Doing the right things and doing things right
Relevant and Efficient Inpatient Drug Surveillance

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WHO AM I?

- Hospital Pharmacist
- Also licensed in California, USA
- With a PhD in applying IT to improve medication safety
- In a 340 bed midsized community hospital the Netherlands
- Which achieved EMRAM stage 6 in January 2017
- Which will achieve EMRAM stage 7 on November 28th
WHO ARE YOU? BY SHOW OF HANDS…. 

- How many of you are prescribers / clinicians?
- How many of you are pharmacists?
- How many of you have experience with inpatient drug surveillance?
- Who is currently happy with their drug surveillance practices?
DOING THE RIGHT THINGS
CONVENTIONAL DRUG SURVEILLANCE PRACTICES

1. Ordering
2. Verifying
3. Dispensing
4. Distribution
5. Administration
6. Monitoring

GAP 1: No computerized surveillance

Medication safety alert pop-up (prescriber)

GAP 2: no computerized check of administration

Full pop-up alert report and verification queue (pharmacist)
DOING THE RIGHT THINGS
CONTINUOUS PATIENT MONITORING AND BCMA AT ST JANSDAL

Continuous patiënt monitoring by CDSS (pharmacist)

1. Ordering
2. Verifying
3. Dispensing
4. Distribution
5. Administration
6. Monitoring

Multidisciplinary Core pharmacy

Only pop-up alert when relevant for prescriber

Limited pop-up alert report and verification queue (pharmacist)

Barcode assisted medication administration (BCMA)
DOING THINGS RIGHT

- The **right** information presented
- to the **right** professional
- in the **right** format (alert, order set etc)
- through the **right** channel (EMR, mobile device)
- at the **right** moment
RIGHT ALERT, NOT THE RIGHT MOMENT...
TIMING OF ALERTING: IMMEDIATE OR DELAYED?

• Dosing alerts?
• Allergy alerts?
• Drug use in renal failure alerts?
• Duplicate therapy alerts?
• Drug-drug interaction (DDI) alerts?

Immediate alerting

Delayed alerting
DRUG SURVEILLANCE: OUR APPROACH

Define the problem

- Define the most frequently occurring interaction alerts (80/20 rule)
- Investigate the CPOE possibilities for prevention (e.g. ordersets, standardized orders)

Discuss in expert panel

- Define relevance for inpatient setting
- Define the alert strategy: alert the clinician AND pharmacist, alert ONLY the pharmacist, don’t alert at all.
- If relevant, define when an alert is appropriate.

Build content for CDSS

- Build and validate the decision algorithm based on the national drug surveillance database (G-Standard)
- Move the algorithm to production
Raas-inhibitors + diuretics (19)
Nsaid's (ex. coxib's) + corticosteroids (2046)
Raas-inhibitors + nsaid's (27)
Cumadins + antibiotics (ex. cotrim/metron/cefam.) (566)
Diuretics + nsaid's (1155)
Betablockers + nsaid's (272)
Raas-inhibitors + potassium or potassium sparing agents (35)
Salicylates antitrombotic + nsaid's (ex ibuprof) (7951)
Betablockers + oral blood (8494)
Cumadins + (es)omeprazole (302)
Selective betablockers + insulin (302)

85% OF DDI ALERTS ARE CAUSED BY 29 DDI'S
85% of CPOE DDI alerts are caused by 29 DDI’s

- 10 refined using lab data
- 5 refined using concomitant medication
- 3 refined using administration times
- 1 refined using dosing
- 2 not refined

- 4 DDI’s still appear in CPOE (and pharmacy)
- 8 DDI’s not clinically relevant
- 17 DDI’s are evaluated only by pharmacy

5% of DDI alerts remaining
CONTINUOUS MEDICATION MONITORING

10.30 AM
Lab values

Administration times

CDSS including national DDI and renal function checking software (G-standard)

3.00 PM

Patient demographics

Concomitant medication

7.00 AM
## BARRIERS TO ADOPTION OF CDSS

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Functionality</th>
<th>Content</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Limited CDSS capabilities of existing CPOE products</td>
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<tr>
<td>2  Limited usability of systems and CDSS modules</td>
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<tr>
<td>3  Limited access to patient data needed to support a CDSS</td>
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<tr>
<td>4  Limited access to best CDSS knowledge</td>
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<tr>
<td>5  Local management of the CDSS knowledgebase</td>
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<tr>
<td>6  Lack of standards for data</td>
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<tr>
<td>7  High cost and difficulty of implementation</td>
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<tr>
<td>8  High cost of use and maintenance</td>
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<tr>
<td>9  Difficulty in recognizing and objectifying value</td>
<td></td>
<td></td>
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<tr>
<td>10 Perception of increased liability if CDSS recommendations are rejected</td>
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<td></td>
</tr>
</tbody>
</table>

Teich JM et al. J. Am Med Inform Assoc. 2005;M1822
2017: A LOT LESS BARRIERS

Guideline development software
1. Grouping features
2. Looping features
3. Alert suppression
4. Audit trail option

Content standardization (G-Standard)
- DDI’s
- Drug dosing in renal failure
- Updated monthly

Req’d data (commonly available):
1. Medication
2. Administration times
3. Patient demographics
4. Lab values

