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Improving allergy office scheduling increases patient follow up and reduces asthma readmission after pediatric asthma hospitalization

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Abstract

Background: Pediatric asthma is a major contributor to emergency room utilization and hospital readmission rates.

Objective: To develop an allergy department-based intervention to improve follow-up appointment scheduling processes for pediatric asthma patients following discharge for asthma exacerbation.

Methods: This quality improvement (QI) study was conducted in the allergy clinic of an urban, tertiary children's hospital. Children receiving subspecialty allergy care for asthma were included into the intervention group during the intervention period. The QI intervention consisted of three attempts by telephone to reach the family to schedule the follow-up appointment. If this was unsuccessful or if the appointment was not kept then a reminder letter was sent to the family. The primary outcome of interest in this study was the percent of post-discharge follow-up appointments scheduled within 30 days of discharge. Secondary outcomes measured were the percent of allergy appointments attended within 30 days of discharge and the 30-day hospital readmission rate.

Results: Demographics did not differ significantly between the intervention and baseline pre-intervention year. The initial baseline scheduled allergy follow-up visit rate was 48.8±13.3% of patients discharged per month. This increased to an overall rate of 75.7±20.1% patients scheduling allergy follow-up within 30-days of discharge during the intervention year. We additionally observed a significant increase in attended allergy visits 30 days post-discharge from 35.5±15.6%

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Conflicts of Interest: none

in Year 1 to $53.9 \pm 25.5\%$ during the intervention year and a significant decrease in the 30-day readmission rate on the allergy service.

Conclusion: This data suggests that minor changes in allergy practice organization can significantly affect post-hospitalization follow-up rates and decrease asthma readmission rates.

Keywords

quality improvement; allergist; pediatric asthma; childhood asthma; post-discharge follow up; post-hospitalization follow up; hospital readmission; telephone reminder; appointment reminder

Introduction:

Pediatric asthma is the most common chronic illness in childhood, with increasing prevalence.¹ In the United States alone, pediatric asthma has accounted for more than 136,000 admissions, more than 200 pediatric deaths and health care utilization costs of 37 billion dollars.^{1,2} Compliance with medications and follow-up visits is challenging, as patients with persistent asthma require complex daily preventative medication regimens.³ Patients who do not follow medical recommendations risk increased asthma morbidity and mortality.^{4,5}

In particular, patients frequently admitted for asthma have an increased 30-day readmission risk for asthma.⁶ Timely follow-up care reduces this risk, however rates of follow-up often remain low in patients with nontrivial disease burden.^{4,5} Previous studies have demonstrated that subspecialty follow-up can reduce readmission risk in children with complex asthma and high rates of readmission.^{7,8,9} This suggests that focusing on improving subspecialty asthma care follow-up after hospitalization can lead to improved patient outcomes.

Approximately 3% of our established allergy patients are admitted to our subspecialty inpatient service for acute asthma exacerbation each year. The rationale for the quality improvement (QI) intervention described herein was that although many of these patients were admitted frequently, our baseline data indicated low rates of scheduled post-hospitalization allergy clinic follow-up. Our traditional workflow relied on advising parents to schedule the follow-up visit, providing the telephone number on discharge paper work and providing no additional support services to facilitate appointment scheduling. In this project, we focused on developing a telephone-based intervention within the allergy department staff which relieved some of the burden for scheduling post-hospitalization follow-up visits from patients' families. In doing so, our aim was to increase the percentage of scheduled follow-up outpatient allergy visits within 30 days of discharge from a baseline of 47% to over 95% within one year.

Methods:

Context:

Our hospital maintains an inpatient allergy admitting service; asthma patients managed by allergists are admitted to this service (while asthmatic patients followed by Pulmonary are admitted to that service and all other asthma admissions to General Pediatrics). We

examined a baseline year of discharged patients' follow-up data prior to beginning any interventions (161 patients, Year 1; 7/1/13–6/30/14). During the intervention period (Year 2; 7/1/14–6/30/15), 123 patients were admitted for asthma flare. All asthma patients discharged from the allergy service during the intervention period were included in the intervention. We also examined rates of follow-up visits during a post-intervention year (Year 3; 7/1/15–6/30/16) to assess the sustainability of the QI intervention.

