INTEGRATED ELECTRONIC PRESCRIBING AND ROBOTIC PHARMACY DISPENSING

R.J.BEARD
B.PHARM. M.SC. M.B.A. M.PROF. M.R.PHARM.S
PRINCIPAL PHARMACIST, SUNDERLAND ROYAL HOSPITAL, KAYLL ROAD, SUNDERLAND ENGLAND SR4 7TP

ROD.BEARD@CHSFT.NHS.UK

Excellence in Health putting People first

• Declarations of interest
• Employee of City Hospitals Sunderland
• No other declarations
• Three questions.
• 1: What year did Sunderland start using EP?
• 2: From DEAS study, which was the most frequent dispensing error?
• 3: Individually, would you expect EP or Robot to prevent this type of error?

Excellence in Health putting People first

• Sunderland is an Anglo-Saxon word and means

Land set asunder, or a special place.

c.f. German: sonder or besonders

Excellence in Health putting People first
• 1000 beds (EP to all)
• Have used integrated Electronic prescribing system since 2001
• (integration means direct electronic link between prescribing and pharmacy modules……more later)
• Installed robot for main dispensary in September 2009
• Serves 350,000 population
• 5,000 staff work at Sunderland

Electronic prescribing (EP)

• Literature conflicting on best features.
• Context of EP important.
Electronic prescribing

- Level of integration is key ("dockside to bedside")
- Higher level of integration, greater the efficiencies
- Integration of prescribing, pharmacy systems, PAS, pathology, radiology, drug administration records

---

Suggested taxonomy (EP)

- Level 1: Basic messaging system from ward to pharmacy (Cantrill paper)
- Level 2: EP system + e-medication administration record
- Level 3: Levels 1 +2 + safety alerts
- Level 4: Level 3 + Patient database links (Hospital patient administration system) (more integrated)
- Level 5: Level 4 + Link to pharmacy STOCK and automatically adjusting it when prescriptions are authorised (more integration) (Sunderland)
- Level 6: Level 5 + Links to other departments (e.g. Pathology) for monitoring
Suggested taxonomy (RD)

Level 1: ‘mechanical shelf.’ Products retrieved and put onto conveyor (or channel) to be moved to requestor (May include a fridge).

Level 2: level 1 + automatic refilling (e.g., Hopper) Significant efficiencies if refill is automated.

Level 3: Level 2 + automatic labellers. Label applied at point of picking to avoid mis-labelling of product. (more complex system)

Level 4: level 3 + direct link with EP system. Stock is automatically picked from robot, labelled, and stock adjusted, from anywhere in hospital, not just dispensary. Completes final link to make dispensing error free.

Electronic prescribing: benefits

- Greater formulary control: lower rate of rising of drug expenditure.
- More control of medicines processes: less iatrogenic illness, greater patient throughput.
- Easily identifies missed doses
- Information flows: efficiencies in handling information: staff call down information

Excellence in Health putting People first
• Interface between EP and robot vital
• For business case, little in literature to identify benefits of EP and Robot
• Literature does not make clear what features give best value, efficiency of safety
• Literature uses different nomenclature reflecting local (or national) experience.

Medication errors
• Department of Health report 2005
• Dispensing error analysis scheme
• Cardiff and Vale trust
• Biggest survey of its type in UK
• 66 hospitals surveyed from 1991 to 2001
• 7,000 dispensing errors analysed.
## Dispensing error analysis scheme (DEAS)

<table>
<thead>
<tr>
<th>Type of error</th>
<th>Proportion %</th>
</tr>
</thead>
<tbody>
<tr>
<td>wrong drug supplied</td>
<td>23%</td>
</tr>
<tr>
<td>wrong strength of correct drug</td>
<td>22%</td>
</tr>
<tr>
<td>wrong quantity</td>
<td>10%</td>
</tr>
<tr>
<td>wrong warnings or directions</td>
<td>10%</td>
</tr>
<tr>
<td>wrong drug name on the label</td>
<td>9%</td>
</tr>
<tr>
<td>wrong strength on label</td>
<td>8%</td>
</tr>
<tr>
<td>wrong formulation</td>
<td>7%</td>
</tr>
<tr>
<td>wrong patient name on label</td>
<td>7%</td>
</tr>
</tbody>
</table>

---

## Types of error, EP and robots

<table>
<thead>
<tr>
<th>Error Type</th>
<th>EP stops</th>
<th>Robot stops</th>
<th>EP+Robot stops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong drug (picking error)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Wrong strength</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Wrong quantity</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Wrong labelling</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Wrong drug name (on label)</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Wrong strength (on label)</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Wrong formulation</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
<tr>
<td>Wrong patient name</td>
<td>Y</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

---

*Excellence in Health putting People first*
The problem

- According to research at an English university, it doesn't matter in what order the letters in a word are written, the only important thing is that the first and last letter are in the right place. The rest can be a total mess and you could still read it without a problem. This is because we do not read every letter by itself but the word as a whole.

Excellence in Health putting People first

Conditions for benefits

- Integration: when doctor prescribes, also writes label
- Because label is always accurate, no transcription errors
- Drugs can only be stored in robot by bar code. Integration means there is a direct electronic link between prescription, bar code medicine AND the label that the robot applies. These are the crucial links for safety benefits of the technology
- This system allows 60% of dispensing to be started outside of the pharmacy
- The links make dispensing instantaneous
Conditions for benefits

- Designing in the links designs out potential errors
- A critical feature is the automatic labeller
- In achieving ‘instantaneous dispensing’ it starts to change pharmacy professional model.

