HAMilton ACUTE PAIN SAFETY STUDY

James Paul MD MSc FRCPC
Associate Clinical Professor, Department of Anesthesia, McMaster University

www.acutepainsafety.org

CARF
SUMMARY

• Study Rationale: Why this is important to patient safety

• Methods:

• Results: RCA recommendations and outcome

• Lessons Learned: Advantages/Disadvantages of RCA process
ADVERSE EVENT DEFINED

Canadian Patient Safety Dictionary Definition: (one of three ways)

• An unexpected and undesired incident directly that was directly associated with the care of the patient;

• An incident that occurs during the process of providing health care and results in patient injury or death;

• An adverse outcome for a patient, including an injury or complication.

Ross Baker & Peter Norton Definition: (CMAJ 2004; 170 (11))

• An unintended injury or complication that results in disability at the time of discharge, death or prolonged hospital stay and that is caused by health care management rather than by the patient’s underlying disease process.
ADVERSE EVENT INCIDENCE

- Ross Baker & Peter Norton: (CMAJ 2004; 170 (11))

- Retrospective review of 3745 charts from 20 randomly selected hospitals in five provinces

- 7.5% of adults admitted to acute care hospitals in Canada experienced 1 or more AEs in 2000

- 36.9% were judged to be highly preventable

- Most (64.4%) of the AEs resulted in no physical impairment or disability, or in minimal to moderate impairment with recovery within 6 months

- 5.2% of the AEs resulted in permanent disability and 15.9% resulted in death

- There was a trend toward higher numbers of AEs in teaching hospitals than in small or large community hospitals

- Surgery was the most responsible service for 51.4% of the AEs and anesthesia was responsible for 1.9%
**SYSTEMS APPROACH**

- **Sharp end**: the point where health care services are delivered to the patient. e.g. medication adverse events

- **Blunt end**: the broader management, organizational and regulatory factors involved in the system. e.g. communications, culture, polices and procedures

- To understand why an adverse event occurs in the “sharp end,” it is necessary to examine and analyze the contributing factors in the “blunt end.”
ROOT CAUSE ANALYSIS

- Definition:

- An analytic tool that can be used to perform a comprehensive system-based review of critical incidents. It includes the identification of the root and contributory factors, identification of risk reduction strategies, and development of action plans along with measurement strategies to evaluate the effectiveness of the plans.

### APS “NOTABLE” EVENTS: 2002-2008

<table>
<thead>
<tr>
<th>Event</th>
<th>Definition</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Hypotension</td>
<td>Systolic BP ≤ 80 mmHg</td>
<td>265</td>
</tr>
<tr>
<td>Severe Respiratory Depression</td>
<td>Respiratory rate ≤ 6 OR SpO2 &lt; 90%</td>
<td>141</td>
</tr>
<tr>
<td>Pain Pump Programming Error</td>
<td>Mistake in setup or programming of PCA or Epidural Pumps</td>
<td>19</td>
</tr>
<tr>
<td>Inappropriate Systemic Anticoagulation</td>
<td>IV Heparin in patients with indwelling epidural catheters</td>
<td>14</td>
</tr>
<tr>
<td>Cardiac Arrest / Death</td>
<td>Death or cardiac arrest</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total APS Patients</strong></td>
<td></td>
<td><strong>32, 935</strong></td>
</tr>
</tbody>
</table>
APS “NOTABLE” EVENTS: 2002-2008

Background

Severe Hypotension
Respiratory Depression
Inappropriate Anticoagulation
Cardiac Arrest
NOTABLE EVENTS

- Respiratory Depression
  - McMaster: 1%
  - Henderson: 1%
  - General: 1%

- Severe Hypotension
  - McMaster: 3%
  - Henderson: 3%
  - General: 2%
STUDY RATIONALE

- An adverse event occurred in 1 out of every 35 acute pain patients.
- Severe hypotension, respiratory depression and pump programming errors were the most common events.
- Despite six years of tracking events and implementing changes at a local level these notable events continued.
- Formal root cause analysis of these events may uncover important system issues.
- If the decision makers are informed of these system issues then they can be addressed and the safety of these patients may be improved.
RESPIRATORY DEPRESSION

- Incidence comparison

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schug 1993</td>
<td>3016</td>
<td>Antagonist</td>
</tr>
<tr>
<td>Sidebotham 1997</td>
<td>6035</td>
<td>RR&lt;8</td>
</tr>
<tr>
<td>Walder 2001</td>
<td>869</td>
<td>RR&lt;10</td>
</tr>
<tr>
<td>Shapiro 2004</td>
<td>4617</td>
<td>RR&lt;10</td>
</tr>
<tr>
<td>Paul 2005</td>
<td>33000</td>
<td>RR&lt;6 Antagonist</td>
</tr>
</tbody>
</table>

Legend:
- Epidural
- PCA + Infusion
- PCA
- IV/IM/SC Opioid
METHODS

• **Design:** before / after study of the incidence of adverse events amongst acute pain patients

• **Population:**
  - Before cohort: 23,000 APS patients from 2002 to 2007 at HHS
  - After cohort: APS patients from HHS for 1 year

• **Intervention:** Root cause analysis of adverse events with notification of hospital administration

**Outcome:**
1. Incidence of adverse events
2. Root causes of the events
3. Number of safety recommendations made and number implemented
<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Does RCA reduce the incidence of adverse events amongst acute pain patients?</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN</td>
<td>Before/After prospective cohort study</td>
</tr>
<tr>
<td>POPULATION</td>
<td>ALL patients on the Acute Pain Service (APS)</td>
</tr>
<tr>
<td></td>
<td><strong>Before Cohort</strong>&lt;br&gt;Feb 2002 - Jul 2007&lt;br&gt;N = 23,198</td>
</tr>
<tr>
<td></td>
<td><strong>After Cohort</strong>&lt;br&gt;Jan 2009 - Dec 2009&lt;br&gt;N = 4,352</td>
</tr>
<tr>
<td>INTERVENTION</td>
<td>Aug 2007 - Dec 2008</td>
</tr>
<tr>
<td></td>
<td>Formal root cause analysis of 10 select adverse events with notification of hospital administration and followup of recommendations</td>
</tr>
<tr>
<td>OUTCOME</td>
<td>1. Incidence of adverse events pre/post RCA&lt;br&gt;2. Root causes of the events&lt;br&gt;3. Number of safety recommendations made and number implemented</td>
</tr>
</tbody>
</table>
ROOT CAUSE ANALYSIS GOALS

- Root cause analysis using the CPSI framework
- Monthly meeting of the RCA team
- Team members:

