Medication Errors:
What You Cannot Afford to Ignore in the Perioperative Setting

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Institute for Safe Medication Practices Canada (ISMP Canada) is an independent not-for-profit organization dedicated to reducing preventable harm from medications.

Our goal is the creation of safe and reliable systems for managing medications in all environments.
Presentation Goals

• Increase awareness of the potential for medication incidents and reasons why they occur.

• To provide learnings from incidents
  • the inadvertent injection of epinephrine for topical use – review strategies to reduce the likelihood of error.
Preventable medical mistakes cause more deaths per year than car accidents, breast cancer or AIDS

Deaths per Year

- Preventable Medical Mistakes: 98,000
- Car Accidents: 43,458
- Breast Cancer: 42,297
- AIDS: 16,516

Source: The Institute of Medicine: To Err is Human: Building a safer health system, 1999. Additional estimates from the Centres for Disease Control and Prevention, National Vital Statistics Reports Vol. 47 No. 25
MAJOR CAUSES OF DEATH IN THE UNITED STATES:

- AIDS
- Breast Cancer
- Vehicular Accidents

Oops!
How Safe Is Health Care in Canada?

The Canadian Adverse Events Study

- 7.5% of patients in Canadian hospitals are harmed by their care (1 in 13)
- 9,250 to 23,750 people die in Canadian hospitals every year as a result of adverse events
- 37% of adverse events were determined to be preventable

Baker et al. CMAJ. 2004; 1780(11): 1678-1686
What if Other Industries had 99.9% Accuracy?

- 2 unsafe landings at O’Hare Airport per day
- 16,000 pieces of mail lost/ day
- 32,000 bank cheques deducted from the wrong account each HOUR!
- 50 babies dropped at birth everyday in the U.S.

(Deming, 1987)
Context: Risky Activities

Adapted by Dr. Philip Hébert

“Acceptable public risk”

<table>
<thead>
<tr>
<th>Number of encounters for each fatality</th>
<th>Total Lives Lost per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dangerous (&gt;1/1000)</td>
<td></td>
</tr>
<tr>
<td>Regulated</td>
<td></td>
</tr>
<tr>
<td>Ultra-safe (&lt;1/100K)</td>
<td></td>
</tr>
</tbody>
</table>
Context: Risky Activities
Adapted by Dr. Philip Hébert

Number of encounters for each fatality

- Dangerous (>1/1000)
- Regulated
- Ultra-safe (<1/100K)

Total Lives Lost per year

Driving
Offshore rig
Coal Mining
Timber
Rock Climbing for 25 hrs
Firearms
Commercial airlines

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Context: Risky Activities

Adapted by Dr. Philip Hébert

15,000 deaths/yr

<table>
<thead>
<tr>
<th>Dangerous (≥1/1000)</th>
<th>Regulated</th>
<th>Ultra-safe (&lt;1/100K)</th>
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</thead>
<tbody>
<tr>
<td>Hospitalization</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Lives Lost per year

Number of encounters for each fatality
• Risk of hospitalization in part due to the illness or injury that brought the patient to the hospital; interventions can be life-saving

• Relevant comparison would be against those that do not come to the hospital

e.g., the risk of hospitalization is small compared to the close to certain risk of death with bacterial meningitis or a ruptured viscus
Errors Reported
(3-6%)

Errors NOT Reported
Blaming Practitioners vs. System Failure

“People working in health care are among the most educated and dedicated workforce in any industry. The problem is not bad people; the problem is that the system needs to be made safer.”

To Err is Human: Building a Safer Health System, IOM Report 1999
Swiss Cheese Model

Barriers & Safeguards against Errors

- Poorly Designed Order Forms
- Poorly Designed Drug Packaging
- Poorly Designed Storage facility
- Inadequate Training and Skills Mix
- Multiple Demands on Attention
- Poor Lighting

Patient receives wrong drug

Latent Failures

(modified from James Reason, 1991)
IT SAYS HERE THAT THE RATE OF MEDICAL ERRORS IS STUNNINGLY HIGH.

THAT EXPLAINS MY HYSTERECTOMY.
Solutions for Change

“Just telling doctors and nurses to be more careful won’t do much. We need to change the systems that allow errors to happen.”

James Bagian: anesthesiologist, former space shuttle astronaut who was involved in the analysis of the Challenger explosion.

