Contextual Factors Influencing Implementation of Evidence-Based Care for Children Hospitalized With Asthma

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**ABSTRACT**

BACKGROUND AND OBJECTIVES: The translation of research findings into routine care remains slow and challenging. We previously reported successful implementation of an asthma evidence-based care process model (EB-CPM) at 8 (1 tertiary care and 7 community) hospitals, leading to a high health care provider (HCP) adherence with the EB-CPM and improved outcomes. In this study, we explore contextual factors perceived by HCPs to facilitate successful EB-CPM implementation.

METHODS: Structured and open-ended questions were used to survey HCPs (n = 260) including physicians, nurses, and respiratory therapists, about contextual factors perceived to facilitate EB-CPM implementation. Quantitative analysis was used to identify significant factors (correlation coefficient ≥0.5; P ≤ .05) and qualitative analysis to assess additional facilitators.

RESULTS: Factors perceived by HCPs to facilitate EB-CPM implementation were related to (1) inner setting (leadership support, adequate resources, communication and/or collaboration, culture, and previous experience with guideline implementation), (2) intervention characteristics (relevant and applicable to the HCP’s practice), (3) individuals (HCPs) targeted (agreement with the EB-CPM and knowledge of supporting evidence), and (4) implementation process (participation of HCPs in implementation activities, teamwork, implementation team with a mix of expertise and professional’s input, and data feedback). Additional facilitators included (1) having appropriate preparation and (2) providing education and training.

CONCLUSIONS: Multiple factors were associated with successful EB-CPM implementation and may be used by others as a guide to facilitate implementation and dissemination of evidence-based interventions for pediatric asthma and other chronic diseases in the hospital setting.
Pediatric asthma accounted for 640,000 emergency department (ED) visits and 157,000 hospitalizations in 2009–13 and ~15.9 billion dollars in annual costs.1,3 Despite substantial burden, gaps persist between the evidence and actual care children with asthma receive,6–9 with low health care providers’ (HCP) adherence with guideline recommendations.10–12 The Institute of Medicine has identified translation of research findings into improved patient care and safety as a priority.13 However, the translation of research findings into routine practice remains slow, lags 15 to 20 years after discovery of effective treatments, and leads to suboptimal care.14 One of the reasons for this lag is the difficulty of translating the complex content of guidelines into routine clinical practice.15 Implementation of evidence-based interventions (EBIs) via decision support tools (eg, care pathways, protocols, care process models, etc) is often used to accelerate the translation of research findings and guidelines into routine care and improve patient outcomes. Although single-center EBIs are commonly implemented at tertiary care hospitals,16–18 efforts to disseminate successful EBIs to other hospitals are rare19–22 and are not always successful.24–26 Researchers have reported the role of contextual factors in facilitating successful implementation (leading to a high HCP adherence) of EBIs in clinical practice.27–30 Contextual factors have an indirect effect on HCP practice and patient care via various means, including the availability of resources, staffing, expertise, and via policies, rewards, sanctions, etc.24 Yet, in existing studies for children hospitalized with asthma, authors focus primarily on assessing EBI impact on asthma outcomes and often fail to assess contextual factors. Strategies to successfully implement EBIs for children hospitalized with asthma are not well known. Better understanding of contextual factors will help promote broad implementation of EBIs for children with asthma and other conditions in the hospital setting.

We previously reported successful implementation of an asthma evidence-based care process model (EB-CPM) at a tertiary care hospital and its subsequent dissemination to 7 community hospitals.19,21 EB-CPM implementation and dissemination resulted in a high HCP adherence with asthma quality measures at all hospitals (25%–58% at baseline to 80%–99% postimplementation) and significant and sustained reductions in length of stay, hospital costs, and readmissions.18,21

The successful implementation of the EB-CPM at these hospitals provided a unique opportunity to evaluate contextual factors that led to successful implementation. Thus, the objective of the current study was to determine key contextual factors perceived by HCPs to facilitate successful EB-CPM implementation in participating hospitals.

