model adds to the evidence supporting the CDC guidelines recommending a consulting physician for children with asthma in all schools. The results suggest that more research is required to determine if this association is valid and to better understand the cause of such an association.

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