Barriers and Facilitators to Guideline-Adherent Pulse Oximetry Use in Bronchiolitis

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OBJECTIVE: Continuous pulse oximetry monitoring ($cSpO_2$) in children with bronchiolitis does not improve clinical outcomes and has been associated with increased resource use and alarm fatigue. It is critical to understand the factors that contribute to $cSpO_2$ overuse in order to reduce overuse and its associated harms.

METHODS: This multicenter qualitative study took place in the context of the Eliminating Monitor Overuse (EMO) SpO_2 study, a cross-sectional study to establish rates of $cSpO_2$ in bronchiolitis. We conducted semistructured interviews, informed by the Consolidated Framework for Implementation Research, with a purposive sample of stakeholders at sites with high and low $cSpO_2$ use rates to identify barriers and facilitators to addressing $cSpO_2$ overuse. Interviews were audio recorded and transcribed. Analyses were conducted using an integrated approach.

RESULTS: Participants (n = 56) included EMO study site principal investigators (n = 12), hospital administrators (n = 8), physicians (n = 15), nurses (n = 12), and respiratory therapists (n = 9) from 12 hospitals. Results suggest that leadership buy-in, clear authoritative guidelines for SpO_2 use incorporated into electronic order sets, regular education about $cSpO_2$ in bronchiolitis, and visual reminders may be needed to reduce $cSpO_2$ utilization. Parental perceptions and individual clinician comfort affect $cSpO_2$ practice.

CONCLUSION: We identified barriers and facilitators to deimplementation of $cSpO_2$ for stable patients with bronchiolitis across children's hospitals with high- and low-$cSpO_2$ use. Based on these data, future deimplementation efforts should focus on clear protocols for $cSpO_2$, EHR changes, and education for hospital staff on bronchiolitis features and rationale for reducing $cSpO_2$. *Journal of Hospital Medicine* 2021;16:23-30. © 2021 Society of Hospital Medicine

Continuous pulse oximetry monitoring ($cSpO_2$) in children with bronchiolitis is associated with increased rates of hospital admission, longer lengths of stay, more frequent treatment with supplemental oxygen, alarm fatigue, and higher hospital cost. There is no evidence that it improves clinical outcomes.[1-7] The safety of reducing $cSpO_2$ for stable bronchiolitis patients (ie, those who are clinically well and not requiring supplemental oxygen) has been assessed in quality improvement initiatives[8-10] and a randomized controlled trial.[2] These studies showed no increase in intensive care unit transfers, codes, or readmissions associated with reduced $cSpO_2$. Current national guidelines from the American Academy of Pediatrics[5] and the Society of Hospital Medicine Choosing Wisely in Pediatric Hospital Medicine workgroup[4] support limiting monitoring of children with bronchiolitis. Despite this, the practice of $cSpO_2$ in stable bronchiolitis patients off supplemental oxygen remains widespread.[11,12]

Deimplementation, defined as reducing or stopping low-value or ineffective healthcare practices,[13,14] is a discrete focus area within implementation science. Deimplementation

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TABLE 1. **Domains and Definitions Drawn From the Consolidated Framework for Implementation Research With Examples of How Constructs Were Incorporated in the Interview**

Domain	Definition	Example questions from interview guide
Intervention	The characteristics of the particular intervention that may impact its deimplementation in a particular organization or setting.	The American Academy of Pediatrics clinical practice guideline for bronchiolitis, as well as the *Choosing Wisely®* campaign, discourage the use of continuous pulse oximetry in stable bronchiolitis. How familiar are you with these guidelines? How relevant are they to the day-to-day care of bronchiolitis patients? What strategy do you think would be most effective in decreasing the use of continuous pulse oximetry in stable bronchiolitis patients?
Outer setting	The political, social, or economic forces external to the setting of deimplementation.	What preferences or expectations do parents express about continuous monitoring? What hospital policies, protocols, or pathways exist at your institution that would affect the success of an intervention to reduce continuous pulse oximetry monitoring in stable bronchiolitis patients?
Inner setting	The structure, political, and social setting in which the deimplementation occurs.	How would you describe the culture within your discipline with respect to continuous monitoring in bronchiolitis? What prior experience implementing interventions aimed at reducing pulse oximetry monitoring in bronchiolitis have you or your hospital had?
Individuals	The people involved in the deimplementation process.	What, if anything, worries you about using less continuous pulse oximetry in stable bronchiolitis patients at your hospital? How confident are you that you and your team could successfully implement an intervention to reduce continuous pulse oximetry monitoring in stable bronchiolitis patients at your hospital?