METHODS
Setting
We involved 8 hospitals from Intermountain Healthcare (IH), an integrated health care system in Utah and southeastern Idaho, with 22 hospitals and 185 clinics and urgent care facilities.29 Participating hospitals ranged from a 289-bed tertiary facility (Primary Children’s Hospital [PCH]), staffed by pediatric subspecialists and located in a metropolitan area (Salt Lake City), to 7 rural and urban community facilities, staffed by family physicians, general pediatricians, and midlevel and ancillary staff, with limited pediatric-specific resources, including American Fork Hospital, Dixie Regional Medical Center, Logan Regional Hospital, McKay-Dee Hospital, Riverton Hospital, Utah Valley Hospital, and Cedar City Hospital.

Asthma EB-CPM Description
The EB-CPM was designed to standardize care of children age 2 to 17 years hospitalized for asthma19,21 and improve hospital adherence with evidence-based inpatient asthma care quality measures.5 The EB-CPM included decision support tools (admission and discharge orders), patient- and/or parent-oriented competency regarding asthma education, and an algorithm to guide step therapy.40

Asthma EB-CPM Implementation and Dissemination
EB-CPM implementation at PCH occurred between January 2008 and March 2009,21 and its dissemination to 7 community hospitals occurred between January and June 2011.18 We used facilitation18 to implement the EB-CPM at PCH and the Replicating Effective Programs approach41 combined with facilitation to disseminate it to community hospitals, including obtaining leadership support and clinical staff (physicians, nurses, and respiratory therapists [RTs]) buy-in, assembling a multidisciplinary team, providing education and/or training, supporting local physician champions and teams, and providing ongoing assistance and data feedback.9

Study Design and Population
The cross-sectional survey, administered 1 year after completion of the implementation, involved HCPs (eg, physicians, nurses, and RTs) from participating hospitals who implemented and/or used the EB-CPM to deliver care to children hospitalized with asthma.

Survey Questionnaire and Conceptual Framework
The questionnaire was adapted from a previous study of contextual factors influencing chronic heart failure care in an integrated health care system15 by changing chronic heart failure references to “asthma” and rewording a few questions (see Survey Procedures and Data Collection). The survey assessed 5 constructs of the Consolidated Framework for Implementation Research,42 including (1) inner setting (eg, leadership support, resource availability, support staff, quality improvement [QI] commitment, previous QI experience and culture, relationship between hospital management and physicians, need for the intervention, staff empowerment, communication and/or collaboration within the organization, competing demands, and organizational readiness to change, etc); (2) outer setting or hospital structure variables (eg, size, type [tertiary and community], location [rural and urban], and HCP incentive); (3) intervention characteristics (eg, if it fits the
HCPs’ needs, was relevant or applicable to the HCPs’ practice, was perceived effective in improving the HCPs’ practice, and its clarity, ease of use, and understandability; (4) individuals involved (eg, the HCP’s years of experience, previous QI or guideline implementation experience, personal involvement in EB-CPM implementation or with the implementation team, or whether they were knowledgeable about, complied, or agreed with the EB-CPM, whether they were resistant); and (5) implementation process (eg, QI professionals’ participation in the implementation team, teamwork, team composition, use of a champion, if there were structural changes made to facilitate EB-CPM implementation, data feedback, feedback mechanisms, use of a brief EB-CPM summary [eg, pocket card, algorithm, etc], education and/or training of HCPs and approach used [eg, grand rounds, clinical meetings, etc], whether additional staff was used, and if there was a rearrangement of roles, change in workflow, and delegation of certain work).

Overall, the survey included 82 structured questions, with responses ranging from 1 to 6 (1 = not at all, 2 = very little, 3 = some, 4 = great, 5 = very great, and 6 = do not know). An open-ended question (“What do you feel were the most important factors that helped facilitate EB-CPM implementation?”) was used to identify additional constructs missed in the structured survey.