<table>
<thead>
<tr>
<th>Ward Manager</th>
<th>Research Coordinator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse(s)</td>
<td>APS Nurses</td>
</tr>
<tr>
<td>Anesthesiologist</td>
<td>Nurse Educator</td>
</tr>
<tr>
<td>Surgeon</td>
<td>Pharmacist</td>
</tr>
<tr>
<td>Director</td>
<td>Risk Management</td>
</tr>
</tbody>
</table>

- Goals:
  1. Describe **WHAT** happened
  2. Identify **WHY** it happened (root causes)
  3. Develop an action plan to **PREVENT** similar events
ROOT CAUSE ANALYSIS PROCESS

**Methods**

1. **Flag event for RCA**
2. **Investigation by Research Coordinator**
   - Chart Review
   - Interviews with Staff
   - Review with PI
3. **Sequence of Events Flowchart**
4. **Determine Root Causes**
   - RCA Meeting:
     - Present Timeline
     - Triage/Triggering Questions
     - Create Cause-Effect Diagram
   - Additional Information
   - Literature Review
   - Consultation with Management
5. **Formulate Causal Statements**
6. **Develop Actions**
7. **Assign to Followup Designates**
   - Notify via email with Report
   - Record Resolution with Online Tracking System: HSOS
EXAMPLE: CAUSE-EFFECT DIAGRAM
ROOT CAUSE ANALYSIS PROCESS: NOTIFICATION
From: Michelle Martin
Subject: Safety recommendation for HSOS case 0002: follow-up request
Date: October 20, 2008 7:07:38 AM GMT-04:00
To: James (E-mail)

CAIS: Hospital Safety Occurrence System
Case: 0002
Report Type: Root Cause Analysis
Class of Event: Acute Pain/PostOp
Event Type: Cardiac arrest
Event Date: Aug 1, 07
Facility: McMaster University Medical Center
Location: ICU / CCU / TCU

Dear Colleague:

Please read this important notice.

You have been assigned the role of "follow-up designate" in a patient safety initiative currently underway in the Hamilton Health Sciences and St. Joseph's Health Care systems. A Root Cause Analysis (RCA) has been conducted on a critical event within the Acute Pain Service (APS) and your input is required as a part of the recommendation process. Please download and read the attached RCA report and then click on the link below to record your resolution to the recommendation.

HSOS - Case 0002

Once you have entered the system please indicate the completion status of the recommendation on the Hospital Occurrence Safety System (HSOS) pull down menu.

Thank you for your time and consideration with this matter.

Sincerely,

Michelle Martin
Case Investigator
RCA Coordinator

This information is directed in confidence solely to the person named above and may not otherwise be distributed, copied or disclosed. Therefore, this information should be considered strictly confidential. If you have received this email in error, please notify the sender immediately via a return email for further direction. Thank you for your assistance.

NotableEven...pdf (56.1 KB)
RCA FEEDBACK PROCESS

2) RECORD RESOLUTION

On 20/10/2008 07:20 Martin Michelle wrote:

CAIS: Hospital Safety Occurrence System

Notable Event:
Case Number: 0007
Report Type: Root Cause Analysis
Class of Events: Acute Pain/PostOp
Event Type: Delirium
Event Date: Jan 8, 08
Facility: McMaster University Medical Center
Location: Patient Room

Recommendation: Implement a system whereby the acute pain nurses screen all PCA orders to ensure that opioid dosages are within specified limits as outlined in the measurement plan.

Please use the interface below to record your response.

Sincerely,

Michelle Martin
Case Investigator
RCA Coordinator

This information is directed in confidence solely to the person named above and may not otherwise be distributed, copied or disclosed. Therefore, this information should be considered strictly confidential. If you have received this email in error, please notify the sender immediately via a return email for further direction. Thank you for your assistance.

Your response:

From: james_paul@sympatico.ca
To: mhart@mcmaster.ca
Subject: Re: Safety recommendation for HSOS case 0007: follow:

Body:

Awaiting Feedback
Completed
To Be Completed
Under Consideration
Not To Be Completed

Please update the status of the recommendation.

After 31/03/2009 reminders will be sent every 7 days until recommendation is resolved;
RCA FEEDBACK PROCESS
3) FEEDBACK REMINDER

From: martm@mcmaster.ca
Subject: Hospital Safety Occurrence System
Date: December 15, 2008 4:59:19 AM GMT-05:00
To: James (E-mail)

HSOS Recommendation you are assigned to is past due and still not resolved. Please take steps to complete it. To respond to this email, please follow the link below:

