Medication Safety: Lessons Learned

CINA 30th Anniversary Conference

October 20th, 2005
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Medication Safety: Lessons Learned

- ISMP Canada
- Research Highlights
- Making Health Care Safer: Key Steps
ISMP CANADA

- Independent nonprofit national organization
- Founded in 1999 with assistance from ISMP US and Board of Directors
- Established for:
  - collection and analysis of medication error reports
  - development of recommendations for the enhancement of patient safety.
Collection of Reports

• To date, we have collected 11,687 medication incidents in our database.

• Voluntary reporting
  ■ Errors, near-misses and hazardous situations confidential
  ■ non-punitive
  ■ Front-line practitioners provide detailed, unrestricted information on incidents
How Error Reports are received:

1. website: www.ismp-canada.org;
2. e-mail: info@ismp-canada.org;

*ISMP Canada guarantees confidentiality and security of information received. ISMP Canada respects the wishes of the reporter as to the level of detail to be included in publications.*
How Error Reports are received:

4.

Supported by MOHLTC for facilities in Ontario
ISMP Canada Programs cont’d

- Analyze-Err
- Medication Safety Support Service
  - Potassium Chloride
  - Narcotics
- Medication Safety Self-Assessment
- Fellowship program- new
- Education/ Presentations
Analysis and Recommendations

- Supported by Canadian Medication Incident and Reporting and Prevention System (CMIRPS)
- Collaborative between Health Canada, Canadian Institute for Health Information (CIHI) and ISMP Canada
- 12 per year
Distribution supported by MOHLTC
Other Initiatives:

- Journal publications on medication safety
  - *CMAJ, CACCN, CHSP*
- *Hospital News* - monthly article
- Collaborations:
  - organizations, associations, pharmaceutical, manufacturers, provincial and federal governments
Relationships Between Med Errors, Potential ADEs and ADEs

- Medication Errors
- Non-Preventable ADEs (ADRs)
- Pot ADEs
- Preventable ADEs
Hospital medical errors kill 44,000-98,000 people per year:

“More people die from medical errors each year than from suicides, highway accidents, breast cancer, or AIDS.”

“These stunningly high rates of medical errors - resulting in deaths, permanent disability, and unnecessary suffering - are simply unacceptable in a system that promises to first ‘do no harm’.”

William Richardson
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

Comparisons to Other Industries:

What if we had 99.9% Accuracy?

- 2 unsafe landings at O’Hare Airport/ day
- 16,000 pieces of mail lost/ day
- 32,000 bank cheques deducted from the wrong account each HOUR!

(Deming, 1987)
One specialist says:
‘The pen and prescription pad are killing people’
## Incidence From Other Chart Review Studies

<table>
<thead>
<tr>
<th>Country</th>
<th>N Charts</th>
<th>Year</th>
<th>Incidence of AE</th>
<th>Preventable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>14,000</td>
<td>1995</td>
<td>16.6%</td>
<td>51%</td>
</tr>
<tr>
<td>USA (Utah &amp; Colorado)</td>
<td>15,000</td>
<td>1999</td>
<td>2.9%</td>
<td>--</td>
</tr>
<tr>
<td>England</td>
<td>1014</td>
<td>2001</td>
<td>11.7%</td>
<td>50%</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1326</td>
<td>2001</td>
<td>10.7%</td>
<td>71.8%</td>
</tr>
<tr>
<td>Denmark</td>
<td>1097</td>
<td>2001</td>
<td>9.0%</td>
<td>40.4%</td>
</tr>
</tbody>
</table>
Wrong injection causes death

LIBRARY OF ERRORS

1. Inadequate training of health care professionals
2. Medication error caused by incorrect dosage or route of administration
3. Failure to monitor patient response to medication
4. Use of outdated or incorrect medical references
5. Lack of communication among healthcare providers

In 1999, the Institute for Safe Medication Practices Canada (ISMP) reported that

Hospital errors hidden for too long, critics say

The Institute for Safe Medication Practices Canada (ISMP) has identified over

Mistakes That Kill

THE BOTTOM LINE

Besides their harmful effects on patient health, medical errors are expensive. While Canadian data are hard to come by, U.S. studies from the late 1990s calculate costs (in Canadian dollars) to that health system:

- Patients suffering adverse reactions to drugs stayed an additional 2.2 days in hospital with an increased cost of $4,866 per patient
- Total annual health-care costs for preventable adverse effects: $31 billion

Injection death second in 3 years

In 1999, Ontario’s health care system was shaken when a 61-year-old woman died

Unintended thousands of Canadians die each year because of avoidable medical errors. A program is just beginning to monitor the errors and eliminate the causes.

