Digital solutions to investigate hospital prescribing accuracy and improve prescribing standards

Dr Jamie Coleman
*Senior Lecturer in Clinical Pharmacology*

Prof John Marriott
*Professor of Pharmacy Practice*

Sarah Thomas
*Research Pharmacist and SCRIPT Editorial Manager*
Medication errors

<table>
<thead>
<tr>
<th>Stage of medication process</th>
<th>Incidents</th>
<th>Percentage of medication incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration of medicines</td>
<td>263,228</td>
<td>50.01</td>
</tr>
<tr>
<td>Prescribing of medicines</td>
<td>97,097</td>
<td>18.45</td>
</tr>
<tr>
<td>Preparation/dispensing of medicines</td>
<td>87,057</td>
<td>16.54</td>
</tr>
<tr>
<td>Other</td>
<td>48,410</td>
<td>9.20</td>
</tr>
<tr>
<td>Monitoring/follow-up of medicine use</td>
<td>23,648</td>
<td>4.49</td>
</tr>
<tr>
<td>Advice</td>
<td>3,537</td>
<td>0.67</td>
</tr>
<tr>
<td>Supply or use of over-the-counter medicine</td>
<td>3,045</td>
<td>0.58</td>
</tr>
<tr>
<td>Not applicable</td>
<td>240</td>
<td>0.05</td>
</tr>
<tr>
<td>Blank</td>
<td>117</td>
<td>0.02</td>
</tr>
<tr>
<td>Other/unspecified</td>
<td>48,410</td>
<td>9.20</td>
</tr>
<tr>
<td>Total</td>
<td>526,379</td>
<td>100.00</td>
</tr>
</tbody>
</table>

*Based on the May 2011 extraction following clinical validation for deaths and severe harm.

Setting the scene

The facts

- Prescribing errors occur in 1.5-9.2% of medication orders written for hospital inpatients\(^3\)
- Electronic prescribing systems can reduce medication errors by between 50-88%
- There is a consistent theme of under-preparedness for prescribing amongst foundation trainees
- Education in practical prescribing was recommended by the EQUIP study to form part of foundation training
Overview

• National Evaluation: The implementation of ePrescribing systems in English hospitals
  – WP2: Assessing impact on prescribing safety

• iMPACT tool

• SCRIPT eLearning
Investigating **Medication** Prescribing Accuracy for **Critical Error** Types

Dr Jamie Coleman  
Senior Lecturer in Clinical Pharmacology  
University of Birmingham

Sarah Thomas  
Research Pharmacist  
University of Birmingham

*Investigating the implementation, adoption and effectiveness of ePrescribing systems in English hospitals: a mixed methods national evaluation*

NIHR Programme Grant for Applied Research
Electronic Prescribing & Medication Administration

“The utilisation of electronic systems to facilitate and enhance the communication of a prescription or medicine order, aiding the choice, administration and supply of a medicine through knowledge and decision support and providing a robust audit trail for the entire medicines use process”

(NHS Connecting for Health)
National Evaluation: The implementation of ePrescribing systems in English hospitals

Aims:

• Describe the procurement, implementation, adoption and maintenance of the basic and more advanced HEPMA systems
• Estimate their effectiveness and cost-effectiveness
• Develop best practice recommendations for procurement and a toolkit for their successful integration into NHS hospitals
Four Work packages (WPs)

Work package 1
Procurement, implementation, adoption and connectivity
Documentary data, semi-structured interviews, on-site observations, field notes ethnography

Work package 2
Assessing impact on prescribing safety
Stepped-wedge design evaluation with 6 & 12 months follow-up analyses of prescribing indicators

Work package 3
Health economics and a value of investment analysis
Estimation of costs (including opportunity costs) of computer systems of different types; framework for cost categories

Work package 4
Integration across WPs to develop recommendations and a toolkit for the NHS
Interlink the qualitative and quantitative components; develop a detailed typology of existing systems and their capabilities

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Assessing the impact of ePMA on prescribing safety: problems

• Definitions of error vary
• Classification of errors vary
• Errors are subjectively (and usually retrospectively) scored for seriousness
• No standard data collection technique
• A single error rate in a healthcare setting is therefore difficult to determine, making it challenging to recommend strategies for quality improvement
Aims

• To develop a list of **prescribing indicators** specific for the hospital setting that would facilitate the prospective collection of high-severity and/or high-frequency prescribing errors

• For the indicators to be amenable to electronic clinical decision support

• To design and develop an electronic tool to assist data collection
Why indicators?

