NIHR Greater Manchester
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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

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- Provide an overview of the extent and impact of medication error
- Highlight some of the research that we doing to reduce this and improve the safety of prescribing in primary care
- Summarise some of our research findings and how are we implementing these findings into practice
- Plans for future work

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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

Research

Anthony J Avery, Maisoon Ghaleb, Nick Barber, Bryony Dean Franklin, Sarah J Armstrong, Brian Serumaga, Soraya Dhillon, Anette Freyer, Rachel Howard, Olanrewaju Talabi and Rajnikant L Mehta

The prevalence and nature of prescribing and monitoring errors in English general practice:

a retrospective case note review

Abstract

Background

Aim

Design and setting

Method

Results

Conclusion

Keywords

INTRODUCTION

Big implications in terms of patient safety and costs

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Medication without harm: WHO's Third Global Patient Safety Challenge

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Medication Without Harm: WHO's Third Global Patient Safety Challenge

For the **WHO Global Patient Safety Challenge on Medication Without Harm** see http://www.who.int/patientsafety/medication-safety/en/

In 1960, Alphonse Chapanis, turned his attention from engineering to health care. In a study of medication-related errors in a 1100-bed hospital,[1] he and his colleague identified seven sources of such errors potentially leading to harm to a patient: medicine omitted, or given to the wrong patient, at the wrong dose, as an unintended extra dose, by the wrong route, at the wrong time, or as the wrong drug entirely. Almost 60 years later, these same types of errors still happen worldwide. Later that year in a follow-up policy paper,[2] Chapanis identified four areas of recommendations that could prevent harm and remain relevant today: written communication, medication procedures, the working environment, training, and education. Indeed, it is difficult to avoid the conclusion that had the recommendations from this revelatory patient safety research been assiduously followed over the past five decades, hundreds of thousands fewer patients would have been killed or seriously harmed by the medicines intended to make them well.

Beginning in 2004, WHO, working in partnership with the then World Alliance for Patient Safety, initiated two Global Patient Safety Challenges, Clean Care is Safer Care[3] and Safe Surgery Saves Lives.[4] These challenges mobilised worldwide commitment and action to reduce health-care-associated infections and risk associated with surgery, respectively. At the second Global Summit of Health Ministers on Patient Safety in Bonn, Germany, on March 29, 2017, the Director-General of WHO announced that the Third Global Patient Safety Challenge, Medication Without Harm, would address medication safety.[5]

The previous challenges secured strong and early commitment from health ministers, professional bodies, regulators, health leaders, civil society, and health-care practitioners. The action required to deliver the goals of each was broadly similar: an evidence-based analysis of the key problems and solutions; an invitation to WHO member states and other relevant parties to pledge, or sign-up, to address the aims of the challenge; high-profile actions to generate passion and enthusiasm; facilitation

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

The University Of Sheffield.

UNIVERSITY of York

MANCHESTER 1824

EEPRU Policy Research Unit in Economic Evaluation of Health & Care Interventions

Policy Research Unit in Economic Evaluation of Health & Care Interventions (EEPRU)

PREVALENCE AND ECONOMIC BURDEN OF MEDICATION ERRORS IN THE NHS IN ENGLAND

Rapid evidence synthesis and economic analysis of the prevalence and burden of medication error in the UK

Authors: Rachel A Elliott[1], Elizabeth Camacho[1], Fiona Campbell[2], Dina Jankovic[3], Marriesa Martyn St James[2], Eva Kaltenthaler[2], Ruth Wong[2], Mark J Sculpher[3], Rita Faria[3]

[1] Manchester Centre for Health Economics
Division of Population Health, Health Services Research and Primary Care,
School of Health Sciences, The University of Manchester
[2] ScHARR, University of Sheffield
[3] Centre for Health Economics, University of York