After wrong drug used, patient dies from narcotic administered by mistake

“A dramatically lower number of patient deaths were reported to the ISMP in 2000,” said Jennifer Quinn, a senior analyst at the Institute. “This is encouraging news, but we must continue to work towards reducing medical errors.”

In the years since, the ISMP has continued to

STORING MEDICINE THAT KILLS

Drugs with potassium chloride are the leading cause of death among inpatients. In 1999, the ISMP reported that 87

Canada’s weekly newsmagazine

Maclean’s

August 13, 2001

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Canadian Adverse Events Study


Adverse Event

“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.” (p.1679).
Canadian Results

- 7.5% (or 187,500) patients in Canadian hospitals were seriously harmed by their care.
- As many as 9,250 to 23,750 people died in a Canadian hospital as a result of medical errors.
- 37% of adverse events were determined to be preventable.
Related Adverse Events

#1 Surgical = 34.2%

#2 Medication and fluid-related = 23.6%
Other Canadian Studies

- Forster AJ et al. Ottawa Hospital Patient Safety Study: incidence and timing of adverse events in patients admitted to a Canadian teaching hospital. CMAJ 2004; 170(8): 1235

- Forster AJ et al. Adverse events among medical patients after discharge from hospital. CMAJ 2004; 170(3): 345

- Gurwitz JH et al. The incidence of adverse drug events in two large academic long-term care facilities. AMJ 2005; 118: 251-258
James Bagian, Anesthesiologist, space shuttle astronaut involved in the analysis of the Challenger explosion

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

Scientific America May 2000 New and analysis : Medicine
### Human Error Rates With Selected Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Rate of Human Error**</th>
</tr>
</thead>
<tbody>
<tr>
<td>General error of commission for example, misreading a label</td>
<td>3/1000</td>
</tr>
<tr>
<td>General error of omission in the absence of reminders</td>
<td>1/100</td>
</tr>
<tr>
<td>General error of omission when items are embedded in a procedure for example, cash card is returned from cash machine before money is dispensed</td>
<td>3/1000</td>
</tr>
<tr>
<td>Simple arithmetic errors with self checking but without repeating the calculation on another sheet of paper</td>
<td>3/100</td>
</tr>
<tr>
<td>Monitor or inspector fails to recognize an error</td>
<td>1/10</td>
</tr>
<tr>
<td>Staff on different shifts fail to check hardware condition unless required by checklist or written directive</td>
<td>1/10</td>
</tr>
<tr>
<td>General error rate given very high stress levels where dangerous activities are occurring rapidly</td>
<td>1/4</td>
</tr>
</tbody>
</table>

* Unless otherwise indicated, assumes the activities are performed under no undue time pressures or stress.

** (# of errors / # of opportunities for the error)

Swiss Cheese Model

Barriers & Safeguards against Errors

Patient receives wrong drug

Poorly Designed Order Forms

Multiple Demands on Attention

Inadequate Training and Skills Mix

Poor Lighting

Poorly Designed Storage facility

Poorly Designed Drug Packaging

Latent Failures

(modified from James Reason, 1991)
Making Health Care Safer

Key steps:

A. **Recognize** that improving safety is a **priority**
B. Improve the **reporting** of errors and near misses
C. Increase focus on **system changes**
D. Gain greater **knowledge** about safer systems – much already exists
E. **Leadership** is needed on all levels

G R Baker & P G Norton
A. Recognize that Improving Safety is a Priority

• National
  - CPSI: Safer Healthcare Now! – Medication reconciliation
  - Canadian Medication Incident Reporting and Prevention System (CMIRPS)
  - Canadian Council on Health Services Accreditation (CCHSA) include patient safety goals

• Provincial (MOHLTC)
  - ISMP Canada – Medication Safety Support Service (KCI, Opioids, next anticoagulants)
    - EMS / LTC / Community Pharmacy
  - Patients (OHA)
CCHSA Patient Safety Goals

**Culture**

**Goal 1:** Create a culture of safety within the organization

**Communication**

**Goal 2:** Improve the effectiveness and coordination among care/service providers and with the recipients of care/service across the continuum

**Medication Use**

**Goal 3:** Ensure the safe use of high risk medications

**Goal 4:** Ensure the safe administration of parenteral medications
B. Improve Reporting of Errors and Near Misses
## Incident Reports As Safety Measures

