HIGH-RISK MEDICATIONS: HOW TO IMPROVE THE SAFETY?

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Head of pharmacy
Pfizer Belgium
November 23, 2017

A simple story

- Insuline – heparine
  - Storage error (insuline → fridge)
  - Selection error (look-alike)
  - Control failure
  - Late clinical detection
    (hypoglycaemic coma or massive bleeding)

Potentially severe consequences for the patient
How errors occur?

The addition of 2 errors
Commission error **AND** Control failure

- Selection
- Dilution
- Calculation

... Check
- Double-check

Order of magnitude of dispensing errors by healthcare professionals?

- A. 0.01%
- B. 0.1%
- C. 1%
- D. 10%

Quiz
Quiz - answer

- Order of magnitude of dispensing errors by healthcare professionals?
  A. 0.01%
  B. 0.1%
  C. 1%
  D. 10%

Dispensing errors
(simulation)

- Error rate = 3%

Preparation errors
(real-life)

- Unused syringes in anaesthesiology
  - $\pm 10\%$: 29%
  - $\pm 50\%$: 8%
  - $\pm 100\%$: 4%

Stucki C, Am J Health-Syst Pharm 2013;70:137

Quiz

- Performance of controls to catch errors?
  - Example: double-check of dispensed drugs?
  - A. 70%
  - B. 85%
  - C. 95%
  - D. 99%
Quiz - answer

- Performance of controls to catch errors?
  Example: double-check of dispensed drugs?
  A. 70%
  B. 85%
  C. 95%
  D. 99%

Limited performance of controls

- Introduction of errors during unit dose dispensing
- Detection ability during human-performed control:
  - Pharmacists: 87.7%
  - Nurses: 82.1%

Efficacy ≈ 85%
(known value in the industry)

Do not be too confident with double-checks!
“We cannot change the human condition, but we can change the conditions under which humans work.”

James Reason

How to improve the safety?

- Implement strategies to
  - Increase the reliability of controls
  - Reduce the frequency of errors
Human factors principles to progress

1. Avoid reliance on memory
2. Simplify
3. Standardize
4. Use constraints and forcing functions
5. Use protocols & checklists wisely
6. Improve information access
7. Reduce handoffs
8. Increase feedback

Hierarchy of risk reduction strategies

- **High**
  - Technology
  - Constraints
  - Forcing functions

- **Medium**
  - Standardisation
  - Redundancies
  - Check-lists

- **Low**
  - Procedures
  - Education
  - Vigilance
“Medications that bear a heightened risk of causing significant harm to individuals when they are used in error”

The Joint Commission
High-risk medications: short list

10 drugs responsible for 73% of deaths

<table>
<thead>
<tr>
<th>Drug</th>
<th>Number (%)</th>
<th>Number of fatal Mi</th>
<th>References</th>
<th>Cumulative DDD/LAFDd h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methotrexate</td>
<td>37 (26)</td>
<td>270</td>
<td>[24-26]</td>
<td>3.3</td>
</tr>
<tr>
<td>Opioids</td>
<td>8 (0.6)</td>
<td>12</td>
<td>[25-30]</td>
<td>8.5</td>
</tr>
<tr>
<td>Diuretics</td>
<td>6 (0.4)</td>
<td>8</td>
<td>[30-35, 36-41]</td>
<td>20.0</td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>4 (0.3)</td>
<td>6</td>
<td>[30, 31, 34, 41]</td>
<td>3.5</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>4 (0.3)</td>
<td>6</td>
<td>[30, 34, 41]</td>
<td>4.0</td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>3 (0.2)</td>
<td>4</td>
<td>[30, 35, 41]</td>
<td>2.0</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>3 (0.2)</td>
<td>4</td>
<td>[27, 32, 35]</td>
<td>2.0</td>
</tr>
<tr>
<td>Total</td>
<td>135 (9.3)</td>
<td>198</td>
<td></td>
<td>21.5</td>
</tr>
</tbody>
</table>

Review, 135 publications

Saedder E, Eur J Clin Pharmacol 2014;70:637

Numerous actors & guidelines

2004-2006

2006-2008

2008-2010

... and many others
Self-assessment tools

- ISMP Medication Safety Self Assessment® for Hospitals (2011)
- ISMP International Medication Safety Self Assessment® for Oncology (2012)
- ISMP Medication Safety Self Assessment® for Antithrombotic Therapy (2017)

Self-assessment tools: Switzerland

- www.ismp.org
- www.cec.health.nsw.gov.au

- www.gsasa.ch > Qualité&Sécurité > Parenteralia Self Assessment Tool (PSAT)