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

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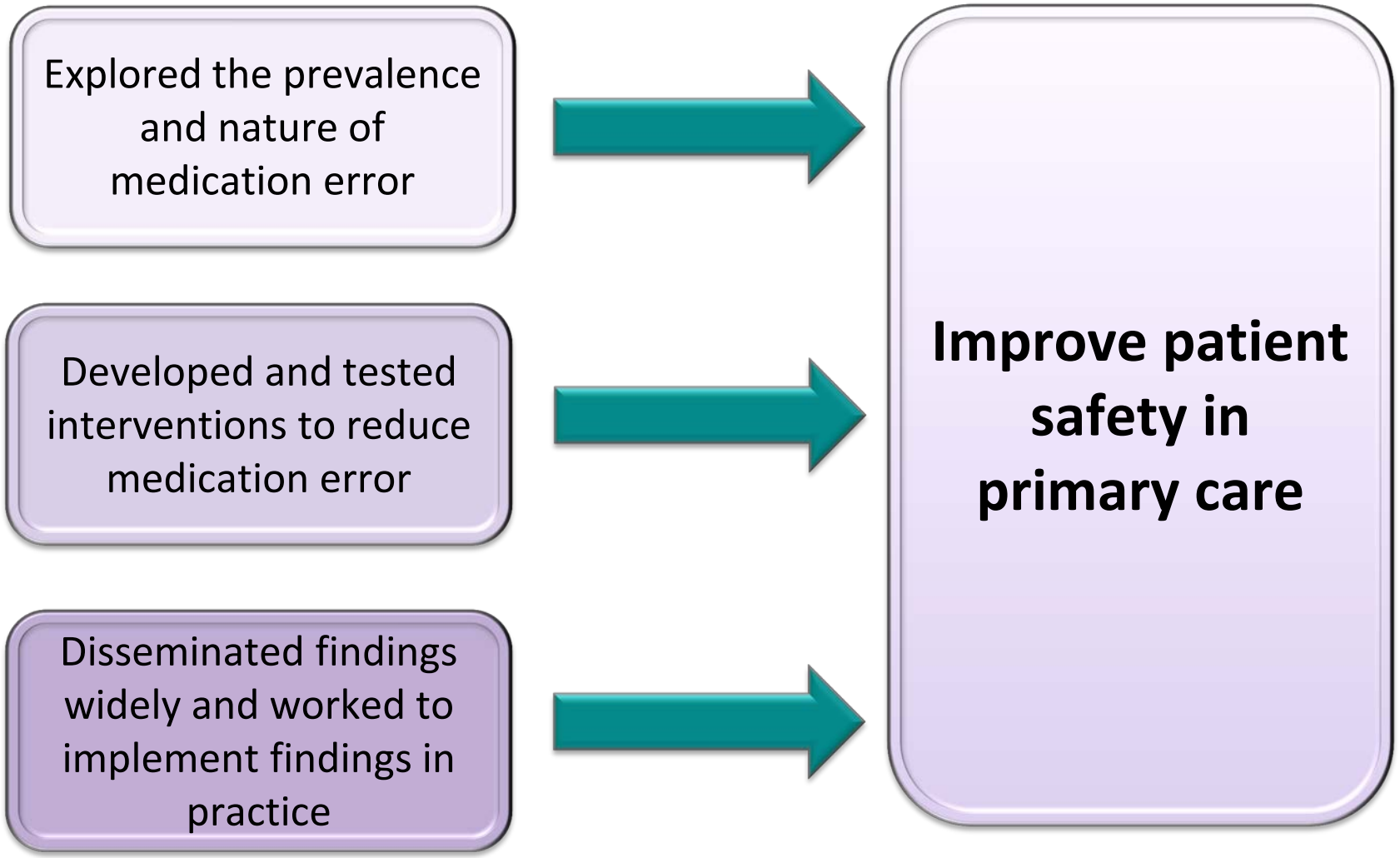