<table>
<thead>
<tr>
<th>Method</th>
<th>AE/1000 admissions</th>
</tr>
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<tbody>
<tr>
<td>Incident Reports</td>
<td>5</td>
</tr>
<tr>
<td>Retrospective Chart Review</td>
<td>30</td>
</tr>
<tr>
<td>Stimulated Voluntary Reports</td>
<td>30</td>
</tr>
<tr>
<td>Computer Flags</td>
<td>55</td>
</tr>
<tr>
<td>Daily chart review</td>
<td>85</td>
</tr>
<tr>
<td>Computer Flags and Daily review</td>
<td>130</td>
</tr>
</tbody>
</table>

Jha J Am Med Inf Assoc 1998;5:305
O'Neil Ann Int Med 1993;119:370
ISMP Canada Safety Bulletin

Volume 2, Issue 4

April, 2002

SENTINEL EVENT WITH STERILE WATER – LESSONS SHARED

Hospitals are urged to review their storage conditions and supply processes for selected sterile water preparations.

ISMP Canada has recently received an error report describing accidental intravenous infusion of sterile water, instead of the intended normal saline solution. Unfortunately, close to 600 mL

3. The one-litre Sterile Water for Injection product had been used as an alternate to other sterile water products (inhalation and irrigation solutions) as a result of previous back-orders with the sterile water products. This resulted in increased availability of the product in the hospital.
Canada: 3 reports
2 hospital
1 ambulance

US: several reports
1 death
C. Increase the Focus on System Changes
Typical Medication Error Response

“I should have read the label.”
“This has not happened before.”
“This is unlikely to happen again.”

Physician who reported a medication error
Culture Change

Need to dispel the belief that healthcare workers are or can be perfect
“High-alert medications are drugs that bear a heightened risk of causing significant harm when they are used in error.”

From the ISMP Medication Safety Alert!, October 16, 2003, Survey on high-alert medications - Differences between nursing and pharmacy perspectives revealed
Examples of High-Alert (Risk) Medications

- hypertonic IV solutions
- IV potassium (phosphate & chloride)
- all narcotic medications
- chemotherapeutic agents

- heparin & oral warfarin
- neuromuscular blocking agents
- insulin & oral hypoglycemics
- inotropic medication (e.g. digoxin)

www.ismp.org/msaarticles/highalert
Reality of Health Care Environments

- Cognitive overload
- Workloads
- Multitasking
- Interruptions
- Miscommunication
- Difficult technology
Figure 2. Cognitive pathway for RN #1

*8:10  *8:41

*Omission
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>
<td>1</td>
<td>0734</td>
<td>Unit Clerk inquiry</td>
<td>Nurses desk</td>
<td>Delay</td>
<td>N/A</td>
<td>5</td>
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<tr>
<td>2</td>
<td>0808</td>
<td>Paged</td>
<td>Patient room</td>
<td>Disrupt direct</td>
<td>Intervention</td>
<td>10</td>
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<tr>
<td>3</td>
<td>0852</td>
<td>RN inquiry</td>
<td>Nurses desk</td>
<td>Disrupt indirect</td>
<td>Intervention</td>
<td>18</td>
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<td>4</td>
<td>0853</td>
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<td>Nurses desk</td>
<td>Disrupt indirect</td>
<td>Intervention</td>
<td>19</td>
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<tr>
<td>5</td>
<td>0935</td>
<td>MD rounds</td>
<td>Patient room</td>
<td>Disrupt direct</td>
<td>Intervention</td>
<td>18</td>
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<td>6</td>
<td>0941</td>
<td>Paged</td>
<td>Patient room</td>
<td>Disrupt Indirect</td>
<td>Intervention</td>
<td>18</td>
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<td>7</td>
<td>0957</td>
<td>Answers phone</td>
<td>Patient room</td>
<td>Delay</td>
<td>N/A</td>
<td>17</td>
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<tr>
<td>8</td>
<td>1010</td>
<td>Responds to patient call out</td>
<td>Hallway</td>
<td>Delay</td>
<td>N/A</td>
<td>17</td>
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<tr>
<td>9</td>
<td>1014</td>
<td>Computer malfunction</td>
<td>Patient room</td>
<td>Delay</td>
<td>N/A</td>
<td>17</td>
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<tr>
<td>10</td>
<td>1021</td>
<td>Unit Clerk report</td>
<td>Nurses desk</td>
<td>Disrupt direct</td>
<td>Planning</td>
<td>17</td>
</tr>
<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>
</tr>
<tr>
<td>12</td>
<td>1105</td>
<td>Unit Clerk inquiry</td>
<td>Nurses desk</td>
<td>Delay</td>
<td>N/A</td>
<td>18</td>
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<tr>
<td>13</td>
<td>1239</td>
<td>Computer malfunction</td>
<td>Patient room</td>
<td>Delay</td>
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<td>14</td>
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<tr>
<td>14</td>
<td>1248</td>
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<td>Delay</td>
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<td>15</td>
<td>1359</td>
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<td>Hallway</td>
<td>Delay</td>
<td>N/A</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>
Confirmation Bias

