Implementation and Case-Study Results of Potentially Better Practices to Improve Pain Management of Neonates

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ABSTRACT

OBJECTIVE. Collaborative quality improvement techniques were used to facilitate local quality improvement in the management of pain in infants. Several case studies are presented to highlight this process.

METHODS. Twelve NICUs in the Neonatal Intensive Care Quality Improvement Collaborative 2002 focused on improving neonatal pain management and sedation practices. These centers developed and implemented evidence-based potentially better practices for pain management and sedation in neonates. The group introduced changes through plan-do-study-act cycles and tracked performance measures throughout the process.

RESULTS. Strategies for implementing potentially better practices varied between centers on the basis of local characteristics. Individual centers identified barriers to implementation, developed tools for improvement, and shared their experience with the collaborative. Baseline data from the 12 sites revealed substantial opportunities for improved pain management, and local potentially better practice implementation resulted in measurable improvements in pain management at participating centers.

CONCLUSIONS. The use of collaborative quality improvement techniques enhanced local quality improvement efforts and resulted in effective implementation of potentially better practices at participating centers.
Increased understanding of neonatal pain physiology along with an expanded repertoire of pain management strategies has made optimal pain management in neonates achievable. Despite this progress, there frequently is a discrepancy between optimal and applied pain management in neonates. In an effort to narrow this gap between theory and practice, 12 NICUs focused on improving neonatal pain management and sedation practices during the Neonatal Intensive Care Quality Improvement Collaborative 2002 (NIC/Q 2002). The “I Feel Good” exploratory group convened to work collaboratively on improving neonatal pain management. Previous experience has demonstrated the benefits of collaborative quality improvement techniques in implementing evidence-based potentially better practices (PBPs). This article provides examples of improvement strategies that were used and results that were attained by individual sites that participated in the collaborative.

**METHODS**

Multidisciplinary teams from 12 NICUs that participated in the NIC/Q 2002 formed the pain and sedation focus group (Table 1). The group collaborated to develop PBPs for a range of neonatal pain management topics, and each site collected baseline pain management data using a previously described approach. On the basis of areas for improvement that were identified by these baseline data, multidisciplinary teams from each site selected PBPs for implementation, developed strategies for implementation, and tracked performance measures throughout the process. Team composition varied between centers and ranged from standing quality improvement committees to teams that specifically were chartered for pain-related topics. Typically, teams were composed of nurses, respiratory therapists, nurse practitioners, and physicians, although teams often were tailored with the addition of specialized members (eg, pharmacists, administration, quality managers). Teams implemented changes through plan-do-study-act cycles. The statistical significance of measured improvements was assessed through chi-squared analysis for categorical data and paired t tests for continuous data. Statistical testing was performed using commercially available software (SPSS 13.0; SPSS Inc, Chicago, IL).

**RESULTS**

**Reducing Frequency of Painful Procedures: Endotracheal Tube Suctioning**

Endotracheal tube (ETT) suctioning is a painful procedure that is associated with pronounced fluctuations in physiologic variables. Baseline measurements at New Hanover Regional Medical Center demonstrated routine suctioning in 10 (40%) of 25 intubated infants regardless of clinical indications. The team at New Hanover Regional Medical Center developed an evidence-based protocol whereby infants are suctioned only as needed on the basis of clinical indicators. An in-service program that addressed the indications for and painful effects of ETT suctioning introduced the practice of avoiding routine suctioning. The in-service program and supporting literature were posted at all times in the unit for staff reference. Members of the implementation team reinforced the in-service training with staff, either in small groups or one on one. This approach resulted in 96% of the staff’s completing in-service training. Measurements after implementation demonstrated a reduction in the routine suctioning rate to <5% of intubated infants (n = 22; P = .005).

**Sucrose Consensus Protocol**

Baseline data that were compiled from centers that participated in the group suggested that pharmacologic analgesia was used in <20% of painful procedures. Oral sucrose solutions have demonstrated efficacy in reducing procedural pain in neonates. All centers that participated in the pain and sedation focus group implemented oral sucrose analgesia protocols during the collaborative, and these centers faced common issues with implementation (Table 2). The 11 centers that remained in the focus group at the end of the collaborative were surveyed regarding the implementation of sucrose analgesia at their centers.

