Title

Strategies for sustaining high-quality pediatric asthma care in community hospitals.

Journal

Health Services Research, 57(1)

Authors

Jaladanki, Sravya
Schechter, Sarah
Genies, Marquita
et al.

Publication Date

2022-02-01

DOI

10.1111/1475-6773.13870

Peer reviewed

DOI: 10.1111/1475-6773.13870

RESEARCH ARTICLE

HSR Health Services Research

Strategies for sustaining high-quality pediatric asthma care in community hospitals

Sravya Jaladanki BA[1] | Sarah B. Schechter MD[1] | Marquita C. Genies MD, MPH[2] | Michael D. Cabana MD, MPH[3] | Roberta S. Rehm RN, Ph.D.[4] | Eric Howell MD[5] | Sunitha V. Kaiser MD, MSc[6]

[1]Department of Pediatrics, University of California, San Francisco, San Francisco, California, USA

[2]Department of Pediatrics, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA

[3]Department of Pediatrics, Albert Einstein College of Medicine, New York, New York, USA

[4]Department of Family Health Care Nursing, University of California, San Francisco, San Francisco, California, USA

[5]Society of Hospital Medicine, Philadelphia, Pennsylvania, USA

[6]Departments of Pediatrics, Epidemiology and Biostatistics, Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco, San Francisco, California, USA

Correspondence
Sunitha V. Kaiser, Departments of Pediatrics, Epidemiology and Biostatistics, Philip R. Lee Institute for Health Policy Studies, University of California, San Francisco, 550 16th St., San Francisco, CA 94158, USA.
Email: sunitha.kaiser@ucsf.edu

Funding information
This study was funded by a grant from the Agency for Healthcare Research and Quality (R03HS027041)

Abstract

Objective: To identify strategies associated with sustained guideline adherence and high-quality pediatric asthma care in community hospitals.

Data sources: Primary qualitative data from clinicians in hospitals across the United States (collected December 2019–February 2021).

Study design: Pathways for Improving Pediatric Asthma Care (PIPA) was a national quality improvement (QI) intervention. In a prior quantitative study, data from 23 community hospitals in PIPA were analyzed to identify sites with the highest and lowest performance in sustaining improvements for 2 years. In this qualitative study, we conducted semi-structured interviews with multidisciplinary clinicians from these hospitals to identify strategies associated with sustainability.

Data collection/extraction methods: We purposefully sampled and interviewed participants involved in clinical care of children hospitalized with asthma at the identified hospitals (those with the highest/lowest sustainability performance). We transcribed and analyzed interview data using constant comparative methods.

Principal findings: Clinicians ($n = 19$) from five higher- and three lower-performing hospitals participated. In higher-performing hospitals, dedicated local champions more consistently provided reminders of evidence-based practices and delivered ongoing education. They also modified/developed electronic health record (EHR) tools (e.g., order sets with decision support). Higher-performing hospitals had a collaborative culture receptive to practice change and set firm expectations that evidence-based practices would be followed without exception. In lower-performing hospitals, participants described unique barriers, including delays in modifying the EHR and lack of automation of EHR tools (requiring clinicians to remember new EHR tasks without automated prompts). Barriers to sustainability for all hospitals included challenges with quality monitoring, decreasing focus of local champions over time, and ongoing difficulties developing consensus around evidence-based practices.

Conclusions: To better ensure sustained high-quality care for children with asthma and greater returns on QI investments, QI leaders should prioritize: designating long-term local champions to continue reminders and educational efforts and developing electronic order sets to provide ongoing decision support.

KEYWORDS
asthma, child, hospitals, program evaluation, quality improvement

What is known on this topic

- In the majority of cases, clinicians' guideline adherence and care quality decline after quality improvement interventions end.
- Community hospitals, which care for over 70% of hospitalized children in the United States, may be especially vulnerable to declines in guideline adherence and pediatric care quality over time.
- Prior quality improvement and implementation research efforts have predominantly focused on short-term impacts, leaving critical knowledge gaps in how to promote sustained, high-quality care, and improved health outcomes for children in community hospitals.

What this study adds

- We compared community hospitals with higher and lower performance in sustaining improvements in pediatric asthma care quality after the end of a national quality improvement intervention.
- We found, in higher-performing hospitals, dedicated local champions more consistently provided reminders of evidence-based practices, delivered ongoing education, and modified/developed electronic health record tools (e.g., order sets with decision support).
- Hospital leaders should consider prioritizing these strategies to ensure sustained, high-quality care for children hospitalized with asthma and greater returns on quality improvement investments.

1 | INTRODUCTION

Although asthma is a leading cause of childhood hospitalization,[1] critical knowledge gaps prevent delivery of sustained, high-quality hospital care for children with asthma.[1–3] Each year in the United States, there are over 100,000 pediatric asthma hospitalizations leading to ~$1.6 billion in direct costs.[1] Hospitals invest substantial resources into quality improvement (QI) interventions focused on improving clinicians' adherence to evidence-based guidelines and optimizing health outcomes for patients, such as children with asthma. However, most studies show clinicians' guideline adherence and care quality decline after such QI interventions end.[4,5] Prior QI and implementation research efforts have predominantly focused on short-term impacts, leaving critical knowledge gaps in how to sustain high-quality care over time.[2]

Community hospitals, which care for over 70% of hospitalized children in the United States,[6] may be especially vulnerable to declines in guideline adherence and pediatric care quality over time. Community hospitals primarily provide care to adults, and costs and payments related to adult care are higher than for pediatric care; additionally, Medicare and Joint Commission QI initiatives are predominantly adult-focused.[7] Consequently, pediatric QI efforts often have limited access to key QI resources that help sustain high-quality, evidence-based care. Pediatric QI leaders at community hospitals have reported that, compared to adult-focused colleagues, they have limited access to support staff for modifying electronic health records (EHRs)/adding electronic decision support tools, limited access to QI consultants or data analysts, limited ability to train and expand the scope of practice of clinicians that provide care to both adults and children (e.g., respiratory therapists), and limited influence in changing hospital formularies to align with pediatric evidence-based guidelines.[7,8] Such limitations can impact the sustainability of QIs. In prior study, we found concerning declines in care quality in community hospitals after the end of a national pediatric asthma QI intervention.[3] Such declines in care quality lead to poor health outcomes for children with asthma, including longer recovery time/hospital stay, higher rates of transfer to intensive care units, and increased risk of hospital readmission.[9–11]

