High Alert Medication Program

Nicholas Kostek, RPh, MS
Pharmacy Quality and Patient Safety Coordinator
Kaiser Permanente, Northern California
Disclosure

- Nicholas Kostek has indicated that he has no relevant financial relationships to disclose in regard to the content of this presentation.
Objectives

• Review the development and implementation of a high-alert medication program at Kaiser Permanente
• Discuss factors in your practice environment that can contribute to the occurrence of medication errors
• Demonstrate how medication error and near miss data can be used to identify opportunities for improving patient safety
• Describe the application of system strategies to reduce medication administration errors with IV heparin and improve patient outcomes
Kaiser Permanente - 2012

- 9.1 million members
- 8 regions serving 9 states and the District of Columbia
- 37 medical centers (with hospitals)
- 618 medical offices and other outpatient facilities
- 17,157 physicians
- 175,668 employees (including 49,034 nurses)
- $50.6 billion operating revenue
- $2.6 billion net income
- $169.4 million invested in health research
- 1,070 articles published in peer reviewed journals
Northwest Region
- Portland, OR
- Vancouver, WA
- 484,349 members

Northern California Region
- 3,403,871 members

Southern California Region
- 3,594,848 members

Colorado Region
- Denver / Boulder, CO
- Colorado Springs, CO
- Pueblo, CO
- 540,442 members

Ohio Region
- Cleveland, OH
- Akron, OH
- 86,338 members

Mid-Atlantic Region
- Washington, DC
- Maryland
- Virginia
- 481,755 members

Georgia Region
- Atlanta, GA
- 233,880 members

Hawaii Region
- 224,591 members
Preventable Medication Errors

San Jose Mercury News (CA)

November 3, 2005
Section: Front
Edition: Morning Final
Page: 1A

'TERrible ERROR,' THEN A DEATH
DAVID L. BECK AND JULIE SEVRENS LYONS, Mercury News

They called him Critter.

When he was little, Chris Wibeto wore a Superman costume and acted out cartoons. He grew into a 6-foot, brown-haired kid with a wispy beard who loved baseball, Oreos, progressive rock and black humor. "It's all good," he would say.

He said that even when he was in a Stanford hospital bed waiting to die, not from the non-Hodgkin's lymphoma with which he had been diagnosed, but from what his parents called a "terrible error" at Kaiser Permanente's Santa Teresa Medical Center, where he was given someone else's medication.

"This," according to a report by the California Department of Health Services, "resulted in a negative patient outcome." It was a phrase that Critter, a fan of ironic movies like "Dogma" and "Jay and Silent Bob Strike Back," might have appreciated.

Christopher Robin Wibeto, 21, died Aug. 29, three days after he received a chemotherapy drug called vincristine that, unlike the drug he was supposed to have received, cannot be injected into the spine.

A spokeswoman for Kaiser Permanente confirmed Wednesday that the hospital has reached a financial settlement with the family for an undisclosed amount, but refused to give specifics.
ANOTHER DEATH IN '05 ATTRIBUTED TO HOSPITAL ERROR

JULIE SEVRENS LYONS, Mercury News

Christopher Wibeto wasn't the only South Bay Kaiser patient to die this year after receiving the wrong medication. In July, a 12-year-old girl hospitalized at Kaiser Permanente Medical Center-Santa Clara was mistakenly given a double dose of epinephrine, which speeds up the heart rate, state records show.

Josephine Frances Hart, a San Jose resident who loved to play with marbles, died July 26, the same day of the error. Her official cause of death is still being investigated by the county coroner's office, but state health investigators determined that a nurse failed to check the medication label.

"The death of this young girl is tragic, and we're holding the hospital responsible," said Lea Brooks, a spokeswoman for the California Department of Health Services.
And More...

San Jose Mercury News (CA)

November 10, 2005
Section: Front
Edition: Morning Final
Page: 1A
Memo: Mercury News Staff Writer Julie Sevrens Lyons contributed to this report.

HOSPITALS BLAMED IN MORE DEATHS
DAVID L. BECK, Mercury News

Kaiser Permanente officials have confirmed the deaths of two more patients caused by staff errors at its South Bay hospitals. The deaths bring to at least four the number of fatal incidents at Kaiser facilities during the past 13 months.

Three of the deaths involved either the wrong medications, or the right medications in the wrong dosage. The fourth was an elderly man who choked on food he was not supposed to have been given.