HSOS - Case 0007
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Methods presented at the 4th Annual Hamilton Health Sciences Symposium</td>
<td>May 31, 2007</td>
</tr>
<tr>
<td>• Hospital Safety Occurrence System (HSOS) launched</td>
<td>July 1, 2007</td>
</tr>
<tr>
<td>• Canadian Patient Safety Institute (CPSI) root cause analysis framework morning workshop</td>
<td>July 19, 2007</td>
</tr>
<tr>
<td>• RCA 1 - Severe hypotension</td>
<td>August 9, 2007</td>
</tr>
<tr>
<td>• RCA 2 - Cardiac arrest</td>
<td>September 10, 2007</td>
</tr>
<tr>
<td>• CPSI root cause analysis framework full-day workshop</td>
<td>October 2, 2007</td>
</tr>
<tr>
<td>• RCA 3 - Respiratory depression</td>
<td>November 14, 2007</td>
</tr>
<tr>
<td>• RCA 4 - Inappropriate anticoagulation</td>
<td>December 19, 2007</td>
</tr>
<tr>
<td>• RCA 5 - Respiratory depression</td>
<td>January 22, 2008</td>
</tr>
<tr>
<td>• RCA 6 - Respiratory depression</td>
<td>February 26, 2008</td>
</tr>
<tr>
<td>• Interim study results posted in an acute pain newsletter distributed to all hospital staff</td>
<td>March 31, 2008</td>
</tr>
<tr>
<td>• Vital signs monitoring round table discussion</td>
<td>April 15, 2008</td>
</tr>
<tr>
<td>• RCA 7 - Delirium</td>
<td>May 1, 2008</td>
</tr>
<tr>
<td>• RCA study recommendation follow up strategy meeting</td>
<td>May 8, 2008</td>
</tr>
<tr>
<td>• Interim results from RCAs 1-7 presented to the Hamilton Health Sciences newly formed Quality of Care Committee</td>
<td>June 6, 2008</td>
</tr>
<tr>
<td>• RCA 8 - Prolonged severe pain</td>
<td>June 24, 2008</td>
</tr>
<tr>
<td>• Interim study results presented at the 2008 Ontario Anesthesia Meeting</td>
<td>October 5, 2008</td>
</tr>
<tr>
<td>• RCA 9 - Prolonged motor block</td>
<td>October 23, 2008</td>
</tr>
<tr>
<td>• RCA 10 - Unresponsive patient</td>
<td>December 12, 2008</td>
</tr>
<tr>
<td>• Final study recommendations presented to the Hamilton Health Sciences Quality of Care Committee</td>
<td>April 3, 2009</td>
</tr>
<tr>
<td>• Final study recommendations presented to the nursing administration</td>
<td>April 16, 2009</td>
</tr>
<tr>
<td>• The Ontario Ministry of Health via the Nursing Graduate Guarantee Program funded the Back to Basics Leaders Project</td>
<td>November 11, 2009</td>
</tr>
<tr>
<td>• Final study results to be presented at the 5th Hamilton Health Sciences Patient Safety Symposium</td>
<td>May 18, 2010</td>
</tr>
<tr>
<td>RCA</td>
<td>Event Type</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Severe Prolonged Hypotension</td>
</tr>
<tr>
<td>2</td>
<td>Cardiac Arrest</td>
</tr>
<tr>
<td>3</td>
<td>Respiratory Depression</td>
</tr>
<tr>
<td>4</td>
<td>Inappropriate Anticoagulation</td>
</tr>
<tr>
<td>5</td>
<td>Respiratory Depression</td>
</tr>
<tr>
<td>6</td>
<td>Respiratory Depression</td>
</tr>
<tr>
<td>7</td>
<td>Delirium</td>
</tr>
<tr>
<td>8</td>
<td>Prolonged Severe Pain</td>
</tr>
<tr>
<td>9</td>
<td>Prolonged Motor Block</td>
</tr>
<tr>
<td>10</td>
<td>Unresponsive Patient</td>
</tr>
<tr>
<td>RCA</td>
<td>Event Type</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------</td>
</tr>
</tbody>
</table>
| 1   | Severe Prolonged Hypotension | • Transferred from ICU while still unstable  
• High acuity patients regularly managed on surgical ward  
• Acute pain service first contact for hypotension  
• **Insufficient vital sign assessments** |
| 2   | Cardiac Arrest              | • High dose of PCA Morphine  
• PCA by proxy  
• Respiratory arrest was unwitnessed despite the nurse being in the frequently  
• **Insufficient vital sign assessments** |
| 3   | Respiratory Depression      | • High dose of PCA Morphine  
• **Insufficient knowledge of pain management**  
• Inadequate nurse staffing  
• **Insufficient vital sign assessments** |
| 5   | Respiratory Depression      | • High dose of PCA Morphine  
• **Insufficient knowledge of pain management**  
• Inadequate nurse staffing  
• **Insufficient vital sign assessments**  
• Nursing care fragmented by team based staffing  
• Nursing assignments not always equitable |
| 6   | Respiratory Depression      | • High dose of PCA Morphine  
• **Insufficient knowledge of pain management**  
• Inadequate nurse staffing  
• **Insufficient vital sign assessments**  
• Nursing care fragmented by team based staffing  
• Nursing assignments not always equitable |
| 7   | Delirium                    | • **Insufficient knowledge of pain management**  
• High acuity patients regularly managed on surgical ward |
| 8   | Prolonged Severe Pain       | • Inadequate communication between the APS and ICU staff  
• **Insufficient knowledge of pain management**  
• No pain parameters on the ICU vital sign flow sheet  
• Ineffective bedside patient call bell system  
• **Insufficient vital sign assessments** |
| 9   | Prolonged Motor Block       | • **Insufficient knowledge of pain management**  
• **Insufficient vital sign assessments** |
| 10  | Unresponsive Patient        | • **Insufficient knowledge of pain management**  
• **Insufficient vital sign assessments**  
• Inconsistent management of Sickle Cell patients |
| 4   | Inappropriate Anticoagulation| • Confusion regarding anticoagulation of patients with epidurals  
• Insufficient communication between the physicians |
### RCA 1: SEVERE HYPOTENSION

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
</table>
| 1 | • 53 yo male (4Z) Elective Whipple’s procedure for Tx of Pancreatic Tumor  
  • PMHx: Hep C, Asthma, Chronic Pain, IV drug/ EtOH abuse  
  • Sx: Gen / Epid Anesth  
  • ICU: Hypotension, ++ IV fluid: 1400 cc of LR & 1000 of cc 5% albumin am of transfer = 340 cc/hr  
  - poor pain control  
  • Transferred to ward POD #1 | Prolonged episodes of hypotension:  
  • POD #0 (ICU): SBP 85 evening of adm  
  • PCA Hydromorphone started in addition to epidural  
  • POD #1 (4Z): SBP < 100 X 7 hrs evening of adm  
  - aggressive IV fluid Tx: 5 boluses in first 24 hrs  
  - 6 hr gap in PS, sedation, RR and BP assessment  
  • POD #2 (4Z) SBP 77-92 X 8 hrs  
  • POD #3 (4Z): SBP 75 X 70 min  
  - a/w anemia (Hb 70) - 4 U PRBCs  
  • Discharged without further complications |

### Root Causes

<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
</table>
| 1. Policies / Procedures: ICU D/C Criteria  
Lack of formal discharge criteria  
(Aggregate recommendation: 2/10 RCAs: 1, 7) | Create a discharge criteria outlining minimum parameters for pt transfer | Awaiting feedback |
| 2. Communication: MRP for hypotension  
APS, not the MRP notified 1st for hypotension | Redesign epidural orders | To be completed |
| 3. Fatigue / Scheduling  
Insufficient baseline staff to staff up to patient acuity  
(Aggregate recommendation: 2/10 RCAs: 1, 7) | Increase staffing on 4Z to enable unit to staff up to patient acuity | Awaiting feedback |
| 4. Education / Training, Policy / Procedures and Barriers:  
Insufficient vital sign monitoring  
(Aggregate recommendation: 8/10 RCAs: 1, 2, 3, 5, 6, 8, 9, 10) | Vital Signs Monitoring Recommendation Bundle | Awaiting Feedback |
## RCA 2: CARDIAC ARREST