• Prescribing indicators are agreed by a range of stakeholders to be a valid method to measure or monitor an area of prescribing, where there is a perceived direction in which the prescribing being measured should move over time [The NHS Information Centre, Health Care]
eDelphi

• To gain consensus in an area where published information is inadequate

• **Participants**: 20 experts (pharmacists, clinical pharmacologists and physicians)

• Two rounds, scoring using a 5-point Likert scale:
  1. Likelihood of the error occurring in the hospital setting
  2. Seriousness of the most likely outcome
# Risk Matrix

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Rare</strong></td>
<td><strong>5 Almost certain</strong></td>
</tr>
<tr>
<td>This will probably never occur</td>
<td>This will undoubtedly occur, possibly frequently</td>
</tr>
<tr>
<td><strong>2 Unlikely</strong></td>
<td></td>
</tr>
<tr>
<td>Do not expect it to occur but it is possible it may do</td>
<td></td>
</tr>
<tr>
<td><strong>3 Possible</strong></td>
<td></td>
</tr>
<tr>
<td>This might occasionally occur</td>
<td></td>
</tr>
<tr>
<td><strong>4 Likely</strong></td>
<td></td>
</tr>
<tr>
<td>This will probably occur</td>
<td></td>
</tr>
<tr>
<td><strong>5 Catastrophic</strong></td>
<td></td>
</tr>
<tr>
<td>Leads to death, multiple permanent injuries, or irreversible health effects</td>
<td></td>
</tr>
<tr>
<td><strong>4 Major</strong></td>
<td></td>
</tr>
<tr>
<td>Major injury leading to long-term incapacity/ disability</td>
<td></td>
</tr>
<tr>
<td><strong>3 Moderate</strong></td>
<td></td>
</tr>
<tr>
<td>Moderate injury requiring intervention</td>
<td></td>
</tr>
<tr>
<td><strong>2 Minor</strong></td>
<td></td>
</tr>
<tr>
<td>Minor injury or illness requiring minor intervention</td>
<td></td>
</tr>
<tr>
<td><strong>1 Insignificant</strong></td>
<td></td>
</tr>
<tr>
<td>No risk of patient injury or harm and no intervention required</td>
<td></td>
</tr>
</tbody>
</table>

Initial Literature Search

Initial identification of relevant prescribing errors (n=210)

Feasibility Review

Feasibility screen undertaken by two reviewers (pharmacist and clinical pharmacologist)

Unfeasible indicators / duplicates removed (n=121)

Suggestions from reviewers for new indicators (n=21)

Exploratory round

List sent to participants to review for accuracy and to suggest additional indicators (n=89)

Suggestions from reviewers for new indicators (n=21)

Indicators sent out for scoring in Rounds 2 and 3 (n=110)

Indicators removed if not in high or extreme risk categories (NPSA 2008 risk matrix) (n=30)

eDelphi SECOND & THIRD ROUNDS

Indicators eligible for inclusion (n=80)

Final Indicator Selection

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Prescribing indicators

- Allergy
- Clinical contraindications
- Dosing
- Drug-drug interaction
- Frequency
- Route

Prescribing of incorrect or inequivalent morphine (opiate) dose via multiple routes. *Risk of toxicity*
Publication

Developing consensus on hospital prescribing indicators of potential harms amenable to decision support

Sarah Katie Thomas, Sarah E. McDowell, James Hodson, Ugochi Nwulu, Rachel Louise Howard, Anthony J. Avery, Ann Slee & Jamie J. Coleman, University of Birmingham, UK

Keywords: clinical decision support, consensus, drug prescriptions, hospitals, medication errors, quality indicators

Received: 4 December 2012
Accepted: 17 January 2013
Accepted Article Published Online

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Data capture

- Need to capture the rate at which the 80 indicators occur in a hospital setting
- Need to capture the information during normal clinical activities
- Information governance needs to be a priority
- Need to avoid subjectivity in any analysis
• Standalone Windows application (XP, 7, 8)
• Easy to use and mobile
• Asks clear and concise questions
• Data encrypted before secure transfer
• Can reflect local Trust formularies
Demographics and documentation

- Patient (initials, age)
- Medication process
- No. of medicines prescribed
- Incomplete orders
- VTE assessment
- Weight
- Allergy
Indicators

- Divided into BNF categories
  - CVS
  - CNS
  - Infection...
- Drug or drug class
Capturing the indicators

Method:
1. Perform usual prescription chart review
2. If patient is prescribed a drug listed on iMPACT, select the drug
3. Answer the questions
Capturing the indicators

Patient is prescribed colestyramine

1. Look to see if colestyramine is listed under ‘GI’ section
2. If yes, select colestyramine
Capturing the indicators

3. Answer the questions displayed

<table>
<thead>
<tr>
<th>Concomitant treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the patient prescribed oral drug treatments in addition to colestyramine?</td>
</tr>
<tr>
<td>Yes ☐ No ○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timing of doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are any doses due to be administered within one hour prior to the colestyramine dose, or within 4-6 hours after it has been taken?</td>
</tr>
<tr>
<td>Yes ☐ No ○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harm ☰</td>
</tr>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>Please provide information</td>
</tr>
</tbody>
</table>
Capturing the indicators

Questions displayed can be dependent on previous answers
HELP!