As it has before, Kaiser issued written statements saying that it "has expressed its deepest regret and sympathy to the family for their tragic loss" and accepting "full responsibility" for the errors.

Kaiser would not comment when asked whether there were any more cases that have not yet come to light.
High Alert Medication Program (HAMP) Goals

- Eliminate harm
- Promote standardization
- Monitor performance
- Generate ongoing system improvements
- Ensure sustainability
HAMP Program Components

- Identification of High Alert drugs
- Independent double checks
- Specialized HAMP labeling
- Standardization of drugs, concentrations and procedures
- Use of premixed IV solutions
- Elimination of unapproved abbreviations
High Alert Program Description

- Standardized order sets and protocols
- Segregation of high alert drugs
- “Clinical Data Categories”
- “Smart” IV pumps
- Staff training & testing for competency
- Universal application
- Regional oversight
“High alert medications are those medications involved in a high percentage of errors and/or sentinel events as well as medications that carry a higher risk for abuse or other adverse outcomes.”

The Joint Commission Standard MM.01.01.03. CAMH Update 2, September 2012.
High Alert Medications

- More frequently involved in serious medication errors
- Narrow margin of safety
- Increased risk of harm if an error should occur
- Generally recognized as problematic
High Alert Medications

- Heparin and argatroban* infusions
- Insulin infusions and U-500 insulin*
- Neuromuscular blocking agents (e.g., succinylcholine, vecuronium, rocuronium, etc.)
- Cytotoxic chemotherapy agents
- Concentrated electrolytes (sodium injection >0.9%; potassium injection >0.4mEq/mL)
- Magnesium sulfate infusions (>100 mL)
- Alteplase (Activase) and tenecteplase (TNKase)*
- Vinca alkaloids (vinCRISTine, vinBLASTine, vinorelbine)
- Bortezomib (Velcade) injection*
- Parenteral nutrition solutions (TPN, PPN)*
High Alert Medications

- Epoprostenol (Flolan)*
- All opiate infusions (including PCA)
- Epinephrine, isoproterenol, norepinephrine and phenylephrine* infusions
- Medications administered via intrathecal route
- Medications administered via epidural route
- Neonates: all doses of IV and oral medications (except for oral doses of vitamins and/or iron)
- Pediatrics: all adult HAMP drugs; all medications used for procedural sedation except when administered by anesthesia provider; all IV medications in critical care areas (including ED); and digoxin (all routes)
Standardized Concentrations

- Heparin 100 units/mL
- Insulin 1 unit/mL
- Magnesium sulfate 40 mg/mL
- Epinephrine 8 mcg/mL
- Norepinephrine 16 mcg/mL
- Isoproterenol 4 mcg/mL
- Morphine sulfate 1 mg/mL
- Meperidine 10 mg/mL
- Hydromorphone 0.2 mg/mL
Independent Double Check

“A procedure in which two authorized, qualified practitioners will separately check each component of the work process. For example, one person calculating a medication dose for a specific patient and a second individual independently performing the same calculation (not just verifying the calculation) and matching the results. A pharmacist will be consulted in the event that agreement cannot be reached.”
Independent double checks: undervalued and misused

Selective use of this strategy can play an important role in medication safety

A manual independent double check of high-alert medications is a strategy that has been widely promoted in healthcare to help detect potentially harmful errors before they reach patients.¹⁻³ However, independent double checks used as a risk-reduction strategy have long been disputed as well as misused in healthcare. Its use has been a source of stress for busy prescribers, pharmacists, and nurses who are short on time. Its impact on safety has check must be conducted independently by a second person⁵⁻⁷⁻¹⁰ to reduce the risk of bias that occurs when the person preparing and checking the medication is likely to see what they expect to see, even if an error has occurred. An independent double check requires two people to separately check each component of the work process. For example, a pharmacist calculates a dose, prepares a syringe of medication, and compares the product to the order; then, a
Independent Double Checks

- Five “rights”
- IV pump settings
- Volume standardization
- Label accuracy
- IV tubing connections
- Site of line insertion
A Culture of Safety

- Awareness, understanding, and ownership of medication safety at all levels of the organization
- Mindset of constant vigilance and situational awareness to prevent medication errors
- Emphasis on identification of system faults and latent errors
- A “just culture” where individuals are treated fairly when errors occur