research involves the reduction of unnecessary and overused services for which there is potential for harm or no benefit.[15,16] In pediatrics, there are a number of potential targets for deimplementation,[4,17-20] including $cSpO_2$ for stable infants with bronchiolitis, but efforts to reduce low-value practices have met limited success to date.[21,22]

Implementation science offers rigorous methods for advancing the development and evaluation of strategies for deimplementation.[23] In particular, implementation science frameworks can facilitate our understanding of relevant contextual factors that may hinder or help efforts to deimplement low-value practices. To develop broadly applicable strategies to reduce monitoring overuse, it is important to understand the barriers, facilitators, and contextual factors (eg, clinical, political, interpersonal) that contribute to guideline-discordant $cSpO_2$ in hospitalized bronchiolitis patients. Further, the process by which one can develop a rigorous understanding of these factors and how they may impact deimplementation efforts could generalize to other scenarios in pediatrics where overuse remains an issue.

The goal of this study was to use semistructured interviews, informed by an established implementation science framework, specifically the Consolidated Framework for Implementation Research (CFIR),[24] to (1) identify barriers and facilitators to deimplementing unnecessary $cSpO_2$, and (2) develop strategies to deimplement $cSpO_2$ in a multicenter cohort of hospital-based clinician and administrative stakeholders.

METHODS

Study Setting

This multicenter qualitative study using semistructured interviews took place within the Eliminating Monitor Overuse (EMO) SpO_2 study. The EMO SpO_2 study established rates of $cSpO_2$ in bronchiolitis patients not receiving supplemental oxygen or not receiving room air flow at 56 hospitals across the United States and in Canada from December 1, 2018, through March 31, 2019.[12] The study identified hospital-level risk-adjusted $cSpO_2$ rates ranging from 6% to 82%. A description of the EMO SpO_2 study methods[25] and its findings[12] have been published elsewhere.

Participants

We approached EMO study site principal investigators at 12 hospitals: the two highest- and two lowest-use hospitals within three hospital types (ie, freestanding children's hospitals, children's hospitals within large general hospitals, and community hospitals). We collaborated with the participating site principal investigators (n = 12), who were primarily hospitalist physicians in leadership roles, to recruit a purposive sample of additional stakeholders including bedside nurses (n = 12), hospitalist physicians (n = 15), respiratory therapists (n = 9), and hospital administrators (n = 8) to participate in semistructured interviews. Interviews were conducted until we achieved thematic saturation within each stakeholder group and within the high and low performing strata (total 56 interviews). Participants were asked to self-report basic demographic information (see Appendix, interview guide) as required by the study funder and to allow us to comment on the representativeness of the participant group.

Procedure

The interview guide was informed by the CFIR, a comprehensive framework detailing contextual factors that require consideration when planning for the implementation of a health service intervention. Table 1 details the CFIR domains with study-related examples. The interview guide (Appendix) provided limited clinical context apart from the age, diagnosis, and oxygen requirement for the population of interest to promote a broad array of responses and to avoid anchoring on specific clinical scenarios. Interviews were conducted by master's degree or doctoral-level research coordinators with qualitative interviewing experience and supervised by a medical

anthropologist and qualitative methods expert (F.K.B.). Prior to engaging in audio recorded phone interviews, the interviewer explained the risks and benefits of participating. Participants were compensated $50. Audio recordings were transcribed, deidentified, and uploaded to NVivo 12 Plus (QSR International) for data management.