Chart Review

Drug chart available for review
Yes ☐ No ☐
Please state if any additional drug charts are in use
Please select...

Non Alerting Decision Support

Weight documented
Allergy status documented

MAOI

Please include the reversible and non-selective MAOIs, moclobemide and linezolid.

Concomitant treatment

Is the patient prescribed a tricyclic antidepressant? Yes ☐ No ☐
Is the patient prescribed tramadol? Yes ☐ No ☐

Harm

Harm ☐
Please select...
Data analysis

Data collated at the University of Birmingham

• Positive indicators:
  – Rate at which the errors occur
  – Types of errors that occur in a paper-based system
  – How the rate/type change post-CPOE implementation

• Additional information:
  – Documentation, legality, legibility

...Informs how CPOE impacts on prescribing safety
iMPACT

• Captures standardised and validated error types
• Allows comparative studies to be carried out between sites
• Can facilitate research into the impact of electronic prescribing and clinical decision support
• Provides a mechanism for documenting how quality and safety initiatives may improve patient safety over time.
References


6. The Information Centre (Healthcare). The Prescribing Toolkit. Available at http://www.ic.nhs.uk/prescribing/measures

An innovative eLearning programme to improve prescribing

Sarah Thomas
SCRIPT Content and Editorial Manager
Research Pharmacist
University of Birmingham
Background

• There is a consistent theme of under-preparedness for prescribing amongst foundation trainees\(^1\)

• Education in practical prescribing should be part of foundation training\(^2\)

• Education in prescribing should be a continuing process in postgraduate medicine, not only because of the constant emergence of new medicines but also rapid changes in the knowledge base of those that are already established in clinical practice\(^3\)
Prescribing Confidence

- 36% of F1 doctors frequently felt anxious or stressed at the thought of prescribing.

- 40% of F1 doctors sometimes felt anxious or stressed at the thought of prescribing.

- 44% of F1 doctors felt they would only sometimes feel confident in decisions to prescribe a medicine.
SCRIPT eLearning

- Prescribing and Therapeutics
  - Principles
  - Safe and legal practice
  - Patient safety
  - Patient participation
  - Evidence-based
- Clear learning outcomes
- Generic, not regionally specific

www.safeprescriber.org
Module Categories

- Principles of Prescribing
- Prescribing in Medical Emergencies
- Managing the Risks of Prescribing
- Prescribing in Special Circumstances
- Therapeutic Groups
- Advanced Prescribing
- Clinical Governance

SimScript

UNIVERSITY OF BIRMINGHAM
Module Content

41 eLearning modules

- Background pharmacological knowledge
- Scenario-based learning
- Pre- and post-test assessments to identify learning needs
- In-module formative assessment to embed knowledge
- Interactive using multi-media
- Certification
Interactivity

Inhaled Drug Delivery
- Inhaler technique
- Step wise management of asthma

Potassium Chloride
- Intravenous Administration Video
- Check you have the correct product

Dangers of parenteral potassium chloride
West Midlands

- 5 Foundation Schools, 45 hospital sites, 1200 trainees
- 16 mandatory modules in F1 reflecting foundation curriculum

<table>
<thead>
<tr>
<th>Adverse Drug Reactions</th>
<th>Prescribing in Renal Dysfunction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticoagulation</td>
<td>Prescribing in Older Adults</td>
</tr>
<tr>
<td>Dosing and Calculation</td>
<td>Pain Management</td>
</tr>
<tr>
<td>Drug Allergy and Anaphylaxis</td>
<td>Parenteral Poisons</td>
</tr>
<tr>
<td>Drug Interactions</td>
<td>Prescribing in Infection</td>
</tr>
<tr>
<td>Fluids</td>
<td>Rational Drug Choice</td>
</tr>
<tr>
<td>Medication Errors</td>
<td>Taking a Safe and Effective Drug History</td>
</tr>
<tr>
<td>Prescription Documentation</td>
<td>Toxic Tablets</td>
</tr>
</tbody>
</table>

- A further 15 modules are completed in F2 which are most relevant to the trainee’s speciality placements
Extending Access
UK Foundation Trainees
# Monitoring Trainee Progress

