Reducing hazardous prescribing and improving patient safety in primary care

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Yorkshire Quality and Safety Research group seminar
Bradford, 28th February 2019

This presentation summarises independent research funded by the NIHR Greater Manchester PSTRC. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.
• Provide an overview of the extent and impact of medication error

• Highlight some of the research that we are doing to reduce this and improve the safety of prescribing in primary care

• Summarise some of our research findings and how we are implementing these findings into practice

• Plans for future work
Medication errors in primary and secondary care are an important cause of morbidity and mortality

- **Prescribing errors**
  - 1 in 20 items with an error – 1 in 550 with a serious error
  - Over 1.1 billion items dispensed in 2017 = 2 million serious prescribing errors

- **Preventable medication-related admissions to hospital**
  - These account for around 1 in 25 hospital admissions
  - Annual cost of £650m per year

- **4 classes of drug account for over 50% of these admissions:**
  - anti-platelets, non-steroidal anti-inflammatory drugs (NSAIDs), diuretics and anticoagulants

**Big implications in terms of patient safety and costs**
Medication without harm: WHO’s Third Global Patient Safety Challenge

Its goal will be to reduce the level of severe, avoidable harm related to medications by 50% over 5 years, globally

The report estimated that there were 230,000 errors each year in the administering of medication in the NHS, contributing to 22,000 deaths

Need to develop and test interventions to reduce medication error
Meeting the challenge: our research

- Explored the prevalence and nature of medication error
- Developed and tested interventions to reduce medication error
- Disseminated findings widely and worked to implement findings in practice

Improve patient safety in primary care

Funded by NIHR
The PINCER Intervention

Pharmacist-led IT-based intervention to reduce rates of clinically important errors in medicines management in general practices

1. Conducting searches on GP clinical systems to identify patients at risk from common and important prescribing errors

2. Pharmacists (trained in the PINCER approach) working with general practices to develop an action plan to correct and prevent potentially hazardous prescribing

3. Pharmacists (and pharmacy technicians) working with and supporting general practice staff to implement the action plan
PINCER Trial

A cluster randomised trial comparing the effectiveness of a pharmacist-led IT-based intervention with simple feedback in reducing rates of clinically important errors in medicines management in general practices.
• The study involved at-risk patients in 72 general practices who were being prescribed drugs that are commonly and consistently associated with medication errors

• These included the prescription of NSAIDs and beta blockers, and the monitoring of ACE inhibitors or loop diuretics, methotrexate, lithium, warfarin, and amiodarone
Cluster randomised trial

72 General Practices consented into the study

- Simple feedback
  Computer-generated feedback on patients at potential risk from hazardous prescribing (n=36)

- Pharmacist-led intervention (PINCER)
  Simple feedback plus educational outreach and dedicated support to correct and prevent potentially hazardous prescribing (n=36)
Findings from the PINCER Trial

- PINCER intervention is an effective method for reducing a range of clinically important and commonly made medication errors in primary care

- At 6-months follow-up patients in the PINCER group had significantly fewer prescribing errors than those in the control group

- There was evidence that the intervention was cost-effective

- Could be rolled out across NHS at low cost to reduce medication errors
What next after PINCER?

- We had a great opportunity to develop things further through our NIHR Greater Manchester Patient Safety Translational Research Centre.
- PINCER was “proof of principle”
- In terms of taking the PINCER work forward, we now wanted to focus on:
  - Which prescribing safety indicators were the most important/most cost-effective
  - Rollout of the PINCER prescribing safety indicators at scale
  - Whether the PINCER approach reduces morbidity
Examining variations in prescribing safety in UK general practice: cross sectional study using the Clinical Practice Research Datalink

S Jill Stocks,1 Evangelos Kontopantelis,2,3 Artur Akbarov,3 Sarah Rodgers,4 Anthony J Avery,4 Darren M Ashcroft1,5
Clinical Practice Research Datalink

- A longitudinal database of anonymised routine healthcare records
- England, Scotland, Wales and NI

- 28 years of data collection
- Total > 21 million lives on database
- 711 contributing GP practices
- > 5 million currently registered patients
Data collected from primary care record

1.8 billion consultations including

- Drug exposure
- Diagnoses and symptoms
- Referrals
- Laboratory tests
- Vaccination history
- Demographic data

- Full coded record
- Patient identifiers removed at source
- Linked to range of other health data
• Anonymised patient records from 526 practices contributing to the Clinical Practice Research Datalink