Prior studies have identified potentially promising strategies for promoting sustained high-quality care,[12] but none have focused on children in community hospital settings. In 2020, Cowie et al published a systematic review that summarized 32 studies of barriers and facilitators of sustained QIs in hospital settings.[12] The authors found that the most important facilitators of sustainability were creating accountability of roles and responsibilities, ensuring the availability of champions advocating use of the intervention, and having adequate support at the organizational level. Additional facilitators included monitoring long-term progress, ensuring adequate training, and having the needed resources/infrastructure. However, none of the included prior studies focused on children in community hospital settings. Our team has conducted studies on strategies/facilitators of initial implementation in these settings,[13,14] but sustainability is likely a unique, dynamic process that requires specific study to identify feasible, effective strategies.[2,15,16] Thus, there are critical knowledge gaps in

how to promote sustained, high-quality care and health outcomes for children hospitalized with asthma.

In a prior quantitative study, we analyzed data from 23 community hospitals in a national pediatric asthma QI intervention to identify sites with the highest and lowest performance in sustaining clinicians' guideline adherence over a 2-year period.[3] In this qualitative study, our objective was to study these community hospitals to identify strategies associated with sustained, high-quality pediatric asthma care. This knowledge can help community hospitals optimize health outcomes for children and achieve greater returns on QI investments.

2 | METHODS

2.1 | Study setting

Pathways for Improving Pediatric Asthma Care (PIPA) was a national QI intervention led by the Value in Inpatient Pediatrics Network, the inpatient QI network at the American Academy of Pediatrics.[17] PIPA included 85 hospitals, of which 45 were community hospitals (verified using data from the American Hospital Association Annual Survey Database[18]). Participating hospitals varied in terms of size, geographic region, type (e.g., nonprofit, government), and location (e.g., urban). The timeline of the QI intervention is illustrated in Figure 1. Hospitals started the intervention in two groups, with half of sites starting in January 2018 and half starting in April 2018. The QI intervention lasted 12 months for both groups. Thirty-four community hospitals (out of 45) completed the intervention and were approached to participate in extended sustainability monitoring. Of these 34 hospitals, 23 hospitals participated (68% of eligible). Sustainability monitoring lasted from the end of the QI intervention through the end of 2019 (9–12 months from intervention end date, depending on group).

The QI intervention focused on increasing evidence-based practices (early administration of bronchodilator via metered-dose inhalers,[19] screening for exposure to secondhand tobacco,[20] referral to smoking cessation resources[20]) and improving a patient-centered health outcome (decreasing time to recovery/hospital length of stay). Details on the supports provided by the QI intervention and fidelity to the intervention are detailed in other manuscripts.[14,17] Briefly, participating sites were provided with pediatric asthma pathways, educational materials and seminars, QI mentorship/facilitation, monthly data reports, a free mobile application with pathway content, and peer-to-peer learning opportunities. In the Fall of 2018 (near the end of the collaborative), local site leaders from all PIPA sites participated in an educational seminar focused on sustainability, as well as meetings with external QI mentors to facilitate sustainability planning.

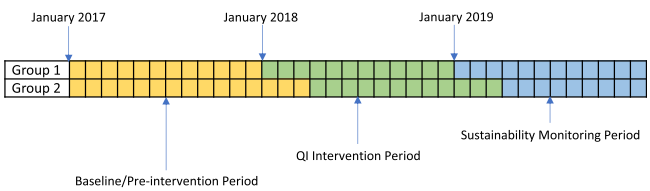

FIGURE 1 Quality improvement (QI) intervention timeline. Each cell represents 1 month. Hospitals collected baseline/preintervention data. They then started the QI intervention in two groups, with half of sites starting in January 2018 and half starting in April 2018. The QI intervention lasted 12 months for both groups. Sustainability monitoring lasted from the end of the QI intervention through the end of 2019 [Color figure can be viewed at wileyonlinelibrary.com]

2.2 | Theoretical framework

This study builds on our team's and others' successful prior work leveraging the positive deviance framework, which posits that knowledge about "what works" is available in existing organizations that demonstrate consistently exceptional performance.[21] This framework is new to health care research but has already proven its dramatic potential—it was used to guide interventions that increased the proportion of patients in the United States with myocardial infarction whose care met national targets for timeliness from ≈50% to >75%.[21,22] The framework outlines four steps that harness the strengths of mixed-methods to better understand the complex processes of implementing health-system interventions and modifying individual clinician's behaviors: (1) identify "positive deviants" (organizations that demonstrate exceptionally high performance) using quantitative methods; (2) study these organizations using qualitative methods to generate hypotheses about strategies that drive high performance; (3) test hypotheses/practices in larger, generalizable samples; and (4) work with key stakeholders/partners to disseminate findings.[21]

2.3 | Design and population

This qualitative study represents "Step 2" of the positive deviance framework, and our primary aim was to identify strategies associated with sustained, high-quality pediatric asthma care. Thus, we purposefully sampled PIPA implementation leaders and other pediatric clinicians from community hospitals with the highest sustainability performance, and we concluded interviews once we had reached saturation around themes focused on sustainability strategies. While the positive deviance framework outlines solely studying higher performers/positive deviants, our group and others recognize the importance of also using a smaller sample of participants from lower performers to confirm that the strategies identified in higher-performing sites differ from those used in lower-performing sites.[13,23] Thus, we also interviewed a smaller sample of participants from lower-performing sites to achieve this confirmation. With all interviews, we collected additional data for an exploratory aim around characterizing important contextual factors and barriers to sustainability.