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>72 yo male (4Z)</td>
<td>Elective laparoscopic splenectomy 2°  Polycythemia Rub Vera  • PMHx: Myelofibrosis with poor prognosis, splenomegaly, anemia  • Sx: General Anesth, EBL 1000 cc  • PACU: Hypotension, bleeding wound, poor pain control  • PCA Morphine 2.0 mg q 7 min + PO Hydromorphone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Transferred to ward at 18:25  RN in room frequently because of positional IV  8-hour gap between sedation assessments (19:15 to 03:00)  <strong>Cardiac Arrest at 03:00</strong> (12.5 h post Sx)  • Found unresponsive by son  • Code blue: asystole  • Resuscitated and transferred to ICU  • Died in ICU a few hours later</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Education / Training: Large PCA dosing</td>
<td>Physician education: M&amp;M rounds, Memo, APS RN order screening</td>
<td>Completed</td>
</tr>
<tr>
<td>Relatively large PCA morphine dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Aggregate Recommendation 2/10 RCAs: 2, 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Education / Training: PCA by proxy</td>
<td>• Warning tags on PCA button;</td>
<td>Completed</td>
</tr>
<tr>
<td>Family member assisted patient with PCA dosing</td>
<td>• Patient &amp; family education</td>
<td></td>
</tr>
<tr>
<td>3. Equipment / Environment: Green button effect</td>
<td>Reprogram PCA so that the green button on all the time</td>
<td>Completed (then revised back to baseline status)</td>
</tr>
<tr>
<td>PCA button light feedback may encourage patients to press button more often</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Policies / Procedures: Large PCA dosing</td>
<td>Implement a policy whereby APS nurses screen PCA orders before transferring patients to the ward</td>
<td>Completed</td>
</tr>
<tr>
<td>Relatively large PCA dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Education / Training, Policy / Procedures and Barriers:</td>
<td>Vital Signs Monitoring Recommendation Bundle</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>Insufficient vital sign monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate recommendation: 8/10 RCAs: 1, 2, 3, 5, 6, 7, 9, 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### RCA 3, 5, 6: SEVERE RESPIRATORY DEPRESSION

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
</table>
| 3  | 47 yo male (6S) MVA with mult #s  
Sx: ORIF hip, acetabulum  
PCA Morphine 2.0 q 8'  
Pt sedated on ward - attributed to EtOH - PCA decreased to 1.5 mg after 8 hr  
10:1 Pt:RN ratio evening before, 6:1 at the time  
13 hr gap in pain, sedation and respiration assessments night before event | • Decreased LOC and Hypoxic (34 h Post-OP): Pt found with SpO\textsubscript{2} of 40% - Naloxone not given since RR was 16  
• Race team resuscitated with O\textsubscript{2} + Naloxone  
• Recovered without incident |
| 5  | 80 yo female (F4) PMHx: HTN  
Sx: R THR, Spinal Anesth  
PCA Morphine 1.0 q 8' + Gabapentin & Oxycontin  
POD#1: 6 hour gap with NO vital signs prior to the event | • Decreased LOC and Hypoxic (26 h Post-OP): Pt found by PACU RN with SpO\textsubscript{2} of 50% & unresponsive  
• PACU RN initiated Naloxone  
• Recovered without incident |
| 6  | 81 yo female (F4) PMHx: HTN, LBB - on telemetry  
Sx: R TKR, Spinal Anesth  
Epidural Bup + Fent  
POD#1: 5 hour gap with NO vital signs prior to the event | • Decreased LOC and Hypoxic (22 h Post-OP): Pt found with SpO\textsubscript{2} of 80%, unresponsive & HR 40s  
• RN initiated Naloxone, Called Cardiology  
• Recovered without incident |
## RCA 3, 5, 6: SEVERE RESPIRATORY DEPRESSION

<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Education / Training, Policy / Procedures and Barriers: Insufficient vital sign monitoring</td>
<td>Vital Signs Monitoring Recommendation Bundle</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>Aggregate recommendation: 8/10 RCAs: 1, 2, 3, 5, 6, 8, 9, 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Education / Training: Large PCA dosing</td>
<td>Physician education: M&amp;M rounds, Memo, APS RN order screening</td>
<td>Completed</td>
</tr>
<tr>
<td>Relatively large PCA morphine dose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Aggregate Recommendation 2/10 RCAs: 2, 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fatigue / Scheduling: Short staffed prior to event (RCA 3)</td>
<td>Increase staffing on 6S to enable unit to staff up to patient acuity</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>Insufficient baseline staff to staff up to patient acuity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Fatigue / Scheduling: Team vs Collaborative Care Nursing (RCA 5, 6)</td>
<td>Support transition to collaborative care nursing model</td>
<td>Completed</td>
</tr>
<tr>
<td>Team based nursing model with RPNs and RNs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Fatigue / Scheduling: Weekend APS RN coverage (RCA 6)</td>
<td>Train PACU RNs to do rounds on weekends and holidays</td>
<td>To Be Completed</td>
</tr>
<tr>
<td>No APS nurse coverage on weekends or holidays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Fatigue / Scheduling: Workload Distribution (RCA 5)</td>
<td>Support the use of the new patient acuity measurement tool on the ward</td>
<td>Completed</td>
</tr>
<tr>
<td>RPN involved in case complained of an inequitable nursing assignment because of the high acuity of her patients</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**INAPPROPRIATE SYSTEMIC ANTICOAGULATION**

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>72 yo male (5W-SD) Elective abdominal aortic aneurysm repair • PMHx: IHD, HTN, Post LUL lobectomy, GERD, Renal insufficiency • Sx: Gen/Epid Anesth • ICU POD 0: Arrived extubated • Ward POD 1: Uncontrolled pain, SVT • POD 2: Elevated Troponin (NSTEMI)</td>
<td>• RACE MD ordered <em>Fondaparinux</em> - After deliberation with the thrombosis pharmacist and an ICU physician AND after the RN refused to give the medication • Epidural removed without incident • Current <em>recommendations</em> from the ASRA and ACCP specifically state not to use Fondaparinux in patients with epidurals because of <em>risk of spinal hematomas</em></td>
</tr>
</tbody>
</table>

### Root Causes

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Policies / Procedures: Anticoagulation &amp; epidurals policy No policy regarding use of anticoagulants in patients with epidurals</td>
<td>Develop policy</td>
</tr>
<tr>
<td>2. Policies / Procedures: Pre-printed orders No pre-printed orders to guide physicians when ordering anticoagulants in patients with epidurals</td>
<td>Develop orders</td>
</tr>
<tr>
<td>3. Policies / Procedures: Warning alerts in pharmacy system No alert in pharmacy order-entry system</td>
<td>Program warning alerts in pharmacy system</td>
</tr>
</tbody>
</table>
# Adult Anticoagulation Orders For Adult Prophylactic Anticoagulation

For patients with indwelling epidural catheters, please note the following:

**MAY ORDER:** Heparin and LMWH at prophylactic doses for DVT prevention, ASA 81 mg, Ketorolac, Ibuprofen, COX-2 inhibitors (Celecoxib, Meloxicam).

**CONTRAINDICATED:** Heparin and low molecular weight heparin (LMWH) at therapeutic doses, Fondaparinux, Clopidogrel, Ticlopidine, ASA greater than 100 mg, or NSAIDS not listed above.