• Almost 5 million patients attended the 526 practices

• Almost 1 million patients had diagnoses or prescriptions that put them at risk of potentially hazardous prescribing (i.e. the denominator)
• Cross-sectional study leading up to 1st April 2013
• Measure prevalence of prescribing safety indicators
• Use multilevel logistic regression models with random effects at the practice level
  • to quantify the variability between practices
  • to identify which factors are important in predicting what type of practice or patient is at higher risk of potentially hazardous prescribing
Patients prescribed gastroprotection were excluded from the indicators involving peptic ulcer, warfarin and patients aged over 65.
Prevalence of patients with h/o peptic ulcer and prescribed NSAIDs by practice

Overall prevalence: 4.1%
Median: 1.7%
Interquartile range: 0% to 6.3%
Intraclass correlation coefficient = 0.06 (0.03 to 0.10)
Practices with zero prevalence = 250 (48%)

Practices ordered by increasing prevalence

Funded by NIHR
Our take home messages from the study:

- Around 5% of patients at risk of potentially hazardous prescribing did actually receive the potentially hazardous prescription (49927/949552)
- High variation in the prevalence of potentially hazardous prescribing between practices points towards important targets for improving patient safety
- Older patients and those receiving multiple repeat prescriptions had higher risk of potentially hazardous prescribing
Prescribing Safety Indicators

We have focused on indicators associated with significant harm:

- Gastrointestinal bleed (6 indicators + composite outcome)
- Acute exacerbation of asthma (2 indicators)
- Heart failure (1 indicator)
- Stroke in dementia (1 indicator)
- Acute kidney injury (1 indicator)
OUTCOME: GI BLEED
Query A: Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient aged ≥65 years
Query B: Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient with a history of peptic ulceration
Query C: Prescription of an antiplatelet drug without co-prescription of an ulcer-healing drug, to a patient with a history of peptic ulceration.
Query D: Prescription of warfarin or NOAC in combination with an oral NSAID
Query E: Prescription of warfarin or NOAC and an antiplatelet drug in combination without co-prescription of an ulcer-healing drug
Query F: Prescription of aspirin in combination with another antiplatelet drug without co-prescription of an ulcer-healing drug

OUTCOME: EXACERBATION OF ASTHMA
Query G: Prescription of a non-selective beta-blocker to a patient with a history of asthma
Query H: Prescription of a long-acting beta-2 agonist inhaler (excluding combination products with inhaled corticosteroid) to a patient with asthma who is not also prescribed an inhaled corticosteroid

OUTCOME: HEART FAILURE
Query I: Prescription of an oral NSAID to a patient with heart failure

OUTCOME: STROKE
Query J: Prescription of antipsychotics for >6weeks in a patient aged ≥65 years with dementia but not psychosis

OUTCOME: KIDNEY INJURY
Query K: Prescription of an oral NSAID to a patient with eGFR <45
Health Foundation Scaling Up PINCER

- Led by Lincolnshire Community Health Services NHS Trust supported by the Universities of Lincoln, Nottingham and Manchester, the EMAHSN and 12 of the region's CCGs

- Project aim: to spread this proven intervention to at least 150 general practices in the East Midlands region within two years and to evaluate both the implementation and impact of this

- New set of 11 prescribing safety indicators

- Improvement being measured using anonymised routinely recorded data from general practices collected retrospectively at three monthly time points

- Acceptability and feasibility of the rollout of the PINCER intervention being explored using qualitative methods
1. CHART software installed on GP practice computer
   http://www.nottingham.ac.uk/primis/tools-software/chart/chart.aspx

2. CHART software used to download the PINCER Query Library
   http://www.nottingham.ac.uk/primis/tools-audits/list-of-audit-tools/pincer.aspx

3. PINCER Queries run on GP clinical system using MIQUEST software

4. Data provided to GP practices at individual patient level, with those patients ‘at risk’ highlighted
PINCER QUERY SET

PEPTIC ULCER, NSAID AND PPI

PATIENTS AT RISK

(look over figure for full descriptors)

3

FURTHER DETAILS

<table>
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<tr>
<th>Patients aged 18 or over with a Peptic Ulcer Read code that is dated over 6 months ago</th>
<th>339</th>
<th>7</th>
<th>332</th>
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<tbody>
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<td>100.0%</td>
<td>2.0%</td>
<td>98.0%</td>
<td></td>
</tr>
<tr>
<td>100.0%</td>
<td>2.0%</td>
<td>98.0%</td>
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<table>
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<th>Prescription of PPI dated within the last 6 months</th>
<th>83</th>
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<th>3</th>
<th>253</th>
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<tr>
<td>100.0%</td>
<td>1.1%</td>
<td>98.9%</td>
<td></td>
</tr>
</tbody>
</table>

These patients can be identified by using preset filter 1 on the data sheet.

