

Enhancing Postdischarge Asthma Care by Using Pharmacy Claims and Telephone Follow-up

Ronald J. Teufel II, MD, MSCR,^a Anita B. Shuler, RRT,^b Myla D. Ebeling,^c Kristen Morella, MPH,^d Annie L. Andrews, MD, MSCR^a

ABSTRACT

BACKGROUND AND OBJECTIVES: Asthma is a common reason for hospital readmission. The majority of children are not receiving adequate preventive care after discharge. Our objective is to decrease return visits to the emergency department (ED) or hospital for asthma through a series of interventions (eg, access to real-time claims data and structured follow-up phone calls) designed to increase preventive care.

METHODS: We performed a single-site quality improvement project for children 2 to 17 years old discharged with asthma from January 2010 to March 2014. We compared a baseline period and a stepwise intervention period including the following: brief follow-up phone calls to families, access to medication claims data, and structured phone calls. The primary outcome of return visits to the ED or hospital and preventive care outcomes (controller refills and ambulatory visits) up to 90 days were assessed using state all-payer and Medicaid data sets. Interrupted time series analysis was used to investigate secular trends.

RESULTS: Six hundred and seventy-seven asthma discharges were analyzed. The majority of children were 2 to 7 years old, African American, and insured by Medicaid. Successful phone contact occurred in 57% of encounters. Ninety-day revisits to the ED or hospital demonstrated a significant decline (15% to 8%; $P < .05$), but preventive care measures did not improve.

CONCLUSIONS: A process to improve transitions for children who are hospitalized with an asthma exacerbation that includes follow-up phone calls was associated with a decrease in ED or hospital revisits. The lack of a detectable increase in preventive care warrants further exploration.



^aDivision of General Pediatrics, Department of Pediatrics, ^bDepartment of Pediatric Respiratory Therapy, and ^dDepartment of Public Health, The Medical University of South Carolina, Charleston, South Carolina; and ^cDepartment of Pediatrics, College of Medicine, The Medical University of South Carolina, Charleston, South Carolina

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Address correspondence to Ronald J. Teufel II, MD, MSCR, Department of Pediatrics, The Medical University of South Carolina, 135 Rutledge Ave, Charleston, SC 29425. E-mail: teufelr@musc.edu

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Hospitalizations for children with asthma account for one-third of all asthma-related costs, and asthma exacerbations are one of the most common causes of pediatric hospital readmissions.^{1,2} Despite the effectiveness of preventive asthma care,^{3,4} a minority of children attend outpatient follow-up visits and fill prescriptions for controller medications after an emergency department (ED) or hospital visit for asthma.^{5,6} For children with asthma, barriers to the receipt of appropriate preventive care may include gaps in asthma knowledge, lack of belief in treatment efficacy, financial constraints, and forgetfulness.^{7,8} Preventive care may improve asthma symptoms, but numerous other social and behavioral factors can also impact hospital readmissions and return ED visits, including access to care, socioeconomic status, and health-seeking behavior.

The use of hospital discharge phone calls to reduce readmissions has offered some encouraging but inconsistent results in adult populations.^{9,10} Given the complex etiology of asthma return visits to the emergent care setting, we aimed to design and implement a follow-up phone call process specific to the needs of patients with asthma who are recently discharged from the hospital. This process focused on the domains of assessing controller medication use and current asthma control, including signs of wheezing, barriers to care, reinforcement of asthma education, and encouraging ambulatory follow-up visits. Because decreased medication adherence has been shown to be associated with asthma readmission, we attempted to enhance these calls with a Web-based tool that allows providers access to medication refill history.^{8,11}

The purpose of our study is to evaluate the effectiveness of an asthma educator–delivered, refill behavior–informed postdischarge phone call to caregivers of children who were recently hospitalized for asthma. Primary outcome measures include 90-day return visits to the ED or hospital and the use of preventive asthma care as measured by controller medication claims and outpatient appointment attendance.

METHODS

Setting

This quality improvement study occurred in a tertiary referral center located in the Southeast. The medical center has over 740 ED encounters and 140 pediatric hospital encounters for asthma annually, serviced by over 30 attending physicians, 120 registered nurses, and 30 respiratory therapists. A team of physicians, nurses, respiratory therapists, data analysts, and health information technology specialists regularly meet to discuss quality and health services research projects focused on pediatric asthma. Members of this team previously published research on the limited use of preventive asthma care during and after emergent care visits.^{5,6,12} Previous quality efforts include improving inpatient prescribing of inhaled corticosteroids (ICSs) and efforts to ensure patients leave with ICS medications in hand. For this project, the team noted various barriers to postdischarge preventive care and causes for return visits to the emergent care setting. Key drivers discussed included caregiver asthma knowledge, adherence to preventive care, provider knowledge of adherence behaviors, and limitations in access to care (Fig 1). This study was approved after full review by the institutional review board.