1. Start Prophylactic dose of heparin or LMWH:
   - [ ] 12 hours after insertion of epidural catheter OR
   - [ ] 24 hours after insertion of epidural catheter if presence of blood in needle or catheter during placement (as per Anesthesia Record)

2. Select ONE:
   - [ ] Dalteparin _____ units subcutaneously once daily to maximum 5000 units per 24 hours.
   - [ ] Enoxaparin _____ mg subcutaneously once daily to maximum 40 mg per 24 hours.
   - [ ] Heparin 5000 units subcutaneously twice daily.

3. CBC, Creatinine, PT (INR), PTT – if platelet count less than 100 x 10⁹/L notify physician.
4. CBC every 2 days after starting anticoagulation and while epidural catheter in situ.
5. Hold heparin and/or LMWH if Hgb less than _____ g/L or if excessive bleeding present.

6. Warfarin _____ mg PO at 1800 hours on the day prior to epidural catheter removal only if INR less than 1.3.
7. PT (INR) daily after start of Warfarin.
8. Discontinue heparin or LMWH when INR is at least 2.0.

### Discontinue Warfarin

10. Remove epidural catheter 11 hours after last heparin dose OR 22 hours after LMWH dose.
11. Resume heparin or LMWH 2 hours after epidural catheter removal.
## RCA 7: DELIRIUM

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>• 57 yo male (4Z) Admitted to hospital after presenting to 2F clinic with SOB, fever, chills and abdominal pain&lt;br&gt;• PMHx: Ulcerative colitis - complex course with recent 1-yr admission at the HGH, Ileostomy, Fistulas, -TPN via Hickman, -Chronic abdominal pain</td>
<td>Day 1-3: Poor pain control with prn dilaudid Rx: Oxycontin, Oxycontin IR, Flexeril, Gabapentin, Amitriptyllline - Oxycontin tabs found in ostomy bag Day 4: APS consulted - narcotic orders d/c, pt started on PCA dilaudid 0.5 mg q 10'&lt;br&gt;Day 5: Auditory and visual hallucinations - PCA d/c in am by APS, Naloxone by surgeon at 14:40, admitted to ICU overnight Day 6: Transferred back to ward and then readmitted to ICU 2.5 hours later with fever</td>
</tr>
</tbody>
</table>

### Root Causes

<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fatigue / Scheduling: Ward pharmacist&lt;br&gt;The patient was receiving sustained release oral analgesics despite having a high-output ostomy</td>
<td>Hire a 4Z pharmacist</td>
<td>Completed</td>
</tr>
<tr>
<td>2. Fatigue / Scheduling&lt;br&gt;Insufficient baseline staff to staff up to patient acuity</td>
<td>Increase staffing on 4Z to enable unit to staff up to patient acuity</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>3. Education/Training: PCA Dilaudid&lt;br&gt;PCA Dilaudid dose relatively large = 2.5 mg of Morphine</td>
<td>APS nurses to screen PCA orders and discuss case where dosages are higher than usual</td>
<td>Completed</td>
</tr>
<tr>
<td>4. Education / Training: Insufficient pain knowledge&lt;br&gt;Nursing staff unaware of the concern of sustained release meds in patients with ostomies. Aggregate recommendation - 8/10 RCAs;2. 3, 5, 6, 7, 8, 9, 10)</td>
<td>Develop a mandatory annual e-learning acute pain education package for all sites</td>
<td>To be completed</td>
</tr>
</tbody>
</table>
## RCA 8: PROLONGED SEVERE PAIN

<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>68 yo female (MUMC ICU) Admitted to general surgery with advanced sigmoid cancer</td>
<td></td>
</tr>
</tbody>
</table>
|    | PMHx: Healthy  
|    | Sx: Radical TAH, BSO, loop ileostomy - epidural inserted for postop analgesia, started at 6 cc/hr  
|    | Transferred to ICU postop at 14:30 |
|    | ICU - POD 0 - 19:00: Hypotension (86/43 mmHg) - epidural rate decreased to 4 cc/hr  
|    | 20:00-23:00: Hypotension (88/43 mmHg) - epidural decreased to 2 cc/hr  
|    | POD 1 - 02:00: Epidural turned off  
|    | 0300: Epidural turned back on at 1 cc/hr  
|    | 06:30: Chief Resident noted poor pain control - BP 146/62  
|    | No pain scores X 7 hrs, no sensory/motor status  
|    | 08:00: Epidural increased to 4 cc/hr  
|    | 09:00: APS Rounds - epidural boluses given  
|    | 4Z - POD 2: APS Rounds - patient complained of severe pain in ICU |

### Root Causes

| 1. Communication: ICU and APS Staff  
The lack of communication between ICU and APS staff resulted in inadequate analgesia |
| 2. Education / Training: Insufficient pain knowledge  
8-hour gap in sedation assessments preceded this event Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10 |
| 3. Equipment / Environment: Call bell system  
Call bell system in MUMC ICU not adequate |
| 4. Policies / Procedures: ICU Charting  
Pain outcomes not currently on ICU flowsheet |
| 5. Education / Training, Policy / Procedures and Barriers:  
Insufficient vital sign monitoring Aggregate Recommendation 8/10 |

### Recommendations

| Implement a policy whereby ICU staff contact the APS with any changes to PCA or epidural orders |
| Develop a mandatory annual e-learning acute pain education package for all sites |
| Purchase new call bell system |
| Add acute pain assessments to ICU flowsheet |
| Vital Signs Monitoring Recommendation Bundle |

### Status

<p>| To Be Completed |
| To Be completed |
| Under Consideration |
| Completed |
| Awaiting Feedback |</p>
<table>
<thead>
<tr>
<th>#</th>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
</table>
| 9  | 79 yo male (5WSD) Admitted to hospital for an elective abdominal aortic aneurysm repair. PMHx: Abdominal aortic aneurysm, Lung CA, Stroke, CAD, OA | 5WSD POD 0: Pain 4-8/10 - no pain or sedation scores × 9 hrs 
• POD 1 - 13:00 unable to move legs × 15-16 hrs - epidural stopped, then restarted at 6 cc/hr 
- no sensory or motor assessments × 8 hrs 
• POD 2: 04:00 - Low BP (79/32 mmHg) and motor block at 04:00, anesthesia resident called - epidural held, and then restarted at 06:20 
- Epidural d/c at 08:30 by anesthesia, morphine ordered |