<table>
<thead>
<tr>
<th>Patients with Peptic Ulcer AND who have no prescription of PPI in the last 6 months</th>
<th>256</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Of which have a prescription for NSAID in the last 6 months.</th>
<th>3</th>
</tr>
</thead>
</table>

| Percentage | 1.17% |
General practice comparative view

Practice position in the CCG for each analysis
Sort order: event rate or % at risk

- GI Bleed Composite score
  40 events / 40 patients

- Age >= 65, no gastroprotection but oral NSAID
  19 patients at risk

- Asthma & non-selective beta blocker
  6 patients at risk

- Peptic ulcer, no gastroprotection but oral NSAID
  No patients at risk

- Peptic ulcer, no gastroprotection but antiplatelet
  1 patient at risk

- Asthma, long acting beta 2-agonist inhalers & inhaled corticosteroids
  No patients at risk

- Heart failure & NSAID
  1 patient at risk

- Warfarin / NOAC & oral NSAID
  2 patients at risk

- Warfarin / NOAC antiplatelet & no gastroprotection
  6 patients at risk

- Dementia but no psychosis & anti-psychotics
  7 patients at risk

- Chronic renal impairment & NSAID
  1 patient at risk

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Rollout of the PINCER Intervention

Feedback provided to general practices and CCGs:

- Statistical process control (SPC) charts
- Funnel plots comparing practices within a CCG
- Funnel plots comparing CCGs
Pharmacists/pharmacy technicians received one day of training

1. PINCER Query Library Tool
   - Downloading the queries using CHART
   - Running MIQUEST queries
   - Uploading data back into CHART
   - Interpreting the results

2. The PINCER intervention
   - Evidence base
   - Prescribing safety indicators
   - Root cause analysis
   - Educational outreach
What happened across the East Midlands?

Rollout: September 2015 to April 2017

- Number of CCGs = 12
- Number of practices = 361
- 279 TPP; 82 EMIS WEB
- Mean list size = 8,068
- >2.9 million patient records searched
- 21,617 cases of potentially hazardous prescribing identified

Using figures provided by two CCGs, we estimate that over 10,500 patients have received an active intervention to make their medication safer.
Indicator A: Prescription of an oral NSAID, without co-prescription of an ulcer healing drug, to a patient aged ≥65 years
NIHR Programme Grant (PROTECT)

• Collaborative project between Nottingham, Manchester, Dundee and Edinburgh Universities which started on 1/3/17

• Prescribing safety indicators used in two complementary ways to:
  – Prevent hazardous prescribing using computerised decision support when a prescribing decision is being made;
  – Identify on-going hazardous prescriptions by searching GP computer systems to identify patients at risk, so that corrective action can be taken.

• How effective they are in improving safety of prescribing in general practices
• Whether they reduce hospital admissions and deaths and
• Whether they are a good use of money for the NHS
Developing a learning health system: experience of SMASH

SMASH The Salford medication safety dashboard

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University of Manchester, Manchester, United Kingdom

Colin Davies
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Benjamin Brown
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ABSTRACT

Background Patient safety is vital to well-functioning health systems. A key component is safe prescribing, particularly in primary care where most medications are prescribed. Previous research has demonstrated that the number of patients exposed to potentially hazardous prescribing can be reduced by Intervening the electronic health record (EHR) database of general practices and providing feedback to general practitioners (GPs) in a pharmacist-led intervention. We aimed to develop and roll out an online dashboard that delivers this audit and feedback intervention in a continuous fashion.

Research Article

Developing a learning health system: Insights from a qualitative process evaluation of a pharmacist-led electronic audit and feedback intervention to improve medication safety in primary care

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Abstract

Introduction Developments in information technology offer opportunities to enhance medication safety in primary care. We evaluated the implementation and adoption of a complex pharmacist-led intervention involving the use of an electronic audit and feedback surveillance dashboard to identify patients potentially at risk of hazardous prescribing or monitoring of medicines in general practices. The intervention aimed to create a rapid learning health system for medication safety in primary care. This study aimed to explore how the intervention was implemented, adopted and embedded into practice using a qualitative process evaluation.