Sustainability performance was determined using data from our prior quantitative study.[3] For that study, community hospitals collected data on care quality outcomes via chart review of children aged

2–17 years hospitalized with a primary diagnosis of asthma, identified using International Classification of Diseases-10 codes.[24] Care quality was analyzed by examining clinicians' adherence to the evidence-based practices noted above and patients' hospital length of stay. We identified community hospitals with the highest and lowest sustainability performance based on changes in these outcomes.

We used interrupted time series analyses to evaluate these outcomes over a total period of 21–24 months from the start of the QI intervention. Interrupted time series analyses account for pre-existing trends in each outcome and evaluate: (1) changes in an outcome at the time of an event and (2) changes in the rate of change in an outcome after versus before an event. Our primary event of focus was prespecified as the end of the 12-month QI intervention, which was chosen because this time-point was when sites no longer had access to several QI supports that were being provided externally. Thus, this event represented a decline in QI resources that commonly occurs at the end of such quality interventions.

In determining performance, we primarily focused on changes in performance happening at and after this event, the end of QI intervention. However, we also wanted to incorporate an assessment of long-term performance (over the 21- to 24-month period evaluated), in line with an established definition of sustainability—long-term maintenance of improvements in guideline adherence and/or patient outcomes.[25] Consequently, we defined higher performers as those with (1) no significant declines in performance at/after the end of the QI intervention and (2) long-term improvements in ≥2 of 4 outcome measures ($n = 5$ hospitals). We defined lower performers as those with (1) declines in ≥3 of 4 outcome measures after the end of the QI intervention and (2) no significant long-term improvements ($n = 3$ hospitals). Of note, both higher- and lower-performing hospitals (1) had comparable performance at baseline with substantial room for improvement (mean performance across all guideline adherence measures 34% in higher performers and 30% in lower performers [target 100%]) and (2) had significant improvements in ≥2 of 4 outcome measures during the initial QI intervention.

This study was approved by the institutional review board at the University of California, San Francisco.

2.4 | Data collection

We drafted a semi-structured interview guide using two resources: the Consolidated Framework for Sustainability Constructs in Healthcare and the Expert Recommendations for Implementing Change (ERIC) compilation of implementation strategies (Appendix A).[26,27] We conducted one-on-one interviews with clinicians via videoconference. Interviews began with open-ended questions, followed by semi-structured probes. Since we collected retrospective data on sustainability strategies, we used specific interview techniques to facilitate effective retrospective responses (1) providing a clear anchor reference point to orient their experience (date of the end of the PIPA intervention) and (2) asking clarifying questions about temporal relationships.[22,28] We used the first three interviews as pilot tests, reviewing them immediately to analyze the interview process and modifying the interview guide as needed. All interviews were recorded and transcribed, then proofread for accuracy. The final sample size was determined on the basis of saturation (i.e., new data regarding sustainability strategies at higher-performing sites were repetitive, with no new emergent themes or concepts generated).[29]

2.5 | Analysis

We analyzed qualitative interview data in *Dedoose* 8.3.45 (Manhattan Beach, CA) using constant comparative methods, informed by grounded theory.[29] To ensure reliability, our team worked together to review several interview transcripts and develop a preliminary codebook. Three authors (SJ, SBS, and SVK) then simultaneously, but independently, coded five transcripts and compared codes to ensure agreement. We developed the code structure through an iterative, inductive process using the selected frameworks[26,27] as a resource. Our whole team then examined the coded data together to finalize the codebook. We performed line-by-line coding and identification of key themes. Every transcript was coded independently by at least two coders, and coders met periodically throughout the coding process to ensure consistency. Coding and analysis were conducted in parallel with interviews, so we could continue interviews until we reached saturation (with regards to sustainability strategies). We compared data from higher- and lower-performing hospitals to confirm differences in the utilization of the identified sustainability strategies. Disagreements were resolved through review of primary data and iterative discussions among all study investigators. To ensure study rigor, we used reflexivity, member checking, and triangulation (use of multiple investigators and participants from multiple roles [investigators: administrator, physician, nurse, fellow-in-training, and student; participants: physicians, nurses, respiratory therapists, and pharmacists]).[29,30]

3 | RESULTS

3.1 | Participants

PIPA implementation leaders from five higher-performing and three lower-performing community hospitals participated in the study, and they helped recruit additional clinicians from each hospital. We approached a total of 22 potential participants for this study, of which 19 (86%) participated ($n = 13$ participants from higher performers and $n = 6$ participants from lower performers). We included one to three pediatric clinicians from each hospital (total: 10 physicians, 5 nurses, 3 respiratory therapists, and 1 pharmacist).

3.2 | Findings

A full list of themes with exemplary quotes is provided in Appendix B, and a narrative summary of major themes and findings is outlined below.

3.3 | Sustainability strategies

We identified three promising strategies that were consistently used by community hospitals with higher pediatric QI sustainability performance but were uncommon or inconsistent at hospitals with lower performance. Higher-performing hospitals had designated local champions that consistently continued using two strategies after the end of the QI intervention (1) providing ongoing reminders of evidence-based practices and (2) delivering education on evidence-based pediatric asthma care. Additionally, higher-performing hospitals modified/developed EHR tools that remained available to support clinicians after the QI intervention ended (e.g., order sets with decision support).

After the QI intervention ended, local champions at higher-performing sites continued to remind clinicians regularly about evidence-based practices in pediatric asthma care. Reminders included verbal reminders during meetings and patient care, visual reminders in the environment (e.g., handouts, flyers), and e-mail reminders. Lower-performing sites described substantial decreases or discontinuation of such reminders after the end of the QI intervention.