*Scientific America May 2000 News and Analysis : Medicine*
The Person Approach

"You weren't listening. I said, 'Don't fall.'"
The Systems Approach

“...though we cannot change the human condition, we can change the conditions under which humans work”


BMJ, 320(7237): 768-770. Retrieved from: 
http://www.bmj.com/cgi/content/full/320/7237/768
Humans have limitations that impact on performance ...
What is Human Factors Engineering (HFE)?

• A discipline concerned with design of systems, tools, processes, machines that takes into account human capabilities, limitations, and characteristics.

• Human factors engineers work to make the environment function in a way that seems natural to people.
Human Factors Engineering (HFE)
Everyday Human Factors Problems

www.baddesigns.com
Reality of Health Care Environments

- Cognitive overload
- Workloads
- Multitasking
- Interruptions
- Miscommunication
- Difficult technology
Figure 1. Link analysis for RN #1
<table>
<thead>
<tr>
<th>Interruption</th>
<th>Time</th>
<th>Description of interruption</th>
<th>Location</th>
<th>Type</th>
<th>Nursing process</th>
<th>Cognitive stacking measure: # activities</th>
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</thead>
<tbody>
<tr>
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<td>Unit Clerk inquiry</td>
<td>Nurses desk</td>
<td>Delay</td>
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<td>2</td>
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<td>Paged</td>
<td>Patient room</td>
<td>Disrupt direct</td>
<td>Intervention</td>
<td>10</td>
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<td>Intervention</td>
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<td>19</td>
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<td>Intervention</td>
<td>18</td>
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<td>18</td>
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<td>Delay</td>
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<td>8</td>
<td>1010</td>
<td>Responds to patient call out</td>
<td>Hallway</td>
<td>Delay</td>
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<td>17</td>
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<tr>
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<td>1014</td>
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<td>Patient room</td>
<td>Delay</td>
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<td>17</td>
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<tr>
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<td>1021</td>
<td>Unit Clerk report</td>
<td>Nurses desk</td>
<td>Disrupt direct</td>
<td>Planning</td>
<td>17</td>
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<tr>
<td>11</td>
<td>1104</td>
<td>MD inquiry</td>
<td>Nurses desk</td>
<td>Disrupt direct</td>
<td>Planning</td>
<td>19</td>
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<td>1105</td>
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<tr>
<td>16</td>
<td>1451</td>
<td>Unit Clerk report</td>
<td>Nurses station</td>
<td>Delay</td>
<td>N/A</td>
<td>11</td>
</tr>
</tbody>
</table>
Don't you just hate it when you walk into a room and forget what you came in for?
Confirmation Bias

It leads one to “see” information that confirms our expectation rather than to see information that contradicts our expectation.
HINT: “A”
Hint: “12”
RUN 0.5 ML/H
Verbal Miscommunications

- Take off power
  - ? discontinue power ?
  - ? take off and increase to full power ?
Verbal Miscommunication

- Fentanyl drip ‘5200 micrograms per hour’
  - Nurse read back telephone order several times and received confirmation
  - Pharmacy called to clarify

- Intended was fentanyl drip 50 to 100 mcg per hour.”

Verbal Miscommunication

• Surgeon orders “heparin 10,000 units” to be administered during carotid endarterectomy.

• Anesthesiologist administers “heparin 2,000 units”

• What occurred?

Cutting errors out of the operating room.
ISMP Medication Safety Alert; March 6, 2002;6(5):1.
Verbal Miscommunication

- Communication through mask
  - Requires clear pronunciation
  - Certain words can be misheard / similar sound
    - ten can sound like a two
    - Also other examples: fifteen can sound like fifty, sixteen can sound like sixty, etc...

- Distraction - anesthesiologist teaching resident ECG monitoring machine
The power of the human mind

According to a research at Cambridge University, it doesn't matter in what order the letters in a word are. The only important thing is that the first and last letter be at the right place. The rest can be a total mess and you can still read it without problem. This is because the human mind does not read every letter by itself, but the word as a whole. Amazing huh?
Canada:
3 reports
2 hospital
1 ambulance

US:
several reports
1 death
Additional Differentiation:
Let’s test our attention and memory
Blue

Green

Red
Green

Red

Blue
Green

Blue

Red
Video
How many passes?