Study Population and Design

Patients aged 2 to 17 years who were discharged from the hospital with a primary diagnosis of asthma between January 2010 and March 2014 were included in this quality improvement project. We excluded children with any secondary diagnosis for chronic conditions, including congenital cardiac anomaly, sickle cell disease, and cerebral palsy. Demographics collected include age, sex, race and/or ethnicity, and payer and/or insurance. The study periods include a baseline period (January 2010 to September 2011) and an intervention period (October 2011 to March 2014). A patient was only allowed to enter the baseline and intervention period once. A child discharged during the baseline period was permitted to re-enter as an intervention discharge if readmitted because this patient had not been exposed to the intervention. The initial

study design included a plan for quarterly data review for intervention modification, but because of delays in acquiring and processing refill and ambulatory visit data, modifications to the intervention were informed by general experience with the intervention and local data on ED and hospital return visits. χ^2 was used to assess for change in our outcome means, interrupted time series (ITS) with segmented regression was used to investigate secular trends over time, and control charts were used to display data over time.

Intervention

Brief Follow-up Telephone Call

All intervention phone calls were performed by a respiratory therapist certified in asthma education. Beginning in October 2011, a brief telephone call (~10 minutes) was designed and implemented to quickly assess access to medications and primary care providers via 6 questions. The primary goal of these calls was to provide support to caregivers and reinforce appropriate preventive care. Approximately 20% of the time, the asthma educator would update a staff member from the child's asthma medical home regarding the content of the conversation. In rare circumstances (<10 times each) she performed tasks such as having lost prescriptions mailed to pharmacies, obtaining sample medications, arranging follow-up appointments, and Medicaid transportation. These interventions were patient specific and offered at the discretion of the asthma educator. These calls were performed at 3 and 30 days postdischarge.

Brief Follow-up Telephone Call and Real-Time Access to Claims Data

NaviNet is an electronic Web-based tool that delivers close to real-time pharmacy claims data for children enrolled in a specific Medicaid health maintenance organization with a plurality of our market share (34% during our intervention period). Starting in August 2012, our asthma educator was able to login and access a child's pharmacy claims during both hospitalization and follow-up calls.

Structured Follow-up Telephone Call

For the next iteration of our intervention beginning in March 2013, the brief telephone call ($\pm$ pharmacy claims) (~10–15 minutes) was modified to include 15 questions scripted specifically to assess caregiver knowledge of the child's medications, recent use of preventive asthma care (eg, ambulatory visits and ICSs), and current asthma control, including symptoms of wheezing, reported barriers to care, and reinforcement of asthma education. For patients with near real-time claims data available through NaviNet, the caller used refill history to discuss adherence. For example, "Our records indicate you have not received a controller medication refill, can we do anything to help you obtain this medication?" When designing the structured call, we delayed the second call to 45 days to permit families adequate

time to obtain prescriptions that typically last 30 days.

Data Sources

We merged hospital administrative data and phone call data (recorded in a Microsoft Access data set) with all-payer and Medicaid data from the state's Revenue and Fiscal Affairs Office. The all-payer data set contains all encounter claims for any patient regardless of insurer anywhere in the state for EDs, including urgent care or hospital visits. The Medicaid data contains ambulatory visit claims, pharmacy claims, and elements not recorded in the all-payer data for the subset of children with Medicaid. An investigator-generated data set was sent to the state agency for the merger to state data by using patient name, date of birth, social security number, and Medicaid identification number (if enrolled in

Medicaid). Eighty-three patients were unable to be linked with state data.

Process Measure

Successful contact with any follow-up call was our process measure to determine effectiveness of implementation.

Methods of Outcome Evaluation

Primary Outcome: Return Visits to ED or Hospital Within 90 Days

The primary outcome was a composite measure of return to the emergent care setting (ED visit or hospitalization) with a primary diagnosis of asthma within 90 days of index hospitalization. Returns within 90 days were chosen as our primary outcome, as compared with 7 or 30 days, a priori, on the basis of the design of our intervention, specifically the timing of our phone calls.