> "For the residents, we have our guidelines where they can find them. We have them posted visibly in the call room as well as on a couple of different sites on our internal website." (Physician, Hospital A, Higher Performer)

> "If a new asthmatic was getting admitted, we would make sure that we mentioned to either the nurse or to the respiratory therapist, 'Hey, just a reminder, this kid is going to be on metered-dose inhalers'." (Physician, Hospital B, Higher Performer)

> "There were some early emails initially [during the initial QI intervention], but nothing carried on after it ended, and I don't recall that there was any great feedback." (Physician, Hospital F, Lower Performer)

Local champions at higher-performing sites also provided ongoing education using a variety of approaches. Approaches included review of guidelines one-on-one with clinicians during clinical care tasks, as well as more formal didactic review with larger groups of clinicians during scheduled meetings. Participants also described how important it was to ensure education for new or rotating staff. Lower-performing sites reported discontinuation of formal didactic education and limited informal education efforts after the QI intervention ended.

> "When a new employee comes on during their orientation, they're educated on [the pediatric asthma] pathway. For people who float to our unit, we make sure that if they have an asthma patient that they're aware of the pathway. So, we are resources and mentors to them, so that education piece has truly never gone away." (Nurse, Hospital B, Higher Performer)

> "There was nothing…no formal education ever happened [after the QI intervention ended]." (Physician, Hospital D, Lower Performer)

Higher-performing sites described development/modification of several tools within the EHR that supported clinicians in using evidence-based practices in pediatric asthma care and remained available after the QI intervention ended. These included electronic order sets (with evidence-based treatments preselected or listed first and/or extra text with details on evidence-based practices), modified note templates that included sections on screening for second-hand tobacco exposure and cessation resource referral, and nursing flowsheets that prompted use of a pediatric asthma pathway. Lower-performing sites reported inability to develop/modify EHR tools, substantial delays in these processes, and/or lack of automation of EHR tools (requiring clinicians to remember and perform new EHR tasks without automated prompts to do so).

> "We have a standard template that we use for all of our pediatric admissions and we added a smoking screening question just to default for all admissions." (Physician, Hospital E, Higher Performer)

> "Somebody shouldn't have to remember something on a regular basis, because things are easy to forget. [It] needs to be right there in their face; every time they're ordering the asthma pathway order set it's right there, they see the metered-dose inhaler is coming up…People want to do the right thing, but if it's not made easy, then sometimes things slip away." (Nurse, Hospital B, Higher Performer)

> "[It] comes down to the individual person too and how diligent people are. Since we were still relying on the smart phrase, you actually had to make the effort in putting it in and it wasn't automated. I think that from a reliability standpoint it wasn't ideal." (Physician, Hospital C, Lower Performer)

3.4 | Context

Participants from higher-performing hospitals described the importance of having a hospital culture that was receptive to practice change and collaborative. This collaboration was facilitated when groups of clinicians were small and closer-knit. They also described local champions expressing firm expectations that evidence-based practices would be followed without exception. Champions at lower-performing sites described more hesitance to change current practices and more laxity about deviations from evidence-based practices.

> "The fact that the staff felt comfortable to discuss their concerns about the efficacy of the metered-dose inhalers allowed us to provide resources for them…

If there wasn't strong collaboration and communication, we would have never known that. Then the buy-in might not have been as good." (Nurse, Hospital B, Higher Performer)

"It was difficult to get people on board with doing the metered-dose inhalers in the middle of the night. Because nobody wanted to wake up the patients…So, they would just get a [one-time] dose of nebulizer, but then that would just become carried on through their daytime doses." (Physician, Hospital D, Lower Performer)

3.5 | Barriers to sustainability

Participants from both higher- and lower-performing hospitals described challenges with (1) maintaining long-term quality monitoring, (2) keeping the original multidisciplinary groups of local champions engaged, and (3) addressing ongoing concerns about practice change.

Quality monitoring for this QI intervention was carried out via manual chart review, requiring support from medical records staff (to identify records of children hospitalized with asthma) and substantial time from clinicians performing chart review. Both of these resources were at risk of being reallocated to new priorities and, thus, difficult to sustain over time. Even when certain quality monitoring was automated within the EHR, it required clinician time for data quality review and planning. Additionally, when sites had very low volumes of pediatric asthma patients, it was difficult to meaningfully monitor or interpret changes in quality measures over time.

"I had to almost think like a computer to get the right data…There were enough barriers to discourage me from having a report built and really trusting it." (Physician, Hospital A, Higher Performer)

During the initial QI intervention, each hospital had a designated physician champion that recruited a large multidisciplinary group of clinicians to act as local champions. Participants described difficulties maintaining engagement of these local champions long-term after the QI intervention ended. Decreased engagement was driven by competing, new QI priorities, and lack of resources/dedicated salary support for QI.

"A community site doesn't necessarily give people with non-administrative roles any protected time [for quality improvement/assurance]." (Physician, Hospital A, Higher Performer)

"[Our multidisciplinary group] didn't really meet regularly at that point, other than the physicians meeting and reviewing the data and then myself going to the ER meetings and reviewing the ongoing data." (Physician, Hospital F, Lower Performer)

Additionally, local champions continued to face challenges in addressing new or ongoing concerns about practice change. Champions continued to address these concerns with education and training efforts.

"If you have someone that is a seasoned physician or has their own way of doing things, it might be a little bit more difficult to persuade that person to make the change." (Respiratory Therapist, Hospital C, Lower Performer)

4 | DISCUSSION

Prior QI and implementation research have predominantly focused on initial, short-term effects of interventions (≤1 year).[2] Although some of the same types of strategies may be used to support both initial implementation and sustainability, sustainability is likely a unique, dynamic process that requires specific study and interventions.[2,15,16] Thus, there remain critical knowledge gaps in feasible, effective strategies for achieving long-term improvements in care quality. In this national study, we identified several promising strategies for promoting sustained high-quality care for children hospitalized with asthma in community settings. These include having dedicated local champions provide reminders of evidence-based practices and deliver ongoing education, as well as modifying/developing EHR tools (e.g., order sets) that are available long term to provide clinicians with decision support. Community hospitals should prioritize having the resources in place to support these strategies in order to optimize health outcomes for children and achieve greater returns on QI investments.