## Course Details
### The Principles of Prescribing

<table>
<thead>
<tr>
<th>Module</th>
<th>Progress</th>
<th>Time Spent</th>
<th>Last Accessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription Documentation*</td>
<td>100%</td>
<td>1 hr, 16 mins, 32 secs</td>
<td>Wed 27th Feb 2013, 4:17 pm</td>
</tr>
<tr>
<td>Fundamentals of Pharmacology</td>
<td>100%</td>
<td>31 mins, 7 secs</td>
<td>Mon 15th Oct 2012, 11:53 am</td>
</tr>
<tr>
<td>Taking a Safe &amp; Effective Drug History*</td>
<td>100%</td>
<td>57 mins, 45 secs</td>
<td>Wed 27th Feb 2013, 4:47 pm</td>
</tr>
<tr>
<td>Adherence and Concordance</td>
<td>0%</td>
<td></td>
<td>Never</td>
</tr>
<tr>
<td>Clinical Kinetics</td>
<td>0%</td>
<td></td>
<td>Never</td>
</tr>
<tr>
<td>Dosing and Calculation*</td>
<td>100%</td>
<td>1 hr, 27 mins, 12 secs</td>
<td>Wed 27th Feb 2013, 5:44 pm</td>
</tr>
<tr>
<td>Formulation and Administration</td>
<td>0%</td>
<td></td>
<td>Never</td>
</tr>
<tr>
<td>Prescribing in Infection*</td>
<td>100%</td>
<td>39 mins, 11 secs</td>
<td>Wed 27th Feb 2013, 5:53 pm</td>
</tr>
</tbody>
</table>

## Course Details
### Prescribing in Medical Emergencies

<table>
<thead>
<tr>
<th>Module</th>
<th>Progress</th>
<th>Time Spent</th>
<th>Last Accessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug Allergy and Anaphylaxis*</td>
<td>100%</td>
<td>30 mins, 40 secs</td>
<td>Fri 8th Mar 2013, 5:47 pm</td>
</tr>
<tr>
<td>Poisoning</td>
<td>100%</td>
<td>1 hr, 57 secs</td>
<td>Wed 27th Feb 2013, 9:28 pm</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>100%</td>
<td>17 mins, 42 secs</td>
<td>Wed 27th Feb 2013, 6:17 pm</td>
</tr>
<tr>
<td>Fluids*</td>
<td>100%</td>
<td>39 mins, 45 secs</td>
<td>Mon 6th May 2013, 12:45 am</td>
</tr>
</tbody>
</table>
Comments from trainees

“Perioperative prescribing has been the most useful and practically applicable module I have undertaken thus far – very useful”

“Its made me a better doctor”

Particularly like the 'bath tub' analogy used to illustrate actions of ACE inhibitors on the kidney, revolutionised my understanding!

“Its filled in gaps in my knowledge. It covers everything I need to know at my level”
Patient Safety

“As an example, after doing one module I realised I had made an error in converting a dose of lithium from tablets to liquid. I was able to contact the patient and correct the error”.

“I went back to the toolkit when I was unsure with regards to prescribing a drug in a patient on the ward with renal impairment”.

“I did NOT know you should reduce the dose of paracetemol for an adult weighing less than 50 kg!!!!”
Baseline knowledge
Knowledge acquisition

Anticoagulation

Formulation & Administration

Monitoring Drug Therapy

Toxic Tablets

Mean difference - pre to post test

(p <0.001)
Knowledge acquisition

Which ONE of the following drugs will increase the INR when prescribed concomitantly?

- Amiodarone ✓
- Carbamazepine
- Oestrogens
- St John's Wort
- Rifampicin

Only 15% of trainees got this CORRECT in the pre-test

89% got this CORRECT in the post-test
Knowledge acquisition

When psychosocial models are not effective which ONE of the following licensed drugs would be appropriate for short term management of behaviour seen as challenging?

• Diazepam
• Haloperidol
• Olanzapine
• Promethazine
• Risperidone ✔️

Only 20% of trainees got this CORRECT in the pre-test

Worryingly 42% thought the answer was haloperidol!

88% got this CORRECT in the post-test
Collaborative working
Ron Grimley Undergraduate Centre (DGH)

Clinical Skills
- Subcutaneous administration
- Intramuscular administration
- Blood transfusions
- Nebulisers
- Oxygen therapy
- Vaccination
Monitoring Educational Needs

Dementia Friendly Prescribing

- National Dementia Commissioning for Quality and Innovation (CQUIN) introduced to increase awareness of dementia as people are admitted to hospital

Aim

- To provide the knowledge and skills required for secondary care practitioners to be dementia aware, to be able to assess, manage and refer a patient safely and effectively following an admission to the secondary care setting
“Since this is now the one of the Secretary of State's major priorities, we felt it was very important that all healthcare professional should have access to this important resource”

Prof Elizabeth Hughes (Postgraduate Medical Dean)

www.dementia.safeprescriber.org
Endorsement

Royal Pharmaceutical Society

Institute for Innovation and Improvement

Alzheimer's Society

Leading the fight against dementia

Dementia Action Alliance

University of Birmingham
The Future

- Keep the modules up-to-date and interactive
- Link the learning with GMC and the UKFPO requirements
- Support and promote quality improvement projects
- Dental SCRIPT
  - www.dentalprescriber.org
- Non-medical prescribers
Any Questions?