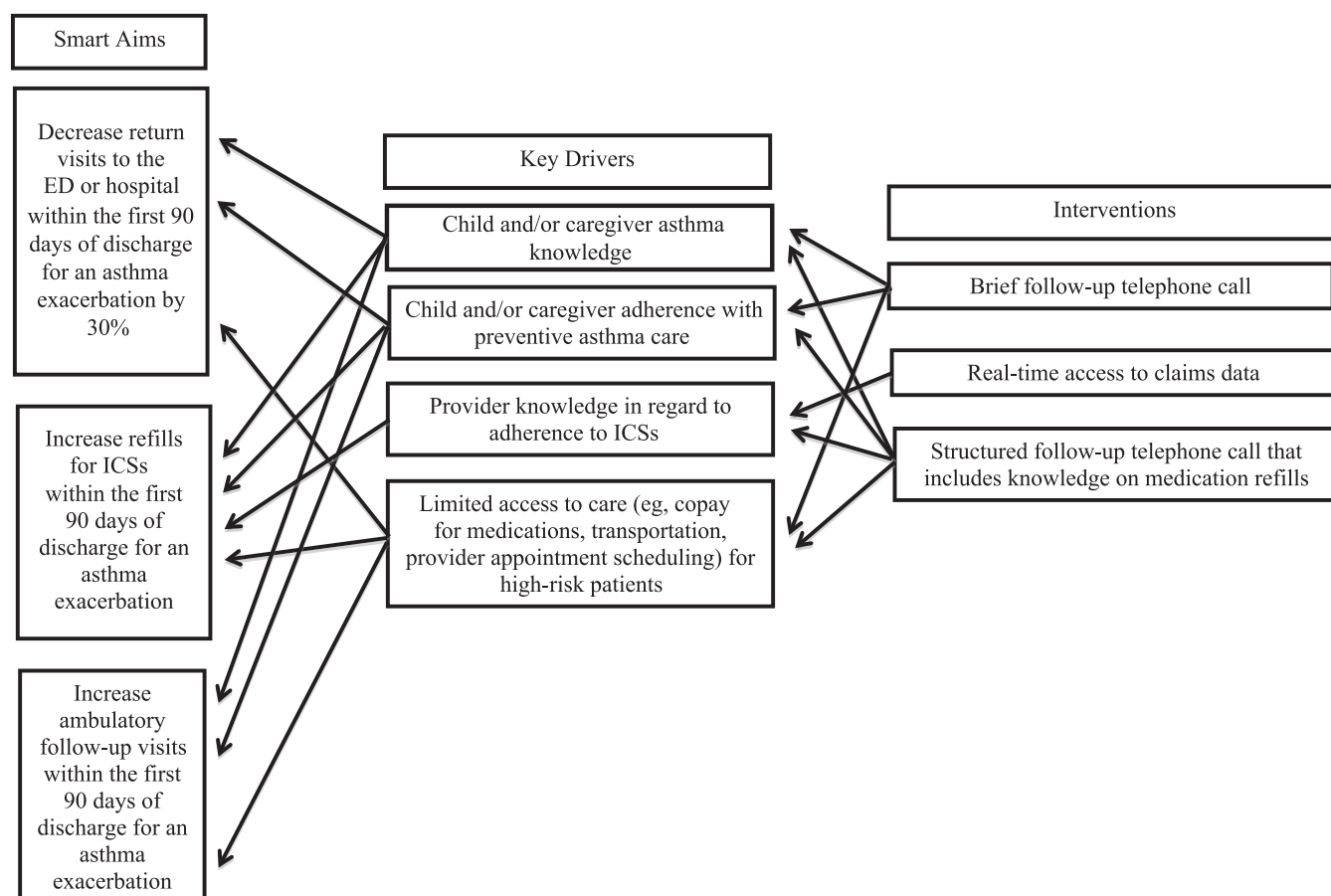


FIGURE 1 Key driver diagram to decrease 90-day return visits to the ED or hospital and increase preventive asthma care after discharge for an asthma exacerbation.

Secondary Outcome: Controller Medication Prescribing and Filling

The Medicaid pharmacy claims data were used to determine if patients filled a controller medication within 90 days of hospital discharge. To ensure any change in controller refills was not due to a change in physician prescribing, we assessed in-hospital prescribing of controllers. To confirm that all controller medication claims were captured, 2 members of our research team (R.J.T and A.L.A.) independently reviewed all of the unique medications ordered in the hospital and Medicaid pharmacy claims data. Because of the superior efficacy over leukotriene receptor antagonists, only ICSs or combined ICSs plus long-acting β -agonists were considered appropriate controller medications.¹³ We excluded pharmacy claims occurring on the day of discharge because some patients had inpatient medications relabeled (with no resultant claim), others filled an outpatient prescription resulting in a Medicaid claim on the day of discharge, and this practice varied over time. Additionally, in this current project, we aim to improve refills after hospitalization.

Secondary Outcome: Ambulatory Care Visits

Ambulatory care encounters were collected from the Medicaid data set for the subset of our cohort enrolled in Medicaid. We used the Healthcare Common Procedure Coding System code to identify ambulatory care visits. Any outpatient encounters up to 90 days after the index hospital admission regardless of primary billing diagnosis were considered successful transitions to a primary provider. Because provider billing practices likely vary, any visit to an ambulatory provider in this population of children at high risk with asthma was considered a successful transition.