15

16

17

18

19
Did you notice anything else????
Given that there are problems in our systems leading to increased risk of errors, how can understanding human factors help us to make changes?
Hierarchy of Effectiveness (Summary)

1. Forcing functions and constraints
2. Automation / computerization
3. Simplification / standardization / differentiation
4. Reminders, checklists, double checks
5. Rules and policies
6. Education & information
Forcing Functions and Constraints
Automation and Computerization

Physician Order Entry/Pharmacist Clinical Order Screening

Electronic MAR and To Do List

Just-In-Time Inventory

Smart Drawer Opens

or, automated med/supply depot door or drawer

Scan Medication

Scan Patient’s Wristband

Care must be taken to ensure processes are accurate and working well before automating!
Simplify and Standardize

Baseline Code Cart Drawer
Range 2.43 to 3.58 min, Average 3.07 min
Code Cart Drawer 5th Version
Range 0.55 sec to 1.25 min, Average 1.08 min

McLaughlin R. Redesigning the crash cart. AJN 2003; 103(4): 64A-E.
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Simplify: An international example of a transferable label

Photos from Miriam Klein, B.S., Pharm.D. presentation “TURNING A PERSONAL TRAGEDY INTO A PASSION: DESIGN A SAFER LABELING SYSTEM FOR HIGH-RISK INJECTABLE MEDICATIONS, ASHP 2007. Meriam provides this as an example of a transferable label in Germany for sufentanil, manufacturer ratiopharm. (At time of presentation in Dr. Meriam Klein Medication Safety Fellow at Kingsbrook Jewish Medical Center, Brooklyn, NY.)
Differentiation Strategies

TALLman lettering for look-alike, sound-alike medication names (e.g.,):

DOPamine
DOBUTamine

Differentiation of Labelling and Packaging…
Differentiation Strategies

Labelling and Packaging (e.g., neuromuscular blocking agents)
Differentiation Strategies
Canadian Anesthesiologists’ Society Survey

Factors contributing to errors

- Syringe swap 60%
- Did not read label 53%
- Misidentification of ampoule or vial 39%

Features used to identify drugs

- 51% color of text, label, ampoule, etc.
- 27% not one feature (“like a face”)
- 7.5% drug name
“...medication errors in surgical setting are more likely to lead to patient harm than those that take place outside surgical settings.”

Safety in the Operating Room. 2006.
The Joint Commission, p33.
High Reliability Organizations

E.g., aviation, nuclear power

• Collective preoccupation with the possibility of failure

• Expect to make errors and train their workforce to recognize and recover from them

• Continually rehearse familiar scenarios of failure
High-Alert Medications

Examples:

- Parenteral narcotics
- Conscious sedation
- Neuromuscular blocking agents
- Adrenergics
- Insulin
- Concentrated electrolytes (potassium, magnesium, phosphate)

Full list of high-alert medications available from www.ismp.org/MSAarticles/highalert
What Can Perioperative Nurses Do?
“We have created systems that depend on idealized standards of behaviour that require individual physicians, nurses and pharmacists to perform tasks at levels of perfection that cannot be achieved by human beings.”

What Can Perioperative Nurses Do?

• Learn from past incidents (internal and external)
• Report potential hazards
• Report incidents and near misses
  • Consider Human Factors Engineering principles when suggesting changes

....Create a learning environment
What Can Perioperative Nurses Do?

Culture change:

• System focused vs person focused
  • Utilize concepts from Human Factors Engineering (e.g.,):
    • reliance on memory and sustained attention
    • consider strategies when developing or reviewing processes, when evaluating equipment and other purchases
Culture of Safety

- Anticipate mistakes will be made – achieving high reliability is not about if but when.
  - Prevention strategies
  - Design for recovery

- Promote effective team functioning and communication
  - Consider how you are incorporating communication of high-alert medications into the Surgical Safety Checklist (SSCL) process
What Can Perioperative Nurses Do?

- Repeat back / read back of orders
  - “fifteen, one five milligrams”
  - “ten thousand, one zero thousand units”

- Encourage patient involvement (e.g.,):
  - Current medications and dose, ? last dose ?
  - Use of two unique patient identifiers
What Can Perioperative Nurses Do?