<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Education / Training: Anesthesia residents</td>
<td>Residents to take part in APS rounds at all three HHS sites</td>
<td>Completed</td>
</tr>
<tr>
<td>High thoracic epidural necessitated high infusion rate and subsequent motor block and hypotension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Education / Training, Policy / Procedures and Barriers:</td>
<td>Vital Signs Monitoring Recommendation Bundle</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>Insufficient vital sign monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate recommendation: 8/10 RCAs: 1, 2, 3, 5, 6, 8, 9, 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# RCA 10: UNRESPONSIVE PATIENT

<table>
<thead>
<tr>
<th>ID</th>
<th>Event</th>
</tr>
</thead>
</table>
| 10 | **Day 1 - ER @ 05:00:** Admitted to hospital with morphine prn  
|    | **3B @9:40:** Patient with 10/10 pain  
|    | **10:53:** APS Consulted - PCA orders written  
|    | **Day 2:**  
|    | 20:00 - 09:00: Sedation status not assessed X 13 hours, no response to BP check at 24:00  
|    | - patient found incontinent of urine & unresponsive at 09:00  
|    | - APS paged, Naloxone given - no improvement  
|    | - PACE team called, CT = large frontal hematoma  
|    | **Sx @ 14:00:** Craniotomy + evacuation hematoma |

## Root Causes

1. Policy / Procedure: Sickle Cell Protocol  
The lack of protocol increased the chances that this patient was not monitored sufficiently

2. Education / Training, Policy / Procedures and Barriers:  
Insufficient vital sign monitoring  
Aggregate recommendation: 8/10 RCAs: 1, 2, 3, 5, 6, 8, 9, 10

## Recommendations

Create preprinted orders for patients with Sickle Cell Crisis  

Vital Signs Monitoring Recommendation Bundle

## Status

To Be Completed  

Awaiting Feedback
## VITAL SIGN ASSESSMENT GAPS

<table>
<thead>
<tr>
<th>RCA</th>
<th>Modality</th>
<th>Event</th>
<th>Pain Q4H</th>
<th>Sedation Q2H</th>
<th>Respirations Q2H</th>
<th>BP/HR Q4H</th>
<th>Sensory/Motor Q4H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Epidural</td>
<td>Hypotension</td>
<td>6.25</td>
<td>6.25</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PCA</td>
<td>Cardiac Arrest</td>
<td>6.5</td>
<td>8.5</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>PCA</td>
<td>Respiratory Depression</td>
<td>13</td>
<td>13</td>
<td>9.25</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Epidural</td>
<td>Inappropriate Anticoagulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>PCA</td>
<td>Respiratory Depression</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Epidural</td>
<td>Respiratory Depression</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PCA</td>
<td>Delirium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Epidural</td>
<td>Prolonged Severe Pain</td>
<td>10.5</td>
<td>not assessed</td>
<td></td>
<td></td>
<td>not assessed</td>
</tr>
<tr>
<td>9</td>
<td>Epidural</td>
<td>Prolonged Motor Block</td>
<td>13</td>
<td>13</td>
<td>3.6</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>10</td>
<td>PCA</td>
<td>Unresponsive Patient</td>
<td>6</td>
<td>13</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Mean and # (%)

<table>
<thead>
<tr>
<th></th>
<th># (%)</th>
<th>Pain Q4H</th>
<th>Sedation Q2H</th>
<th>Respirations Q2H</th>
<th>BP/HR Q4H</th>
<th>Sensory/Motor Q4H</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% Cases</td>
<td>6 (60%)</td>
<td>7 (70%)</td>
<td>7 (70%)</td>
<td>5 (50%)</td>
<td>2 (33%)</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>8.3</td>
<td>9.1</td>
<td>5.3</td>
<td>6.4</td>
<td>9.5</td>
<td></td>
</tr>
</tbody>
</table>
BARRIERS TO VITAL SIGNS MONITORING

- Remote Monitoring
- Need for Visual Prompts
- Vital Sign Charting
- Transfer of Accountability Process
- Portable Monitors
- Pain/Monitoring Knowledge
<table>
<thead>
<tr>
<th>Factor</th>
<th>Recommendation</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Equipment</td>
<td>Remote Monitoring</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>2. Equipment</td>
<td>Portable Monitors</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>3. Education</td>
<td>Pain/Monitoring Knowledge</td>
<td>To Be Completed</td>
</tr>
<tr>
<td>4. Policy/Procedures</td>
<td>VS Charting</td>
<td>To Be Completed</td>
</tr>
<tr>
<td>5. Policy/Procedures</td>
<td>Transfer of Accountability</td>
<td>Awaiting Feedback</td>
</tr>
<tr>
<td>6. Equipment</td>
<td>Visual Prompts</td>
<td>To Be Completed</td>
</tr>
<tr>
<td>7. Policy/Procedures</td>
<td>Corporate Initiative</td>
<td>Awaiting Feedback</td>
</tr>
</tbody>
</table>
CORPORATE INITIATIVE
RATIONALE

• Gaps in vital signs monitoring a major latent threat to patient safety

• Need support to complete necessary recommendations: education, equipment and policy