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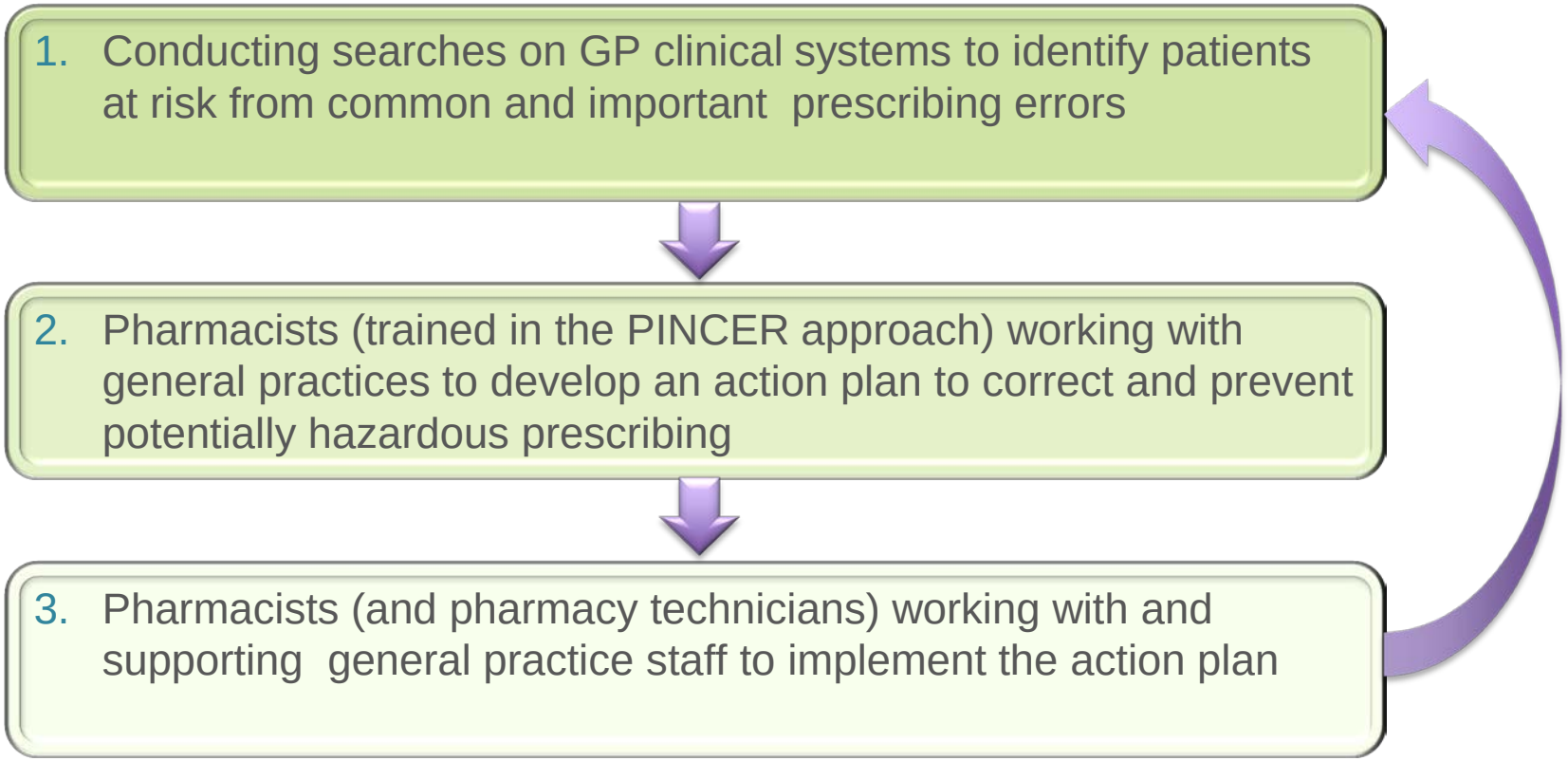
The PINCER Intervention

Pharmacist-led **I**T-based i**n**tervention to reduce rates of **c**linically important **er**rors in medicines management in general practices



PINCER Trial

A cluster randomised trial comparing the effectiveness of a **p**harmacist-led **I**T-based i**n**tervention with simple feedback in reducing rates of **c**linically important **er**rors in medicines management in general practices

Articles

A pharmacist-led information technology intervention for medication errors (PINCER): a multicentre, cluster randomised, controlled trial and cost-effectiveness analysis

Anthony J Avery, Sarah Rodgers, Judith A Cantrill, Sarah Armstrong, Kathrin Cresswell, Martin Eden, Rachel A Elliott, Rachel Howard, Denise Kendrick, Caroline J Morris, Robin J Prescott, Glen Swanwick, Matthew Franklin, Koen Putman, Matthew Boyd, Aziz Sheikh

