WHAT are medication errors?

Medication errors are preventable events that lead to medications being used inappropriately.

Medication errors that cause harm are called adverse drug events.

Wrong drug  Wrong rate
Wrong dose  Wrong preparation
Wrong patient Wrong route of
Wrong time  administration
Impacts of Medication Errors

Preventable adverse drug events in hospitals are estimated to injure hundreds of thousands of people and cost >$37B per year in the US.

Per Institute of Medicine, a hospital patient can expect on average to be subjected to more than one medication error per day.

Death or serious disability associated with a medication error is a “never event” (National Quality Forum)

NHS Never Events

- Mis-selection of a strong potassium containing solution (rather than an intended different medication)
- Wrong route administration of medication
  - Intravenous chemotherapy administered via the intrathecal route
  - Oral/enteral medication or feed/flush administered by an parenteral route
  - Intravenous administration of a medicine intended to be administered via the epidural route
NHS Never events (cont.)

- Overdose of insulin due to abbreviations or incorrect device
- Overdose of methotrexate for non-cancer treatment
- Mis-selection of high strength midazolam during conscious sedation

Canadian Patient Safety Institute Never Events

- Patient death or serious harm due to a failure to inquire whether a patient has a known allergy to medication, or due to administration of a medication where a patient’s allergy had been identified.
Canadian Patient Safety Institute Never Events (cont.)

Patient death or serious harm as a result of one of five pharmaceutical events

- Wrong-route administration of chemotherapy agents
- Intravenous administration of concentrated potassium solution
- Inadvertent injection of epinephrine intended for topical use
- Overdose of hydromorphine by administration of a higher-concentrated solution than intended
- Neuromuscular blockade without sedation, airway control and ventilation capability

NOW WHAT do we do to reduce patient risk?

- Review medication administration process
- Causes of medication errors
- Case studies
Healthcare Case Study: Medication Errors

Medication Delivery Process

- Medication prescribed
- Medication transcribed
- Medication prepared
- Medication administered to patient

Process Map – Medication Prescribed/Transcribed

- Physician determines patient need for medication
- Physician selects medication
- Physician selects dose
- Wrong medication selected
- Wrong dose selected
- Physician writes/enters prescription
- Wrong medication/dose written/entered
- Patient not informed about medication
- Physician explains prescription to patient
Healthcare Case Study: Medication Errors

Process Map – Medication Prepared/ Administered

Pharmacist selects medication → Pharmacist measures medication → Medication labeled → Medication delivered to patient → Medication administered to patient → Patient monitored

Wrong dose selected → Wrong medication/dose labeled → Wrong route/timing → Wrong medication given to wrong patient → Patient not monitored

Medication Errors – Error Reporting

Medication Errors by Stage

- Administering: 38%
- Prescribing: 39%
- Dispensing: 11%
- Transcribing: 12%

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New study: Pharmacy Errors

- Study of >1.8M medication orders at medical center in Texas found the following error rates per 100 shifts:
  - 2.58 for 100-200 verified orders per shift
  - 8.44 for 201-400 verified orders per shift
  - 11.11 for >400 verified orders per shift
- Overall error rate is 4.87 errors per 100,000 verified orders

Case study 1: Infant Heparin Overdoses

Step 1. Outline

<table>
<thead>
<tr>
<th>What</th>
<th>What</th>
<th>Problem(s)</th>
<th>Adult heparin dose given to 6 newborns</th>
</tr>
</thead>
<tbody>
<tr>
<td>When</td>
<td>Date</td>
<td></td>
<td>September 16, 2006</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td></td>
<td>?</td>
</tr>
<tr>
<td>Where</td>
<td>Different, unusual, unique</td>
<td></td>
<td>Saturday; dose 1000x higher</td>
</tr>
<tr>
<td></td>
<td>Facility, site</td>
<td></td>
<td>Indianapolis, IN</td>
</tr>
<tr>
<td></td>
<td>Unit, area, equipment</td>
<td></td>
<td>NICU</td>
</tr>
<tr>
<td></td>
<td>Task being performed</td>
<td></td>
<td>Administration of heparin (blood thinner)</td>
</tr>
<tr>
<td>Impact to the Goals</td>
<td>Patient Safety</td>
<td>3 fatalities, premature newborns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Complianc</td>
<td>e</td>
<td>“Never event”</td>
</tr>
<tr>
<td></td>
<td>Patient Services</td>
<td>Incorrect drug dose delivery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labor/ Time</td>
<td>Investigation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>16,000 incorrect dosing errors between 2001-2006</td>
<td></td>
</tr>
</tbody>
</table>
Heparin Overdoses
Step 2. Cause Map

- Heparin administered to infants
  - AND
    - Wrong dosage removed from bottle
    - Medication checks ineffective

Patient Safety Goal Impacted
- 3 infant fatalities, 3 critical injuries
- Wrong dosage heparin administered