Implementation typically began with selection of a sucrose product and a method for administering the solution. Centers researched commercially available products and investigated pharmacy formulation of solutions. The majority (91%) of the centers selected Sweet-Ease (prepackaged 11-mL container of 24% sucrose solution; Children’s Medical Ventures, Norwell, MA) as a convenient source of oral sucrose. Because of the added analgesic effect observed when infants suck on a pacifier during sucrose administration, each center in the group administers sucrose in combination with oral stimulation (by oral syringe for precise administration followed by a pacifier for nonnutritive sucking or by pacifier dipped in solution).

**TABLE 1.** Members of the Pain and Sedation Focus Group

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children’s Hospital of Oakland</td>
<td>Oakland, CA</td>
</tr>
<tr>
<td>Dartmouth-Hitchcock Medical Center</td>
<td>Lebanon, NH</td>
</tr>
<tr>
<td>DeVos Children’s Hospital</td>
<td>Grand Rapids, MI</td>
</tr>
<tr>
<td>Hackensack University Medical Center</td>
<td>Hackensack, NJ</td>
</tr>
<tr>
<td>Inova Fairfax Hospital for Children</td>
<td>Falls Church, VA</td>
</tr>
<tr>
<td>Legacy Emanuel Children’s Hospital</td>
<td>Portland, OR</td>
</tr>
<tr>
<td>Lucile Packard Children’s Hospital at Stanford</td>
<td>Palo Alto, CA</td>
</tr>
<tr>
<td>Miami Valley Hospital</td>
<td>Dayton, OH</td>
</tr>
<tr>
<td>New Hanover Regional Medical Center</td>
<td>Wilmington, NC</td>
</tr>
<tr>
<td>St Johns Mercy Medical Center</td>
<td>St Louis, MO</td>
</tr>
<tr>
<td>Wesley Medical Center</td>
<td>Wichita, KS</td>
</tr>
<tr>
<td>Woman’s Hospital</td>
<td>Baton Rouge, LA</td>
</tr>
</tbody>
</table>
The appropriate population for sucrose analgesia still is being defined, and centers differ in the patients who are considered eligible for sucrose analgesia. Sucrose has analgesic effects in infants as low as 25 weeks’ gestation, and most (91%) of the centers in the group use sucrose in very low birth weight infants. The Inova Fairfax Hospital for Children (IFHC) NICU limited sucrose use to infants who are >32 weeks’ gestational age because of literature that suggested potential adverse events for very low birth weight infants. Because of concerns of adverse effects with administration to infants who were listed as nil per os (nothing by mouth; NPO), the baseline practice at Wesley Medical Center (WMC) was to limit sucrose administration to infants who receive feeds. However, local data revealed that, because of NPO status, few patients received sucrose before drawing of admission laboratory work. These data, coupled with the lack of evidence of adverse events that are associated with sucrose administration in patients who are NPO, led WMC to develop admission orders to facilitate use of Sweet-Ease for infants who were not fed enterally. By this strategy, most (91%) of the centers in the group suggested that pain assessments accompanied <20% of painful procedures. To improve compliance with assessing pain as a vital sign at WMC, the policies and procedures were amended to clarify the minimum frequency for pain assessment. Also, pain assessments were moved to the front of the nursing flow sheet with the other vital signs. Improvements followed these initial changes, but the improvements were not sustained. Use of a task reminder sticker incorporating the “Pain: The Fifth Vital Sign” phrase boosted compliance, and follow-up mea-

### TABLE 2 PBPs Implemented at Each Participating “I Feel Good” Site

<table>
<thead>
<tr>
<th>PBP</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Reduce the frequency of avoidable painful procedures: ETT suctioning</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1b. Reduce the frequency of avoidable painful procedures: heel sticks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Develop and use standardized recommendations for sucrose analgesia</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Assess pain frequently</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>O</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Implement strategies to manage pain during heel sticks</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Implement strategies to manage pain during peripheral vascular procedures</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. Implement strategies to manage pain during circumcision</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7. Implement strategies to manage pain during nonemergent intubation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8. Implement strategies to manage pain during mechanical ventilation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9. Implement strategies to manage pain during the postoperative time frame</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10. Implement strategies to wean neonates effectively and safely from opiates</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

* indicates implemented during inclusion in the “I Feel Good” (IFG) focus group; O, implemented before IFG focus group.