Survey Procedures and Data Collection
We pretested the survey on a sample of 6 participants, including 2 physicians, 2 nurses, and 2 RTs, ensuring questions were clearly worded and easily understood. We reworded unclear questions for clarity without changing the concepts. We contacted clinical program leaders at each hospital to identify individuals who were exposed to the EB-CPM through patient care or involvement with local implementation teams.

We obtained potential participants’ names and e-mails and conducted the survey using SurveyGizmo. The survey packet included an introductory letter describing its purpose, a letter of support from clinical program leaders, consent form, confidentiality measures, and the questionnaire. All nonrespondents were contacted up to 3 times to optimize the response rate. The IH privacy and the University of Utah Institutional Review Boards approved the study.

Data Analysis
Quantitative Analysis
We used descriptive analysis and Pearson partial correlation, controlling for the hospital, to assess the association between the participant’s response about the HCP’s adherence with EB-CPM and individual factors. We used individual responses to the structured question (“… please indicate to what extent HCPs used or complied with the EB-CPM”) as the dependent variable to determine factors associated with EB-CPM implementation (or the HCPs’ perceived adherence). We included responses 1 through 5, and excluded response 6 (do not know) and missing. Pearson correlations provide a single measure of the degree of linear association between responses on 1-to-5 Likert scales for each relationship investigated. Contextual factors for which the correlation coefficient (r) was high (r ≥ 0.50)43–48 with a P value ≤.05 were classified as significantly associated with EB-CPM implementation.

Qualitative Analysis (Open-ended Question)
Two authors (F.L.N. and J.B.P.) reviewed participants’ responses independently and used thematic analysis to develop a preliminary coding scheme using constant comparison method and open coding principles. We created a nonhierarchical list of first-level codes describing responses. We then categorized the data, assessed relationships, and combined similar categories; then, the 2 authors met to discuss and refine the coding scheme. The discussions during coding sessions included reflections on previous literature, relevant theories, and the goals of the study. Any discrepancies between the 2 reviewers were resolved through consensus. Analysis was descriptive.

Results
Quantitative Analysis Results
Of 523 individuals invited, 260 responded (50% response rate) to the survey, including 24 (of 82) physicians, 164 (of 300) nurses, and 72 (of 141) RTs. The majority of participants (65%) had >5 years of job experience, and 97% were familiar with the EB-CPM. Eight respondents unfamiliar with the EB-CPM were excluded, leaving 252 participants for analyses. Similar to our finding with objective measures of adherence from a previous study,18 perceived HCPs’ adherence (responses 3, 4, and 5 on the survey) was also high (96.8%) overall, by role (98.2% nurses, 95.2% RTs, and 91.7% physicians), hospital type (97.8% tertiary care and 95.6% community), and individual hospitals (Table 1).

Overall, no outer setting factor was associated with EB-CPM implementation. We found significant associations with factors related to inner setting, intervention characteristics, individuals involved, and implementation process (Table 2).

Inner Setting
EB-CPM implementation was positively associated with HCPs’ perception that there was (1) leadership support, (2) effective collaboration between senior administration and physicians, (3) effective communication between physicians and nonphysician HCPs, (4) effective collaboration between departments involved, (5) previous hospital experience with guideline implementation, (6) data-driven decision-making organizational culture, and (7) sufficient resources, time, or personnel allocated to the effort.

Intervention Characteristics
EB-CPM implementation was positively associated with HCPs’ perception that it was relevant and applicable to HCPs’ practice.

Individuals Involved
EB-CPM implementation was positively associated with perception that HCPs (1) agreed with the EB-CPM and (2) were knowledgeable of evidence supporting the EB-CPM. Interestingly, the number of years individuals worked in the hospital was inversely associated with EB-CPM implementation.