The Institutional Review Boards of Children's Hospital of Philadelphia, Pennsylvania, and the University of Pennsylvania in Philadelphia determined that the study met eligibility criteria for IRB exemption.

Data Analysis

Using an integrated approach to codebook development,[26] a priori codes were developed using constructs from the CFIR. Additional codes were added by the research team following a close reading of the first five transcripts.[27,28] Each code was defined, including decision rules for its application. Two research coordinators independently coded each transcript. Using the intercoder reliability function within NVivo, the coders established strong interrater reliability accordance scores ($\kappa > .8$) by double coding 20% of the transcripts. Data were stratified by sites with low and high use of $cSpO_2$ to examine differences in barriers and facilitators to deimplementation. Each code was subcoded, summarized, and examined for patterns within and across participating disciplines, which yielded themes related to barriers and facilitators. We conducted member checking and reviewed our conclusions with a multidisciplinary group of clinical stakeholders (n = 13) to validate our analyses.

RESULTS

Barriers and facilitators to deimplementation were identified in multiple domains of the CFIR: outer setting, inner setting, characteristics of the individuals, and intervention characteristics (Table 1). Participants also suggested strategies to facilitate deimplementation in response to some identified barriers. See Table 2 for participant demographics and Table 3 for illustrative participant quotations.

TABLE 2. **Interview Participant Demographics**

Variable	n (%)
Mean age (SD), y	40.5 (10.0)
Sex	
Male	16 (29)
Female	40 (71)
Ethnicity	
Hispanic and/or Latinx	1 (2)
Non-Hispanic and/or non-Latinx	55 (98)
Prefer not to disclose	0 (0)
Race	
American Indian or Alaska Native	0 (0)
Asian	4 (7)
Black or African American	1 (2)
Native Hawaiian or Pacific Islander	0 (0)
White	46 (82)
Multiple races	3 (5)
Other	1 (2)
Prefer not to disclose	1 (2)
Primary role[a]	
Administrator	8 (14)
Physician	15 (27)
Nurse	12 (21)
Respiratory therapist	9 (16)
Site PI	12 (21)
Site type[b]	
Low $cSpO_2$ use	28 (50)
High $cSpO_2$ use	29 (50)

[a]Some participants had multiple roles (eg, Site PIs were also typically attending physicians).

[b]"Low $cSpO_2$ use" site denotes fewer than 25% of stable bronchiolitis patients were monitored with $cSpO_2$ during observations conducted in a previous study; "High $cSpO_2$ use" site denotes more than 25% of stable bronchiolitis patients were monitored. Among the 6 hospitals categorized as low overuse, the median percent monitored was 12% (IQR 5%-21%, range 1%-25%). Among the 6 hospitals categorized as high overuse, the median percent monitored was 79%, IQR 78%-81%, range 76%-92%.

Barriers

Outer Setting: Clinician Perceptions of Parental Discomfort With Discontinuing Monitoring

Participants mentioned parental preferences as a barrier to discontinuing $cSpO_2$, noting that parents seem to take comfort in watching the numbers on the monitor screen and are reluctant to have it withdrawn. Clinicians noted that parents sometimes put the monitor back on their child after a clinician removed it or have expressed concern that their unmonitored child was not receiving the same level of care as other patients who were being monitored. In these scenarios, clinicians reported they have found it helpful to educate caregivers about when $cSpO_2$ is and is not appropriate.

Inner Setting: Unclear or Nonexistent Guideline to Discontinue $cSpO_2$

Guidelines to discontinue $cSpO_2$ reportedly did not exist at all institutions. If a guideline did exist, lack of clarity or conflicting guidelines about when to use oxygen presented a barrier. Participants suggested that a clear guideline or additional oversight to ensure all clinicians are informed of the procedure for discontinuing $cSpO_2$ may help prevent miscommunication. Participants noted that their electronic health record (EHR) order sets commonly included $cSpO_2$ orders and that removing that option would facilitate deimplementation.

