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Facilitators of inter-departmental quality improvement: a mixed-methods analysis of a collaborative to improve pediatric community acquired pneumonia management

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Abstract

Background: Emergency medicine and pediatric hospital medicine physicians each provide a portion of the initial clinical care for the majority of hospitalized children in the United States. While these disciplines share goals to increase quality of care, there are scant data describing their collaboration. Our national, multi-hospital learning collaborative, which aimed to increase narrow spectrum antibiotic prescribing for pediatric community acquired pneumonia, provided an opportunity to examine factors influencing the success of quality improvement efforts across these two clinical departments.

Objective: To identify barriers to and facilitators of interdepartmental quality improvement implementation, with a particular focus on increasing narrow spectrum antibiotic use in the emergency department (ED) and inpatient settings for children hospitalized with pneumonia.

Methods: We used a mixed-methods design, analyzing interviews, written reports, and quality measures. To describe hospital characteristics and quality measures we calculated medians/interquartile ranges (IQR) for continuous variables, frequencies for categorical variables, and Pearson correlation coefficients. We conducted in-depth, semi-structured interviews by phone with collaborative site leaders; interviews were transcribed verbatim and, with progress reports, analyzed using a general inductive approach.

Results: 47 US-based hospitals were included in this analysis. Qualitative analysis of 35 interview transcripts and 142 written reports yielded 8 inter-related domains that facilitated successful interdepartmental quality improvement: (i) hospital leadership and support, (ii) quality

improvement champions, (iii) evidence supporting the intervention, (iv) national health system influences, (v) collaborative culture, (vi) departments' structure and resources, (vii) quality improvement implementation strategies, and (viii) inter-departmental relationships.

Conclusions: The conceptual framework presented here may be used to identify hospitals' strengths and potential barriers to successful implementation of quality improvement efforts across clinical departments.

INTRODUCTION

Pneumonia is a common childhood infectious disease and a leading cause of pediatric hospitalization, resulting in more than 100,000 hospitalizations and greater than 500 million dollars of healthcare costs annually in the United States (US).¹ Global estimates suggest that children experience 120 million episodes of pneumonia each year, resulting in 1.3 million pediatric deaths.² Recognizing this substantial disease burden, broad efforts have been made to improve the quality of pneumonia care, including optimizing antibiotic management and reducing unnecessary diagnostic testing and ineffective adjuvant therapies.³⁻⁷ However, the quality of care provided to children hospitalized with pneumonia varies substantially across hospitals.^{6,8-12} In the US, provision of broad spectrum antibiotics for childhood pneumonia, particularly ceftriaxone, is commonplace, with rates of ampicillin/penicillin prescribing less than 5% in several multi-site studies prior to quality improvement (QI) efforts.¹¹⁻¹³

Approximately 75% of children hospitalized in the US for acute illnesses are cared for in emergency departments (EDs) prior to hospital admission, with initial disease management decisions correspondingly made by ED providers.¹⁴ Following initial evaluation and clinical management in EDs, care is usually handed off to pediatricians.^{15,16} Emergency medicine (EM) and pediatric training differ as do their attendant cultural mores, and there is scant literature describing the interface between these disciplines. In fact, differences in clinical training, practice culture and departmental affiliations may challenge effective collaboration.¹⁷ Few practice- or evidence-based conceptual frameworks exist to inform inter-departmental QI collaboration in hospital settings, despite a widespread emphasis on QI within hospitals.

The Improving Community Acquired Pneumonia (ICAP) Collaborative, a multi-site learning collaborative which aimed to increase narrow spectrum antibiotic (NSA) prescribing for community acquired pneumonia (CAP), provided an opportunity to examine QI implementation across clinical departments.¹⁸ Engaging healthcare providers across a national sample of hospitals, we aimed to identify barriers to and facilitators of inter-departmental QI implementation, with a particular focus on increasing NSA use in the ED and inpatient settings.

