

# BMJ Open Quality Knowledge translation and process improvement interventions increased pain assessment documentation in a large quaternary paediatric post-anaesthesia care unit

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## ABSTRACT

**Background** Due to inadequate pain assessment documentation in our paediatric post-anaesthetic care unit (PACU), we were unable to monitor pain intensity, and target factors contributing to moderate and severe postoperative pain in children. The purpose of this study was to improve pain assessment documentation in PACU through a process improvement intervention and knowledge translation (KT) strategy. The study was set in a PACU within a large university affiliated paediatric hospital. Participants included PACU and Acute Pain Service nursing staff, administrative staff and anaesthesiologists.

**Methods** The Plan–Do–Study–Act method of quality improvement was used. Benchmark data were obtained by chart review of 99 patient medical records prior to interventions. Data included pain assessment documentation (pain intensity score, use of validated pain intensity measure) during PACU stay. Repeat chart audit took place at 4, 5 and 6 months after the intervention.

**Intervention** Key informant interviews were conducted to identify barriers to pain assessment documentation. A process improvement was implemented whereby the PACU flowsheets were modified to facilitate pain assessment documentation. KT strategy was implemented to increase awareness of pain assessment documentation and to provide the knowledge, skill and judgement to support this practice. The KT strategy was directed at PACU nursing staff and comprised education outreach (educational meetings for PACU nurses, discussions at daily huddles), reminders (screensavers, bedside posters, email reminders) and feedback of audit results.

**Results** The proportion of charts that included at least one documented pain assessment was 69%. After intervention, pain assessment documentation increased to >90% at 4 and 5 months, respectively, and to 100% after 6 months.

**Conclusion** After implementing process improvement and KT interventions, pain assessment documentation improved. Additional work is needed in several key areas, specifically monitoring moderate to severe pain, in order to target factors contributing to significant postoperative pain in children.

## INTRODUCTION

Pain in hospitalised children is common and a cause of morbidity, leading to unnecessary suffering, unplanned admissions to hospital, and reduced child and family satisfaction.<sup>1 2</sup> Postoperative pain outcomes are increasingly the subject of scientific investigation, yet little is known about pain outcomes in paediatric post-anaesthesia care units (PACUs). Inadequately managed pain could delay discharge from PACU.<sup>3</sup> Postoperative pain can lead to neurohumoral changes, psychological and emotional distress, and the development of persistent postoperative pain and chronic pain.<sup>4–8</sup>

Pain is a key performance indicator at our hospital. Hospital policy states that every patient (in PACU) will have a pain assessment on admission, with ordered vital signs, with moderate to severe pain as needed, and a minimum of every 4 hours. Pain assessment shall be done using a developmentally appropriate, reliable and valid measure. Earlier initiatives on inpatient units had improved the rate of pain assessment documentation from 20% to >90%.<sup>1 9</sup> Clinical experience in our PACU suggested that children were receiving variable analgesic regimens for similar procedures intraoperatively, leading to disparities in comfort on waking, yet there was no formal investigation of pain outcomes to evaluate the extent to which this observation was true. Standardised pain assessment documentation allows investigating immediate postoperative pain outcomes in children after surgery.

The purpose of this study was to apply quality improvement (QI) methodology to establish a process of regular pain assessment documentation in PACU, in accordance with hospital policy. The ultimate aim was

to provide a platform by which we can begin to identify moderate to severe pain so that we can reduce disparities in care and improve pain prevention and treatment for children immediately after surgery.<sup>10</sup>

**METHODS**

In a university-affiliated quaternary paediatric medical centre, about 12000 surgeries are performed annually under general anaesthesia with or without additional regional anaesthesia. The Department of Anaesthesia and Pain Medicine comprises 36 full-time equivalent staff anaesthesiologists, 10 to 12 fellows that rotate annually, 10 residents that rotate on a 6-monthly basis, 2 anaesthesia assistants, 2 pain specialist nurses and 40 PACU nurses.

After routine surgery, patients are transferred to PACU for recovery from general anaesthesia. Nursing staff monitor and document vital signs and provide immediate postoperative care, including pain management. Our hospital has a Pain Assessment Policy which mandates regular pain assessment documentation using validated developmentally appropriate pain intensity measures.