Intervention:

We implemented a standardized post-discharge scheduling workflow in our department that is represented as a process flow chart in Figure 1. Inpatient physicians provided admitted asthma patients' names to office staff during discharge preparation and counseled patients regarding the importance of follow-up. As part of the QI project, staff were trained to make three telephone call attempts to schedule the appointment within one business day of discharge. If no contact was made with the family, a second and third call attempt was made at an interval of every other business day. No official script was used, however staff generally followed a format for calls and messages, saying: "Hello, my name is (*name*) calling from the Allergy Department to help schedule a followup appointment for your child's asthma care. Please call us back at (*our office telephone number*)."

The primary parent or guardian listed as a contact on the child's chart was contacted on the first call attempt. If a second parent or guardian was listed on the chart, this number was tried with the third call attempt. This contact information is updated during each admission in our hospital system. Initially one primary staff member was responsible for calling family members, and after several months additional staff were trained and a work queue was implemented in the EMR to coordinate the work between staff members. In subsequent improvement cycles, unsuccessful scheduling attempts or missed appointments were followed by a letter sent to the home. The primary goal of this project was to increase scheduled post-hospitalization appointments to 95% or greater per month. Secondary outcomes included improved 30-day appointment attendance and decreased hospital readmission.

Study of the Intervention:

Data was monitored throughout the intervention to determine success of the QI project. Scheduling staff maintained a work queue within our EMR to keep track of all patients requiring followup. Scheduling attempts were documented in the EMR and monitored monthly as a process measure.

Measures:

The primary outcome measured in this study was the number of scheduled appointments within 30 days. Secondary outcomes examined were number of attended allergy appointments within 30 days and the 30-day readmission rate. Data regarding these outcomes were collected on a rolling basis every month by the QI team from a list of patients discharged from the hospital.

Analysis:

A list of all hospitalized patients was reviewed monthly by the QI team to determine the proportion with completed 30-day follow-up. This data was used to determine the need for ad hoc process adjustments. This was monitored by process run chart to determine if variations resulted from implemented changes or from chance.

To analyze the data from the baseline (Year 1) pre-and post-intervention (Year 2) groups in additional depth, we also extracted retrospective data from the electronic medical record. This enabled precise analysis of one of our secondary goals, 30-day readmission rate, as well as post-hoc analysis of individual patient factors within our population affecting follow-up and readmission risk. Direct patient identifiers (e.g., medical record number, name, etc.) were removed by an honest broker to create a dataset with limited identifiers (e.g., date of birth, dates of healthcare encounters, diagnoses, etc.). The data extraction included demographic data, length of asthma admission, follow-up appointment details, treatments, and readmission outcomes. The asthma severity information was obtained from the patient's longitudinal problem list in the electronic medical record. If no such description was on the problem list at the time of admission, we looked for evidence of the diagnosis severity within 30 days after discharge. Data and statistical analysis tasks were completed using R version 3.3.2 (Wien, Austria). We used time to event analysis with Cox proportional hazard assumption to determine the adjusted hazard ratio for 30-day follow-up, and Kaplan Meier survival curves for 30-day readmission were plotted. Logistic regression models were constructed to determine characteristics within our patient population that affected the likelihood of followup at 30 days. The logistic regression model included age group, gender, race, ethnicity, insurance status, asthma severity, pediatric intensive care (PICU) admission, and physician-ordered level of asthma care required during admission. These patient data were retrospectively extracted from the patient EMR and were coded as categorical variables whereas length of admission in hours was analyzed as a continuous variable within the model.