Lancet 2012; 379: 1310–19
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See Comment page 1278

Division of Primary Care, University of Nottingham Medical School, Queen's Medical Centre, Nottingham, UK (Prof A J Avery MD, Prof D Kendrick DM); Division of Primary Care, NIHR Collaboration for Leadership in Applied Health Research and Care—Nottinghamshire, Derbyshire & Lincolnshire (S Rodgers PhD), and Division for Social Research in Medicine and Health, The School of Pharmacy (Prof R A Elliott PhD, M Franklin MSc, M Boyd PhD), University of Nottingham, Nottingham, UK; Drug Usage & Pharmacy Practice Group, School of Pharmacy & Pharmaceutical Sciences, University of Manchester, Manchester, UK (Prof J A Cantrill MSc, M Eden MRes); The NIHR Research Design Service, Division of Primary Care, Nottingham, UK (S Armstrong PhD); eHealth Research Group, Centre for Population Health Sciences, The University of Edinburgh, Edinburgh, UK (K Cresswell PhD, Prof R J Prescott PhD, Prof A Sheikh PhD); School of Pharmacy, University of Reading, Reading, UK (R Howard PhD); Department of Primary Health Care and General Practice, Wellington School of Medicine and Health Sciences, University of Otago, Wellington South, New Zealand (C J Morris PhD); Consumers in Research Advisory Group, Research and Evaluation Team,

Summary

Background Medication errors are common in primary care and are associated with considerable risk of patient harm. We tested whether a pharmacist-led, information technology-based intervention was more effective than simple feedback in reducing the number of patients at risk of measures related to hazardous prescribing and inadequate blood-test monitoring of medicines 6 months after the intervention.

Methods In this pragmatic, cluster randomised trial general practices in the UK were stratified by research site and list size, and randomly assigned by a web-based randomisation service in block sizes of two or four to one of two groups. The practices were allocated to either computer-generated simple feedback for at-risk patients (control) or a pharmacist-led information technology intervention (PINCER), composed of feedback, educational outreach, and dedicated support. The allocation was masked to researchers and statisticians involved in processing and analysing the data. The outcomes were the proportions of patients at 6 months after the intervention who had had any of three clinically important errors: non-selective non-steroidal anti-inflammatory drugs (NSAIDs) prescribed to those with a history of peptic ulcer without co-prescription of a proton-pump inhibitor; β blockers prescribed to those with a history of asthma; long-term prescription of angiotensin converting enzyme (ACE) inhibitor or loop diuretics to those 75 years or older without assessment of urea and electrolytes in the preceding 15 months. The cost per error avoided was estimated by incremental cost-effectiveness analysis. This study is registered with Controlled-Trials.com, number ISRCTN21785299.

Findings 72 general practices with a combined list size of 480 942 patients were randomised. At 6 months' follow-up, patients in the PINCER group were significantly less likely to have been prescribed a non-selective NSAID if they had a history of peptic ulcer without gastroprotection (OR 0·58, 95% CI 0·38–0·89); a β blocker if they had asthma (0·73, 0·58–0·91); or an ACE inhibitor or loop diuretic without appropriate monitoring (0·51, 0·34–0·78). PINCER has a 95% probability of being cost effective if the decision-maker's ceiling willingness to pay reaches £75 per error avoided at 6 months.

Interpretation The PINCER intervention is an effective method for reducing a range of medication errors in general practices with computerised clinical records.

Funding Patient Safety Research Portfolio, Department of Health, England.