The Department of Quality and Risk Management approved this single centre QI study and formal consent was waived by the Research and Ethics Board on the condition that anonymity was maintained and no individuals (whether patient or healthcare professional) were

identifiable. All information collected was treated and stored confidentially.

**Design**

This retrospective observational study, with prospective observational follow-up, was undertaken in the PACU as part of a hospital-wide QI strategy to improve pain assessment documentation and pain outcomes. The Plan-Do-Study-Act (PDSA) method of QI was used for this project. Benchmark data were extracted, from the patient medical record by one anaesthesia fellow prior to implementing the intervention. Data pertaining to pain assessment documentation (pain intensity score, use of a validated pain intensity measure) during PACU stay were extracted using a paper data collection sheet (figure 1). Pain assessment data were presented as overall percentages and did not reflect individual provider performance.

Repeat chart review audit, by one PACU nurse, took place at 4, 5 and 6 months, respectively, after process improvement implementation and during continuous KT interventions.

**Interventions**

Key informant interviews were conducted to identify barriers to pain assessment documentation. Key stakeholders, including anaesthesiologists, PACU administrators and nurses, met together to review the pain

**QIP - PACU Pain Assessment**

**Data collection sheet**

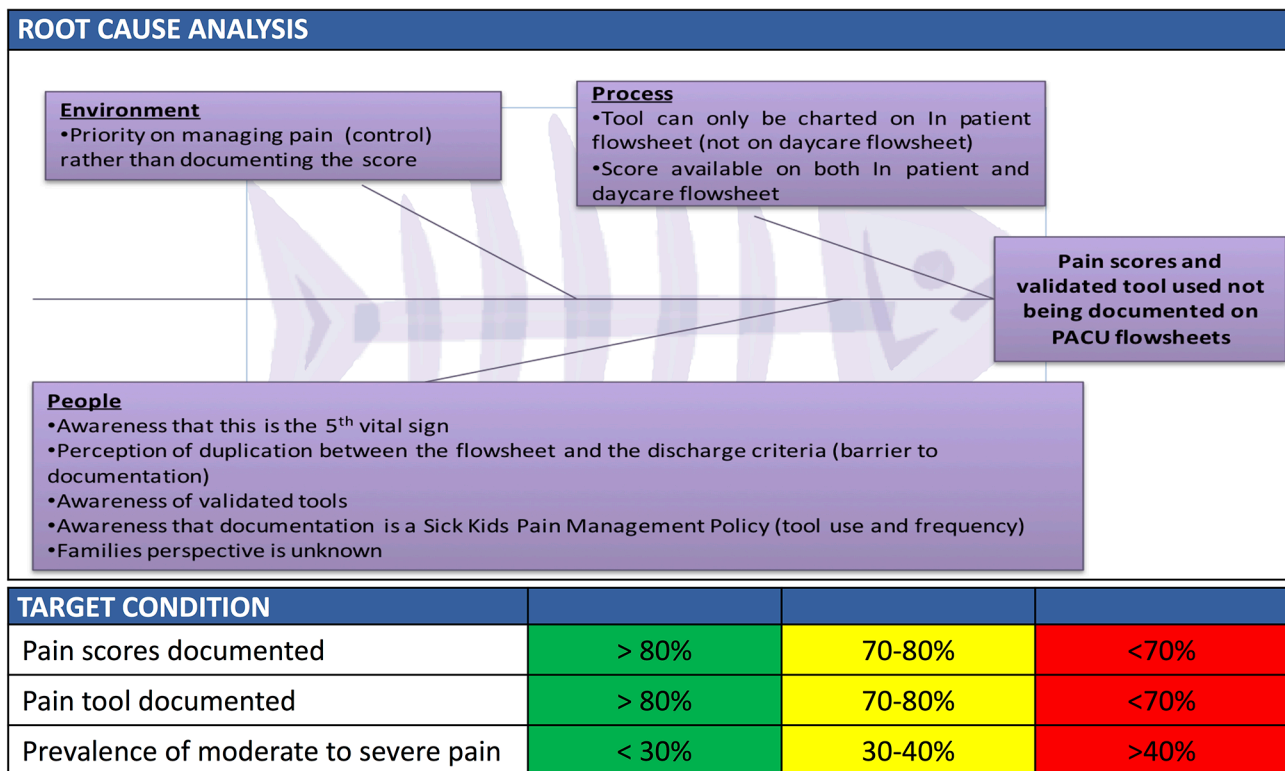
- Demographics
- Process Outcomes
- Clinical Outcomes
- Clinical Outcomes
- Process Outcomes
- Process Outcomes