Our findings align with other observational studies of potentially promising sustainability strategies. Studies focused on initial implementation of evidence-based practices have demonstrated the effectiveness of local champions, education, reminders, and EHR decision support.[31] Studies focused explicitly on sustainability have also reinforced the effectiveness of these strategies.[32,23] A multicenter study of a pediatric asthma QI intervention also showed sustained QIs over a 5-year period with these strategies in place for a long term.[32] A qualitative study by Brewster et al comparing hospitals with higher and lower performance in sustaining adult hospital readmission prevention after a QI intervention reported a key factor was at least "a single person that continued to devote substantial effort to holding the intervention in place for as a long as a year, [which involved] monitoring the new practice, proactively reminding staff to continue to performing it, and solving problems that arose." For simple practices, they reported sustainability was also promoted by automation involving the EHR (e.g., order sets).[23]

Our findings also align with prior literature on barriers and facilitators of sustainability but provide unique insights applicable to pediatric care in community hospitals. Our findings align with the systematic review of barriers and facilitators of sustainability published by Cowie et al in 2020, which synthesized findings from 32 prior studies.[12]

Like us, they found important facilitators included having strong local champions, creating accountability of roles, ensuring adequate training/education, having adequate resources, and monitoring long-term progress. However, Cowie et al identified additional important factors that our findings indicate may be less important in pediatric settings of community hospitals, such as those in the external environment/outside the hospital (e.g., national policies, community-based resources, quality performance reporting). In terms of barriers, Cowie et al also identified workload pressures and lack of leadership by local champions, but they did not detail the challenges with ongoing data monitoring and change management that our findings indicate. Our findings also align with our prior work identifying barriers to initial implementation efforts (e.g., concerns about practice change, difficulties with performance monitoring),[13,14] which may reflect the long-term persistence of such barriers. However, this current study provides unique insights into potentially feasible, effective strategies for overcoming such barriers and achieving sustained improvements in care.

Although community hospitals often lack robust QI infrastructure focused on pediatric QI,[8] the sustainability strategies we identified are likely feasible to maintain long term in these settings. The higher-performing hospitals in this study reported use of these strategies for 2 years during and after the QI intervention, indicating long-term feasibility. Moreover, in our prior study of 104 hospitals that participated in a national pediatric QI intervention, we also found the majority of sites sustained local champions, reminders of evidence-based practices, and electronic order sets. However, few were able to sustain audit and feedback, organizational support, or other QI activities (e.g., Plan-Do-Study-Act cycles).[33] To increase feasibility, QI leaders must proactively plan for continuing such strategies for a long term and initiate this planning at the start of QI interventions. Future studies are also needed to prospectively test the effectiveness of these and other potential strategies, as well as quantify the associated costs.

Participants described several important barriers to long-term monitoring of quality performance, including lack of time to continue manual chart review, poor quality of automated data reports from the EHR, and difficulties in meaningfully interpreting data when patient volumes were very low. Chart review was used as the data collection method for the PIPA QI intervention because developing EHR reports was not feasible in many community hospitals and because several quality measures could not be accurately collected automatically (e.g., early administration bronchodilator via metered-dose inhalers). New technologies like natural language processing may eventually overcome such barriers,[34] but they will still require time and cost for implementation and data quality control. These limitations underscore the importance of establishing dedicated informatics resources for QI efforts, including for QI efforts focused on children in community hospitals.

Our findings also highlight the importance of having a hospital culture that is collaborative and receptive to practice change. Our study participants described an open and collaborative culture where they were free to express concerns. They also described a strong, positive reception to data supporting new practices and willingness to change. Hospital culture has been associated with use of evidence-based guidelines and important patient outcomes.[28] Yet, few studies have examined interventions for promoting broad changes in hospital culture.[35] Curry et al examined a program "Leadership Saves Lives," which was designed to foster improvements in five domains of hospital culture: (1) learning environment, (2) psychological safety, (3) senior management support, (4) commitment to the organization, and (5) time for improvement efforts. Authors found the intervention was associated with improvements in hospital culture, use of evidence-based guidelines, and adult mortality rates.[36] Thus, QI leaders should consider preassessment of aspects of hospital culture (e.g., leadership support, readiness to change practice) to help guide more targeted and successful QI efforts.[37] QI leaders might also consider integrating efforts to improve culture (e.g., "Leadership Saves Lives" program) as a means to improve sustainability and returns on QI investments.

This qualitative study is meant to generate hypotheses about sustainability strategies, but it is limited/unable to assert causal associations. Additionally, while the majority of eligible community hospitals participated in sustainability monitoring and this qualitative study, our findings may not be generalizable to those that dropped out or the larger national pool of community hospitals that provide pediatric care.

In conclusion, we identified several potentially promising strategies for promoting sustained high-quality asthma care for children in community hospitals. Our data align with prior studies but provide unique insights into what may be most feasible and effective in this setting. It remains important that these and other strategies be prospectively tested to establish their effectiveness and costs.

ACKNOWLEDGMENT

We would like to acknowledge the Value in Inpatient Pediatrics Network, which funded the PIPA quality improvement initiative. We would also like to acknowledge all the clinicians involved in leading QI efforts and participating in this study.