Ethical Considerations:

This QI work focused on improving practices to increase the rate of scheduled asthma followup care. No additional therapeutic interventions were performed and patients were not subject to randomization. Therefore, this QI work and subsequent analysis of resulting data was granted exemption status from the Institutional Review Board of Children's Hospital of Philadelphia as it was not considered human subjects' research.

Results:

A total of 161 patients were admitted for asthma exacerbation in the baseline year (Year 1). During the intervention period (Year 2), 123 patients were admitted onto the allergy service for asthma flare. 90% of patients were scheduled during or following the first telephone call made by staff. If parents returned the call to schedule the appointment then they were counted into this group. The remaining 10% were reached in subsequent phone calls, with approximately 5% of patients called three times in order to try to schedule an appointment. The majority of patients called three times did not respond, which resulted in a letter being

sent to the home. However, in the majority of these cases, no follow-up appointment was scheduled. Follow-up letters were also sent when patients missed a scheduled follow-up appointment. If parents rescheduled a follow-up visit outside of the 30-day window, this was not counted as successful 30-day scheduled follow-up.

We examined demographic characteristics (Table 1) between patients hospitalized during the pre-implementation year and the QI implementation year in order to assess for potential confounding differences. As shown, admitted patients during the pre-implementation baseline year and implementation year had similar median and interquartile ages as well as distributions of race, ethnicity and insurance status. There was notably a lower proportion of uninsured patients in the intervention year (Year 2) falling to 0.8% from 6.8% the prior year. Our cohort was primarily African-American (75.8 and 71.5% in year 1 and 2, respectively), with a public payer insurance type (59.6% in year 1 and 61.8% in year 2, Table 1). To assess patients' intrinsic asthma severity, we examined diagnosis codes recorded on the longitudinal problem list at the time asthma admission. When no codes were available at the time of admission, we used any available asthma severity information recorded up to 30 days after discharge. We next assessed proxy measures of asthma exacerbation severity from the EMR including if the patient required care in the pediatric intensive care unit (PICU). As shown in Table 2, these characteristics were similar between patients in the pre-implementation and QI project implementation years.

The change in percent of scheduled visits throughout the intervention is shown in Figure 2. The initial baseline scheduled follow-up visit rate during Year 1 was $48.8 \pm 13.3\%$ per month. This was used as the initial background rate in our process control monitoring (Figure 2). Beginning in July of the intervention year, we noted a sustained improvement in the rate of patient's scheduled visits. Following a series of eight out of nine months with sustained improvement in scheduled follow-up above the established Year 1 baseline, a new baseline for our QI process was established in year 2. During this initial period of year 2, average scheduled visit rate increased to $75.7 \pm 20.1\%$ per month. Notably, by the second half of the active intervention (Year 2), we were meeting our primary project goal in most months with 95% or more patients scheduled for follow-up within 30 days of hospitalization (average scheduled follow-up $90.3 \pm 10.6\%$). However, in the beginning of year 3, we noted a need for more rapid training of new staff upon their arrival when the scheduling rate abruptly dropped for two months. When this was corrected, our QI intervention continued with an overall rate of $86.8 \pm 13.2\%$ patients per month scheduled for the remainder of Year 3.

As a secondary outcome, we were interested in determining if our new workflow for appointment scheduling facilitated an improvement in attendance of patient follow-up visits. Notably, our intervention did not alter the existing appointment reminder system. Nor did we offer transportation assistance or financial reimbursement for transportation expenses, which have been features of several other QI interventions for pediatric asthma follow-up.^{3,7,8,10,11} Nonetheless, concomitant with our QI project, we observed a significant increase the yearly average attendance of follow-up visits within 30-days post discharge increased from $35.5 \pm 15.6\%$ in Year 1 to $53.9 \pm 25.5\%$ during the intervention. Figure 3A is a Kaplan Meier curve showing the time to follow-up in Year 2 versus Year 1. We performed Cox proportional regression analysis ($p = 0.001$, figure 3A) which demonstrates that there is a

statistically significant increase in the proportion of 30-day arrived allergy visits in the intervention year.