• Consider that it is not just about double checking and labelling every medication / fluid for the sterile field BUT also how this is done
  • unbiased verification
  • process for each medication / fluid – ? one at a time ?
  • how separate are the processes from eachother (person, place and time)
Trust your intuition!

• if it doesn’t feel right, it probably isn’t
What Can Perioperative Nurses Do?

“Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”

Margaret Mead
(as quoted by Helvarg, 1995)
OR – Unique Environment and Risks

- Transition point - many patients
- Medications removed from original containers
- Medications required on the sterile field
  - labels required
- Medications may be routinely prepared prior to surgery
  - prior to communication with surgeon and/or anesthesiologist
- Change of nursing staff (break, shift change) and communication of medications (e.g. back table)
Operating Room Medication Safety

- Supported by the Ontario Ministry of Health and Long-Term Care

The Project:

1. To provide the ISMP Canada *Operating Room Medication Safety Checklist* Program to Ontario hospitals

2. To prevent the inadvertent injection (infiltration) of concentrated epinephrine intended for topical use
Overview of Concentrated Epinephrine Project

• In Ontario, ISMP Canada’s goals:
  • To collaboratively develop a targeted intervention strategy for the prevention of inadvertent injection of concentrated epinephrine 1 mg/mL intended for topical use.
  • Disseminate and support intervention across the province.
Reports of harm and death: Canadian Incidents

The practice of withdrawing a medication intended for topical use into a parenteral syringe poses a risk for a substitution error and/or inadvertent injection. All
• All medications and solutions removed from their original packaging and placed onto the sterile field must be clearly labelled.

• Careful review and attention of high-alert medications that are to be placed on the sterile field
  
  • E.g., epinephrine 1 mg/mL for topical application and local with dilute epinephrine (e.g., 0.01 mg/mL, 0.005 mg/mL)
The American Academy of Otolaryngology - Head and Neck Surgery

68.9% of respondents to a survey of members were concerned about a potential mix-up in the administration of concentrated epinephrine during surgery.


“An otherwise healthy adult male sustained a bicycle accident resulting in a nasal fracture....rather than lidocaine with epinephrine, the surgeon injected 4 mL of 1:1000 epinephrine....Despite several hours of aggressive measures to stabilize the patient’s condition, the patient expired.”
• A physician’s story
To view the alert or the video from the Food and Drug Administration, visit FDA website. Also available from ISMP Canada website:

http://www.ismp-canada.org/download/FDA_Topical_Epinephrine_200909.wmv
Surgical Safety Checklist

• How are medications for the sterile field incorporated into the surgical safety checklist?

• Any concerns that need mention regarding procedure specific medications?
  • High-alert medications?
  • Medications and/or fluids to be administered by different routes (e.g., topical versus injectable)?
<table>
<thead>
<tr>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Currently on any infusions</td>
</tr>
<tr>
<td>- Currently on anticoagulant therapy</td>
</tr>
<tr>
<td>- Procedure specific meds to be considered</td>
</tr>
</tbody>
</table>
Long Term Strategies: Learning Added to Safety Tools

- Concentrated Potassium Chloride Project
- Narcotic Project
- Anticoagulant Project
Operating Room Medication Safety Checklist Program

• Complements the Surgical Safety Checklist
  • Every 1 to 2 years
• Developed in collaboration with ORNAC and CAS
• Supported by MOHLTC
• Web-based assessment program available free to Ontario hospitals
Operating Room Medication Safety Checklist Program

- Version 2 - incorporates learnings from the most recent error related to epinephrine for topical use
- A Failure Mode and Effects Analysis (FMEA) is being conducted in collaboration with a hospital and human factors engineer to identify system safeguards
- In progress - discussions with manufacturers regarding the product labeling and packaging
“A smart man learns from his own mistakes….a wise man learns from the mistakes of others.”

Chesley B. "Sully" Sullenberger
“Miracle on the Hudson”
Report Medication Incidents

www.ismp-canada.org
416-733-3131
1-866-544-7672
(1-866-54 ISMPC)

ISMP Canada is a key partner in the Canadian Medication Incident Reporting and Prevention System (CMIRPS)
“Technically the biggest ‘safety system’ in healthcare is the minds and hearts of the workers who keep intercepting the flaws in the system and prevent patients from being hurt. They are the safety net, not the cause of injury”.

Don Berwick in To Err is Human: Building a Safer Health System