Inner Setting: Difficulty Educating All Staff

Participants noted difficulty with incorporating education about discontinuing $cSpO_2$ to all clinicians, particularly to those who are nightshift only or to rotating staff or trainees. This created barriers for frequent re-education because these staff are not familiar with the policies and procedures of the unit, which is crucial to developing a culture that supports the deimplementation of $cSpO_2$. Participants suggested that recurring education about procedures for discontinuing $cSpO_2$ should target trainees, new nurses, and overnight nurses. This would help to ensure that the guideline is uniformly followed.

TABLE 3. **Illustrative Quotations of Barriers and Facilitators in Deimplementation**

Domain/Theme	Quote
Barriers	
Outer setting: Perception of parental preference	*Nurse:* "I think that, if it was a parent that has already had numerous of their children in the hospital, like within one family for similar things and they're used to that level of care, then they might be a little bit apprehensive and questioning as to why you weren't providing the same level of monitoring." *Site PI:* "Sometimes it's challenging to get parents to let go of the pulse ox. Especially if that child is housed in a unit where other patients are getting continuous pulse ox."
Inner setting: Pathways to discontinuation	*Physician:* "I think once it's started, like you said, we need a weaning protocol. There isn't always a clear protocol. Yes, we know when to stop the oxygen, but we don't necessarily think to stop the pulse ox." *Physician:* "If the order set is continuous pulse oximetry and in parentheses it says while on oxygen. That may be interpreted as, the order never gets discontinued because it technically has, like, an 'If this happens, then you do this.'"
Inner setting: Educating staff	*Nurse:* "It got really good for a while, but we get new residents every year, and so I don't feel like it gets pushed again. It got good, and then every month they change over as well." *Site PI:* "The nurses are crucial to the success of this, and so there's so many nurses and so many shifts that I think it's really hard to educate nurses at all levels at all times."
Inner setting: Culture of monitoring	*Administrator:* "So a nurse can be a part of a four- or sometimes five-patient assignment, two of which are getting chemotherapy, and so they want all of the safeguards they can have, which they interpret that as sometimes having continuous pulse ox." *Site PI:* "We're doing our job if we have a fancy monitor hooked up and we're recording all this stuff. That, again, is a cultural thing that I think is going to have to be removed or taken away."
Characteristics of individuals: Clinician discomfort	*Nurse:* "Sometimes it benefits you to have the baby on pulse ox. You can keep a good eye on them, and then you can judge when they need to be suctioned." *Respiratory therapist:* "I would expect to see people resistant to change, to start. Nobody likes change to start off with, and the continuous pulse ox is viewed as a safety net. And so, taking away that safety net will be a challenge."
Facilitators	
Outer setting	*Administrator:* "So I think that's going to be information that is driven by data and nursing tend to like the specifics and data and numbers like that. I think that they would also buy in from the American Academy of Pediatrics. . . . Obviously that's a very reputable organization that they will trust, and so it would help with their buy-in. But if we tell the staff there's evidence to suggest that this new way is better for patients, they want to do what's best for their patients, so they're going to understand, and that will help tremendously." *Administrator:* "I mean we do have this, we have guidelines, but if there was a huge intervention that was kind of national, yeah, I think that adds a lot of credibility."
Inner setting: Leadership	*Physician:* "Yeah, I really think that our, you know, our—the nurse educator and the nurse manager would be great facilitators for change to happen." *Site PI:* "At the same time, you do have to have, I think, physician champions or nurse champions, particularly people that are seasoned and more well respected, so getting some of those folks."
Inner setting: EHR	*Administrator:* "Changing the order set so that there isn't even a box that can be checked for it." *Site PI:* "Now, the order 2 years ago used to say to 'monitor pulse oximetry continuously,' and period, that was the end of the order. Couple of years ago, we change that order to say, 'Monitor while they're on oxygen,' and then once they're off of oxygen, or move to O_2 sat monitoring."
Intervention characteristics/ inner setting: Guidelines	*Nurse:* "They haven't really made any policies or procedures quite yet on exactly what kids need to be monitored and what kids don't, but more of just an FYI, newsletter, flier thing. 'Hey, rethink this.' 'Think about this.'" *Site PI:* "I think creating an evidence-based policy. Making sure that the entire staff has higher education on that policy."