METHODS

Context

Most children in the US are cared for at general hospitals (as opposed to freestanding children's hospitals), where most ED physicians are not pediatric specialists. Approximately

80% of children hospitalized with CAP receive their initial care in the ED, with care then handed off to a pediatrician for the duration of the hospital stay.¹⁴

The ICAP Collaborative, conducted in 2015, was sponsored by the Value in Inpatient Pediatrics Network, part of the American Academy of Pediatrics (AAP) and was approved by the AAP Institutional Review Board (IRB). The primary goal of the collaborative was to increase appropriate NSA prescribing, with NSA defined as oral or IV amoxicillin, penicillin, or ampicillin. Baseline NSA prescribing rates among participating hospitals were 14.7% (interquartile range [IQR]: 8.8–27%) in the ED and 36.0% (IQR: 21.2–54.4%) in inpatient settings.¹⁸ Based on goals developed by a leadership team of CAP and QI experts, ICAP aimed to increase rates of NSA prescribing to >80% for eligible patients as detailed below.

Approach

Written informed consent was obtained from the team leader at each site, and local teams received IRB approvals as deemed necessary by each institution. Participating institutions were required to develop a multidisciplinary improvement team of at least 3 members. Inclusion of an EM physician on the team was encouraged but was not required. Project leadership facilitated educational webinars, a project listserv, and individual site coaching by e-mail and telephone. Each site was encouraged to implement a change package comprised of: (1) evidence-based pathways and order sets; (2) a toolkit for developing an antibiotic stewardship program; (3) communication tools for promoting behavior change; and (4) slide sets for use in educational initiatives. Additional interventions to achieve project goals were implemented by individual sites based on locally perceived needs and facilitated by project leadership as well as coaching from national experts.

Children 3 months to 18 years of age hospitalized with a discharge diagnosis of pneumonia and who received antibiotics for CAP were considered for inclusion. Children with chronic, comorbid conditions predisposing them to recurrent respiratory illnesses, those requiring intensive care or a pleural drainage procedure, and those who underwent inter-hospital transfers were excluded. Each site had access to real-time run charts summarizing their performance and was benchmarked by group aggregate performance quarterly. Full project methodology and results are published elsewhere.¹⁸

Study Design

We employed a qualitative approach to identify barriers to and facilitators of collaboration for quality improvement between EM and pediatric hospital medicine (PHM) services, including content analysis of project reports collected during the ICAP Collaborative as well as semi-structured interviews with ICAP site leaders following project completion. Site leaders were contacted by email to request their participation and informed consent for further interviews was obtained. First round interviews focused broadly on sites' local experiences with project implementation, while a second round of more focused interviews probed barriers to and facilitators of successful inter-departmental project implementation.

Our sampling framework for second-round interviews was informed by rates of NSA utilization achieved during the collaborative, with participants purposefully sampled using

positive deviance sampling methods.¹⁹ We requested participation of sites achieving the highest rates of NSA prescribing in inpatient setting, including sites with both high and low rates of NSA antibiotic prescribing in the ED. This allowed for in-depth interviews of sites with concordant and discordant performance rankings between the inpatient and ED settings. All interviews were conducted by telephone with one member of the research team. Interviews were audio-recorded with permission, transcribed verbatim, and verified for accuracy.

Analysis

To describe hospital characteristics and rates of NSA prescribing we calculated medians and IQRs for continuous variables, frequencies and percentages for categorical variables, and Pearson correlation coefficients to evaluate the relationship between rates of NSA prescribing in the ED and inpatient setting.

Using open-coding, an approach rooted in grounded theory, transcripts and written reports were reviewed by three members of the research team (CA, EO, JL) to identify emergent concepts related to inter-departmental QI collaboration. Emergent concepts and associated definitions were summarized in a coding framework developed by the research team.^{20,21} Two members of the research team then independently applied codes to a subset of transcripts; areas of coding disagreement were resolved through in-depth discussions of the concepts, corresponding codes, and definitions. Following assurance of coding agreement, transcripts were uploaded to Dedoose, a mixed-methods data management and analysis program, and one member of the research team coded the transcripts, with coding audits performed by the principal investigator.²² Analysis was performed during the interview period, and interviews were continued until the research team agreed that no new relevant concepts or insights were emerging from the data (data saturation).^{23–25} Following coding completion, all codes and associated transcript excerpts were reviewed by the research team to group similar concepts into themes, and similar themes into domains. During this axial coding process, domains were conceptualized within the context of the QI literature, with an aim to develop a framework to inform hospital-based inter-departmental QI implementation.