With this encouraging increase in patients scheduling and attending clinic followup, we were also encouraged to see that there was an improvement in our secondary outcome of decreasing hospital readmission within 30-days post-discharge. A Kaplan-Meier survival curve showing the time to readmission is shown in figure 3B ($p = 0.05$, Cox proportional regression). The average readmission rate in Year 1 was 5.6% with decrease to 0.8% in Year 2.

We next used multivariable regression analysis to examine the impact of multiple variables on patient follow-up in allergy clinic at 30 days. Logistic regression was performed with a model including patient age, race, gender, ethnicity, insurance status, length of admission, asthma severity and level of asthma care required during admission (Table 2). The odds of follow-up in year 2 versus year 1 were significantly increased with odds ratio (OR) 2.79 (95% CI [1.60, 4.92], $p = 0.001$), reflecting a significant effect of the QI intervention when all additional factors were accounted for in the model. Additionally, patients with severe persistent asthma (OR 5.52, 95% CI [2.18, 14.17], $p = 0.001$) and increased hospital length of stay (OR 1.01, 95% CI [1.004, 1.03], $p = 0.05$) were significantly more likely to follow-up in the allergy office within 30 days. As previously indicated, there were no significant differences in the numbers of patients with allergist-assessed severe persistent asthma in Year 1 versus Year 2 (Table 1). Additionally, there were no significant differences in the median length of stay between the baseline (median 49.95 hours, IQ range [39.38, 69.57]) and intervention years (median 50.7 hours, IQ range [37.5, 66.9] Wilcoxon rank sum $p=0.65$). Therefore, although these factors affect the odds of attending office followup within 30-days of asthma hospitalization, they did not vary from the pre-intervention to the intervention year. In aggregate, our data from multivariate regression modeling indicates that patients in the intervention year were more likely to attend 30-day followup. Severe persistent asthma and length of hospital stay were positively correlated with likelihood of completing 30-day allergy follow-up visit.

Discussion:

In this study, we describe the implementation of a standardized, telephone-call based office workflow to schedule subspecialty pediatric allergy clinic visits following inpatient asthma hospitalization. The main aspect of the intervention was that clinic staff proactively made three calls to the parent or guardian of discharged patients to schedule the follow-up appointment. Scheduling was successful on or after the first attempt in approximately 90% of cases. We demonstrate that this QI intervention significantly improved both scheduled and attended post-hospitalization visits at 30-days within our urban, academic allergy practice. Further, we observed a significant decrease in the 30-day readmission rate with implementation of this QI project.

Telephone-based interventions have been studied to improve pediatric primary care follow-up after asthma flares with reasonable success. Baren et al conducted an intervention with telephone reminders, appointment and transportation assistance and transportation vouchers,

finding that this combination significantly increased the likelihood of follow-up.^{12,13} Similarly a study by Smith et al provided telephone coaching and monetary incentive to encourage primary care follow-up after emergency department visit for asthma.¹⁴ These studies were conducted in a general pediatric population, which has different challenges compared to our population of subspecialty allergic asthmatic patients. Additionally, these studies involved hiring of additional staff or providing transportation assistance to families which may not be feasible in all practice settings. Our study in that we did not provide any monetary incentive yet we did see improvement in the scheduling and attendance of pediatric asthma outpatient follow-up visits. The main focus of our interventions was to provide a telephone-based appointment scheduling workflow to the clinic staff. Few studies have examined the effect of telephone-based intervention in pediatric allergy practice.

During this intervention, the 30-day asthma readmission rate significantly decreased. Previous work from Kelly et al have demonstrated that in a pediatric Medicaid-insured population, outpatient evaluation, education and treatment in a pediatric allergy clinic decreased asthma-related hospitalizations and emergency room visits.⁷ This study employed a asthma education nurse to schedule followup and provide patient education. In contrast, our intervention utilized our existing office staff which may allow broader generalization to other settings as it was completed without hiring additional staff for this QI project.