ORCID

Sunitha V. Kaiser https://orcid.org/0000-0002-9862-9362

REFERENCES

1. Agency for Healthcare Research and Quality. Overview of Hospital Stays for Children in the United States, 2012; December 2014; Rockville, MD.
2. Proctor E, Luke D, Calhoun A, et al. Sustainability of evidence-based healthcare: research agenda, methodological advances, and infrastructure support. *Implement Sci*. 2015;10:88.
3. Schechter S, Jaladanki S, Rodean J, et al. Sustainability of paediatric asthma care quality in community hospitals after ending a national quality improvement collaborative. *BMJ Qual Saf*. 2021;bmjqs-2020-012292.
4. Ament SM, de Groot JJ, Maessen JM, Dirksen CD, van der Weijden T, Kleijnen J. Sustainability of professionals' adherence to clinical practice guidelines in medical care: a systematic review. *BMJ Open*. 2015; 5(12):e008073.
5. Wiltsey Stirman S, Kimberly J, Cook N, Calloway A, Castro F, Charns M. The sustainability of new programs and innovations: a review of the empirical literature and recommendations for future research. *Implement Sci*. 2012;7:17.

6. Leyenaar JK, Ralston SL, Shieh MS, Pekow PS, Mangione-Smith R, Lindenauer PK. Epidemiology of pediatric hospitalizations at general hospitals and freestanding children's hospitals in the United States. *J Hosp Med*. 2016;11(11):743-749.
7. McDaniel CE, Jennings R, Schroeder AR, Paciorkowski N, Hofmann M, Leyenaar J. Aligning inpatient pediatric research with settings of care: a call to action. *Pediatrics*. 2019;143(5):e20182648.
8. McDaniel CE, Jeske M, Sampayo EM, Liu P, Walls TW, Kaiser SV. Implementing pediatric asthma pathways in community hospitals: a National Qualitative Study. *J Hosp Med*. 2020;15(1):35-41.
9. Hasegawa K, Tsugawa Y, Clark S, et al. Improving quality of acute asthma care in US hospitals: changes between 1999-2000 and 2012-2013. *Chest*. 2016;150(1):112-122.
10. Kenyon CC, Melvin PR, Chiang VW, Elliott MN, Schuster MA, Berry JG. Rehospitalization for childhood asthma: timing, variation, and opportunities for intervention. *J Pediatr*. 2014;164(2):300-305.
11. Silber JH, Rosenbaum PR, Wang W, et al. Auditing practice style variation in pediatric inpatient asthma care. *JAMA Pediatr*. 2016;170(9):878-886.
12. Cowie J, Nicoll A, Dimova ED, Campbell P, Duncan EA. The barriers and facilitators influencing the sustainability of hospital-based interventions: a systematic review. *BMC Health Serv Res*. 2020;20(1):588.
13. Kaiser SV, Lam R, Cabana MD, et al. Pediatric Research in Inpatient Settings (PRIS) Network. Best practices in implementing inpatient pediatric asthma pathways: a qualitative study. *J Asthma*. 2020;57(7):744-754.
14. Gupta N, Cattamanchi A, Cabana MD, Jennings B, Parikh K, Kaiser SV. Implementing pediatric inpatient asthma pathways. *J Asthma*. 2021;58(7):893-902.
15. Shelton RC, Cooper BR, Stirman SW. The sustainability of evidence-based interventions and practices in public health and health care. *Annu Rev Public Health*. 2018;39:55-76.
16. Chambers DA, Glasgow RE, Stange KC. The dynamic sustainability framework: addressing the paradox of sustainment amid ongoing change. *Implement Sci*. 2013;8:117.
17. Kaiser SV, Jennings B, Rodean J, et al. Pathways for improving inpatient pediatric asthma care (PIPA): a multicenter, National Study. *Pediatrics*. 2020;145(6):e20193026.
18. American Hospital Association. AHA Annual Survey Database; 2019. Accessed November 10, 2019. https://www.ahadata.com/aha-annual-survey-database-asdb/
19. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention; 2020.
20. National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma Summary Report 2007; 2007; Bethesda, MD.
21. Bradley EH, Curry LA, Ramanadhan S, Rowe L, Nembhard IM, Krumholz HM. Research in action: using positive deviance to improve quality of health care. *Implement Sci*. 2009;4:25.
22. Bradley EH, Curry LA, Webster TR, et al. Achieving rapid door-to-balloon times: how top hospitals improve complex clinical systems. *Circulation*. 2006;113(8):1079-1085.
23. Brewster AL, Curry LA, Cherlin EJ, Talbert-Slagle K, Horwitz LI, Bradley EH. Integrating new practices: a qualitative study of how hospital innovations become routine. *Implement Sci*. 2015;10:168.
24. Agency for Healthcare Research and Quality. Pediatric quality indicator 14 asthma admission rate; 2018; Rockville, MD.
25. Moore JE, Mascarenhas A, Bain J, Straus SE. Developing a comprehensive definition of sustainability. *Implement Sci*. 2017;12(1):110.
26. Lennox L, Maher L, Reed J. Navigating the sustainability landscape: a systematic review of sustainability approaches in healthcare. *Implement Sci*. 2018;13(1):27.
27. Powell BJ, Waltz TJ, Chinman MJ, et al. A refined compilation of implementation strategies: results from the expert recommendations for implementing change (ERIC) project. *Implement Sci*. 2015;10:21.
28. Curry LA, Spatz E, Cherlin E, et al. What distinguishes top-performing hospitals in acute myocardial infarction mortality rates? A qualitative study. *Ann Intern Med*. 2011;154(6):384-390.
29. Charmaz K. *Constructing Grounded Theory*. Vol 2. Thousand Oaks, California: Sage Publications; 2014.
30. Creswell J. *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. Thousand Oaks, California: Sage; 2012.
31. Grimshaw JM, Eccles MP, Lavis JN, Hill SJ, Squires JE. Knowledge translation of research findings. *Implement Sci*. 2012;7:50.
32. Nkoy FL, Fassl BA, Wolfe D, Colling D, Hales JW, Maloney CG. Sustaining compliance with pediatric asthma inpatient quality measures. *AMIA Annu Symp Proc*. 2010;2010:547-551.
33. Kaiser SV, Shadman KA, Biondi EA, McCulloh RJ. Feasible strategies for sustaining guideline adherence: cross-sectional analysis of a National Collaborative. *Hosp Pediatr*. 2019;9(11):903-908.
34. Velupillai S, Suominen H, Liakata M, et al. Using clinical natural language processing for health outcomes research: overview and actionable suggestions for future advances. *J Biomed Inform*. 2018;88:11-19.
35. Parmelli E, Flodgren G, Beyer F, Baillie N, Schaafsma ME, Eccles MP. The effectiveness of strategies to change organisational culture to improve healthcare performance: a systematic review. *Implement Sci*. 2011;6:33.
36. Curry LA, Brault MA, Linnander EL, et al. Influencing organisational culture to improve hospital performance in care of patients with acute myocardial infarction: a mixed-methods intervention study. *BMJ Qual Saf*. 2018;27(3):207-217.
37. Helfrich CD, Li YF, Sharp ND, Sales AE. Organizational readiness to change assessment (ORCA): development of an instrument based on the promoting action on research in health services (PARIHS) framework. *Implement Sci*. 2009;4:38.