RESULTS

Participants

A total of 47 US-based hospitals participated in the ICAP Collaborative. Participating hospitals included community hospitals with pediatric beds, children's hospitals nested within larger adult hospitals, and freestanding children's hospitals. Team composition varied substantially across sites; teams were led by pediatric hospitalists in partnership with nurses, pharmacists, EM physicians and other pediatric specialists (Table 1). We analyzed 142 written progress reports collected during three time points of the collaborative and conducted 35 semi-structured interviews with 30 site leaders, including 27 first-round interviews and 8 second-round interviews.

Narrow-spectrum antibiotic prescribing

Figure 1 illustrates mean rates of NSA prescribing in the ED and inpatient setting achieved during the improvement phase of the collaborative. Median NSA prescribing was 43% [IQR 34–55%] in the ED and 59% [IQR 43–76%] in inpatient settings ($p<0.01$), with a moderately strong positive correlation between these rates in ED and inpatient services ($r=0.49$).

Barriers to and Facilitators of Inter-departmental QI Implementation

We identified 8 domains and associated themes regarding barriers to and facilitators of inter-departmental QI implementation. During our axial coding process, we identified parallels between our findings and Pettigrew and colleagues' Receptive Contexts of Organizational Change framework.²⁷ Therefore, building on the unique themes emerging in our research, we adapted Pettigrew's framework of organizational change to illustrate our 8 domains of inter-departmental QI in hospital settings and how these domains are inter-related (Figure 2).

1. Hospital leadership and support—Within this domain, emergent themes included (i) hospital leadership and (ii) administrative support for QI. Participants described how support from hospital leaders enabled more efficient implementation of changes to order sets and minimized bureaucratic barriers. In contrast, participants who reported less administrative support described substantial delays in *“institutional roll out.”* For example, one participant reported, *“There is very poor oversight of, and little uniformity in, pathway development, approval and dissemination... We also struggled with getting our inpatient order set approved--the process has taken us nearly 5–6 months. This is because of the bureaucracy associated with creating/modifying order sets, despite the fact that our modification to the existing order set was minor.”* (P11) Participants reported how institutional leadership and support were closely related to departmental structure and resources, including systems to access and analyze administrative data and *“protected time”* for project implementation. For example, one participant whose site achieved below average rates of NSA prescribing stated, *“If I'm not doing my clinical work I'm not getting paid... It wasn't like [hospital administration] said ‘No, you can't do it.’ ... It wasn't supportive but it wasn't obstructionist.”* (P3) Institutional leadership and support was also described as influential to the organizational culture, with participants describing project participation as *“in line with our mission and values.”* (P16)

2. Quality Improvement Champions—Emergent themes within the domain of QI champions included: (i) multi-disciplinary team composition and (ii) project advocates in each department. High performing sites reported high levels of engagement of residents, nurses, respiratory therapists, pharmacists and staff physicians from across departments. In the words of one participant, *“We truly have a great team comprised of multiple representatives from all parts of the hospital--ED, pulmonary, infectious disease, and the residency program. Each of the members of our team has been able to effectively engage his/her respective groups to help facilitate change.”* (P14) In contrast, other sites described significant challenges with multidisciplinary engagement and *“holding each other accountable”* (P7) given the large number of disciplines involved with clinical management of pneumonia. Teams with high rates of NSA prescribing described the importance of

having a champion within the ED to serve as a voice to their professional group, and that the absence of such a voice challenged effective information dissemination and changes to clinical practices. For example, *“...I think a lot of ERs are like ours where they have a mix of different types of providers and it’s hard. As a hospitalist, you feel like you are preaching to the emergency room and I think having a champion in the ER is helpful.”* (P2) In addition, successful project implementation was described as being facilitated by infrastructure and personnel to support QI efforts, including hospital-wide QI staff and antimicrobial stewardship programs. Accordingly this domain was related to departments’ structure and resources, as well as the organizational culture.