Analysis

Demographics are reported as percentages for baseline and intervention periods. The primary outcome measure and secondary outcome measures were assessed with χ^2 and ITS with segmented regression by using generalized linear mixed models to

investigate trends over time.^{14–16} If an outcome was improving during the baseline period before the intervention was implemented, we would detect the trend toward improvement via the ITS analyses to avoid attribution of this improvement to the postintervention period. We also accounted for month-by-month variation in the total number of hospital discharges related to asthma (eg, offset function) via the models on monthly percentage of outcomes over time to ensure variations in patient volume over time were taken into account and did not have a disproportionate effect on the model.¹⁶ All analyses were performed as intention-to-treat on the basis of the

hospital discharge date. Power analysis on the composite outcome (ED visit or hospitalization) and stratified outcome of hospital readmission were performed a priori. With 700 observations, a baseline 90-day composite revisit rate of 20%, and a hospital readmission rate of 5%, we have 90% power to detect a 30% relative difference in the composite measure but only 40% power to detect a difference in hospital readmissions. We performed a secondary analysis on the outcomes of hospital readmission and return to ED without admission over 0 to 30, 0 to 60, and 0 to 90 days postdischarge to further explore the interventions impact. All the

TABLE 1 Description of Children Discharged From the Hospital With the Primary Diagnosis of Asthma From January 2010 to March 2014

	Baseline Period <i>n</i> (%)	Intervention Period <i>n</i> (%)
<i>N</i> = 677		
Age, y		
2–7	120 (64)	331 (67)
8–12	54 (29)	128 (26)
13–17	12 (6)	32 (6)
Sex		
Male	122 (65)	296 (60)
Female	64 (34)	195 (40)
Race and/or ethnicity*		
African American	135 (72)	307 (62)
White	32 (17)	129 (26)
Hispanic	16 (8)	30 (6)
Other	3 (3)	25 (5)
Insurance and/or payer**		
Medicaid	162 (87)	377 (77)
Private	23 (12)	114 (23)
Self-pay and/or indigent	1 (0.5)	0 (0)
Process measure		
Successful postdischarge phone call	0 (0)	282 (57)
Successful postdischarge phone call by intervention time period		
Brief follow-up call	—	133 (68)
Brief follow-up call plus access to medication claims data	—	70 (52)
Structured phone call plus access to medication claims data	—	79 (48)

The baseline period (January 2010 to September 2011) and intervention period (October 2011 to March 2014) included the following: brief follow-up call (October 2011 to July 2012), brief follow-up call plus access to medication claims data (August 2012 to March 2013), and structured phone call plus access to medication claims data (March 2013 to March 2014). χ^2 test for significance was performed between row and column variable. Insurance and/or payer test excluded “self-pay and/or indigent” because of the 0 value. —, not applicable.

* $P < .05$; ** $P < .001$.

data were analyzed with SAS version 9.4 (SAS Institute, Inc, Cary, NC).

RESULTS

The study cohort included 677 discharges with a primary diagnosis of asthma linked to data on ED and hospital visits, with 539 of those being matched to the Medicaid data set during the baseline and intervention periods (Fig 2). The majority of children were 2 to 7 years of age, nonwhite, boys, and insured by Medicaid (Table 1). Thirty-four percent of intervention patients were insured by the specific Medicaid health maintenance organization with NaviNet access. The percentage of children prescribed ICSs in the hospital remained high during both the baseline (93%) and intervention (92%) periods, suggesting limited impact of physician prescribing on our outcomes. Overall, 57% of caregivers in the intervention group received a phone call, but this contact rate declined over time (Table 1).

The percentage of children with a revisit to the ED or hospital within 90 days of discharge significantly decreased during the intervention period compared with the

baseline period (15%–8%; $P < .05$) (Fig 3). In Table 2, we describe the results of the ITS with segmented regression. In the trend analysis, it is suggested that the baseline period had no significant trend in revisits, and the intervention period had a nonsignificant decrease in revisits over time (–10%: 95% confidence interval [CI]: –21 to 3) compared with baseline. Sensitivity analyses were performed, and while accounting for percent African American and excluding an outlier month (July 2011), with ITS, an improvement in revisits continued to be suggested. In Supplemental Table 3, we describe the composite outcome stratified by time and location. Both the percentage of children receiving ICS refills and attending ambulatory visits within 90 days revealed no significant change in mean or secular trends in the baseline period and no significant change in trend during the intervention periods (Table 2, Fig 4, and Fig 5).