Methods Twenty-two participants were purposively recruited from eighteen out of forty-three general practices participating in the intervention as well as clinical commissioning group staff across Salford, UK, which reflected the range of contexts in which the intervention was implemented. Interviews explored how pharmacists and GP staff implemented the intervention and how the system was used. Data analysis was thematic with emerging themes developed into coding frameworks based on Normalisation Process Theory (NPT).

Results Engagement with the dashboard involved a process of sense-making in which pharmacists considered it added value to their work. The intervention helped to build trust, improve transparency and develop relationships between pharmacists and GPs. Collaboration and
The Salford Experience: SMASH Process

Primary Care EHR (Salford Integrated record)

EHR is processed against these safety indicators

Prescribing Safety Indicators

Users can see the specific patients affected by the indicators and act upon them

An interactive electronic dashboard

GP Staff

Actions to resolve safety hazards

Clinical Pharmacist

Funded by NIHR
SMASH Intervention

- Intervention started with a visit from a SMASH-trained pharmacist
- The pharmacist introduces the dashboard to the practice
- Works closely with the practice
- Each practice is monitored for a 12 month period

Quantitative evaluation
Dashboard usage patterns
Impact on rates of hazardous prescribing

Qualitative evaluation
25 semi-structured interviews

Greater Manchester Patient Safety Translational Research Centre
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Affected patients</th>
<th>% of eligible patients affected</th>
<th>CCG Avg (%)</th>
<th>New cases</th>
<th>Trend</th>
<th>Show on top</th>
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<tbody>
<tr>
<td>Age≥65 no GastProt and NSAID</td>
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<td>Asthma and BB</td>
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</table>
Patients with a history of asthma who have been prescribed a β blocker

What is the risk to patients?

In susceptible patients β blockers can precipitate acute attacks of bronchospasm or worsen daily symptoms resulting in mortality or low grade morbidity respectively. The BNF advises that "β blockers should be avoided in patients with a history of asthma or bronchospasm; if there is no alternative, a cardioselective β blockers can be used with extreme caution under specialist supervision. Atenolol, bisoprolol, metoprolol, nebivolol, and (to a lesser extent) acebutolol, have less effect on the β₂ (bronchial) receptors and are, therefore, relatively cardioselective, but they are not cardiospecific. They have a lesser effect on airways resistance but are not free of this side effect". The Committee on Safety of Medicines¹ issued the following advice: "...β blockers, even those with apparent cardioselectivity, should not be used in patients with asthma or a history of obstructive airways disease, unless no alternative treatment is available. In such cases the risk of inducing bronchospasm should be appreciated and appropriate precautions taken."

What evidence is there that this pattern of prescribing is harmful?

β blockers vary in their affinity for β₁- and β₂-adrenoceptors, and are divided into two groups, cardioselective (affinity for β₁), and non-cardioselective (affinity for β₂). The majority show little selectivity for one receptor over the other, except for bisoprolol (14-fold greater affinity for β₁-adrenoceptors) and timolol, sotalol and propranolol (26-fold, 12-fold, and 8-fold greater affinity for β₂-adrenoceptors, respectively).

Table 1: Cardioselective and non-cardioselective betablockers

<table>
<thead>
<tr>
<th>Cardioselective beta-blockers (relative selectivity for β₁-adrenoceptors)²</th>
<th>Non Cardioselective beta-blockers (relative selectivity for β₂-adrenoceptors)²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acebutolol (2.4)</td>
<td>Labetalol (2.5)</td>
</tr>
</tbody>
</table>
Roll-out of SMASH Intervention

- First practice recruited March 2016
- 43 (out of 44) general practices in Salford
- 40 pharmacists trained in SMASH
- Final practice completed follow up in September 2018
Qualitative Process Evaluation

- Explored the potential of the SMASH intervention to be a rapid learning health system
- Aimed to explore the ways in which the SMASH intervention was implemented, adopted and embedded into practice
- Individual participants recruited on a purposive basis from the CCG and 18 GP practices
- Twenty five interviews with a range of stakeholders
- Analysis drew upon Normalisation Process Theory (NPT) - themes were mapped to the NPT constructs
Normalisation Process Theory

Coherence: How do people make sense of the ‘thing’

Cognitive participation: How do people engage with and stay committed to the ‘thing’

Collective Action: How do people work together to make the ‘thing’ work and stay working

Reflexive Monitoring: How do people assess whether it is worth using the ‘thing’