Adopted from Spath
Barriers

- Crisis management
- Short time-line
- Complex program
- Need for physician, staff and labor partner engagement
- Multiple facilities covering a large geographical area
Close Calls

High Alert Medication RRFs - Near Miss - Jan 2005 - Jun 2013

- RRFs: UCL = 33.86, Mean = 20.33, LCL = 6.81 (1 - 12)
- Apr 06 - Jan 07: UCL = 18.30, Mean = 9.20, LCL = 0.10 (16 - 25)
- Feb 07 - Sep 07: UCL = 13.95, Mean = 6.38, LCL = none (26 - 33)
- Jul 09 - Jan 10: UCL = 5.17, Mean = 1.50, LCL = none (55 - 62)

93% decrease from 1st mean to 4th mean
Patient Harm

91% decrease from 1st mean to 4th mean
Key Success Factors

• Leadership support
• Regional coordination and oversight by the Regional Medication Safety Committee
• Involvement of labor partners, medical group and staff from all levels of the organization
• Standardized procedures, high alert medication list, order sets and protocols
• Program sustaining activities such as monthly medication safety calls, staff education and testing for competency, monthly observation audits and coaching
• Notification and investigation of all HAMP errors, data analysis and reporting
• Comprehensive approach – CPOE, BCMA, “Smart” infusion pumps, KP MedRite program, Nurse Knowledge Exchange
Sustainability – The Future

• Thinking and attitudes change with the process and outcome over time
• The systems surrounding the changes become an integrated or mainstream process
Sustainability Tools

- Actionable measurement (process audits)
- Standardized ongoing competencies
- Intensive analysis of events to identify trends
- Continue work to support a “Just Culture”
- Identify and control drift and workarounds
- Ongoing review of the HAMP policy
- Share experiences internally and externally
  - Interregional HAMP assessment
  - Webinar sharing conferences
  - “Docushare” intranet site for policies and tools
  - HAMP collaborative calls
  - HAMP presentations both within and outside KP
Do Not Try This At Home

- Wait for a disaster to occur
- Take a narrow approach
- Leave the staff or patient out of the solution
- Fail to plan for sustainability and control “drift”
- “Set it and forget it”
Hospitals Tackle High-Risk Drugs To Reduce Errors

March 5, 2008; Page D1

Hospitals are taking steps to prevent errors in the use of so-called high-alert medications -- those that, when given in the wrong dose or used incorrectly, have the highest risk of seriously harming or even killing a patient.

Many of the high-alert medications are the most essential to hospitals. Among them are drugs to prevent blood clots, sedate patients, relieve pain and stabilize diabetics. But incorrect use of these drugs can lead to disasters, such as the accidental overdoses of heparin, an anticlotting drug, that killed three infants at an Indiana hospital in 2006 and threatened the newborn twins of actor Dennis Quaid this past November.
## 2012 NCAL HAMP Errors

<table>
<thead>
<tr>
<th>Top Drugs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heparin</td>
<td>117</td>
</tr>
<tr>
<td>hydromorPHONE</td>
<td>34</td>
</tr>
<tr>
<td>TPN/PPN Per Protocol</td>
<td>25</td>
</tr>
<tr>
<td>Morphine</td>
<td>19</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>17</td>
</tr>
<tr>
<td>Insulin</td>
<td>13</td>
</tr>
</tbody>
</table>
Heparin Infusion Errors

Regional Heparin HAMP RRFs, Jan 2009 - Dec 2011

$\mu$ chart
Temporary: UCL = 14.68, Mean = 6.83, LCL = none

Privileged and Confidential
Heparin Infusion Error Rate

Heparin Infusion-Related Medication Error Rate
# of errors/# of heparin infusions administered
Jan 2011 - Apr 2012

Rate


NCAL  SCAL
Heparin Infusion Error Types

Heparin Infusion Error Types
NCAL vs. SCAL Jan 2011-Apr 2012

- Administration
- Monitoring
- Prescribing
- Order communication
- Dispensing
- Compounding
- Product labeling