DISCUSSION

A postdischarge intervention with asthma educator–delivered follow-up phone calls

informed by medication refill claims for children with asthma was associated with a significant decrease in 90-day return visits to the ED or hospital. The process was moderately successful at implementation, with 57% of discharged patients having successful contact by telephone. Interestingly, the measures for ICS refills and ambulatory care visits did not significantly change.

The lack of improvement in our preventive care outcomes despite reductions in ED and hospital revisits is interesting and likely a result of multiple factors. It is possible that our intervention influenced other factors such as asthma self-efficacy and/or knowledge, access to care, health-seeking behavior, and management of triggers or appropriate rescue inhaler use instead of the preventive care metrics we chose to measure. The model for revisits may be more complex than simply preventive care results in decreased acute care. The secondary analysis (Supplemental Table 3) was designed post hoc to investigate when and where the intervention was most effective. An ED visit without a hospital admission may at times represent a mild to moderate exacerbation, with the potential of home management with increased support. Therefore, the difference in ED revisits from 0 to 90 days (11% versus 5%; $P < .01$) is interesting and could suggest our intervention influenced asthma knowledge or health-seeking behavior. Future researchers should consider the use of patient surveys such as asthma self-efficacy scales or asthma knowledge scales to investigate these additional knowledge- and behavior-related factors.

Additionally, during the baseline period, we began an approach to provide the hospital-dispensed ICSs to the patient at discharge but were unable to accurately measure this practice. This medications-in-hand practice and the rare use of sample medications could impact Medicaid claims for ICSs. No significant secular trends in hospital and ED revisits were observed during the baseline period, including months after July 2010; therefore, relabeling inpatient medications is less likely to be considered a competing intervention that

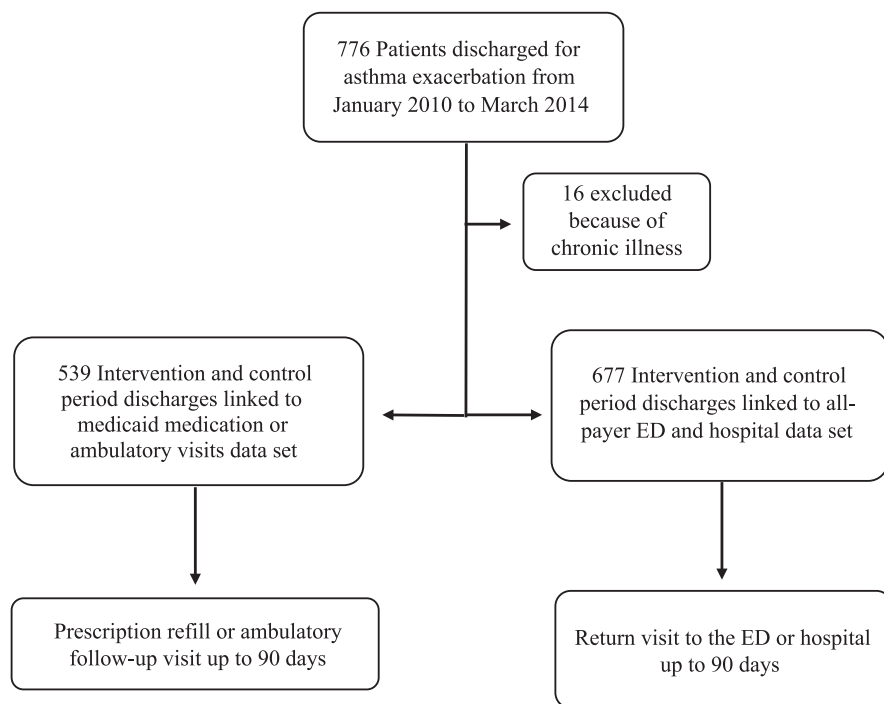


FIGURE 2 Flow diagram for asthma discharges without chronic illness in all-payer and Medicaid data sets.