Implementation Process
EB-CPM implementation was positively associated with HCPs’ perception that there was (1) distribution of the EB-CPM to all hospitals.
physicians, (2) an implementation team with a mix of expertise and professional 
(physicians, nurses, and RTs) input, (3) teamwork, (4) HCPs’ participation in 
implementation activities, (5) performance data shared with physicians, (6) frequent 
data feedback provided to physicians, (7) appropriate checkpoints and deadlines 
during implementation, and (8) organizational changes for EB-CPM 
implementation completed in a reasonable time frame.

Full results with questions and r and P 
values are provided in Supplemental 
Table 4.

Qualitative Analysis Results

Of 252 survey responders, 89 responded to 
the open-ended question. Providing 
education and training (not significant in 
qualitative analysis) was an additional and 
most commonly perceived facilitator of 
EB-CPM implementation reported, with 
responders stating, “Education ensured all 
parties became aware and familiar with the 
EB-CPM.” Many recognized grand rounds 
and department meetings as venues for 
education. Respondents also reported 
having adequate preparation, resources, 
and supporting materials before 
implementation facilitated the process. The 
list of most common facilitators identified 
with exemplar quotes is included in Table 3.

DISCUSSION

We found that successful EB-CPM 
implementation was perceived to be 
influenced by key contextual factors, 
including having an appropriate

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Type</th>
<th>Location</th>
<th>Participants, n</th>
<th>EB-CPM Adherence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Form Hospital</td>
<td>Community</td>
<td>Rural</td>
<td>15</td>
<td>93.3</td>
</tr>
<tr>
<td>Dixie Regional Medical Center</td>
<td>Community</td>
<td>Rural</td>
<td>15</td>
<td>93.3</td>
</tr>
<tr>
<td>Logan Regional Hospital</td>
<td>Community</td>
<td>Rural</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>McKay-Dee Hospital</td>
<td>Community</td>
<td>Urban</td>
<td>19</td>
<td>94.7</td>
</tr>
<tr>
<td>PCH</td>
<td>Tertiary</td>
<td>Urban</td>
<td>138</td>
<td>97.8</td>
</tr>
<tr>
<td>Riverton Hospital</td>
<td>Community</td>
<td>Urban</td>
<td>12</td>
<td>91.7</td>
</tr>
<tr>
<td>Utah Valley Hospital</td>
<td>Community</td>
<td>Urban</td>
<td>38</td>
<td>97.4</td>
</tr>
<tr>
<td>Total</td>
<td>All hospitals</td>
<td></td>
<td>252</td>
<td>96.8</td>
</tr>
</tbody>
</table>

—, not applicable.

* Perceived adherence was calculated by combining responses no. 3 (some), no. 4 (great), and no. 5 (very 
great) to the question “…please indicate to what extent HCPs used or complied with the EB-CPM…”

impact data when it was initially 
implemented at PCH to secure leadership 
support at other hospitals, creating a high 
expectation among leaders to see similar 
improvements when the EB-CPM would be 
implemented locally.

Our findings underscore the value of education 
and training as a facilitator of an EBI 
implementation. Education and training 
provided to HCPs before implementation 
activities increased their knowledge, shaped 
their attitudes toward the EB-CPM, and secured 
their buy-in. In our study, we used grand 
rounds and department meetings as venues to 
educate HCPs at participating facilities about 
the EB-CPM and supporting evidence.

Our results reveal that characteristics of the 
intervention, especially when supported by 
evidence, can influence HCPs’ attitudes. In 
our study, we used decision support tools 
(admit and discharge order sets) to 
integrate and translate asthma evidence-
based recommendations into routine 
hospital care. Because the development of 
these tools was informed by guidelines51 
and their contents were relevant and 
applicable to the HCP’s practice,50 HCPs were 
eager to use them.

We found teamwork (a well-functioning 
team) as another key facilitator of EB-CPM 
implementation, which we established by 
having an equal stakeholder (physicians 
and nonphysicians) representation and 
participation in decision-making and by 
promoting effective intraorganizational 
collaboration, communication, and 
coordination about the EB-CPM.