- Drug selection / procurement
- Logistics / stock management
- Drug information
- Prescription
- Preparation/Administration
- Monitoring
- Education
- Risk management
Self-assessment tools: Switzerland

www.gsasa.ch > Qualité&Sécurité > Parenteralia Self Assessment Tool (PSAT)

General principles to reduce harm

1. Methods to prevent harm include:
   - Develop order sets, preprinted order forms, and clinical pathways or protocols to establish a standardized approach to treating patients with similar problems, disease states, or needs.  
   - Minimize variability by standardizing concentrations and dose strengths to the minimum needed to provide safe care.  
   - Consider centralized pharmacy or nurse-end antimicrobial, insulin management, and pain management services.  
   - Include reminders and information about appropriate monitoring parameters in the order sets, protocols, and flow sheets.  
   - Consider protocols for vulnerable populations such as elderly, pediatric, and obese patients.  
   - Adopt TALL man lettering for pharmacy produced labels to differentiate drug names with potential for mix-up.
General principles to reduce harm

2. Methods to identify errors and harm include:
   - Include reminders and information about appropriate monitoring parameters in the order sets, protocols, and flow sheets.
   - Ensure that critical lab information is available to those who need the information and can take action.
   - Implement independent double-checks where appropriate.
   - Instruct patients on symptoms to monitor for side effects and when to contact a health care provider for assistance.

3. Methods to mitigate harm include:
   - Develop protocols allowing for the administration of reversal agents without having to contact the physician.
   - Ensure that antidotes and reversal agents are readily available.
   - Have rescue protocols available.
Define improvement objectives

- **Never events**
  - Error during the management of anticoagulant treatments
  - Error during the administration of iv potassium
  - Insulin administration error
  - Oral methotrexate administration frequency error
  - Intrathecal administration of intravenous drugs
  - Infusion pumps programming error
  - ...

www.ansm.sante.fr
Concrete actions
Packaging design

- Tall man letters

Concrete actions
Drug selection

- List of critical drugs – risk analysis

<table>
<thead>
<tr>
<th>Medicaments critiques:</th>
<th>In all services</th>
<th>SI</th>
<th>SU</th>
<th>Anesth</th>
<th>U/SI / Neutral</th>
</tr>
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<tbody>
<tr>
<td>Nom de marque (ex.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**ATTENTION!**
Tout l’emplacement d’articles au rejet en stock de produits de cette liste doit être contrôlé par le Service concerné.
Concrete actions
Storage

- Limit the storage (concentrated electrolytes)
  - Ideally, concentrated solutions of electrolytes must be removed from wards
  - If not possible (i.e. intensive care), they must be stored exclusively in well identified locked rooms
  - The exchange of electrolytes between wards must be forbidden
  - ...

Quick-alert N°13, 2010

Concrete actions
Prescription

- Order-sets - anticoagulants

<table>
<thead>
<tr>
<th>Day</th>
<th>Dose</th>
<th>Commentaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>lunedd</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>dimanche</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>lundi</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>mardi</td>
<td>27+</td>
<td>2 mg</td>
</tr>
<tr>
<td>mercredi</td>
<td>20+</td>
<td>2 mg</td>
</tr>
<tr>
<td>jeudi</td>
<td>29+</td>
<td></td>
</tr>
<tr>
<td>vendredi</td>
<td>30+</td>
<td></td>
</tr>
<tr>
<td>samedi</td>
<td>31+</td>
<td></td>
</tr>
</tbody>
</table>
Concrete actions
Prescription

- Clinical pharmacy

- Prioritize interventions of clinical pharmacists by selecting high-risk patients/medications

- Implement rules in a system connected to the electronic patient record:
  - Drug prescriptions
  - Diagnostics
  - Labs
  - Demographic data
  - ...

Concrete actions
Preparation

- Standardized dilutions and labelling
Concrete actions
Preparation

- Ready-to-administer – injectables (CIVAS)
  - Suxamethonium
  - Diluted potassium

In-house production → Sub-contracting → Commercialisation

Concrete actions
Preparation

- Ready-to-administer – oral forms
  - Morphine solution
Concrete actions
Administration

Check-list (cytotoxics)

Mean [IC 95%]

86.4% 98.6%

0 25 50 75 100
No help Check-list

n=62

Concrete actions
Information technologies

Robotized distribution
Central pharmacy stock
Ward stock

Automated dispensing cabinets
CPOE
Clinical information system

Industry stock
Distribution with scanning

Logistic information system
Bedside scanning
Smart Pumps

R. Balbaaki, HUG, 2006
Examples of specific actions

- Heparin
- Oral methotrexate

Main risks (22 identified)
- Using unverified patient weights to calculate dose
- Miscalculating the dose or infusion rate
- Preparing heparin infusion incorrectly
- Mix-up between different concentrations
- Programming the infusion pump incorrectly
- ...