Introduction

Medication errors are an important cause of potentially avoidable morbidity and mortality in primary[1,2] and secondary care[3] and reports from the USA, the UK, and elsewhere have shown the urgent need to reduce the risk of occurrence of these errors.[4–6] Although important progress has been made in the implementation of interventions for use in specialist care settings,[7] particularly in relation to computerised entry of physician orders[8,9] and computerised decision support,[9] the evidence for primary care—in which most patients are now managed worldwide—is still very weak.[5,10]

On the basis of systematic reviews of published work[10,11] and our own research,[12,13] we identified the drugs most commonly associated with medication errors in primary care.[14–16] In view of the few known effective interventions, we focused on the identification of the most promising components of any future intervention.[10] The evidence was strongest for educational outreach[10] and pharmacist-led interventions.[10] Furthermore, most preventable adverse drug events in primary care are attributable to errors in prescription and medication monitoring,[1,12] and changes in practice enabled by information technology have substantial potential to reduce the frequency of these errors.[5] However, translation of this potential into proven benefits is far from straightforward, which relates to the difficulties in making the organisational changes needed to embed information technology into routine models of care.[10] The need for a new multifaceted intervention has been further underscored by two trials that have raised serious doubts about the effectiveness of simple pharmacist-centred interventions.[16,17]

Informed by the Medical Research Council's framework for complex interventions,[18] we aimed to test

- 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

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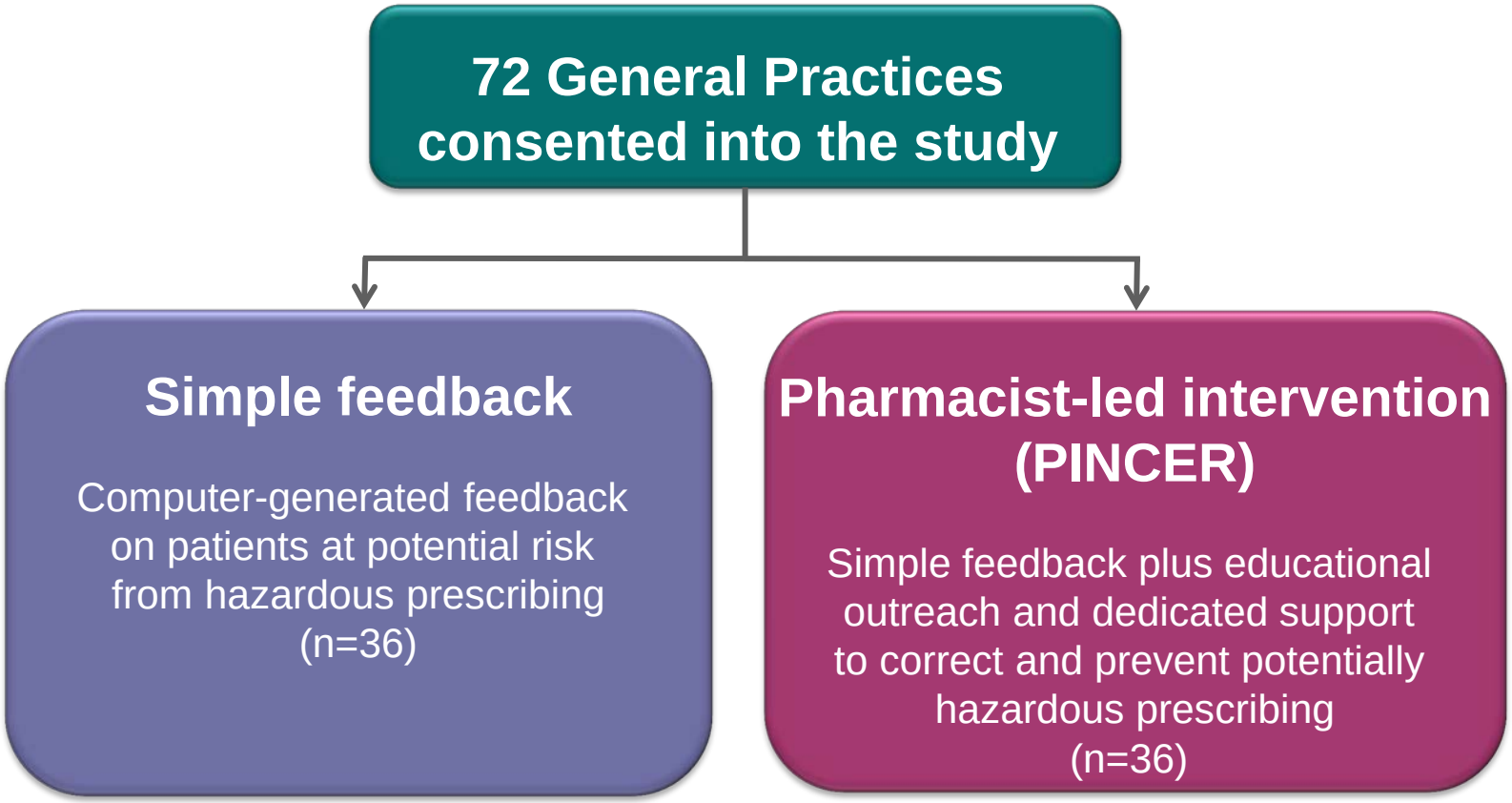
Cluster randomised trial