The work needed to get the ‘thing’ in practice
Coherence

Making sense of the intervention in the context of pharmacist and GP working practices

• SMASH perceived by range of stakeholders as easy to use – provided access to actionable data
• Pharmacists - the dashboard gave value to their work
• The intervention was understood in the context of wider medicines safety activities
• Pharmacists worked to integrate the intervention into practices
“...it’s just quick and easy isn’t it? You can turn up at a surgery, log on the dashboard, ‘cause you’ll have access to that surgery, and within an hour you could have made several safety interventions, from just (Practice Pharmacist 3)

“At the moment there’s seven patients that have fallen off (no longer highlighted by the dashboard as at risk) in the time that I’ve been there that I know that I have personally reviewed. They’re safer now. […] To have that, for it to be quantifiable like that, is really nice” (Practice Pharmacist 1).
Cognitive participation
Enrolment and engagement to establish the intervention

- Establishing the intervention involved collaborations
- Varied access and engagement from different stakeholders
- Trust and confidence important – pharmacists valued
- Trust in the intervention through depersonalised feedback.
“Yeah, it does (improve things in practice) and having this tool depersonalises (feedback), because it is...this system has picked up that you have prescribed this. It’s not...you know, you’ve done this and I don’t think it’s safe...it’s the system has picked this up, so it depersonalises everything [...]so it’s a good way of getting feedback without making it personal.” (GP1)


**Collective action**

Work to adopt and sustain the SMASH intervention including communication, collaborations and divisions of labour

- Communication and collaboration important
- Agreement and planning important to the intervention
- Divisions of labour – drew upon skills of pharmacists
- Building relationships important to the intervention
"It’s difficult, […] it’s quite difficult to get your head around **when’s the best time to approach doctors** to discuss things in tracking one thing, because they go into home (visits)...when the surgery is not on, they’re on home visits or they’re in meetings, **it’s quite a different way of working**. So that’s probably one barrier is getting free time, so it’d be difficult probably to get everybody together unless you went to the practice meeting on another day. “(Practice Pharmacist 3)
Pharmacists working on the intervention met regularly to share best practice

SMASH intervention was seen as a tool that could lead to system changes in practice

Pharmacists extended and broadened the intervention

Education and awareness - sustaining the intervention
“We’ve actually broadened the remit a little bit, because obviously when you have a patient with one thing that’s up with them, or something that’s identified on the dashboard, there often may be other things, and our view is holistic care, [...] we do a few medication reviews on the patients. [...] but when we look at those patients, we’re obviously looking at the indicator that flags, but also making sure we look at the wider patient as well.” (Practice Pharmacist 6).
What we found…

- Intervention allowed for a rapid learning health system to evolve – data in dashboard led to changes in patients’ medication
- Role of the pharmacist pivotal
- Relationships important in how the intervention was implemented, adopted and sustained
- Pharmacists demonstrated their professional skills
- NPT constructs proved useful in drawing out the multifaceted nature of the intervention
Clinical impact and implications for policy

- PINCER Tool accessed by **>2,400 practices** across **198 CCGs** (30% of all practices in England)

- PINCER supported by NICE in ‘Medicines Optimisation Clinical Guideline’ published 04/03/15

- PINCER prescribing safety indicators included in First Databank’s **Optimise Rx** clinical decision support software - rolled out to over **100 CCGs** in England ‘reaching more than 24 million patients’

- **Patient Safety Toolkit** (which includes the PINCER prescribing safety indicators) launched on RCGP website July 2015 and **accessed over 10,000 times**

- Intervention shortlisted from over 800 entries as regional winner of the **Excellence in Primary Care Award** category of the **NHS70 Parliamentary Awards 2018**

- PINCER selected for **national adoption and spread** across all **15 Academic Health Sciences Networks** during 2018-2020
Conclusions

• Risks associated with the use of medication remain high
• Drug-related problems resulting in hospitalisation are common, almost half of which are preventable
• There is HUGE potential to develop technologies and behaviours that create safer care systems, building on innovations in NHS data analytics/interfaces – underpinning establishment of a “learning health system”
• Aligned with this, there is HUGE potential for the pharmacy workforce to drive forward these innovations at scale to improve medication safety
A partnership between

The NIHR Greater Manchester Patient Safety Translational Research Centre
is funded by the National Institute for Health Research (NIHR) and is a partnership between
The University of Manchester and Salford Royal NHS Foundation Trust