Number of Errors

NCAL
SCAL
# Cardiac Heparin Nomogram

## Cardiac Heparin Protocol

### UFH (Unfractionated Heparin) Infusion

Dosing Nomogram Based on Anti-Xa Results

**NOTE:** Obtain Anti-Factor Xa assay 6 hours after initiating infusion.

<table>
<thead>
<tr>
<th>Anti-Xa Results (units/mL)</th>
<th>Bolus dose (units)</th>
<th>Hold Infusion (minutes)</th>
<th>Rate Change (units/hour)</th>
<th>Repeat Anti-Xa assay (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to 0.1</td>
<td>3,000 units</td>
<td>No</td>
<td>Increase by 100 units/hour</td>
<td>6 hours</td>
</tr>
<tr>
<td>0.11-0.4 (Target Range)</td>
<td>None</td>
<td>No</td>
<td>None</td>
<td>6 hours one time, then every AM while on heparin IV infusion</td>
</tr>
<tr>
<td>0.41-0.8</td>
<td>None</td>
<td>No</td>
<td>Decrease by 50 units/hour</td>
<td>6 hours</td>
</tr>
<tr>
<td>0.81-0.92</td>
<td>None</td>
<td>*30 minutes</td>
<td>Decrease by 100 units/hour</td>
<td>6 hours</td>
</tr>
<tr>
<td>0.93-1.4</td>
<td>None</td>
<td>60 minutes</td>
<td>Decrease by 150 units/hour</td>
<td>6 hours</td>
</tr>
<tr>
<td>Greater than 1.4</td>
<td>None</td>
<td>60 minutes</td>
<td>Decrease by 300 units/hour</td>
<td>• STAT Anti-Xa in 2 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Call Attending Physician with 2 hours Anti-Xa result</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Repeat Anti-Xa in 6 hours or per Physician order</td>
</tr>
</tbody>
</table>

* For Anti-Xa results obtained less than 12 hours after initiation of TNKase, do NOT discontinue or decrease infusion unless significant bleeding or anti-Xa greater than 0.92 units/mL.
Phase 1 - Initial pharmacy involvement

- Protocol with dosage algorithm managed by RN with pharmacist available for consultation

Phase 2 - Increased collaboration and communication

- RN calls pharmacy with every anti-Xa level to discuss dosage adjustments using algorithm

Phase 3 – Proactive Pharmacy Consultation

- Pharmacy monitors anti-Xa levels and calls RN to discuss dosage and rate changes
Medical Center Heparin Pilot

IV Heparin Dosing Adjustment

- % correct initial boluses administered
- % correct adjustment boluses based upon anti-Xa result
- % correct infusion adjustments based upon anti-Xa result
Initial Heparin Bolus

% Correct Heparin Initial Bolus

Goal 90%

Mean 96

Mean 78

% Compliance

Pharmacy Full Oversight

Pharmacy Partial Oversight

RN Draw Anti Xa

RN Deliver specimen to Lab

<table>
<thead>
<tr>
<th></th>
<th>Feb-10</th>
<th>Mar-10</th>
<th>Apr-10</th>
<th>May-10</th>
<th>Jun-10</th>
<th>Jul-10</th>
<th>Aug-10</th>
<th>Sep-10</th>
<th>Oct-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Bolus</td>
<td>67%</td>
<td>91%</td>
<td>75%</td>
<td>83%</td>
<td>78%</td>
<td>100%</td>
<td>91%</td>
<td>100%</td>
<td>93%</td>
</tr>
<tr>
<td>Num</td>
<td>2</td>
<td>10</td>
<td>3</td>
<td>10</td>
<td>7</td>
<td>11</td>
<td>10</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Den</td>
<td>3</td>
<td>11</td>
<td>4</td>
<td>12</td>
<td>9</td>
<td>11</td>
<td>11</td>
<td>16</td>
<td>15</td>
</tr>
</tbody>
</table>
Heparin Adjustment Bolus

% Correct Heparin Adjustment Bolus

Goal 90%

<table>
<thead>
<tr>
<th>Date</th>
<th>% Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb-10</td>
<td>100%</td>
</tr>
<tr>
<td>Mar-10</td>
<td>100%</td>
</tr>
<tr>
<td>Apr-10</td>
<td>n/a</td>
</tr>
<tr>
<td>May-10</td>
<td>86%</td>
</tr>
<tr>
<td>Jun-10</td>
<td>93%</td>
</tr>
<tr>
<td>Jul-10</td>
<td>100%</td>
</tr>
<tr>
<td>Aug-10</td>
<td>100%</td>
</tr>
<tr>
<td>Sep-10</td>
<td>100%</td>
</tr>
<tr>
<td>Oct-10</td>
<td>100%</td>
</tr>
</tbody>
</table>