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

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RESEARCH

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 Ashcroft[1,5]

BMJ 2015; 351: h5501

Medicines & Healthcare products Regulatory Agency

NHS National Institute for Health Research

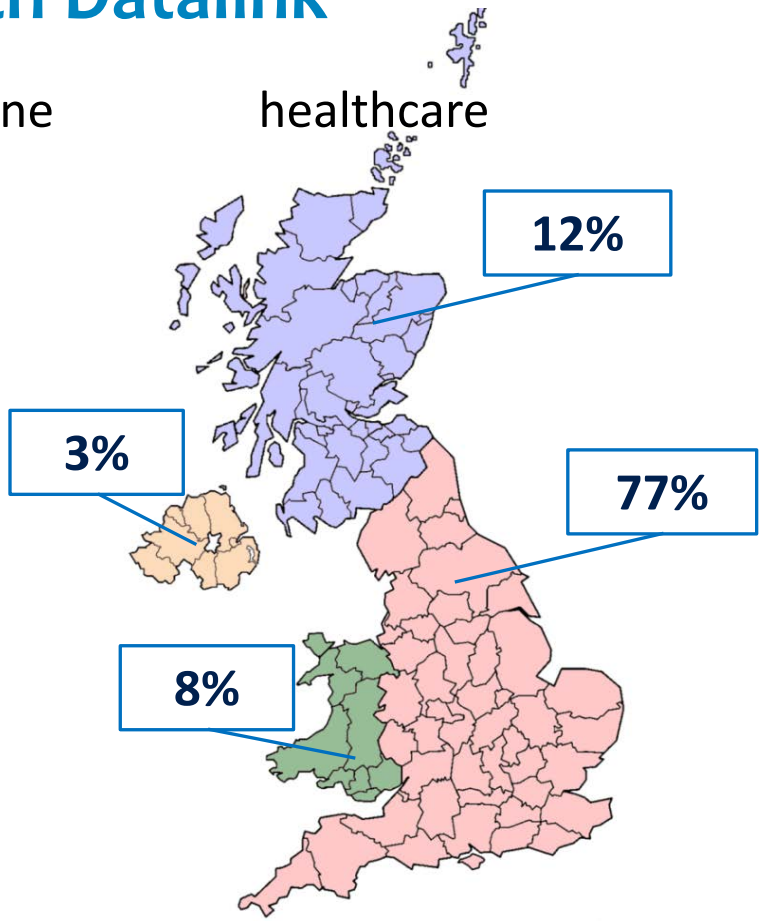
Clinical Practice Research Datalink

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

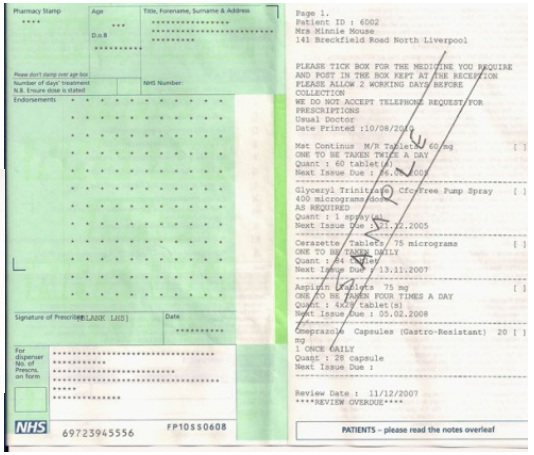
- 28 years of data collection

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)