In addition, we found data feedback 
regarding hospital and physician 
performance a key facilitator.

We posted feedback data online in a 
dashboard accessible by all participants 
and discussed the data regularly with HCPs 
at participating hospitals during monthly 
conference calls, grand rounds, and other 
departmental meetings. Feedback data 
helped promote accountability, identify 
 improvisement opportunities, and support 
continued HCPs’ engagement with the 
process.

Overall, our study corroborates findings of 
many non–asthma-related studies, often
TABLE 2: Contextual Factors Associated With Implementation of the EB-CPM in Clinical Practice

<table>
<thead>
<tr>
<th>Variable Label</th>
<th>Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inner setting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was senior administration supportive of physicians?</td>
<td>0.54</td>
<td>.00</td>
</tr>
<tr>
<td>Did senior administration support the pediatric asthma EB-CPM activities?</td>
<td>0.54</td>
<td>.00</td>
</tr>
<tr>
<td>Did senior administration support changes to improve quality of care?</td>
<td>0.60</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Was there effective communication between physician and nonphysician providers (eg, nurses, RTs, pharmacists)?</td>
<td>0.70</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Was there collaboration and/or cooperation between departments?</td>
<td>0.60</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Was there cooperation and/or cooperation between physicians and senior administration?</td>
<td>0.58</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Did the culture of your hospital support data-driven decision-making?</td>
<td>0.59</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Was there sufficient financial or personnel support to implement the changes?</td>
<td>0.53</td>
<td>.00</td>
</tr>
<tr>
<td>Was there cooperation from other departments with your efforts to improve quality of care?</td>
<td>0.64</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Did your hospital experience with guidelines facilitate implementation of the asthma EB-CPM?</td>
<td>0.54</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Intervention characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providers (physicians, nurses, and RTs) feel this EB-CPM is relevant to their daily practice.</td>
<td>0.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Did physicians believe that the pediatric asthma EB-CPM guidelines are applicable to their practice?</td>
<td>0.50</td>
<td>.01</td>
</tr>
<tr>
<td><strong>Individuals targeted by the intervention</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providers (physicians, nurses, and RTs) agree with this EB-CPM.</td>
<td>0.63</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Providers (physicians, nurses, and RTs) are knowledgeable about this EB-CPM.</td>
<td>0.53</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Did patient care providers (physicians, nurses, and RTs) consistently participate in activities to improve quality of care?</td>
<td>0.50</td>
<td>.00</td>
</tr>
<tr>
<td>How long have you been working at (or with) this hospital?</td>
<td>-0.60</td>
<td>.02</td>
</tr>
<tr>
<td><strong>Implementation process</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were your hospital’s asthma EB-CPM data distributed to all physicians?</td>
<td>0.63</td>
<td>.01</td>
</tr>
<tr>
<td>How often were pediatric asthma EB-CPM data (or feedback data) distributed to physicians in your hospital?</td>
<td>0.56</td>
<td>.04</td>
</tr>
<tr>
<td>Did teamwork exist at your hospital in implementing the EB-CPM?</td>
<td>0.63</td>
<td>.00</td>
</tr>
<tr>
<td>Appropriate checkpoints and deadlines were established.</td>
<td>0.58</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Were changes intended to improve quality of care accomplished in a reasonable time frame?</td>
<td>0.60</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Was there an appropriate mix of expertise?</td>
<td>0.54</td>
<td>.03</td>
</tr>
<tr>
<td>Was there an appropriate balance of input across professions?</td>
<td>0.61</td>
<td>.01</td>
</tr>
</tbody>
</table>

Conducted in the ambulatory setting, supporting that similar factors are important in both the outpatient and hospital setting. Leadership support was found to foster EBI use, secure HCP commitment, promote accountability, and reduce resistance in ambulatory settings. Likewise, implementation of diabetes and blood pressure control guidelines in primary care settings was successful when guidelines fit the needs of patients and HCPs.