Legend:
- Adj Bolus
- Num
- Dan

Mean: 86%

No Patient needing Adj Bolus in April
Heparin Infusion Adjustment

% Correct Heparin Infusion Adjustment

Goal 90%

<table>
<thead>
<tr>
<th>Month</th>
<th>Feb-10</th>
<th>Mar-10</th>
<th>Apr-10</th>
<th>May-10</th>
<th>Jun-10</th>
<th>Jul-10</th>
<th>Aug-10</th>
<th>Sep-10</th>
<th>Oct-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infusion Adj</td>
<td>97%</td>
<td>88%</td>
<td>99%</td>
<td>89%</td>
<td>96%</td>
<td>94%</td>
<td>97%</td>
<td>100%</td>
<td>98%</td>
</tr>
<tr>
<td>Norm</td>
<td>29</td>
<td>28</td>
<td>77</td>
<td>42</td>
<td>47</td>
<td>47</td>
<td>94</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Dan</td>
<td>30</td>
<td>41</td>
<td>78</td>
<td>47</td>
<td>49</td>
<td>50</td>
<td>97</td>
<td>120</td>
<td>122</td>
</tr>
</tbody>
</table>
July 2012
- Education for the ancillary departments (pharmacy, nursing, lab) and physicians

September 2012
- “Heparin per Pharmacy” protocol – Pharmacist monitors heparin therapy, orders lab tests and places orders for dosage and rate adjustments
- New Epic tools for staff including heparin order set, patient lists, anticoagulant flow sheet, heparin accordion report, clinical in-basket messaging for labs
- Placeholder established in all IV heparin order sets
Protocol Evaluation

• For Cardiac and Non-Cardiac Protocols reviewed
  ▪ % patients therapeutic after 1st Anti-Xa level
  ▪ % of patients therapeutic after 24 hours
  ▪ Average # of adjustments to therapeutic level (includes first bolus/initial rate)
## Comparison to SCAL Protocol

### 2011 IV Heparin Improvement Project

<table>
<thead>
<tr>
<th>Protocol Description</th>
<th>% Therapeutic within 1st Anti-Xa</th>
<th>% Therapeutic within 24 Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCAL Pharmacy Protocol (Range 0.3 – 0.7) N = 985</td>
<td>46%</td>
<td>66%</td>
</tr>
<tr>
<td>NCAL Nursing Protocol (Range 0.3 – 0.7) N = 778</td>
<td>41%</td>
<td>56%</td>
</tr>
</tbody>
</table>

### 2012 IV Heparin Improvement Project

**October – December 2012 (N = 829)**

<table>
<thead>
<tr>
<th>Protocol Description</th>
<th>% Therapeutic</th>
<th>% Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCAL Pharmacy Non-Cardiac Protocol (Range 0.3 – 0.7)</td>
<td>49%</td>
<td>78%</td>
</tr>
<tr>
<td>NCAL Pharmacy Cardiac Protocol (Range 0.11 – 0.4)</td>
<td>48%</td>
<td>82%</td>
</tr>
</tbody>
</table>
## Heparin Events

### 2012-2013 NCAL IV Heparin Events

<table>
<thead>
<tr>
<th>Month</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Feb</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Mar</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Apr</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>May</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Jun</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Jul</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Aug</td>
<td>9</td>
<td></td>
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<tr>
<td>Sep</td>
<td>11</td>
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<tr>
<td>Oct</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Nov</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Dec</td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

### Graph

The graph shows the number of heparin events in 2012 compared to 2013 for each month from January to December.
Next Steps

• Perioperative heparin workflow
• Improvement of Anti-Xa turn around time
  ▪ Standardize lab draw and lab delivery workflows
• Evaluation of robustness of cardiac and non-cardiac nomograms
  ▪ Weight based protocol?
• Review nomenclature of heparin protocols
• Standardization of the SCAL heparin protocol
• Leverage NCAL and SCAL practices to improve workflows
Barriers

• The “silo” effect
• Resource allocation
• Competencies and training
• Workflow changes
Questions?

Nicholas Kostek, RPh, MS
Regional Pharmacy Quality and Patient Safety
Kaiser Permanente, Northern California
(510) 625-3715
nicholas.e.kostek@kp.org