3. Evidence supporting the intervention—Within this domain, emergent themes included: (i) the role of evidence, (ii) physician knowledge and preferences, and (iii) competing demands. Participants described the importance of evidence to justify the value of the QI intervention and how physician preferences were, at times, at odds with the evidence base. One participant described hesitance by some physicians to follow evidence-based guidelines given concerns that they should not *“supersede their clinical judgement.”* (P25) Competing demands created by multiple concurrent QI initiatives were also reported as a barrier to project success, with one participant describing how implementation of another QI intervention encouraging rapid broad-spectrum antibiotic (BSA) administration challenged effective implementation of the current project: *“One great barrier to the use of narrow spectrum antibiotics in the ED setting is the competing stop sepsis protocol. Any child with fever and tachycardia enters into the sepsis pathway, receiving Ceftriaxone as the antibiotic of choice. They are given a 24-hour dose, and so in many instances, it is the only antibiotic they receive before transfer to the inpatient floor.”* (P5)

4. National health system influences—Participant reported how national-level factors supported inter-departmental project implementation at the hospital level, describing the value of support from a national physicians organization (AAP), national clinical guidelines to inform project goals, and multi-hospital participation in the project. For example, one participant stated, *“In my little community hospital, I don’t really have time for this kind of thing...But to me [being backed by a national organization] was one of the things that made it possible.”* (P6) This domain was described as being particularly important to smaller hospitals with limited past experience implementing QI efforts, with one participant stating, *“I liked feeling that I was part of a bigger group trying to meet a common goal,”* (P25) and another stating, *“It made me feel more in touch with the academic centers around.”* (P3)

5. Collaborative culture—Within this domain, emergent themes included (i) inter-departmental buy-in and (ii) clinical practice culture, with participants describing different cultures and practice styles in the ED and inpatient setting. One site leader from a low-performing site stated, *“You have different physicians, different providers, coming from different schools...so I wouldn’t say that everybody was on the same page...and I still do not say that everybody is on the same page right now.”* (P27) While some participants reported that both ED and PHM departments were *“very open to changes and improvements,”* (P8) others described how differences in the culture of the ED and inpatient

unit challenged project implementation. The importance of local evidence was reported as integral to inter-departmental buy-in, with one participant stating, *“I didn’t really feel that I could make the change in the ED to start with... If I could have done it routinely on the floor and shown that outcomes were good, then I think it would have been easier to sell to the ED. But to have gotten them to buy in initially probably would have been a challenge.”* (P7)

Perspectives shared by participants in this domain were closely related to the departmental structure domain. For example, siloed departmental structures often isolated ED and PHM teams from one another, with resulting differences in the clinical practice culture and pneumonia management priorities. Differing clinical priorities and approaches were particularly evident in general hospital EDs where care for pediatric patients comprised a small proportion of the overall patient volumes, and the majority of ED providers did not have pediatric-specific training.

6. Departmental structure and resources—Themes encompassed by this domain included (i) siloed departmental structures, (ii) departmental size, and (iii) the potential of EMRs to facilitate inter-departmental change. With respect to siloed departments, one participant reported, *“Politically it has been difficult, partly because the pediatric emergency department is part of the department of emergency medicine at our general hospital, and not the department of pediatrics.”* (P5) This challenge was echoed by many participants who described how having the ED and PHM groups in separate departments made it difficult to organize group meetings and to share information. Hospitalists working at larger hospitals more frequently discussed challenges with information dissemination to large departments with a shift-schedule based workforce. For example, *“The ER physicians group is massive. There are probably 30 some physicians alone in the emergency medicine group and then additionally there is mid levels, nurse practitioners and PAs. So trying to get that culture change was a bit more of a challenge.”* (P26) In contrast, participants from small hospitals reported opportunities to *“utilize the strengths of being a smaller place, [including] personal relationships with people.”* (P3)

Participants at general hospitals (non-children’s hospitals) described specific challenges engaging EM physicians who did not have pediatric-specific training; this was one of the most frequently discussed challenges by participants. For example, one participant reported, *“As a general hospital without board-trained pediatric emergency physicians, we need to help them be more comfortable and capable of managing pediatric illnesses...that’s probably by biggest goal...”* (P20)

7. Quality improvement implementation strategies—Within this domain, participants described: (i) successes and challenges associated with their QI implementation strategies, (ii) the value of multidisciplinary education, and (iii) time constraints for QI implementation. Varied approaches to multidisciplinary education were described by participants, including personalized report cards, *“email blasts”*, formal educational sessions to residents, and *“face-to-face education to outlying sister facilities and community medical providers.”* (P14) Participants reported inconsistent success with flyers and printed order sets, but consistently described the value of small group education. For example, one participant reported, *“It seemed like education in small groups with key providers worked*

better than any sort of widespread system changes, so these small sort of grassroots efforts rather than wide process efforts ended up being the key...”(P22) Implementation of EMR notifications and electronic order sets, when supported by hospital infrastructure, was frequently endorsed as effective by participants, illustrating the inter-relatedness of this domain with that of departmental resources.