Abbreviations: EHR, electronic health record; PI, principal investigator; pulse ox, pulse oximetry; sat, saturation..

Inner Setting: Culture of High $cSpO_2$ Use

Participants from high-use sites discussed a culture driven by readily available monitoring features or an expectation that monitoring indicates higher-quality care. Participants from low-use sites discussed increased $cSpO_2$ driven by clinicians who were accustomed to caring for higher-acuity patients, for whom continuous monitoring is likely appropriate, and were simultaneously caring for stable bronchiolitis patients.

Some suggested that visual cues would be useful to clinicians to sustain awareness about a $cSpO_2$ deimplementation guideline. It was also suggested that audit and feedback techniques like posting unit deimplementation statistics and creating a competition among units by posting unit performance could facilitate deimplementation. Additionally, some noted that visual aids in common spaces would be useful to remind clinicians and to engage caregivers about discontinuing $cSpO_2$.

Characteristics of Individuals: Clinician Discomfort Discontinuing $cSpO_2$

One frequently cited barrier across participants is that $cSpO_2$ provides "peace of mind" to alert clinicians to patients with low oxygen saturations that might otherwise be missed. Participants identified that clinician discomfort with reducing $cSpO_2$ may be driven by inexperienced clinicians less familiar with the bronchiolitis disease process, such as trainees, new nurses, or rotating clinicians unaccustomed to pediatric care. Trainees and new nurses were perceived as being more likely to work at night when there are fewer clinicians to provide patient care. Additionally, participants perceived that night shift clinicians

favored $cSpO_2$ because they could measure vital signs without waking patients and families.

Clinicians discussed that discontinuing $cSpO_2$ would require alternative methods for assessing patient status, particularly for night shift nurses. Participants suggested strategies including changes to pulse oximetry assessment procedures to include more frequent "spot checks," incorporation of assessments during sleep events (eg, naps) to ensure the patient does not experience desaturations during sleep, and training nurses to become more comfortable with suctioning patients. Suggestions also included education on the typical features of transient oxygen desaturations in otherwise stable patients with bronchiolitis[2] to bolster clinical confidence for clinicians unfamiliar with caring for bronchiolitis patients. Participants perceived that education about appropriate vs inappropriate use may help to empower clinicians to employ $cSpO_2$ appropriately.

Facilitators

Outer Setting: Standards and Evidence From Research, Professional Organizations, and Leaders in the Field

Many participants expressed the importance of consistent guidelines that are advocated by thought leaders in the field, supported by robust evidence, and consistent with approaches at peer hospitals. The more authoritative support a guideline has, the more comfortable people are adopting it and taking it seriously. Additionally, consistent education about guidelines was desired. Participants noted that all clinicians should be receiving education related to the American Academy of Pediatrics (AAP) Bronchiolitis and *Choosing Wisely*® guidelines, ranging from a one-time update to annually. Continual updates and re-education sessions for clinicians who shared evidence about how $cSpO_2$ deimplementation could improve the quality of patient care by shortening hospital length of stay and lowering cost were suggested strategies.

Inner Setting: Leadership

Participants noted that successful deimplementation depends upon the presence of a champion or educator who will be able to lead the institutional charge in making practice change. This is typically an individual who is trusted at the institution, experienced in their field, or already doing implementation work. This could be either a single individual (champion) or a team. The most commonly noted clinician roles to engage in a leadership role or team were physicians and nurses.