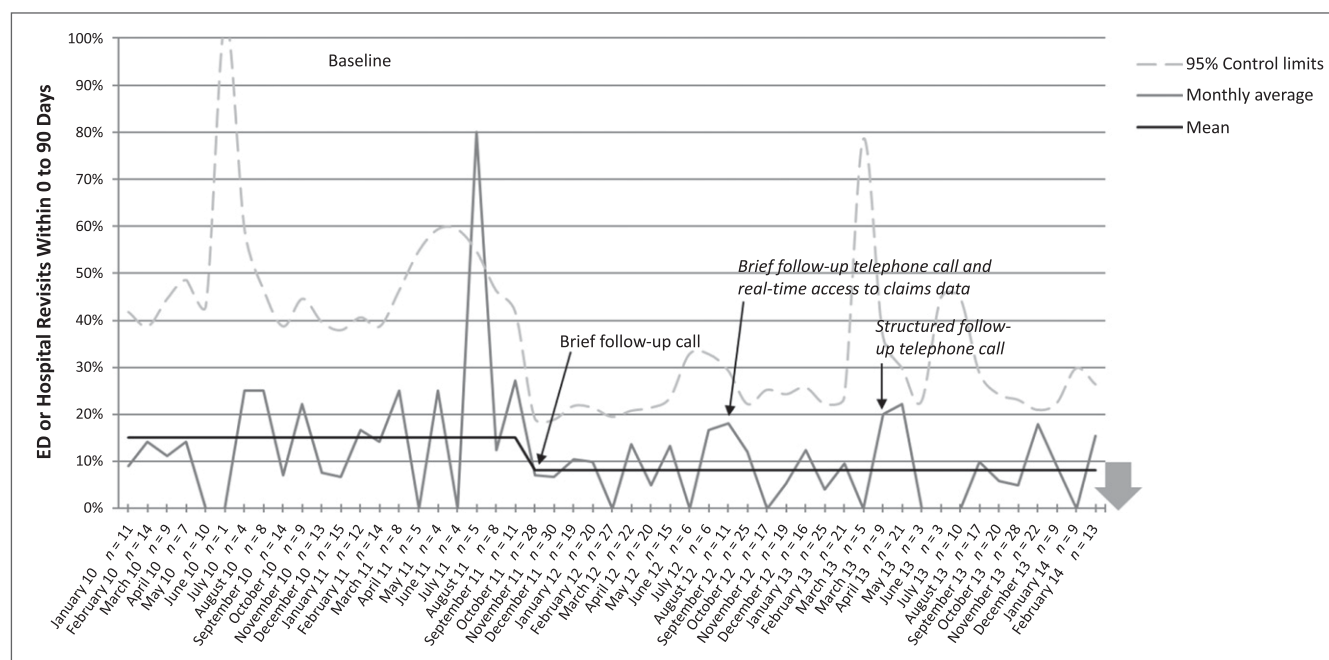


FIGURE 3 Control chart for percent of ED or hospital revisits at 0 to 90 days postdischarge for children hospitalized with asthma. The baseline period was from January 2010 to September 2011. Brief follow-up calls occurred from October 2011 to July 2012. Brief follow-up calls plus access to medication claims data occurred from August 2012 to February 2013. Structured phone calls plus access to medication claims data occurred from March 2013 to March 2014.

decreased revisits. Furthermore, the measure of prescription refills may not detect intermittent daily or weekly increases in ICS adherence that improves asthma symptoms compared with placebo.^{17,18} It is plausible that our efforts have ensured many recently hospitalized patients have medications available to them without refill claims (eg, unused prehospital

inhalers, samples, relabeled inpatient medications), and the benefit of our intervention is the provider engagement encouraging the use of ICSs present in the home. Our experience with these preventive care measures may offer some insight for future researchers to consider, particularly when measuring ICS adherence with refill claims. More so, our emphasis on

improving asthma care may have resulted in other institutional efforts, unknown to us, that were not part of our intervention but could have improved our primary outcome. Although our calls encouraged ambulatory visits, we are somewhat reassured that the visit rate did not significantly decrease. Families could have used this phone encounter in lieu of a visit to their provider.

TABLE 2 Means and ITS Analysis of Trends Assessing the Impact of Follow-up Discharge Calls and Access to Medication Refill Claims on Asthma Revisits and Preventive Care Outcomes

	Mean Baseline Period, n (%)	Mean Intervention Period, n (%)	Trend During Baseline Period ^a (95% CI)	Trend During Intervention Period ^a (95% CI)	Change in Trend per Mo Baseline to Intervention Period ^b (95% CI)
Primary outcome	n = 186	n = 491			
Composite emergency or hospital revisit up to 90 d	28 (15)	41 (8)*	+6 (−1 to 13)	−5 (−12 to 3)	−10 (−21 to 3)
Preventive care outcome measure	n = 162	n = 377			
ICS refill up to 90 d	101 (62)	215 (57)	−2 (−5 to 1)	+3 (−1 to 7)	+5 (−2 to 13)
Ambulatory visits up to 90 d	106 (65)	253 (67)	+1 (−2 to 5)	−1 (−5 to 2)	−3 (−9 to 4)

The baseline period (January 2010 to September 2011) and intervention period (October 2011 to March 2014) were compared by using χ^2 . ITS with segmented regression was performed by using generalized linear mixed models to estimate trends. A “+” indicates an increasing trend or slope, and a “−” indicates a decreasing trend during the baseline or intervention period.

^a Trend analyses assessing slope over time.

^b A change in trend indicates a difference in the trend when comparing pre- versus postintervention. For example, during the intervention period, ICS refills had a nonsignificant increase of 5% month to month compared with the baseline period of −2%.