Demographics	
Patient number	
Age (years)	
Gender (male/female)	
Time admitted to PACU	
Time discharged from PACU	
Total time in PACU (min)	
Surgical service	
Procedure	
Discharged to ward number	
Pain assessment done (yes/no)	

Process and Clinical Outcomes			
Tool used for assessing pain	Time (minutes after arrival in the PACU)	Pain intensity score	Comments
NRS	0		
	15		
	30		
	45		
	60		
	75		
	90		
	105		
	120		
	135		
	150		
	165		
	180		
	195		
	210		

**Figure 1** Audit data collection sheet. FLACC, Face-Legs-Activity-Cry-Consolability; NRS, numerical rating score; PACU, post-anaesthesia care unit; PIPP, premature pain profile; QIP, quality improvement plan.

# PDSA<sub>3</sub>: Pain Management in PACU



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**Figure 2** Fishbone diagram. CIP, continuous improvement project; PACU, post-anaesthesia care unit; PDSA, Plan-Do-Study Act.

assessment documentation process, and after a root cause analysis focused on several areas for improvement. A fishbone diagram was created to address the problem statement ‘Pain scores and validated tool used not being documented on PACU flowsheets’ (figure 2). Three major categories were identified: ‘Environment’, ‘Process’ and ‘People’. Possible causes and subcauses of the problem were brainstormed and listed under the major categories. PACU nurses described an environment where intervening to control patient pain was prioritised over documenting pain scores and pain measures, resulting in documentation sometimes being neglected in favour of clinical intervention for the patient. Further, the process of documentation was identified as problematic when there was no option for documenting the pain measure on the daycare flowsheet, which differed from the inpatient flowsheet. The PACU nursing team reported a perception of duplication between the flowsheet and the discharge criteria documented on the same sheet as a barrier to documentation. An overarching root cause of poor pain assessment documentation was identified as a lack of awareness of how to assess pain using validated measures according to the pain assessment policy, and where to document

pain on the flow sheets. Root cause and subcauses were addressed through the implementation of two innovations:

1. Process improvement initiative: The inpatient and daycare PACU flow sheets were modified and harmonised to facilitate pain assessment documentation. The PACU charts differed between inpatients and daycare patients. The location on the chart for pain assessment documentation was not intuitive for inpatients and was completely missing for daycare patients. There was no place on either chart for identifying which validated pain measure was used. To resolve these issues, the PACU charts for inpatients and daycare patients were unified into one flowsheet. Pain intensity score documentation was moved to the area dedicated for vital sign documentation and thereby also became a reminder to routinely document. The location on the flowsheet for documenting the validated pain measure used was redesigned for ease of identification and documentation.
2. Knowledge translation (KT) strategy: This was directed at PACU nursing staff to increase awareness of appropriate pain assessment documentation processes and to provide the knowledge, skill and judgement

required to support this practice; the KT strategy comprised:

1. **Education outreach:** There were four PACU educational sessions presented primarily by the PACU Nurse Educator, in collaboration with anaesthesiologists and advanced practice nurses from the Acute Pain Service, and the project leader for Daily Continuous Improvement Projects. The sessions aimed to raise awareness of the Pain Assessment Policy and to provide instruction on how to assess pain using validated measures. Each session was attended by approximately six nurses, and in addition the minutes and slide-decks of the meetings were distributed via email to enhance reach. Further, regular discussions took place during the daily huddle, and presentations were made monthly to the leadership team and staff.
2. **Reminders:** Screensavers were designed and placed on PACU computers as a constant reminder to staff to assess and document pain scores. The screensavers did not change over time. Bedside posters were used as reminders to assess and document pain, and also served as an educational resource by providing pain assessment tools to use. Conversations about the importance of pain assessment took place during daily PACU huddles. Emails that were distributed after each PACU educational session to enhance reach also reminded nursing staff to document pain assessment per the Pain Assessment Policy.
3. **Audit and feedback:** In addition to educational outreach, at the end of each data collection, a feedback report was generated by either the nursing project lead, PACU educator or quality leader, and circulated to all staff with the audit results. The results were presented at the daily huddle as part of the PDSA process. Feedback results were also posted on the PACU Huddle Boards ([figure 3](#)). The audit focused on PACU department performance and not on individual performance. The feedback reports were used as a focus for discussion and to inform subsequent education and reminders.

Key drivers are the factors that contribute directly to achieving a stated aim, and interventions are the specific actions designed to address those key drivers:

1. Increase awareness of need for pain score documentation.
2. Increase awareness of established pain measures.
3. Increase accessibility to pain documentation measures.
4. Decrease duplications of documentation.

Ensuring adequate documentation of the key drivers will allow us to monitor the prevalence of patients with significant pain.

### Data collection

Patient charts in PACU are handwritten, then scanned and stored on a computerised hospital patient charting system after patient discharge from hospital. Patient

selection was based on the scheduled operating room list from the first week of July 2013. A total of 99 consecutive PACU charts were audited. Only surgical procedures were included; patients who underwent diagnostic radiological procedures and endoscopies were excluded. All relevant patient charts had been scanned and were available on the computerised hospital-wide patient charting system at the time of the chart audit. A paper data collection sheet was developed to collect relevant data for the primary and secondary key drivers ([figure 1](#)). In addition, information on age, American Society of Anesthesiologists (ASA) physical status (ASA physical status classification system categorises a patient's physiological status that can be helpful in predicting operative risk), surgical specialty, surgical intervention, time in PACU and to which ward the patient was discharged were collected and recorded.<sup>11</sup> All patient chart audit data were extracted retrospectively from the computerised charts. One anaesthesia fellow reviewed all the charts and documented relevant data on the paper audit data collection sheet. Pilot data were initially extracted from 20 charts to identify potential issues. When no issues were identified, the first 20 charts were included in the data collection. All data were entered into an Excel spreadsheet. Data collection and storage followed hospital regulations and requirements.

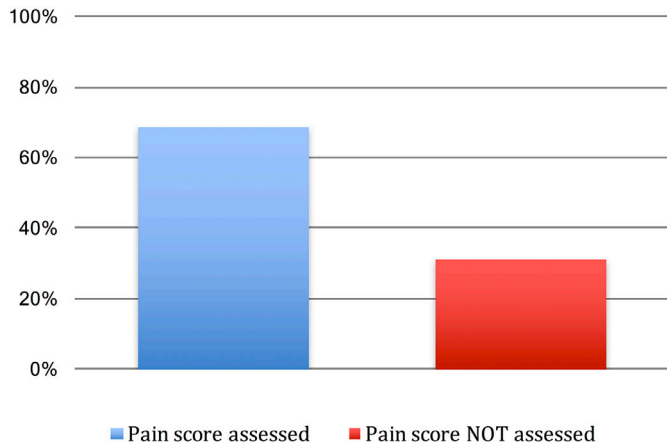
Reaudit took place at 4, 5 and 6 months after initial audit. The first reaudit took place after 4 months to allow time for implementing process improvements and KT interventions. KT interventions were then continuously and regularly repeated. The paper data collection sheet was converted to a computerised Excel spreadsheet and one PACU nurse continued to review 20 random PACU charts monthly.