**Assessment**

Neonates typically respond to pain with changes in behavior and physiologic variables. Although objective scales for assessment of the neonatal pain response exist, reliably assessing and responding to neonatal pain remains a challenge in the NICU. The IFHC NICU began using the Neonatal Pain, Agitation, and Sedation Scale (N-PASS) because of the inability of other tools to capture the multitude of behaviors that are associated with pain, especially when used in preterm infants. Visits from content experts (Pat Hummel and Mary Puchalski, N-PASS creators) who lectured, led workshops, and taught on one on one at the bedside aided implementation. This strategy enhanced staff buy-in for switching assessment tools from the Crying Requires Oxygen Increased Vital Signs Expression Sleep (CRIES) scale to the N-PASS. Additional education methods included a 30-minute video introduction to the N-PASS, posters, journal articles, an N-PASS question-and-answer packet, case studies, N-PASS cards at each bedside, feature articles in the NICU newsletter, and daily one-on-one practice sessions with staff at the bedside. Staff feedback suggests satisfaction with the N-PASS’s ability to quantify neonatal pain. The next steps will involve evaluating implementation efforts, including local interrater reliability testing and continued audits to assess compliance.
Measurements have shown sustained improvement in assessing pain with vital signs \( (P < .001; \text{Fig 1}) \).

Even the most reliable tool for assessing pain is of limited use if the results are not applied clinically. At WMC, an initial data collection indicated that only 1 (10\%) of 10 patients had treatment for pain documented in the progress notes. In response, WMC created a dedicated section in the electronic medical chart to document pain management consistently, including pain assessments and response to treatment. Feedback from physicians, nurse practitioners, and residents who use the computer system to create progress notes was used to design the new section. As a result, a pain management diagnosis was incorporated in the electronic medical chart to track specific pain-related information for each patient (eg, eligibility for sucrose administration, pain management interventions used, range of pain scores recorded for the previous day, effectiveness of current pain management). Postintervention data revealed significant improvement as 100\% of patients had pain management documented in the progress note \( (P < .001) \).

**Pain Management During Heel Lance**

Heel lancing is a common procedure in the NICU and is recognized as a significant source of pain in the neonate.\(^{13}\) Despite this knowledge, analgesia before heel lancing often is sporadic. Baseline data at LPCH demonstrated that only 8\% of heel lances had documented use of sucrose before the procedure. Furthermore, no other forms of pain management were documented at the time of these heel lances. On the basis of these results, the team at LPCH focused on implementing sucrose analgesia before all heel lances in the intermediate NICU. Presentation of baseline data, coupled with staff education using medical literature that described the effectiveness and minimal adverse effects of sucrose analgesia, raised enthusiasm for the sucrose intervention.\(^{8,14-19}\)

The LPCH team sequentially developed an evidence-based policy for administering sucrose, initiated staff education (eg, posters, e-mails, staff meeting presentations, required skills fair), infiltrated the nurseries with sucrose “super users” (staff nurses who were trained in the proper use of sucrose and championed sucrose use with one-on-one encouragement and teaching), involved the phlebotomists (who requested that the nurse give sucrose at the time of heel lance), and publicly displayed biweekly data. In addition, a preprinted, pro re nata (PRN) sucrose order was added to the admission order set. With implementation, the frequency of sucrose administration before heel lances improved, with a 5-month postimplementation mean of 65\% of heel lances with documented premedication with sucrose \( (P < .001; \text{Fig 2}) \).

**Circumcision**

Circumcision is the most commonly performed surgical procedure in newborns, and effective pain management is recognized as the standard of care.\(^{20-22}\) In many institutions, the delivering obstetrician performs the circumcision in the NICU, and the analgesia provided is variable. The team at IFHC conducted a unit survey on pain management before, during, and after circumcision and found that 8 (20\%) of 39 infants received no analgesia with circumcision. In response to these data, the team began an evidence-based staff education program to review the effectiveness of pain management techniques for circumcision. In addition, the team attempted to revise the circumcision policy to incorporate management of pain during circumcision.

The revisions were evidence based and included the American College of Obstetricians and Gynecologists statement endorsing analgesia for circumcisions.\(^{22}\) Un-
fortunately, the revised policy, which included mandatory pain management for circumcision, was not universally accepted, possibly because obstetricians were not included in the policy creation. Subsequently, a new multidisciplinary group that included obstetricians was formed to revise the original circumcision policy. Additional changes also have been made to include incorporation of the American College of Obstetricians and Gynecologists statement endorsing analgesia for circumcision in training obstetric residents as well as routine administration of acetaminophen and oral sucrose (ordered by neonatal staff) for infants who are circumcised in the NICU. The team has continued staff education, emphasizing the role of the nurse as an advocate for pain management during circumcision. Parents also are encouraged to discuss pain management with the physician who performs the circumcision.