* $P < .05$.

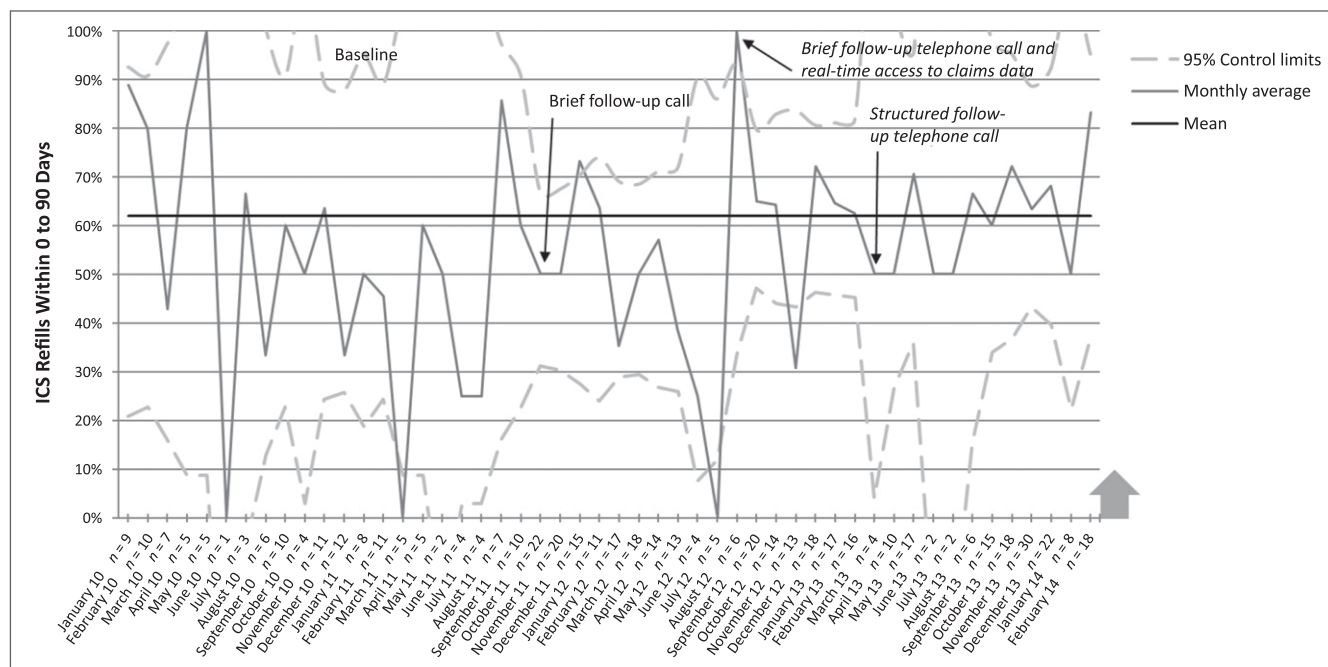


FIGURE 4 Control chart for percent of ICS refills at 0 to 90 days postdischarge for children hospitalized with asthma. The baseline period was from January 2010 to September 2011. Brief follow-up calls occurred from October 2011 to July 2012. Brief follow-up calls plus access to medication claims data occurred from August 2012 to February 2013. Structured phone calls plus access to medication claims data occurred from March 2013 to March 2014.

The use of follow-up phone calls after hospital discharge could be considered an effort to expand the role of a hospital, especially concerning when the hospital process “ends.” This approach is becoming common, with a focus on improving patient satisfaction and decreasing readmission rates, despite reports of variable effectiveness.^{9,10,19,20} We chose this strategy for children with asthma partly because of our previous research in which a gap between evidence and practice for controller medications use after hospitalization was suggested.^{5,6} Our telephone calls were specifically designed around children with asthma and our clinical experience, as compared with a general conversation. We also used a respiratory therapist with AS certification who could offer impromptu aid. Because she was often familiar with the child from the inpatient visit, her comfort in managing mild wheezing and ability to work with the caregiver over the phone to avoid a return visit may have been high. Unfortunately, the structured phone call required added personnel time that we were not able to support financially. This likely

contributed to the decline in successful contact.