## RESULTS

### Baseline audit

Data were collected for 99 patients in the benchmark audit. Sixty-eight patients (69%) had at least one pain intensity score documented in their PACU chart, which is below the hospital standard of 90% ([figure 4](#)). A total of 283 pain intensity scores were documented for the 68 patients resulting in an average of 4 pain assessments documented per patient. Twenty-three (34%) of 68 patient charts had any type of pain assessment tool documented, including non-validated pain assessment tools ([figure 5](#)). A validated pain assessment tool was used in 13 (19%) of the 68 patient charts ([figure 6](#)). The validated pain assessment tools consisted of three (23%) patients assessed using Numerical Rating Score (NRS), six (46%) patients assessed with Face-Legs-Activity-Cry-Consolability Scale and four (31%) patients assessed using the 4-Point Verbal Rating Scale. At least one moderate to severe (NRS 4–10) pain intensity score was documented in 27 (40%) of 68 patient charts ([figure 4](#)). An analgesic was administered to 23 (85%) of the 27 patients with at least one documented moderate to severe pain intensity score. Eight (25%) of 32 patients who did not have any

### Pain score documentation July 2013



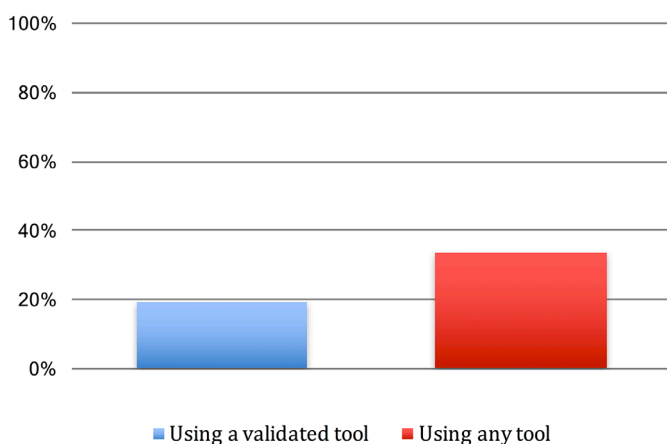
**Figure 4** Benchmark audit pain score documentation, July 2013.

documented pain intensity scores on their chart received an analgesic drug, including opioids. Physical and psychological interventions for moderate to severe pain were not documented (table 1).

#### Postintervention

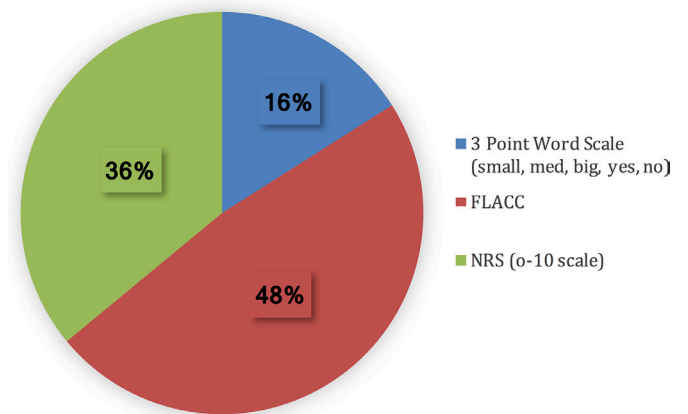
Reaudit took place at 4, 5 and 6 months after implementation of the process improvement and KT interventions. Pain assessment documentation increased to >90% of PACU charts having at least one documented pain intensity score. This further increased by 6 months to 100% of PACU charts having at least one documented pain intensity score (figure 7). The proportion of documented moderate to severe pain scores remained at 40% after improved documentation, unsurprisingly given that this was not the focus of our intervention (figures 8 and 9).

### Documentation of Pain Tool July 2013



**Figure 5** Benchmark audit pain tool documentation, July 2013.

### Pain Tool Used Nov 2013 - Jan 2014



**Figure 6** Reaudit pain measure documentation, November 2013 to January 2014. FLACC, Face-Legs-Activity-Cry-Consolability; med, medium; NRS, numerical rating score.