Similar to our results, education and/or training was found to influence implementation of an EBI, increasing an HCP’s knowledge about supporting evidence and allowing the HCP to be more comfortable and willing to use the EBI. Also, effectiveness data (proof of benefit) were found to shape HCP attitudes. Likewise, Bhatt et al highlighted the importance of teamwork and collaboration and reported that an EBI is successful when all physicians and/or nonphysicians collaborate effectively. Teamwork improves communication and collaboration, allowing individuals of various disciplines to share expertise and skills to achieve a common goal. Breakdown in teamwork is associated with poor communication and adverse patient outcomes.

Some of our findings were similar to results reported in few asthma-related studies of contextual factors in the ED and ambulatory settings. Cabana et al found awareness, familiarity, and agreement as facilitators to pediatricians’ compliance with ED asthma guidelines. Also, perceived lack of benefits was found to impede adherence with the use of metered dose inhalers and spacers in pediatric EDs. Teamwork was a recognized facilitator of an asthma self-management intervention in adult general practice. Likewise, lack of appropriate preparation was a recognized barrier, resulting in low HCP adherence with an ED pediatric asthma protocol. Despite some similarities with non–asthma-related studies, our study is unique in examining a broad range of contextual factors across multiple hospital settings, providing specific strategies that can be used to guide implementation of EBIs.
for children with asthma and accelerate the translation of research findings in the hospital setting. Our study adds evidence of the importance of implementation teams having a balanced mix of disciplines, setting deadlines and checkpoints to complete implementation activities in a reasonable time frame, and establishing effective collaboration among physicians and nonphysician HCPs. Lastly, we found a negative correlation between years worked at the hospital and EB-CPM implementation, suggesting experienced HCPs may be slow to adhere to a new EBI and underscoring the needs for targeted efforts to increase their buy-in and reduce resistance.

Our study is limited in that it only represents views of respondents. Nonrespondents may have different views. Because of our unique study setting, with a strong electronic medical record system, a culture of EB-CPM implementation, and a somewhat underrepresentation of physicians, our results may not capture the full array (eg, use of pocket cards) of factors that may influence EB-CPM implementation. Researchers of a study conducted in another location might identify additional important factors for EBI implementation success. Our surveys were conducted 1 year after the completion of implementation activities raising the possibility of recall bias. The contextual factors identified in our study are subjective (“perceived” by HCPs), as adherence with the EB-CPM was very high (>90%) overall across hospital type, location, HCP type, etc, rendering a comparison of high to low compliers impossible. Although the middle response is often considered neutral, we included “some” (Table 1) in the calculation of adherence because it was considered a positive response. This inclusion did not impact the analyses of contextual factors because adherence was used as a continuous variable. Nevertheless, we believe our study provides a foundation for advancing efforts for disseminating successful single-center EBIs (for asthma and other diseases) to other hospitals. Although we sample multiple HCP types (eg, nurses, RTs, and physicians), some of our qualitative findings stress the unique role of physicians as the most important driving force in influencing EB-CPM implementation in clinical practice. Our analyses were exploratory and were performed without formal adjustment for multiple comparisons. Also, our outcome variable was assessed on the 1-to-5 Likert scale. This limited variability may have impacted our results. Therefore, further studies are needed to confirm our results. Finally, our study was conducted in an integrated health delivery system with an established QI culture and may not be applicable to other settings. However, we believe similarities with many non–asthma- and the few asthma-related studies conducted in ambulatory and ED settings support generalizability of our findings and underscore the importance of addressing.

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multilevel contextual factors when implementing EBIs in the inpatient settings.

CONCLUSIONS

In our study, we provided a set of key facilitators of EBI implementation that can be used by others to facilitate broad implementation and dissemination of EBIs for childhood asthma in the hospital setting, which may be generalizable to other conditions and settings.

Acknowledgments

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