Health information exchange (HIE) is of growing importance as organizations focus on population health, Meaningful Use incentive dollars, and improving outcomes. Studies have revealed that HIE is one of the most challenging aspects of the Meaningful Use criteria for hospitals.²¹ The Web-based platform for this study was used to deliver information to health care providers on medication claims that transcend practice settings. Additionally, our use of state data to assess outcomes is a less-often used approach that takes into account important factors such as return visits to different EDs or hospitals and represents another valuable opportunity for HIE.²²

Our study has additional limitations. We did not have a specific process measure of how often medication claims data were obtained through the Web-based portal during or after the hospitalization for each child. More so, only 34% of patients had available claims data. Analyzing data as intention-to-treat results in a conservative estimate of

effectiveness. Additionally, in our study design, we used an implementation strategy focused on all children with asthma with a modified intervention over time. This allowed us to assess the percent of patients reached over the telephone and evaluate the intervention’s effectiveness for a hospital system. However, this design does not account for unmeasured confounders or differentiate the maximum effectiveness of each individual intervention. Additionally, as a quality improvement project, it would have been ideal to have all data elements to plan the next phase of the intervention. Unfortunately, because of issues in obtaining and processing data in a timely manner and institutional review board constraints, the planning and design of the next intervention phase was both delayed and only partially informed. Furthermore, other unmeasured factors could have influenced our study outcomes. Others may have been aware of the goal to decrease revisits and may have performed additional improvement activities. Additionally, the provision of relabeled inpatient medications on discharge could have impacted the study.

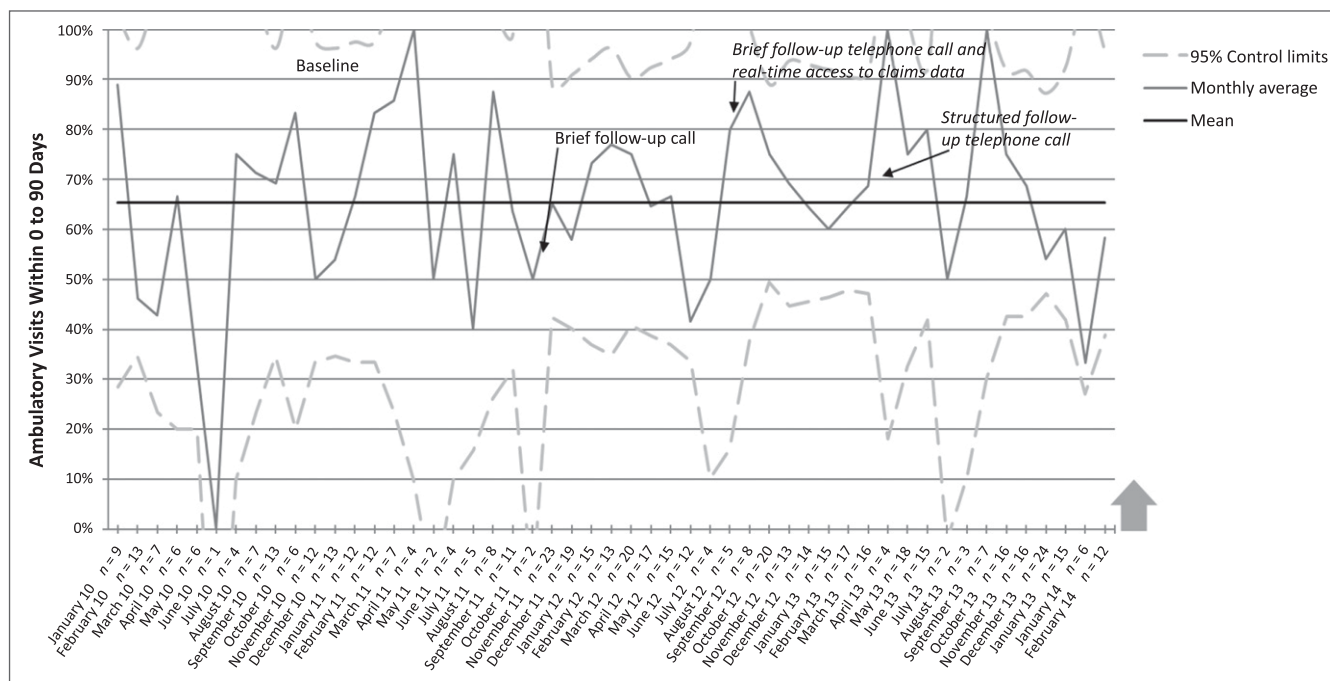


FIGURE 5 Control chart for percent of ambulatory visits at 0 to 90 days postdischarge for children hospitalized with asthma. The baseline period was from January 2010 to September 2011. Brief follow-up calls occurred from October 2011 to July 2012. Brief follow-up calls plus access to medication claims data occurred from August 2012 to February 2013. Structured phone calls plus access to medication claims data occurred from March 2013 to March 2014.

CONCLUSIONS

A process that included follow-up telephone calls and real-time access to pharmacy claims to enhance postdischarge care for children hospitalized with an asthma exacerbation was associated with a decrease in revisits to the ED or hospital. Preventive care measures did not significantly improve, suggesting the primary mechanism for decreased revisits may be through other pathways such as asthma knowledge or intermittent adherence.

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