• Need endorsement to make annual pain education update mandatory
<table>
<thead>
<tr>
<th>Root Causes</th>
<th>Recommendations</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.  Education / Training: Insufficient pain knowledge</td>
<td>Develop a mandatory annual e-learning acute pain education package for all sites</td>
<td>To be completed</td>
</tr>
<tr>
<td>8-hour gap in sedation assessments preceded this event Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td>Make “Back to Basics Nursing” a corporate initiative with emphasis on the importance of vital signs monitoring</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>2.  Policies / Procedures: Insufficient vital sign monitoring</td>
<td>Make a unified vital signs flowsheet and incorporate this in the upcoming electronic documentation system</td>
<td>To be completed</td>
</tr>
<tr>
<td>8-hour gap in sedation assessments preceded this event Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td>Create a unified vital signs flowsheet and incorporate this in the upcoming electronic documentation system</td>
<td>To be completed</td>
</tr>
<tr>
<td>3.  Policies / Procedures: No unified vital signs flowsheet</td>
<td>Mount a laminated card with the APS monitoring protocols on each epidural and PCA pump</td>
<td>To be completed</td>
</tr>
<tr>
<td>Pain Management Flowsheet a barrier to complete RN charting Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td>Incorporate APS monitoring protocol into the TOA process</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>4. Barriers: No visual prompt on PCA/epidural pumps</td>
<td>Pilot a remote respiratory monitoring system on 4Z</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>No visual reminder of the frequency of assessments on the analgesia pumps Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td></td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>5.  Policies / Procedures: Transfer of accountability</td>
<td>Purchase sufficient portable monitors so there is one in every surgical ward room</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>Current TOA process does not remind RNs of the increased monitoring requirements of APS patients Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td></td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>6. Equipment / Environment: Remote monitoring system</td>
<td>Pilot a remote respiratory monitoring system on 4Z</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>Respiratory arrests are unpredictable and sudden Aggregate recommendation - 8/10 RCAs: 2, 3, 5, 6, 7, 8, 9, 10)</td>
<td>Pilot a remote respiratory monitoring system on 4Z</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>7.  Equipment / Environment: Portable monitors</td>
<td>Purchase sufficient portable monitors so there is one in every surgical ward room</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>Lack of sufficient portable monitors Aggregate recommendation - 7/10 RCAs: 2, 3, 5, 6, 7, 9, 10)</td>
<td>Pilot a remote respiratory monitoring system on 4Z</td>
<td>Awaiting feedback</td>
</tr>
<tr>
<td>Root Causes</td>
<td>Recommendations</td>
<td>RCAs</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Communication</td>
<td>Redesign epidural orders</td>
<td>1</td>
</tr>
<tr>
<td>Communication</td>
<td>Have ICU staff contact the APS with changes to PCA or epidural orders</td>
<td>8</td>
</tr>
<tr>
<td>Education / Training</td>
<td>Educate patients and families regarding the dangers of PCA by proxy</td>
<td>2</td>
</tr>
<tr>
<td>Education / Training</td>
<td>Have anesthesia residents take part in APS rounds at HHS</td>
<td>9</td>
</tr>
<tr>
<td>Education / Training</td>
<td>Develop a mandatory annual e-learning acute pain education package for all sites</td>
<td>12,345,678,910</td>
</tr>
<tr>
<td>Education / Training</td>
<td>Educate physicians and residents regarding PCA dosing</td>
<td>2, 3</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>Reprogram the PCA pump button behavior</td>
<td>2</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>Program warning alerts into the pharmacy system</td>
<td>4</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>Purchase a new call bell system for ICU</td>
<td>8</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>Pilot a remote respiratory monitoring system on a surgical ward</td>
<td>1,235,678,910</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>Purchase more portable monitors so there is one in every surgical ward room</td>
<td>1,235,678,910</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Increase staffing on 6S to enable unit to staff up to patient acuity</td>
<td>3</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Support the use of the new patient acuity measurement tool for nursing assignments</td>
<td>5</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Train PACU RNs to do APS rounds on weekends and holidays</td>
<td>6</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Hire a pharmacist for 4Z</td>
<td>7</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Increase staffing on 4Z to enable unit to staff up to patient acuity</td>
<td>1, 7</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>Support transition from team to collaborative nursing care model on F4</td>
<td>5, 6</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Develop pre-printed orders for anticoagulation in patients with epidurals</td>
<td>4</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Develop policy for anticoagulation in patients with epidurals</td>
<td>4</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Develop preprinted orders for Sickle Cell patients</td>
<td>10</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Create a ICU discharge criteria outlining minimum parameters for transfer</td>
<td>1, 7</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Make &quot;Back to Basics Nursing&quot; (with an emphasis on vital signs monitoring) a CORPORATE INITIATIVE</td>
<td>1,235,678,910</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Create a unified vital signs flowsheet - in the upcoming e-documentation system - that includes pain assessments</td>
<td>1,235,678,910</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Incorporate APS monitoring into the transfer of accountability process</td>
<td>1,235,678,910</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>Have APS RNs screen PCA orders for inappropriate dosing</td>
<td>2, 3, 7</td>
</tr>
</tbody>
</table>

**RECOMMENDATION STATUS SUMMARY**
RECOMMENDATIONS

26 Unique Recommendations

76 Applications
# TOP RECOMMENDATIONS

<table>
<thead>
<tr>
<th>Root Cause</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment/Equipment</td>
<td>Create <strong>laminated cards</strong> with the APS vital signs monitoring protocols</td>
</tr>
<tr>
<td>Environment/Equipment</td>
<td>Purchase more <strong>portable monitors</strong></td>
</tr>
<tr>
<td>Environment/Equipment</td>
<td>Pilot a remote <strong>respiratory monitoring system</strong></td>
</tr>
<tr>
<td>Policies/Procedures</td>
<td>Develop a &quot;<strong>back to basics</strong>&quot; nursing campaign</td>
</tr>
<tr>
<td>Policies/Procedures</td>
<td>Incorporate APS monitoring into the <strong>transfer of accountability</strong> process</td>
</tr>
<tr>
<td>Policies/Procedures</td>
<td>Create a <strong>unified vital signs flowsheet</strong></td>
</tr>
<tr>
<td>Training</td>
<td>Acute Pain <strong>e-learning update</strong> for nurses</td>
</tr>
</tbody>
</table>

6 recommendations, accounting for 52/76 (68%)
REMOTE RESPIRATORY MONITORING & NOTIFICATION SYSTEM

Necessary Components

- Bedside Monitors
- Pagers
- Server
- Wireless Network
- Paging Transmitter
- Sensors
## MASIMO PATIENT SAFETYNET QUOTE

<table>
<thead>
<tr>
<th></th>
<th>Reusable No Contract</th>
<th>Reusable Contract</th>
<th>Single Patient Use No Contract</th>
<th>Single Patient Use Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 year Operating Cost - Sensor Purchases</td>
<td>$27,064</td>
<td>$19,720</td>
<td>$134,703</td>
<td>$95,337</td>
</tr>
<tr>
<td>5 year Operating Cost - Service/Warranty Plan</td>
<td>$66,214.59</td>
<td>$79,454.3</td>
<td>$66,214.59</td>
<td>$61,532.55</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$280,356.73</td>
<td>$249,012.44</td>
<td>$387,995.73</td>
<td>$255,502.69</td>
</tr>
</tbody>
</table>

**Non-Contract vs. Contract Capital Cost Savings**

<table>
<thead>
<tr>
<th></th>
<th>Reusable</th>
<th>Single Patient Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital Cost Savings</strong></td>
<td>$37,240</td>
<td>$88,445</td>
</tr>
</tbody>
</table>

### Sensor Pricing

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re Usable Sensor (List Pricing Per Sensor)</td>
<td>$199</td>
</tr>
<tr>
<td>Adhesive Sensor (List Pricing Per Sensor)</td>
<td>$16.63</td>
</tr>
<tr>
<td>Re Usable Sensor (Agreement Pricing Per Sensor)</td>
<td>$145</td>
</tr>
<tr>
<td>Adhesive Sensor (Agreement Pricing Per Sensor)</td>
<td>$11.77</td>
</tr>
</tbody>
</table>
# PORTABLE MONITORS

<table>
<thead>
<tr>
<th>Ward</th>
<th>Patient Rooms</th>
<th>Portable Monitors</th>
<th>Monitor Deficit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Henderson</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>13</td>
<td>32</td>
<td>21</td>
</tr>
<tr>
<td>E3</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E4</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Henderson</td>
<td></td>
</tr>
<tr>
<td>4Z</td>
<td>23</td>
<td>14</td>
<td>60</td>
</tr>
<tr>
<td>4Y</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4B</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4C</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Henderson</td>
<td></td>
</tr>
<tr>
<td>5 West</td>
<td>11</td>
<td>46</td>
<td>7</td>
</tr>
<tr>
<td>6 South</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 West</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 West</td>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: 8 portable monitors currently on 4Z
Save 15 monitors if respiratory monitoring system is purchased.