#### DISCUSSION

Despite increased awareness, there are inconsistencies in pain assessment and management practices in hospitalised children.<sup>12</sup> In this QI study, we show that pain assessment documentation can be improved effectively and successfully in a large quaternary referral paediatric PACU through root cause analysis, targeted process improvement and KT interventions. PACU is an area where we show a higher prevalence of moderate and severe pain (40%) compared with that documented on the wards of this institution (20%–22% according to institutional QI reporting). Pain has acute and long-term negative outcomes affecting social, physiological and psychological aspects for infants, children and adolescents.<sup>13–15</sup> Documentation of pain intensity is important to facilitate monitoring of significant pain and targeting this for improvement.<sup>16</sup>

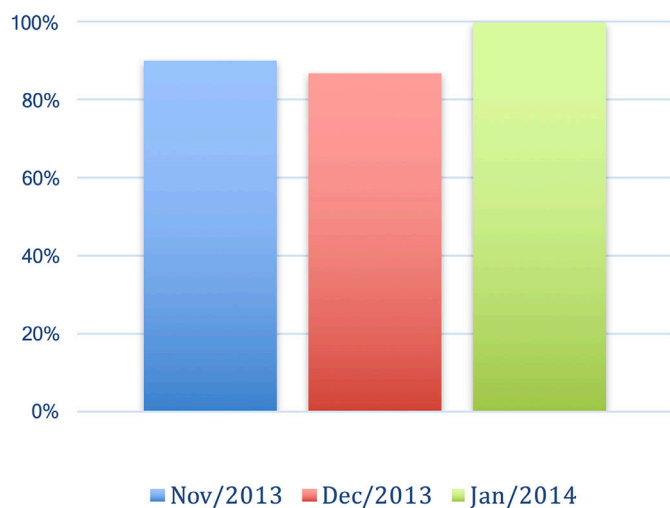
Our benchmark audit revealed that the proportion of charts with pain assessment documentation was 69%,

**Table 1** Pain assessment documentation and intervention

	Incidence (no of charts)	
<b>Documented pain assessment</b>	<b>68/99</b>	<b>69%</b>
Documented pain assessment tool (any tool)	23/68	34%
Documented pain assessment tool (validated tool)	13/68	19%
Incidence of moderate to severe pain	27/68	40%
Pharmacological intervention administered for moderate to severe pain	23/27	85%
Pharmacological intervention without a documented pain assessment	8/23	35%

### Pain Score Documentation

Nov 2013 - Jan 2014

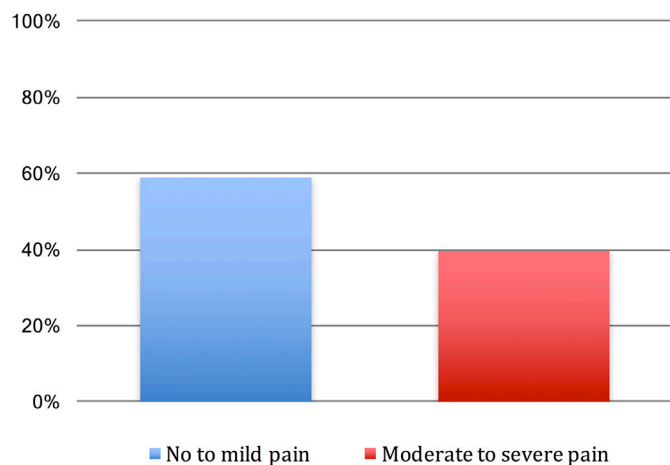


**Figure 7** Reaudit pain score documentation, November 2013 to January 2014.

significantly below the hospital standard of 90%. Root cause analysis suggested areas for improvement including improving the process of pain assessment documentation and enhancing awareness, knowledge and skill. Our interventions improved pain intensity score documentation but did not decrease the proportion of patients reporting moderate to severe pain, suggesting that pain assessment alone is insufficient to address this patient outcome, and targeted strategies to improve pain management practices are also required.<sup>16</sup> Six months after introducing process improvements and KT interventions, we reported 100% pain assessment documentation. Reaudits at 4, 5 and 6 months had shown significant improvement in pain assessment documentation. We believe that it was the result of our bundled KT interventions in the form