How to cite this article: Jaladanki S, Schechter SB, Genies MC, et al. Strategies for sustaining high-quality pediatric asthma care in community hospitals. *Health Serv Res*. 2022;57(1):125-136. doi:10.1111/1475-6773.13870

APPENDIX A

TABLE A1 Semi-structured interview guide

Open-ended questions	Potential probes (selected based on responses to open-ended questions and evolving conceptual model)
Can you tell me about your role and responsibilities at the hospital?	
First, I want to ask you questions about your initial pediatric asthma implementation efforts in 2018 while you had the support of the AAP PIPA project. We will focus on strategies used in the inpatient setting, not the emergency department. Can you describe the role you played in initial implementation of asthma pathways at your hospital?	** Target subsequent questions based on role (e.g., implementation leader ± end-user) **
Implementation strategies: Can you describe the team of people involved in implementation of the PIPA project and these practices?	• What types of people were on the team (e.g., pediatricians, nurses)? How did they come together to work on implementation? How were they trained? • How did this team work together during implementation (e.g., regular meetings)? • What did health care providers think of these implementation leaders? Did they look to them for guidance on best practices? • Can you describe any ways in which senior leaders at the hospital were involved? • Can you describe examples of how your implementation team influenced other staff/providers in using these practices?
Can you describe the strategies that were used to during implementation? These commonly included strategies such as educational meetings with clinicians, training, monitoring asthma care quality, feeding back data on quality to clinicians, modifying electronic health records, conducting improvement cycles, and/or engaging hospital leaders.	• How did providers know if these practices were effective in improving care of children with asthma? • Can you describe an example of how your team monitored performance and quality of care for children with asthma? Are these data given to providers? • How were providers educated about the benefits of these practices and trained? • Were quality improvement methods used to promote use? Can you give an example? • Can you describe any changes that were made in the clinical environment/wards or clinical teams to support use of these practices? • Were any tools integrated into your electronic medical record to remind providers about these practices? How did these tools make using them easier or harder? • Were these practices integrated into hospital guidelines or policies?
Can you tell me about what resources you had available to help with implementation? How did these change after the PIPA project ended?	• Was there any funding allocated for the project? How was it obtained and used?
Now I'd like to switch focus to how these strategies may have changed in 2019 after the official AAP PIPA project and associated supports ended. How did your role or your PIPA implementation team change in 2019?	• How did the implementation team's work change after the PIPA project ended, such as meeting frequency, activities of the team?
What strategies were used to sustain use of these evidence-based practices after the PIPA project ended in 2019?	• How did use of the strategies you mentioned earlier change? (talk through the strategies discussed earlier 1 by 1, "how did educational efforts change in this phase…in frequency/content/focus") • Were any strategies discontinued? Can you describe why? • Were any new strategies used? Can you describe why?
How did your resources change after the PIPA project ended?	• Can you describe any ways in which senior leaders at the hospital were involved after the project ended? • What hospital resources were used to help with sustaining implementation (e.g., data collection/monitoring support, technology support with the electronic medical record)? • How were members of your team able to make time to sustain these practices after the PIPA project ended?
Can you tell me about what aspects of sustaining these practices after the PIPA project ended went well?	• Who was leading the efforts to sustain use of these practices? Can you describe how those leaders were accountable for continued use and quality of care for children with asthma?

(Continues)

TABLE A1 (Continued)

Open-ended questions	Potential probes (selected based on responses to open-ended questions and evolving conceptual model)
	• Can you give an example of a goal that was set around use of these practices or asthma care after the PIPA project ended? • What kinds of incentives were used to help ensure providers continued using these practices? • Can you describe an example of how these changes made providers' work easier? • Can you describe an example of when a provider expressed support/belief in using these practices to improve asthma care for children?
Can you describe any bumps in the road or challenges with sustaining these practices after the PIPA project ended?	• Can you describe an example of when a provider felt these practices were too complex to use? • Can you describe an example of when a provider felt using these practices took too much time? • Was feedback elicited from providers? What was found from that feedback, and how was it handled? • Was there any opposition to continuing to use these practices? Can you describe an example? • To what extent did sustaining these practices take a backseat to other high-priority initiatives?
The organizational setting: How did your hospital's culture and policies affect sustained use of these practices after the PIPA project ended?	• Were these practices integrated into any hospital-wide programs or initiatives? • How do you think your organization's culture affected sustained use of these practices? Can you describe an example that highlights this? • Can you described how these practices were adapted to continue to help providers improve asthma care? • Were providers at your hospital ready/equipped to sustain use of these practices? • What supports were crucial to sustaining use of these practices? • How would do you describe the communication patterns among hospital staff here—for example, strong or weak, formal or informal, or collaborative or hierarchical? How do you think communication patterns affected sustaining use of these practices?
The external environment: Did any factors outside the hospital, like hospital network or external policies, affect efforts to sustain use of these practices at your hospital after the PIPA project ended?	• Can you describe any external factors that played a role in sustaining these practices use after the PIPA project ended? (e.g., competing hospitals' implementing pathways, policies like mandated public reporting of quality metrics, financial incentives like pay-for-performance) • Were people outside your unit/department aware of efforts to improve asthma care for children by implementing these practices? Can you describe how they were involved?