FROM BASIC TO ADVANCED DECISION SUPPORT

Generate unfiltered DDI alerts

Suppress

Generate unfiltered renal failure alerts

Refine frequently occurring DDI alerts (*grouping feature*)

Refine renal failure alerts (*grouping feature*)

Other rules e.g.:
- Opioids and laxatives
- Antibiotic stewardship
- Anticoagulation

Suppress
THE POWER OF GROUPING
TRIMETHOPRIM + RAAS-INHIBITORS/SPIRONOLACTONE

1 DDI

Ace-i
A2-antagonists
Renin-inhibitors

Trimethoprim mono
Trim+ sulfonamide

Lisinopril
Captopril
Zofenopril

Valsartan
Losartan
Telmisartan
Spirolactone

Co-trimoxazol

Enalapril

21.-22. September 2017
@eHealthSummit
1328.2 Hyperkaliëmie bij combinatie van kaliumverhogende middelen. (Generate Message, 01373)

**Probleem:** Kaliumgehalte > 5 mmol/l bij een combinatie van kaliumverhogende middelen. De laatste kaliumspiegel is kalium (K):

Resultaat (Latest) mmol/l gemeten op kalium (K): <br> Gemeten (Latest)

**ACTIE:** Meld arts dat deze combinatie de hyperkaliëmie kan verklaren of verergeren en overleg of middelen kunnen worden gestopt.

**Mogelijk symptomen zijn genoemd in de achtergrondtekst.**

**Medicatie**

Gegroepeerde interacties: GPK1 code,GPK1 etiketnaam,GPK1 opgetreden,GPK1 voorschrijver,GPK1 dosering,GPK1 doseringsfrequentie,GPK1 zo nodig (Latest)<br>Gegroepeerde interacties: GPK1 code,GPK1 etiketnaam,GPK1 opgetreden,GPK1 voorschrijver,GPK1 dosering,GPK1 doseringsfrequentie,GPK1 zo nodig (Latest)

**Lab**

kalium (K): Term Name,Resultaat,Gemeten,Gemeten (Latest 5)

**Ziekenhuistekst:**

Gegroepeerde interacties: HospitalText (Latest)

**Achtergrondtekst:**

Gegroepeerde interacties: backgroundtext (Latest)
<table>
<thead>
<tr>
<th>Clinical rule</th>
<th>DDI’s (#)</th>
<th>Additional variables used in CDSS</th>
<th>Conventional alerts</th>
<th>CDSS assisted alerts</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric protection</td>
<td>6</td>
<td>Concomitant medication (PPI, H2 blockers), labs (magnesium)</td>
<td>35</td>
<td>4</td>
<td>89</td>
</tr>
<tr>
<td>Hyperkalemia monitoring</td>
<td>3</td>
<td>Patient parameters (admin date), Labs (potassium)</td>
<td>19</td>
<td>2</td>
<td>89</td>
</tr>
<tr>
<td>Hypokalemia monitoring</td>
<td>3</td>
<td>Patient parameters (admin date), Labs (potassium)</td>
<td>1</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Hyponatremia monitoring</td>
<td>3</td>
<td>Patient parameters (admin date), Labs (sodium)</td>
<td>2</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Time dependent DDI’s</td>
<td>25</td>
<td>Admin times, Labs (hemoglobin)</td>
<td>10</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>Coumadin DDI’s, INR ↑</td>
<td>13</td>
<td>Medication order data (start date), Labs (INR)</td>
<td>30</td>
<td>5</td>
<td>83</td>
</tr>
<tr>
<td>Coumadin DDI’s, INR ↓</td>
<td>7</td>
<td>Medication order data (start date), Labs (INR)</td>
<td>11</td>
<td>2</td>
<td>82</td>
</tr>
<tr>
<td><strong>TOTAAL</strong></td>
<td><strong>60</strong></td>
<td></td>
<td><strong>108</strong></td>
<td><strong>17</strong></td>
<td><strong>86%</strong></td>
</tr>
</tbody>
</table>
AND WHAT DID IT BRING US (2015)?

- 2204 inpatients were monitored by the CDSS for 5004 potential problems.
- In 1088 patients (49%) monitoring resulted in a change in their medication profile.
- In 269 patients (12%) an advice was given to the doctor for further monitoring/labtests.
- Decreased DDI alerts at the point of prescribing by 80% and within pharmacy by 55%.
- Reduced time of DDI checking by pharmacy by > 50% allowing budget neutral expansion of other drug surveillance activities.

Most of all: clinician (prescriber, pharmacist AND technician) satisfaction.
KEY TAKEAWAYS

1. **Analyze your alert “landscape”**
   - Determine your 80/20 rule
   - Determine relevance: turn off irrelevant alerts
   - Determine the most relevant time of alerting

2. **CDSS capabilities are key to success**
   - Grouping functionality
   - Integration of high quality knowledgebases (see bibliography)
   - User friendly interface

3. **Build smart/low maintenance rules**
   - Only limited additional data are required for a huge effect
   - Build rules based on desired action
   - Create generic alerts with links to standardized knowledgebase and EMR data
OUR ALERTING DASHBOARD: VERY LOW ALERT/ORDER RATIO

Alerts per order

Duplicate therapy

Dose

DDI

Drug allergy
MANY THANKS!