<table>
<thead>
<tr>
<th>Deficit Total</th>
<th>Unit Cost (Welch Allyn)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>88</td>
<td>$3500</td>
<td>$308000.00</td>
</tr>
</tbody>
</table>
BACK TO BASICS NURSING INITIATIVE

• 10 point of care RNs will be hired as ‘Back to Basics Leaders’ on 10 units at HHS

• Chart audits: vital signs, pain management, fluid balance

• Present results to staff

• Form focus groups and develop action plans

• Evaluate results

Funded via the ‘New Graduate Guarantee’ MOHLTC program
## Recommendation Status Summary

<table>
<thead>
<tr>
<th>Status</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awaiting Feedback</td>
<td>0</td>
</tr>
<tr>
<td>Not To Be Completed</td>
<td>2</td>
</tr>
<tr>
<td>Under Consideration</td>
<td>0</td>
</tr>
<tr>
<td>To Be Completed</td>
<td>0</td>
</tr>
<tr>
<td>Completed</td>
<td>24</td>
</tr>
</tbody>
</table>

92% completed or to be completed
<table>
<thead>
<tr>
<th>Event</th>
<th>PRE</th>
<th>POST</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers</td>
<td>23198</td>
<td>4352</td>
<td></td>
</tr>
<tr>
<td>Dates</td>
<td>6376</td>
<td>6376</td>
<td></td>
</tr>
<tr>
<td>Adverse Events</td>
<td>658  (2.84%) 1 in 35</td>
<td>96   (2.21%) 1 in 45</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

7 years
35384 patients
866 adverse events
<table>
<thead>
<tr>
<th>Event</th>
<th>PRE</th>
<th>POST</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Arrest</td>
<td>4 (0.02%)</td>
<td>2 (0.05%)</td>
<td>0.24</td>
</tr>
<tr>
<td>Respiratory Depression</td>
<td>165 (0.71%)</td>
<td>18 (0.41%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Severe Hypotension</td>
<td>310 (1.34%)</td>
<td>34 (0.78%)</td>
<td>0.002%</td>
</tr>
<tr>
<td>Unresponsive</td>
<td>6 (0.03%)</td>
<td>3 (0.07%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Delirium</td>
<td>4 (0.02%)</td>
<td>0 (0.0%)</td>
<td>0.39</td>
</tr>
<tr>
<td>Severe Pain</td>
<td>1508 (6.50%)</td>
<td>441 (10.13%)</td>
<td>0</td>
</tr>
<tr>
<td>Inappropriate Anticoagulation</td>
<td>17 (0.21%)</td>
<td>4 (0.41%)</td>
<td>0.22</td>
</tr>
<tr>
<td>Prolonged Motor Blk</td>
<td>3</td>
<td>1</td>
<td>0.26</td>
</tr>
</tbody>
</table>
## PRE & POST RCA EVENT RATES: OTHER AE

<table>
<thead>
<tr>
<th>Event</th>
<th>PRE</th>
<th>POST</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Pump Programming Error</td>
<td>27 (0.12%)</td>
<td>0 (0.00%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Epidural Abscess</td>
<td>4 (0.05%)</td>
<td>0 (0.00%)</td>
<td>0.49</td>
</tr>
<tr>
<td>Spinal Hematoma</td>
<td>2 (0.02%)</td>
<td>0 (0.00%)</td>
<td>0.62</td>
</tr>
<tr>
<td>Death</td>
<td>2 (0.01%)</td>
<td>2 (0.05%)</td>
<td>0.061</td>
</tr>
</tbody>
</table>

- **2006**: New PCA pumps, orders and education
- **Study not powered to detect impact on rare events**
<table>
<thead>
<tr>
<th>Root Cause</th>
<th>Number Factors</th>
<th>% of RCAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>2</td>
<td>20%</td>
</tr>
<tr>
<td>Education / Training</td>
<td>4</td>
<td>100%</td>
</tr>
<tr>
<td>Equipment / Environment</td>
<td>5</td>
<td>100%</td>
</tr>
<tr>
<td>Fatigue / Scheduling</td>
<td>6</td>
<td>60%</td>
</tr>
<tr>
<td>Policies / Procedures</td>
<td>8</td>
<td>100%</td>
</tr>
</tbody>
</table>
## LESSONS LEARNED

### Advantages of the RCA Process

- It's a **systematic** and **comprehensive** tool
- Adds **credibility** to the resulting recommendations
- The **multidisciplinary** team based approach
- Patients / families experiencing reassured that **appropriate steps were taken**
- Recommendations **not lost to followup**
- By adopting the RCA processes hospitals can ensure **compliance with any patient safety regulations**
<table>
<thead>
<tr>
<th>LESSONS LEARNED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disadvantages of the RCA Process</td>
</tr>
</tbody>
</table>

- The process takes a great deal of **time and energy** to complete.
- Followup designates, that were not part of the RCA meetings, are **less likely to buy into the recommendations**.
- It's inherently a **retrospective** process.
- It's **difficult to organize the meetings**.
- The **results are partially dependent on the biases of the participants**.
- The **impact of the RCA results decreases as time goes by**.
- If RCA is not part of the routine safety process then the hospital **administration is less prepared to respond to the recommendations**.
- **Many recommendations**, although credible, are **not be feasible** because of insufficient hospital funding.
“We’ve learned from our mistakes and we can repeat them exactly”

Rob Lee PhD - Human Factors and Systems Safety Consultant
Melba, Australia
- at Halifax 10 - The Canadian Healthcare Safety Symposium 2010
CONCLUSIONS

• RCA proved effective in reducing the overall AE rate: from 1 in 35 to 1 in 45

• RCA **effective** in reducing the rate of **respiratory depression** and **severe hypotension**

• Pain pump programming errors were not targeted by RCA but were reduced

• RCA **did not reduce** severe pain, cardiac arrest, sedation, delirium, inappropriate anticoagulation or prolonged motor block

• Several key (wireless monitoring system, back to basics nursing and e-learning) recommendations are still being implemented

• RCA process was well supported by the safety infrastructure at HHS