Ongoing Analgesia for the Mechanically Ventilated Infant
It is unclear whether mechanical ventilation is a painful experience in premature infants, and there is controversy about whether ongoing analgesic therapy should be the standard of care for the ventilated preterm infant.13,23-29 The Miami Valley Hospital NICU “Pain Team” observed unexplained episodes of hyperglycemia in ventilated preterm infants. The episodes seemed to improve with morphine administration and raised concerns that untreated pain was the cause of the hyperglycemia. Although the corresponding pain scores in these infants were not significantly elevated, the infants often were described as “touchy,” “desats easily,” and “doesn’t tolerate care well.” Unit practice was to provide analgesia on an as-needed basis for ventilated infants, and these infants often received multiple doses of analgesia, resulting in the delivery of excess fluids. In response to these observations, a guideline using morphine infusions for ventilated preterm infants was developed to improve fluid management, minimize the need for PRN analgesia, and provide ongoing comfort.

The guideline was presented to the physician staff, and a series of in-services were presented to the nursing staff to facilitate implementation. During a 6-month observation period, patient analgesia was evaluated daily on multidisciplinary patient care rounds. Distinct trends including reductions in oxygen requirements, minimal use of PRN analgesia, and improved tolerance of care with less frequent desaturation events were identified in infants who received preemptive or early (within 24 hours after initiation of mechanical ventilation) morphine infusions. These observations bolstered the perception that continuous opiate infusions provide better analgesia than intermittent opiate dosing and improve control of fluid administration.

Given these results, the physician staff decided to prescribe morphine infusions (2–3 μg/kg per hour in preterm infants, 5 μg/kg per hour in term infants) for all newly intubated neonates. Doses were calculated using gestational age–based clearance values to achieve an estimated serum level of 20 ng/mL associated with effective analgesia for postoperative pain.30,31 During the next 3-month observation period, 22 of 23 intubated patients received morphine infusions (96% compliance). Mean duration of infusion was 66 hours (range: 19–132 hours). Although comparison of matched groups of preterm infants before and after implementation of routine morphine infusions revealed that serum glucose levels trended lower in the group that received morphine infusions, these trends were not statistically significant differences (Table 3). Preventing pain and stress may have implications for glucose tolerance in these infants.32

Postoperative Pain Management
The team at DeVos Children’s Hospital (DVCH) selected postoperative pain management as a priority for improvement efforts. An initial review of 16 charts showed that in 66% of postoperative patients, narcotics were ordered PRN, only 13% of these patients received >2 doses in a 24-hour period, and the majority of narcotic doses given were suboptimal. As a result of these baseline data, the pain committee introduced the concept of conducting “pain rounds” to improve postoperative pain management. Pain rounds included all postoperative patients for the first 48 hours after surgery. The clinical team would conduct the rounds at the bedside of postoperative patients to review pain assessments and the effectiveness of pain control and to develop plans for ongoing pain management. Although there was unit consensus to implement pain rounds, there was limited enthusiasm for participation, possibly related to a sustained high census and high acuity during implementation. Also, not all members of the team were comfortable with pain assessment and interventions. Despite these barriers, the team noted improvements in management (Table 4). Follow-up efforts at DVCH have included development and implementation of postoperative pain management guidelines and parallel preprinted postoperative order sets.

![Percentage of heel lances with sucrose administration documented immediately before heel lance LPCH (n = 165, P < .001).](image)
Table 3: Ongoing Analgesia for the Mechanically Ventilated Preterm Infants at Miami Valley Hospital NICU

<table>
<thead>
<tr>
<th></th>
<th>Continuous Morphine Infusions (n = 7)</th>
<th>No Continuous Infusions of Morphine (n = 7)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean birth weight, g</td>
<td>744 (540–860)</td>
<td>819 (760–900)</td>
<td>NS</td>
</tr>
<tr>
<td>Mean gestational age, wk</td>
<td>25.6 (24.0–27.0)</td>
<td>25.4 (24.0–27.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Serum glucose, mg/dL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1 of intubation</td>
<td>102 (44–137)</td>
<td>123 (80–198)</td>
<td>NS</td>
</tr>
<tr>
<td>Day 2 of intubation</td>
<td>90 (43–127)</td>
<td>136 (79–233)</td>
<td>NS</td>
</tr>
<tr>
<td>Day 3 of intubation</td>
<td>99 (50–146)</td>
<td>129 (71–188)</td>
<td>NS</td>
</tr>
<tr>
<td>Dextrose infusion rate, mg/kg per min</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1 of intubation</td>
<td>5.5 (4.2–7.0)</td>
<td>6.0 (5.2–7.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Day 2 of intubation</td>
<td>5.7 (3.4–8.5)</td>
<td>5.7 (4.4–6.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Day 3 of intubation</td>
<td>6.8 (5.3–8.5)</td>
<td>6.0 (4.6–7.4)</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS indicates not significant.