There are some drawbacks to our overall approach for this QI project. There is a risk that telephone-based approaches can worsen racial and economic disparities, however some studies suggest that telephone interventions may reach pediatric patients more successfully.¹⁰ Overall this workflow requires few monetary resources, and in this regard could be generalizable to many practice settings. In our practice, the fraction of admitted patients is small therefore this project did not overextend current office staff. However, this approach may not be feasible if the number of admissions is high and the number of office staff is low, as may be seen in a more general practice setting. At the start of the post-intervention year, our intervention was not initially sustained which we attribute to turnover of staff at that time. This illustrates a drawback of our approach: it is currently reliant on a communication step between inpatient physicians and outpatient staff that is vulnerable to human error. We are examining ways to improve this by utilizing our EMR to bridge inpatient and outpatient settings to prevent this gap in communication. Lastly, our intervention was not blinded. This cohort was small and not designed to examine the effect of therapy, and we did not have access to retail pharmacy dispensing information to assess home medication compliance. Clinicians were not encouraged to change their medical decision-making, however, it is possible that knowledge of an ongoing department-wide QI project may have affected a clinician's asthma care decisions for their patients in ways we are unable to ascertain.

Our study supports previous findings that improved access to outpatient allergy care for asthmatic patients reduces asthma admission.⁷ Specifically, we observe that improving scheduled follow-up within 30-days of hospital discharge was correlated with increased attendance of allergy follow-up visit within 30-days as well as decreased asthma readmission (Figure 3). Using logistic regression modeling to examine confounding variables, we demonstrate that patients in the intervention year (Year 2) were more likely to attend 30-day followup (OR 2.79, 95% CI [1.60, 4.92], $p = 0.001$; Table 2). Severe persistent

asthma was significantly correlated with likelihood of followup, white hospital admission length of stay had a modest positive correlation with likelihood of completing 30-day followup. There was no significant difference in the length of stay in Year 1 and Year 2, making it unlikely that this contributed significantly to the improved attendance of followup visits we observed during the intervention period.

In summary, we have shown that shifting the telephone burden from parents to office staff following asthma hospitalization in a pediatric urban academic allergy practice significantly improves the rate of scheduled follow-up visits within 30-days. Without additional specific changes in our practice's reminder telephone calls, we observed that there was a significant improvement in patients' arrival to follow-up visits within 30 days of asthma exacerbation. This was correlated with a significant decrease in 30-day asthma readmission, suggesting that minor changes in allergy practice organization can improve patient follow-up and significantly decrease asthma readmission rates. We performed this study in a subspecialty context, however, our intervention is broad and could potentially be incorporated to improve follow-up in other medical home contexts, including general pediatric asthma care or in the care of other complex pediatric subspecialty disorders.

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Abbreviations/Acronyms:

QI	Quality Improvement
OR	Odds Ratio
CI	Confidence interval
IQ	Interquartile
SEM	Standard Error of the Mean
EMR	Electronic medical record
PICU	Pediatric intensive care unit

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Figure 1:

Process flowchart diagram representing patient follow-up workflow pre-intervention, in Year 1 (**panel A**) and post-intervention, in Year 2 (**panel B**).

Figure 2:

Scheduled allergy visits are represented in blue and are significantly improved in intervention and post-intervention time frame compared to baseline year. Data displayed monthly with interventions noted at the top of the chart. Dashed red line represents (p) = the expected rate of visits scheduled = (baseline no. of visits scheduled/no. of patients admitted per timeframe assessed). The value of p was reassessed after trend 8 of 9 consecutive months of scheduling data collected on the same side of the previous value of p. 1st and 3rd sigma control limits represented by dashed grey lines.