Excellence in Health putting People first

Other benefits

- Significantly, zero errors for the robot plus EP system combined, based on around 800,00 items per annum.
- Potentially a huge benefit in safety. However, dispensing is not risk-free, since not all items are supplied and labelled from the robot.
- Turn around time for prescriptions Speed of turnaround time is from clinical check is nearly instantaneous.
- Normally dispensing times can often be up to 4 hours for non-urgent dispensing. (Beard J. and Wood D 2010).
Measuring benefits

- **Dispensing rate**  Whittlesea quotes a Welsh benchmark of 10 items per person per hour.
- Sunderland dispenses a maximum of 360 items per hour, equating to 36 dispensing staff. (actual 7-10 staff)
- 36 items per hour per staff = 1 item each every 2 seconds
- Not a directly comparable situation (ward effects)
- 360 items an hour the pharmacy can dispense, it has therefore a capacity of 57,000 items per month, based on a 40 hour week.
- Stockholding value fell from 6 weeks to 3 weeks (£1m saving)

---

**Conclusion**

Clear benefits in using electronic prescribing and robotic dispensing, and these will be realised so long as the following conditions are met:

- The EP system used is integrated with all the other hospital software systems
- The robotic dispenser is integrated to the EP system
- There are automated labellers for those items robotically dispensed.
- When the above conditions are applied several advantages become apparent:
  - For items in the robot, there is no scope to make a dispensing error, improving patient safety.
  - The process is much more efficient, and the skill mix of staff can be adjusted within the dispensary
  - The speed of the prescription process increases dramatically.
Pharmacist’s views of EP-RD

- Qualitative survey using standard thematic analysis methodology
- 26 out of 35 responded.
- 4 main themes came out of the study
- Pharmacists preferred using the technology. They perceived significant benefits. EP-RD reduces dispensary work (10% of time at Sunderland)

**Excellence in Health putting People first**

Benefits for pharmacists

- Information
- Empowerment
- Ward relationships
- Policy enforcement

**Excellence in Health putting People first**
Information

- Scale and quantity of information.
- Clinical results, pathology tests, etc.
- Access to missed doses data
- Nursing notes
- Tidiness of medication screen compared to kardexes

Policy enforcement

- EP removes task of policing the formulary
- Access to relevant clinical information removes communication barriers
- Identified by more senior pharmacist managers as an aid to recruitment
Empowerment

- 87% felt more empowered at ward level.
- ‘system lets pharmacists cover more ground’
- ‘doctors feel we are omnipresent’
- Contrasts with Smith and Preston study (1996) which identified barriers to communications
- Absence of mention of dispensing errors...regarded as being ‘solved’, in contrast to literature.

Ward relationships

- Enhanced ward relationships (more available)
- No need to do policing of formulary.
- 3 months training for pharmacists, much less for doctors
- Consequence is change in power relationship, hence feeds into empowerment, ward relationships,
  - This change in power relationship is the nub of the technology.
### Why is this important?

<table>
<thead>
<tr>
<th>BLOOM (1956)</th>
<th>ACKOFF (1981)</th>
<th>CHS PHARMACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH CREATING</td>
<td>WISDOM</td>
<td>SPECIALIST CLINICAL</td>
</tr>
<tr>
<td>EVALUATING</td>
<td>UNDERSTANDING</td>
<td>CLINICAL</td>
</tr>
<tr>
<td>ANALYSIS</td>
<td>KNOWLEDGE</td>
<td>MANAGEMENT</td>
</tr>
<tr>
<td>APPLYING</td>
<td>INFORMATION</td>
<td>DISPENSING</td>
</tr>
<tr>
<td>LOW UNDERSTANDING</td>
<td>DATA</td>
<td>PROCUREMENT-DISTRIBUTION</td>
</tr>
</tbody>
</table>

*Excellence in Health putting People first*

### TIME SPENT OF HIGHER FUNCTIONS

<table>
<thead>
<tr>
<th>CHS PHARMACY</th>
<th>% STAFF TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIALIST CLINICAL</td>
<td>15</td>
</tr>
<tr>
<td>CLINICAL</td>
<td>45</td>
</tr>
<tr>
<td>MANAGEMENT</td>
<td>12</td>
</tr>
<tr>
<td>DISPENSING</td>
<td>19</td>
</tr>
<tr>
<td>PROCUREMENT-DISTRIBUTION</td>
<td>9</td>
</tr>
</tbody>
</table>

*Excellence in Health putting People first*
Pharmacist numbers wte

Excellence in Health putting People first

City Hospitals
Sunderland

References

- Beard R.J. 2009 : M.Prof thesis, University of Sunderland
Excellence in Health putting People first

- [http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3724990/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3724990/)

---

**1:** What year did Sunderland start using EP?
- 2001?
- 2003?

**2:** From DEAS study, which was the most frequent dispensing error?
- Wrong drug?
- Wrong strength?

**3:** Individually, would you expect EP or Robot to prevent this type of error?
- EP?
- Robot?