Table 4: Postoperative Pain Management at DVCH NICU

<table>
<thead>
<tr>
<th></th>
<th>Baseline (n = 16)</th>
<th>After Pain Rounds (n = 17)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled narcotics, %</td>
<td>13</td>
<td>53</td>
<td>.013</td>
</tr>
<tr>
<td>Therapeutic morphine dosing, %</td>
<td>20</td>
<td>94</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Acetaminophen, %</td>
<td>33a</td>
<td>61a</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS indicates not significant.
a Before participation in this focus group, acetaminophen rarely was ordered for pain management. Sample sizes differed for assessment of acetaminophen use (baseline: n = 9; after pain rounds: n = 11).

**Interventions for Painful Procedures**

Centers in the focus group documented the interventions that were performed for various painful procedures before and after participation in the collaborative (2002 vs 2004). The painful procedures included ETT suction, heel stick, peripheral IV insertion, venipuncture, ETT placement, subcutaneous/intramuscular injection and gavage tube insertion. Table 5 shows the frequency of pharmacological, sucrose and behavioral interventions for these painful procedures in 2002 vs 2004.

**CONCLUSIONS**

Units that participated in the pain and sedation focus group improved many aspects of neonatal pain management. Table 2 shows a complete listing of PBPs that were worked on at each center. The lessons learned during the improvement process aided local implementation efforts. For example, the composition of the team that implemented changes affected success. The differing perspectives that were provided by a diverse multidisciplinary team were essential for anticipating and overcoming potential barriers. The size of the team also affected PBP implementation. At LPCH, for example, the sucrose implementation team was large and well represented on all shifts. This representation enhanced success by allowing champions of the practice to be visible most of the time.

Another lesson is that buy-in to change can be difficult to achieve. The centers in the group used a variety of strategies to obtain and sustain the buy-in. First, soliciting staff feedback can be critical to obtaining buy-in. Early involvement of the staff who were responsible for constructing the progress notes at WMC allowed successful inclusion of the “pain management” diagnosis in progress notes. Second, maximizing project visibility can sustain the momentum for change. WMC used this strategy successfully by introducing the “Pain: The Fifth Vital Sign” reminder to improve pain assessment compliance. Third, presenting evidence-based changes enhanced buy-in to the proposed change. The strength of evidence...
that supported sucrose analgesia facilitated its introduction at many centers in the group. Fourth, using strategies that empower staff members improves buy-in. The team at LPCH introduced preprinted orders for sucrose analgesia, which empowered nurses and phlebotomists to treat heel lance pain and resulted in a sustained increase in pain management with heel lances. However, not all implementation plans seemed to be successful. Barriers to buy-in in these cases varied but included patient volume and acuity at the time of implementation of a practice and poor communication between disciplines.

There is a need to review practices as new evidence is available. This point is highlighted by the publication of the Neurologic Outcomes and Preemptive Analgesia in Neonates (NEOPAIN) trial results. This well-designed, randomized, controlled trial investigated the potential benefits of preemptive morphine infusions for ongoing analgesia in mechanically ventilated preterm infants. Although signs of pain were reduced with preemptive morphine infusions, short-term neurologic or pulmonary outcomes were not improved with this therapy, and potential adverse outcomes were associated with additional intermittent analgesia that was given in response to “pain/discomfort” in both intervention and control groups. These results were not available for the development of the NIC/Q 2002 PBPs but should be considered in the development of future evidence-based strategies for care of ventilated preterm infants.

The final lesson is the importance of not letting perceived failures stop the process of continuous quality improvement. This was highlighted by DVCH’s efforts to improve postoperative pain management during which pain rounds seemed to be unsuccessful. Follow-up data actually revealed improvements in performance. This example reinforces the notion that heightened awareness of issues that prompt implementation of a practice can result in the desired effect.

ACKNOWLEDGMENTS
We thank Sunny Anand (content expert and leader in PBP development) and Jim Handyside (group facilitator) for making this work and these improvements possible. We also thank the staffs and families at each of the 12 sites for dedication to this study and improving the quality of care that is provided at their respective institutions.
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Implementation and Case-Study Results of Potentially Better Practices to Improve Pain Management of Neonates


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