Abbreviations: AAP, American Academy of Pediatrics; PIPA, Pathways for Improving Pediatric Asthma Care.

APPENDIX B: THEMES AND EXEMPLARY QUOTES ON SUSTAINING HIGH-QUALITY PEDIATRIC ASTHMA CARE IN COMMUNITY HOSPITALS

TABLE B1

Themes (in alphabetical order)	Exemplary quotes
Addressing ongoing concerns about practice change	"The only thing that I can tell you is that if you have someone that is a seasoned physician or has their own way of doing things, it might be a little bit more difficult to persuade that person to make the change." (Respiratory Therapist) "One of the challenges was when on occasion, the respiratory therapist or the nurse would feel strongly that the patient's therapy could be advanced and not everyone was on board. Or they would make the decision in a non-collaborative way. That had happened a couple of times. That was a challenge." (Nurse)
Analyzing local performance data	"I think having comparative data was very nice, because we may look good internally, but I think one positive gain from being in the national QI initiative was having that benchmark data to see how [we compared to] other hospitals nationally." (Nurse) "I think as people have seen [from the data] that the patients being treated with metered-dose inhalers do progress appropriately, that we're not having increased [harm events], and that it's decreasing our length of stay. The families seem satisfied, and the providers have seen the success of this. I think that's made it sustainable." (Physician)
Assembling a multidisciplinary implementation team	"I think working as a team was important because the physicians are putting in the orders and monitoring how the patient does, but the nurses and the respiratory therapists are the ones giving all of the treatments. I think having them on board with the rationale, the understanding of how things are supposed to work, it wouldn't have worked without working as a team like that." (Physician) "One big thing that came out of all of this was really standardizing our asthma care…I think through our collaboration as a team—our physician, myself, and the respiratory therapist—we all have come to rely on each other and our specific roles. I think that that's really improved the health of those relationships in regards to the care of these patients." (Nurse)
Conducting audit and feedback with clinicians	"I think these monthly feedback emails with performance data were useful. Because it really made it clear that everything was a team effort. And it brought everybody together so it wasn't just going out to the physician, it wasn't just pointing the finger at a respiratory therapist." (Physician) "I think that having the asthma educator has been really helpful…she's always keeping tabs on [pediatric asthma quality performance] to let me and others know if something goes awry." (Physician)
Delivering ongoing education on evidence-based pediatric asthma care	"Our physician champion did lots and lots of education and re-education with staff…[Then she monitored performance data], and if there was a provider that wasn't as successful she would say, 'Hey, here are your numbers, what can we do to help you do better?'" (Nurse) "So, I think one bump in the road…is dealing with new residents every month and having to continue the education over and over and over again. I think that's a bump in the road." (Physician)
Developing or modifying electronic health record tools	"We implemented a pediatric respiratory scoring system that's attached to the [electronic] order set. So now, all people have access to go in and document on scoring…So, the ability to have the scoring up front and center in your documentation has been really helpful." (Respiratory Therapist) "Yeah, so we have a pathway…it's online, so that anybody [can link to] to the asthma pathway from their computer. And then the respiratory therapists have a protocol based on the pathway, and we also have a protocol that is automatically ordered as part of the [electronic] order set." (Physician)
Having a hospital culture that was receptive to practice change and collaborative	"I love that there's been enough interest that we added these quality measures as long-term departmental measures…So, I think that's excellent, that everybody was invested enough in this project [to do that]." (Physician) "I'm really proud of this hospital's culture. They really do allow autonomy. I think they are fans of evidence-based medicine. You can always get support as long as you're providing the evidence and the reasons. And it truly, I think that our culture is that it does allow for multidisciplinary teams to implement things. We have a culture that trusts the bedside caregivers to follow protocols." (Respiratory Therapist)

(Continues)

TABLE B1 (Continued)

Themes (in alphabetical order)	Exemplary quotes
Integrating evidence-based practices into clinical workflows	"When you have these clinical protocols that are supported by the physicians, and you have a whole team that is capable of following the protocol, it [leads to] far less questions and calls to the physician. Typically, [other team members are just] sending updates to the physician versus saying, 'Come see this patient. I don't know what to do.'…So, I think it allows for a lot more collaboration [when we can carry out these protocols] at the bedside." (Respiratory Therapist) "I think that it just kind of became the workflow that this is it, we do the metered-dose inhalers, we do the parental education, we have the smoking referral education. I think it just became part of the asthma care." (Physician)
Keeping the original multidisciplinary groups of local champions engaged	"They really sort of petered out towards the end of the project. We would still be sending out emails and touching base the last couple of months. But since the project has stopped, we sort of stopped the regular meetings. We do have the same core group of people plus a couple others who have been meeting on other projects. So, we have been updating and touching base in regards to that, but not really focused on pediatric asthma anymore." (Physician) "Once it was implemented, we didn't continue meeting. It was more like if there was something that came up that needs to be addressed or tweaked, we would just talk via email or phone or when we run into each other on the unit." (Nurse)
Maintaining long-term quality monitoring	"I think they only have one clinical/quality improvement information technology person right now for the whole hospital, and [their focus] is more about billing…so, we don't have a ton of support. So, it was really hard for me just to get the right electronic report built [to track pediatric asthma quality performance]." (Physician) "Time is always a challenge…when you're looking at these charts, you do get faster, but at the beginning it's pretty onerous to go through that data manually doing chart review…it would have been great to have some of it automated." (Physician)
Providing ongoing reminders of evidence-based practices	"We started doing routine team huddles on all of our admitted children and we incorporated pediatric asthma pathway review and reminders into these regular huddles." (Respiratory Therapist) "Our physician champions often did just-in-time bedside reminders right on the unit, going over the recommendations with nurses when they had questions." (Physician)