Participants noted that a change in related clinical care pathways or EHR order sets would require cooperation from multiple clinical disciplines, administrators, and information technology leaders and explained that messaging and education about the value of the change would facilitate buy-in from those clinicians.

Inner Setting: EHR Support for Guidelines

Participants often endorsed the use of an order set within the EHR that supports guidelines and includes reminders to decrease $cSpO_2$. These reminders could come up when supplemental oxygen is discontinued or occur regularly throughout the patient's stay to prompt the clinician to consider discontinuing $cSpO_2$.

Intervention Characteristics/Inner Setting: Clear Bronchiolitis Guidelines

The presence of a well-articulated hospital policy that delineates the appropriate and inappropriate use of $cSpO_2$ in bronchiolitis was mentioned as another facilitator of deimplementation.

DISCUSSION

Results of this qualitative study of stakeholders across hospitals with high and low $cSpO_2$ use illustrated the complexities involved with deimplementation of $cSpO_2$ in pediatric patients hospitalized with bronchiolitis. We identified numerous barriers spanning the CFIR constructs, including unclear or absent guidelines for stopping $cSpO_2$, clinician knowledge and comfort with bronchiolitis disease features, and unit culture. This suggests that multicomponent strategies that target various domains and a variety of stakeholders are needed to deimplement $cSpO_2$ use for stable bronchiolitis patients. Participants also identified facilitators, including clear $cSpO_2$ guidelines, supportive leaders and champions, and EHR modifications, that provide insight into strategies that may help sites reduce their use of $cSpO_2$. Additionally, participants also provided concrete, actionable suggestions for ways to reduce unnecessary monitoring that will be useful in informing promising deimplementation strategies for subsequent trials.

The importance of having specific and well-known guidelines from trusted sources, such as the AAP, about $cSpO_2$ and bronchiolitis treatment that are thoughtfully integrated in the EHR came through in multiple themes of our analysis. Prior studies on the effect of guidelines on clinical practice have suggested that rigorously designed guidelines can positively impact practice.[29] Participants also noted that $cSpO_2$ guidelines should be authoritative and that knowledge of guideline adoption by peer institutions was a facilitator of adoption. Usability issues negatively impact clinicians' ability to follow guidelines.[30] Further, prior studies have demonstrated that EHR integration of guidelines can change practice.[31-33] Based on our findings, incorporating clear guidelines into commonly used formats, such as EHR order sets, could be an important deimplementation tool for $cSpO_2$ in stable bronchiolitis patients.

Education about and awareness of $cSpO_2$ guidelines was described as an important facilitator for appropriate $cSpO_2$ use and was suggested as a potential deimplementation strategy. Participants noted that educational need may vary by stakeholder group. For example, education may facilitate obtaining buy-in from hospital leaders, which is necessary to support changes to the EHR. Education incorporating information on the typical features of bronchiolitis and examples of appropriate and inappropriate $cSpO_2$ use was suggested for clinical team members. The limitations of education as a stand-alone deimplementation strategy were also noted, and participants highlighted challenges such as time needed for education

and the need for ongoing education for rotating trainees. Inner and outer setting barriers, such as a perceived "culture of high pulse oximetry use" and patient and family expectations, could also make education less effective as a stand-alone strategy. That—coupled with evidence that education and training alone are generally insufficient for producing reliable, sustained behavior change[34,35]—suggests that a multifaceted approach will be important.

Our respondents consider parental perceptions and preference in their practice, which provides nuance to recent studies suggesting that parents prefer continuous monitors when their child is hospitalized with bronchiolitis. Chi et al described the impact of a brief educational intervention on parental preferences for monitoring children hospitalized for bronchiolitis.[36] This work suggests that educational interventions aimed at families should be considered in future (de)implementation studies because they may indirectly impact clinician behavior. Future studies should directly assess parental discomfort with discontinuing monitoring.