8. Inter-departmental relationships—Themes within this domain included: (i) direct conversation between departments, and (ii) the role of “boundary spanners”. Participants described how participation in the learning collaborative forged new and previously undeveloped relationships between departments, with one stating, *“We recognize that broad spectrum coverage started in the ED, almost always. So the head of the ED group and the head of the hospitalist group brought both groups around a table and we talked, for the first time ever at our institution.”* (P14) Participants also emphasized the role of residents, fellows and physicians as “boundary spanners” whose work across hospital settings enabled change across these settings, as well as the value of effective relationships between staff physicians across departments. For example, *“The team includes a highly motivated pediatric resident... This was paramount since residents work in multiple areas of the hospital and are often the ones putting in orders for patients. They also serve a vital role in the ED where many of the attendings are not peds ED trained.”* (P14) Participants also described the value of specific physicians whose training, moonlighting experience, cross-appointments, or personal relationships enabled successful project implementation across departments.

DISCUSSION

In this mixed-methods study of a national collaborative to improve pediatric CAP management, we identified barriers to and facilitators of collaboration for QI across two hospital departments. Key facilitators of change included institutional support, QI champions, and inter-departmental relationships, particularly facilitated by “boundary spanners” such as trainees and physicians whose work spanned multiple clinical settings. In contrast, key barriers to successful collaboration included siloed clinical departments, challenges with effective information dissemination through large clinical departments, and competing QI priorities. Our conceptual framework, informed by the organizational change literature, fills a gap in the published literature about factors that support or hinder effective QI efforts across clinical departments in hospitals.

Among both children and adults admitted to hospital with general medical conditions such as CAP, the majority experience hospital-based care in multiple departments and from multiple healthcare providers.^{26,27} Despite this, formal efforts to improve healthcare processes and outcomes across clinical departments are relatively rare, perhaps because sponsoring organizations are often discipline- or disease-specific. As a result, few conceptual frameworks exist to guide cross-departmental QI efforts at the hospital level. The framework resulting from our research was adapted from the work of Pettigrew and colleagues who, in 1992, published an analysis of organizational change within England’s National Health Services, derived from qualitative analysis of eight District Health Authorities.²⁸ In this work, which examined change within a national system, they coined

the phrase “receptive contexts for change” and summarized eight drivers of organizational change.

The themes emerging in our work are unique to inter-departmental QI efforts within a hospital, but the overarching domains mirror the structure of Pettigrew’s work in several areas, with some notable differences. Pettigrew’s eight receptive contexts for change are summarized in Table 2, adjacent to our own findings. While Pettigrew highlighted the importance of co-operative inter-organizational networks for national health system change, our analysis identified the importance of inter-departmental relationships within health systems. Within both of these domains, “boundary spanners” were identified as playing an important role, facilitating change through existing relationships as well as knowledge of multiple systems or departments. The other notable difference between Pettigrew’s framework and our own was within the domain described by Pettigrew as “environmental pressure.” While their work identified financial pressures and managerial inertia as key factors influencing organizational change, participants in our study described health system influences beyond their own institutions, and specifically the positive benefits of participation in a multi-institutional learning collaborative sponsored by a national organization.

Consistent with our findings, the importance of interdisciplinary relationships to improve healthcare quality has been called out by a number of professional societies. For example, effective interdisciplinary communication is a key component of efforts to improve hospital-to-home transitions for hospitalized patients and is called out in a policy statement endorsed by seven professional organizations.^{29–31} In addition, the importance of interdisciplinary relationships has been the focus of a number of studies of nurse-physician interactions.^{32–34} There is less information about improving physician-physician relationships and communication, particularly when different disciplines are involved. In this study, pediatricians felt that belonging to a different discipline or department was a significant barrier to interdisciplinary QI efforts with EM physicians. In settings where faculty and/or residents crossed disciplines, this was felt to be a facilitator.