It leads one to “see” information that confirms our expectation rather than to see information that contradict our expectation.
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 in 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?
60 Regular Insulin Now

L-thyroxine 0.1 mg P.O.

Dy 0.125 mg P.O. qid

Minipas 5 mg P.O. qid

Foley catheter. It's said.
Urine test & each meal & NOC
Metha. ul 25mg @ Hs.
Hydrocort. 25mg gid + tablet
Metrosig. 60cc + capsule
2 PKG
Urinalysis

Synthroid Long
RUN 0.5ML/H

D5W at 250cc/h IV
Medication Errors - a new way of thinking

- Who did it?  What allowed it?
- Punishment  Thank you!
- Errors are rare  Errors are everywhere
- Add more layers  Simplify/standardize
- Calculating error rates  No thresholds
D. Gain Greater Knowledge About Safer Systems
Human Factors Engineering

• Research and practical applications designed to improve the interface of humans with systems

• Develops practical design principles that account for the psychological and physical characteristics of people
Principles

• Reduce or eliminate the possibility of errors

• Make errors visible

• Minimize the consequences of errors
Rank Order of Error Reduction Strategies

1. Forcing functions and constraints
2. Automation and computerization
3. Simplify, standardize and differentiate
4. Reminders, check lists and double check systems
5. Rules and policies
6. Education
7. Information
8. Punishment (no value)
Applying Error Reduction Strategies

1. Forcing functions and constraints
Man’s death after drug error to be probed

Red Deer man died from wrong narcotic horse-riding accident

from a drug mix-up in Alberta this year.

The man, who was brought in by ambulance but was in stable condition, was X-rayed and observed in the hospital’s emergency room for a few hours. Before being discharged, he was prescribed 10 milligrams of morphine for pain.

However, a nurse instead injected him with 10 milligrams of hydromorphone — an amount considered an overdose. The medication is a highly concentrated narcotic that can slow breathing and is normally used in palliative care.

“The two drugs have a similar name, they look very similar. There are a number of factors that could have led to the error,” said Denise McBain, the health region’s senior vice-president and chief operating officer.

The mistake was discovered about an hour after the injection, and about 30 minutes after the man left with his family, when the ER shift changed and staff did a routine narcotic count.

A phone message was quickly left instructing the patient to go to hospital immediately.

However, as the man and his family drove home, his condition “deteriorated very quickly,” Dr. Dawson said.

He died after arriving at a hospital in Innisfail, south of the central city of Red Deer, despite the use of a drug to combat the effects of hydromorphone.

The “very experienced” nurse who made the mistake was put on indefinite paid leave and feels terrible, Ms. McBain said.

Officials stressed that they will not know whether the mistake resulted in the man’s death until the medical examiner’s final report is available in about 10 days.

“The evidence is not all in and therefore I think it would be unfair to conclude what the cause of death is,” Dr. Dawson said.

Alberta Health Minister Gary Mar told reporters he will work with the health region to ensure such an error does not happen again.

Ms. McBain said an independent team of experts from outside Alberta will be asked to conduct an investigation and issue public recommendations.

Constraint: Hydromorphone 10 mg was removed.
2. Automation and Computerization:

- CPOE
- Bar Code technology
- Automated bedside verification
- Smart pumps
Applying Error Reduction Strategies

3. Simplify, standardize and differentiate

- **Bedrock Human Factors Principles**
  - reduce steps and interfaces
  - Call 911

- **Standardize processes and procedures**
  - Airline industry
CALCIUM GLUCONATE
Injection/Injectable USP 10%