Participants highlighted the link between knowledge and confidence in caring for typical bronchiolitis patients and monitoring practice, perceiving that less experienced clinicians are more likely to rely on $cSpO_2$. Participants at high-use sites emphasized the expectation that monitoring should occur during hospitalizations. This reflection is particularly pertinent for bronchiolitis, a disease characterized by frequent, self-resolving desaturations even after hospital discharge.[3] This may reinforce a perceived need to capture and react to these desaturation events even though they are expected in bronchiolitis and can occur in healthy infants.[37] Some participants suggested that continuous monitoring be replaced with "nap tests" (ie, assessment for desaturations during a nap prior to discharge); however, like $cSpO_2$ in stable infants with bronchiolitis, this is another low-value practice. Otherwise healthy infants with mild to moderate disease are unlikely to subsequently worsen after showing signs of clinical improvement.[38] Nap tests are likely to lead to infants who are clinically improving being placed unnecessarily back on oxygen in reaction to the transient desaturations. Participants' perception about the importance of $cSpO_2$ in bronchiolitis management, despite evidence suggesting it is a low-value practice, underscores the importance of not simply telling clinicians to stop $cSpO_2$. Employing strategies that replace continuous monitoring with another acceptable and feasible alternative (eg, regular clinician assessments including intermittent pulse oximetry checks) should be considered when planning for deimplementation.[39]

Previous studies indicate that continuous monitoring can affect clinician decision-making, independent of other factors,[6,40] despite limited evidence that continuous monitors improve patient outcomes.[1-7] Studies have demonstrated noticeable increase in admissions based purely on pulse oximetry values,[40] with no evidence that this type of admission changes outcomes for bronchiolitis patients.[6] One previous, single-center study identified inexperience as a potential driver for monitor use,[41] and studies in adult populations have suggested that clinicians overestimate the value that continuous monitoring contributes to patient care,[42,43] which promotes guideline-discordant use. Our study provides novel insight into the issue of monitoring in bronchiolitis. Our results suggest that there is a need to shift organizational cultures around monitoring (which likely vary based on a range of factors) and that educational strategies addressing typical disease course, especially desaturations, in bronchiolitis will be an essential component in any deimplementation effort.

This study is strengthened by its sample of diverse stakeholder groups from multiple US health systems. Additionally, we interviewed individuals at sites with high $cSpO_2$ rates and at sites with low rates, as well as from community hospitals, children's hospitals within general hospitals, and freestanding children's hospitals, which allows us to understand barriers high-use sites encounter and facilitators of lower $cSpO_2$ rates at low-use sites. We also employed an interview approach informed by an established implementation science framework. Nonetheless, several limitations exist. First, participants at low-use sites did not necessarily have direct experience with a previous deimplementation effort to reduce $cSpO_2$. Additionally, participants were predominantly White and female; more diverse perspectives would strengthen confidence in the generalizability of our findings. While thematic saturation was achieved within each stakeholder group and within the high- and low-use strata, we interviewed fewer administrators and respiratory therapists relative to other stakeholder groups. Nevertheless, our conclusions were validated by our interdisciplinary stakeholder panel. As noted by participants, family preferences may influence clinician practice, and parents were not interviewed for this study. The information gleaned from the present study will inform the development of strategies to deimplement unnecessary $cSpO_2$ in pediatric hospitals, which we aim to rigorously evaluate in a future trial.

CONCLUSION

We identified barriers and facilitators to deimplementation of $cSpO_2$ for stable patients with bronchiolitis across children's hospitals with high and low utilization of $cSpO_2$. These themes map to multiple CFIR domains and, along with participant-suggested strategies, can directly inform an approach to $cSpO_2$ deimplementation in a range of inpatient settings. Based on these data, future deimplementation efforts should focus on clear protocols for use and discontinuation of $cSpO_2$, EHR changes, and regular bronchiolitis education for hospital staff that emphasizes reducing unnecessary $cSpO_2$ utilization.

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