Figure 3:

Panel A: Kaplan-Meier plot of 30-day attendance in allergy clinic demonstrates significant improvement with QI intervention in Year 2. $p = 0.001$, Cox proportional regression. **Panel B:** Kaplan-Meier plot of 30-day readmission rates between Year 1 and Year 2. were significantly reduced during the Year 2 intervention period. $p = 0.05$, Cox proportional regression.

Table 1:

Patient demographics during the QI project period (Year 2) and baseline comparison year (Year 1).

	Year 1 Pre-Intervention (n=161)	Year 2 Intervention (n=123)
Age	% of patients, unless otherwise noted otherwise	
0 to 1 years	2.5	7.3
2 to 4 years	19.9	16.3
5 to 11 years	52.2	51.2
12 to 17 years	24.2	22.8
Over 18 years	1.2	2.4
Median (IQ range) in years	8.8 (5.2, 12.2)	7.7 (5.2, 12.0)
Gender, male	58.4	54.5
Race		
White	17.4	22.0
African-American	75.8	71.5
2 or more	0.0	2.4
Asian	3.1	0.8
Not available	3.7	3.3
Ethnicity, Hispanic	4.3	5.7
Insurance status		
Private	33.5	37.4
Public	59.6	61.8
Uninsured	6.8	0.8
Admitted to PICU	11.2	11.4
Asthma Severity		
Unclassified	22.4	16.3
Intermittent	5.6	2.4
Mild-Persistent	13.7	21.1
Moderate-Persistent	36.6	40.7
Severe-Persistent	21.7	19.5

Table 2:

Logistic regression modeling of patient followup at 30-days

	Estimate	Standard Error	Odds ratio	95% CI	p-value
<i>Study Year 1 vs Year 2</i>	<i>1.025</i>	<i>(0.28)</i>	<i>2.79</i>	<i>[1.60, 4.92]</i>	<i>0.0003 ***</i>
Intermittent asthma	−0.070	(0.86)	0.93	[0.15, 4.84]	0.94
Mild-persistent asthma	0.463	(0.49)	1.59	[0.61, 4.20]	0.34
Moderate-persistent asthma	0.719	(0.45)	2.05	[0.87, 5.05]	0.11
<i>Severe-persistent asthma</i>	<i>1.709</i>	<i>(0.48)</i>	<i>5.52</i>	<i>[2.19, 14.74]</i>	<i>0.0004 ***</i>
Age 2–4	−0.56	(0.75)	0.57	[0.13, 2.49]	0.45
Age 5–11	−0.990	(0.71)	0.37	[0.09, 1.50]	0.16
Age 12–17	−0.396	(0.74)	0.67	[0.15, 2.86]	0.59
Age 18+	−0.201	(1.59)	0.82	[0.03, 27.21]	0.89
<i>Length of stay (hrs)</i>	<i>0.016</i>	<i>(0.01)</i>	<i>1.02</i>	<i>[1.00, 1.03]</i>	<i>0.0104 *</i>
Gender (male)	−0.076	(0.29)	0.93	[0.53, 1.64]	0.79
Race (black)	−0.584	(1.01)	0.56	[0.08, 4.93]	0.56
Race (2 or more)	−1.139	(1.65)	0.32	[0.01, 8.35]	0.49
Race (White)	0.723	(1.07)	2.06	[0.26, 20.42]	0.50
Ethnicity (non-Hispanic)	0.202	(0.74)	1.22	[0.29, 5.75]	0.78
Payor (Public)	0.355	(0.36)	1.43	[0.72, 2.91]	0.32
Payor (uninsured)	−1.539	(1.19)	0.21	[0.01, 1.53]	0.20
PICU	−0.304	(0.482)	0.74	[0.28, 1.88]	0.53
Severe asthma pathway	−0.153	0.734	0.86	[0.20, 3.67]	0.84

Note: logistic regression coefficients with standard error in parenthesis, followed by odds ratio with 95% confidence interval in parentheses.

*
p 0.05***
p 0.005

Dependent variable is attendance of 30-day followup in allergy clinic.