10 mL
DIN 0214101
Latex Free Stopper

2.32 mmol Ca++/10 mL

0.232 mmol Ca++/mL

Sterile/Stérile
For IV Infusion After Dilution
Pour perfusion IV après dilution

PPC
CALCIUM GLUCONATE
Injection Injectable USP 10%

10 mL DIN 02141019
Latex Free Stopper

1 g/10 mL
100 mg/mL

Sterile/Stérile
For IV Infusion After Dilution
Pour perfusion IV après dilution

ELECTROLYTE REPLAICHER
Single-dose vial. Discard unused portion. Each mL contains:
* Calcium gluconate 98 mg (0.485 mEq Ca++/mL) plus Calcium saccharate
  betahydrate 8.5 mg which is equivalent
to 100 mg Calcium gluconate
(0.232 mmol Ca++) + Hydrochloric
acid/sodium hydroxide to adjust pH
* Osmolality 680 mOsm/mL

Consult package insert for complete information.

Store between 15°C and 30°C.

PHARMACEUTICAL PARTNERS
OF CANADA INC.
Richmond Hill, ON L4B 3G6

1-877-821-7724
Standardization
Standardize Order Communication

- Use leading zero (0.1 mg not .1 mg)
- No trailing zeros (1 mg not 1.0 mg)
- Avoid nonstandard abbreviations (“U” for unit, q.d., drug name abbreviations such as “MS”)
Differentiate

vincristine
vinblastine

vinCRISStine
vinBLASTtine
Applying Error Reduction Strategies

4. Independent double checks & other redundancies
Where Medication Errors Occur...

- **PRESCRIBING**: 39% of errors
- **TRANSCRIPTION**: 12% of errors
- **DISPENSING**: 11% of errors
- **ADMINISTERING**: 38% of errors
Independent Double Checks: Working Definition

An Independent Double Check is a process in which a second practitioner conducts an individual verification.
Independent Double Checks

- Common in other industries
- Acknowledges complex and high risk systems and that practitioners are human, and therefore fallible
Independent Double Checks

Research show that people find 95% of mistakes when double checking the work of others

It Reduces the Probability of Error

\[
\frac{1}{100} \times \frac{1}{100} = \frac{1}{10,000}
\]
Expectation of the 5 Rights

- Right drug
- Right patient
- Right dose
- Right route
- Right time

These are desired outcomes but do not provide standardized process on how to achieve them.
Patient Safety

MEASURING PATIENT SAFETY

Interventions to **PREVENT** errors

- Medical Product Design
  (IV tubing, pumps, monitors, drug packaging & labels, medical records)
- Work Environment Design
  (Architecture, Work Station Design)
- Task or Process Design

Interventions to **MAKE ERRORS** errors **VISIBLE** and **REDUCE HARM**

- Close Call Reporting
- Checks (auto or manual)
Why do we need independent double checks?

Front line staff work with:

- High Stress Environment
- High Risk Drugs
- Poorly designed Order Forms
- Poorly designed Packages & Labels!
- Poorly designed Pumps
Looking Through the Keyhole

INFUSION PUMP

Underlying Programming Sequence
Looking Through the Keyhole

Poor Usability = Prone to Errors

INFUSION PUMP
5. Rules and Policies

- bring to point of care
### Checklist

- **Patient Name?**
- **Syringe Drug?**
- **Syringe Conc.?**
- **Programmed Conc.?**
- **Micro or Milligram?**
- **Dose?**
- **Lockout?**
- **Four hour limit?**
- **Signature**
Applying Error Reduction Strategies

Culture and Communication

6. Education and Information

• Educating staff:
  - System-based causes of medication errors
  - Hierarchy of effectiveness of error prevention strategies
  - Bring patients and family into the medication-use process
E. Leadership Needed

- “Culture of Safety” = FOUNDATION
- Making safety a priority (quality, outcomes)
- Eliminate use of “error rates” as a measurement tool
- Use of meaningful error tracking methods
- Proactive approach
  - Failure Mode and Effects Analysis (FMEA)
  - Learning from each other (internal, external, outside healthcare)
  - High reliability organizations
What Nurses Can Do?

- Cultivate a culture of safety
  - Report errors/ near misses/ hazardous conditions
  - Learn and talk about errors in your system
- Ensure orders are complete
- Authority gradient challenge
- Avoid use of dangerous abbreviations (telephone or verbal orders, MAR, PCP)
- Embrace patient/ family into process

What Nurses Can Do?

- Avoid work-arounds
- Read-back orders (e.g., “five zero”)
- Independent double checking
- Learn and apply system-based strategies
- Be vigilant
- Trust your intuition: “if it doesn’t feel right, it probably isn’t”
“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, IHI