One unique barrier emerging from our work was the importance of considering “competing demands” when multiple QI initiatives are implemented concurrently in hospitals. Participants reported that BSAs were frequently initiated in the ED; this is evidenced by the lower rate of NSA prescribing observed in EDs in our study, as well as in past studies of pneumonia management.⁹ Several potential reasons for this emerged in our research, including our finding that NSAs recommended for CAP management are at odds with the BSAs recommended for sepsis management.³⁵ Given widespread implementation of QI initiatives within US hospitals, poor performance on quality measures may result from multiple, uncoordinated projects, differing priorities, and differing practice cultures across departments. Co-sponsorship of QI initiatives by multiple clinical departments at the time of project planning may address some of these barriers, and is a lesson learned from this project.

Our results should be interpreted in light of this study’s strengths and limitations. Strengths of our approach include the inclusion of a large national sample of hospitals and our ability

to conduct two rounds of interviews to probe more deeply about inter-departmental implementation. In addition, the availability of quantitative data allowed us to purposefully sample participants based on performance within the collaborative. The inclusion of participants from both children's hospitals and general community hospitals is also a strength, as community hospitals are typically under-represented in published QI work. Study limitations include the fact that only site leaders, all of whom were pediatric hospitalists, were interviewed, thereby excluding the perspectives of key stakeholders in other disciplines and departments. In addition, we acknowledge that potential for response bias and coding bias may have influenced our results, although we made efforts to minimize these by conducting interviews following completion of the collaborative, by double-coding a subset of transcripts, and by ensuring participants that their responses would be de-identified.

In conclusion, this work presents a framework to recognize and address barriers to and facilitators of inter-departmental QI in structurally diverse hospitals. We build on existing organizational change literature, highlighting unique contextual factors that should be considered during project planning and implementation of QI efforts across clinical departments in hospitals. Recognizing that the vast majority of patients who are admitted to hospital receive care in both the ED and inpatient settings, consideration of lessons learned in this work may improve the quality and efficiency of healthcare delivery and the success of future inter-departmental QI efforts.

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Figure 1.
Distribution of narrow-spectrum antibiotic use in emergency department and inpatient settings; each diamond reflects a hospital.

Figure 2.

Conceptual framework, modified from Pettigrew and colleagues' Receptive Contexts of Organizational Change, illustrating the inter-relatedness of eight domains facilitating interdepartmental quality improvement in hospitals.

Table 1.

Characteristics of United States hospitals completing the collaborative

Characteristic (n=47)	n	(%)
Hospital type:		
Community hospital	19	(40.4)
Freestanding children's hospital	11	(23.4)
Non-freestanding children's hospital	17	(36.2)
Hospital location:		
Urban	29	(61.7)
Suburban	14	(29.8)
Rural	4	(8.5)
Geographic region:		
Northeast	10	(21.3)
South	18	(38.3)
Midwest	12	(25.5)
West	7	(14.9)
Pediatric critical care service (yes)	35	(74.5)
Board-certified pediatric emergency medicine services (yes)	31	(66.0)
Full electronic health record (yes)	37	(78.7)
Annual volume of pediatric pneumonia hospitalizations:		
< 50	12	(25.5)
50–100	16	(34.0)
101–200	9	(19.1)
>200	10	(21.3)
ICAP team composition (representation of):		
Pediatric hospital medicine	47	(100)
Clinical pharmacy	13	(27.7)
Nursing	13	(27.7)
Emergency medicine	11	(23.4)
Pediatric subspecialist (infectious diseases or pulmonology)	4	(8.5)
Quality improvement specialist	4	(8.5)

Table 2.

Receptive contexts for change identified by Pettigrew and colleagues and related domains facilitating interdepartmental quality improvement

Receptive contexts for change (Pettigrew)	Domains facilitating interdepartmental quality improvement
Managerial clinical relations	Hospital leadership and support
Key people leading change	Quality improvement champions
The quality and coherence of policy	Evidence supporting the intervention
Environmental pressure	National health system influence
Supportive organization culture	Collaborative culture
The change agenda and its locale	Department structure and resources
Simplicity and clarity of goals	Quality improvement implementation strategies
Co-operative inter-organizational networks	Inter-departmental relationships