Heparin
- Used to prevent blood clots
- Risk of clogging intravenous (IV) tubes
- Drugs, food, water administered via IV
Heparin Overdoses
Step 2. Cause Map

- Wrong dosage
  - Removed from bottle
- Wrong dosage
  - Removed from cabinet
- Wrong dosage
  - In cabinet
- Wrong dosage
  - Removed from pharmacy

10 unit/10,000 unit bottles look similar

AND

- Medication checks ineffective
Heparin Overdoses
Step 2. Cause Map

Patient Safety Goal Impacted

3 infant fatalities, 3 critical injuries
Wrong dosage heparin administered

Heparin administered to infants

AND

Wrong dosage removed from bottle

AND

Medication checks ineffective

Medication dose not verified
Nurse accustomed to only one dose
NICU stocks only one dose of heparin


### Healthcare Case Study: Medication Errors

#### Heparin Overdoses

**Step 3. Solutions**

- **Wrong dosage heparin administered**
  - Solution: Use saline to flush IVs
  - Risk of clogging intravenous (IV) tubes
  - AND
  - Heparin administered to infants
  - Used to prevent blood clots
  - AND
  - Drugs, food, water administered via IV

- **Wrong dosage removed from bottle**
  - AND
  - Wrong dosage removed from cabinet
  - Wrong dosage in cabinet

- **Medication checks ineffective**
  - Solution: Review medication check process
  - Solution: Computer delivery system
  - Solution: Redesign bottles

- **Wrong dosage removed from cabinet**
  - AND
  - Wrong dosage in cabinet
  - Wrong dosage removed from pharmacy

- **Wrong dosage removed from pharmacy**
  - 10 unit/10,000 unit bottles look similar
  - AND
  - Medication checks ineffective

- **NICU stocks only one dose of heparin**

#### Case study 2: Mistaken Administration of Paralytic Agent

**Step 1. Outline**

**What**
- Problem(s)
- Patient death, medication error

**When**
- Date
- December 1, 2014
- Time
- ?

**Where**
- Facility, site
- Fire alarm (code red) at facility
- Unit, area, equipment
- Bend, Oregon
- Task being performed
- Hospital emergency room
- Administration of IV anti-seizure medication

**Impact to the Goals**
- Patient Safety
  - Patient death
- Employee
  - 3 employees placed on administrative leave
  - “Never event”
- Compliance
  - Patient not monitored after IV administration
- Patient Services
  - Investigation
- Labor/Time
  - First time hospital has had issue like this
Healthcare Case Study: Medication Errors

Paralytic Agent Administration
Step 2. Cause Map

- Patient Safety Goal Impacted
- Patient death
- Cardiac arrest/brain damage
- Patient stopped breathing
  - Delay in treatment/response
  - Patient not monitored after IV administered
  - Patient administered paralyzing agent via IV
  - Evidence: Rocuronium

Paralytic Agent Administration
Step 2. Cause Map

- Patient prescribed anti-seizure medication
  - Sought treatment in ER
  - Evidence: Fosphenytoin

- Patient administered paralyzing agent via IV
- Wrong medication put in IV bag
  - Error in pharmacy
  - IV bag marked for prescribed (correct) drug
  - AND
Patient Safety Goal Impacted

Patient death
Cardiac arrest/brain damage

Patient stopped breathing

Delay in treatment/response

Patient not monitored after IV administered

Evidence: Rocuronium

**Step 2. Cause Map**

Staff unavailable

Fire alarm went off

AND

Patient not monitored after IV administered*

Evidence: For ~20 minutes, per staff

Patient's door closed

Protection from potential fire hazards

*The hospital has determined that the patient not being monitored was not a causative factor in the patient’s death.
Healthcare Case Study: Medication Errors

Paralytic Agent Administration

Step 3. Solutions

- Patient prescribed anti-seizure medication
- Sought treatment in ER
- Solution: Update medication protocols; implement detailed checking process & safety zone for medication verification

- Patient administered paralyzing agent via IV
- Wrong medication put in IV bag
- Error in pharmacy
- Solution: Add alert stickers to paralytic agents

- IV bag marked for prescribed (correct) drug

NOW WHAT

- Identify possible improvements to process
  - Minimize distractions
  - Add a double check
  - Alerts/ guides for high risk

- Remember the 5 Rights of medication safety:
  - Right medication
  - Right dose
  - Right time
  - Right route
  - Right patient
Healthcare Case Study: Medication Errors

Resources

Comprehensive guide to medication safety:

Causes of medication administration errors in hospitals (human behavior category based):
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3824584/

Pharmacy study:

California study (error rates in process):
http://www.chcf.org/~media/MEDIA%20LIBRARY%20Files/PDF/PDF%20A/PDF%20addressingmederrorsframework.pdf

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