From the April 8, 2016 issue

Latest death linked to heparin - What have you done to stop the bleeding?

www.ismp.org/NEWSLETTERS/acute-care/articles/20100408.asp
Heparin Prescription

- Weight ranges
- No calculation
- Weight from electronic record
- Up-to-date information
- CPOE
  Complete and unique

Heparin Preparation

- RTU vial
- No dilution
- Differentiation from insulin
  STOP look-alike

Héparine sodique
20'000 UI / 48 ml
IV continue sur 24h
Heparin Administration

**Administration formula:**
- Héparine sodique 20000 UI = 48 ml
- Prelever le contenu total à l’aide d’une seringue de 50 ml (sph. total = 48 ml)
- 1 ml = 417 UI ; 1 UI = 0.0004 ml

<table>
<thead>
<tr>
<th>Dose (UI/24h)</th>
<th>Debit (ml/h)</th>
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<tbody>
<tr>
<td>0000</td>
<td>0.6</td>
</tr>
<tr>
<td>10000</td>
<td>1</td>
</tr>
<tr>
<td>15000</td>
<td>1.5</td>
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<td>20000</td>
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<tr>
<td>60000</td>
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</tr>
</tbody>
</table>

Oral methotrexate

**Patient safety alert**

- Error in administration frequency
- Inadequate packaging (e.g. number of tablets, identification of dosages)
- Confusion with folic acid (look-alike)
- Failure in adequate monitoring

www.nrls.npsa.nhs.uk/resources/?entryId45=59800
Oral methotrexate


NHS, Towards the safer use of oral methotrexate, 2004
Oral methotrexate
Dispensing

Max 3 month treatment
Only 4 days in case of error

Nominative dispensation
Catch error after 4 days

Commercial 100 cpr
Reconditioned 4 cpr

Warning 1/week
Nurse information

Nominative dispensation
Catch error after 4 days

Oral methotrexate
Patient information

TRAITEMENT PAR METHOTREXATE ORAL
INFORMATION POUR LE PATIENT

 Médicament : Methotrexate (MTX), existe sous forme de comprimés à 2,5 mg et 10 mg
Catégorie thérapeutique : Cytostatique / anti-métabolite
Quelles sont les maladies qui peuvent être traitées avec ce médicament ?
- Le leucémie
- La polyarthrite rhumatoïde
- Certaines autres maladies auto-immunes
Comment faut-il prendre ce médicament ?
Les comprimés sont à avaler avec un grand verre d’eau, le jour fixé par votre médecin.
Que faire en cas d’oubli ?
On peut prendre le médicament le lendemain. Si l’on s’en aperçoit plusieurs jours après, il faut contacter
le médecin.
Quels sont les effets secondaires possibles ?
L’apparition d’une fièvre, de troubles ou d’infertilité dans la bouche, des diarrhées, des douleurs
abdominales, d’une toux sèche, de petites lésions de la peau de couleur rouge-jaunâtre devront être
signalées immédiatement à votre médecin (ou à un médecin traitant) en précisant que vous prenez du
methotrexate ainsi que de éventuels autres médicaments.

https://pharmacie.hug-ge.ch/informedic/utilismedic/metho_infopat.pdf
Supporting tools are needed

- Culture & knowledge: education
- Proactive: risk analysis (FMECA)
- Reactive: incident declaration and investigation
- Follow-up: indicators (audit, Trigger tool)

Quiz

Which strategies are you actually following?

A. Separate storage / identification of high-risk medications
B. Protocols / guidelines for prescription
C. Protocols / guidelines for administration
D. Specific education for healthcare workers
E. Standardization of dilution and labelling
F. Ready-to-use injectables
G. Information technologies
Take home messages

- High-risk medication are responsible for the majority of serious incidents
- Many recommendations are existing but their impact is seldom rigourously evaluated
- Robust / high impact measures must be prioritized
- Each hospital has to determine a strategic roadmap, with a continuous evolution over time

Like a spiderweb...
... it has to be built progressively...
... to reduce the risk of an error passing through
THANK YOU FOR YOUR ATTENTION

Hospital pharmacists must be strongly involved in the implementation of solutions to improve the safety of high-risk medications

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