### Prevalence of Moderate to Severe Pain

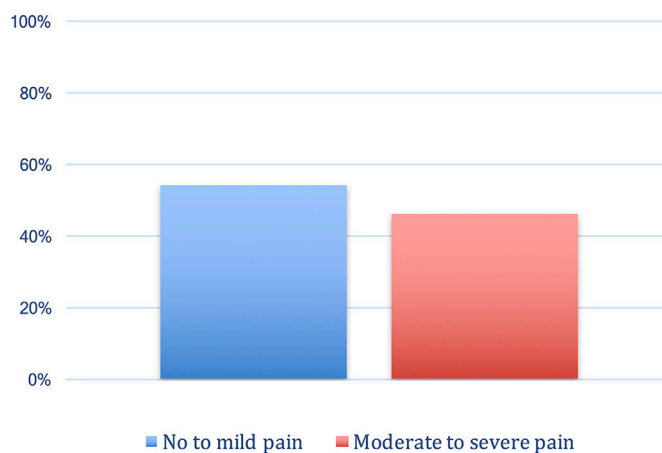
July 2013



**Figure 8** Benchmark audit prevalence of moderate to severe pain, July 2013.

### Prevalence of Moderate to Severe Pain

Nov 2013 - Jan 2014



**Figure 9** Reaudit prevalence of moderate to severe pain, November 2013 to January 2014.

of educational outreach, reminders and audit feedback reports. Awareness increased as well as practice change. The process improvements were crucial to success after identifying significant difficulties using the old PACU charts. The new charts facilitated documentation. However, the continued improvement of pain assessment documentation over a 3-month period is attributable to ongoing bundled KT interventions throughout the study period. We were able to reach every PACU nurse, improve awareness and achieve a change of practice.

Our audit revealed that sometimes an analgesic, including opioids, were administered without any documented pain intensity score. We speculate that in these situations the nursing staff are informally assessing pain, but not documenting. Alternatively, the opioid drugs could have been used for non-analgesic reasons such as sedating an agitated or crying child.<sup>17</sup>

No similar studies in other PACUs have been reported, but our findings are similar to inpatient studies where KT and process improvement interventions have been effective in changing practice.<sup>9 16</sup> This is a small retrospective study in a large North American setting, which may limit generalisability of our findings. However, our interventions are simple and low cost and were effective in identifying substandard pain assessment documentation in children immediately after surgery. The consistency of data collection was ensured by only one person collecting all the data. Another limitation is the small sample used for reauditing (20 random patient charts monthly), but since there is consistency from 1 month to the next during a 6-month follow-up, we believe those results are reliable.

The relatively high incidence of moderate and severe pain identified in this setting provides an incentive to raise awareness of pain prevention and treatment for this at-risk group. Reliable pain assessment documentation in PACU will allow us to identify surgical, anaesthetic and patient factors associated with increased risk for significant pain. This will help inform the development of

strategies to target the prevention and treatment of pain in at-risk groups.

## STUDY LIMITATIONS

There are several study limitations to be acknowledged. Initial data were collected retrospectively from computerised, scanned patient medical records. The forms were handwritten which leaves room for misinterpretation. Documentation may have been incomplete and/or variable. There were documented pain interventions without a documented pain assessment, which lead us to believe that nurses may be performing undocumented pain assessments. There was nowhere to document non-pharmacological interventions on the PACU record, which may explain that no pain intervention was documented despite documented moderate or severe pain. Baseline adherence to hospital policy-stated standards for pain assessment documentation was moderate at 69%, which may explain the significant impact of our KT interventions.

## CONCLUSION

QI methodology was used to improve pain assessment documentation for children admitted to our PACU. Implementing a KT and process improvement intervention which was reviewed monthly, up to 2017, has led to sustained improvements that bring us in line with hospital standards. Furthermore, this has provided a baseline of pain intensity scores, and a platform by which we can begin to identify and target modifiable factors that contribute to moderate and severe pain in the surgical paediatric population, an area of research that is urgently needed.

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**Contributors** DS, CMcD, GW and FC: Contributed to idea. DS, GK and KS: Data collection. DS, CMcD, GW, GK, KS and FC: Active role in developing and implementing interventions. DS: Manuscript preparation and submission. CM and GW: Manuscript preparation.

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