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- 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

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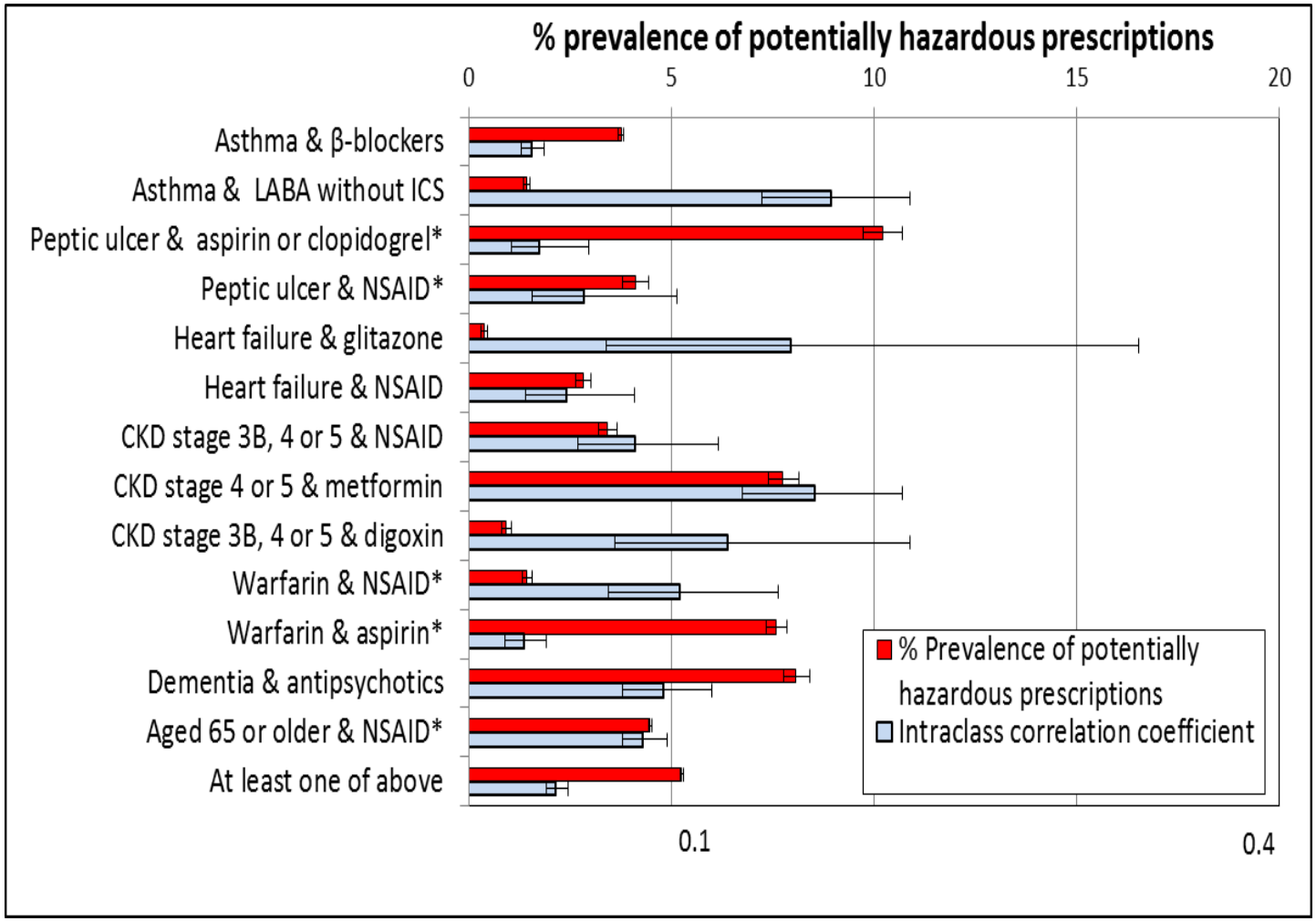

*Patients prescribed gastroprotection were excluded from the indicators involving peptic ulcer, warfarin and patients aged over 65

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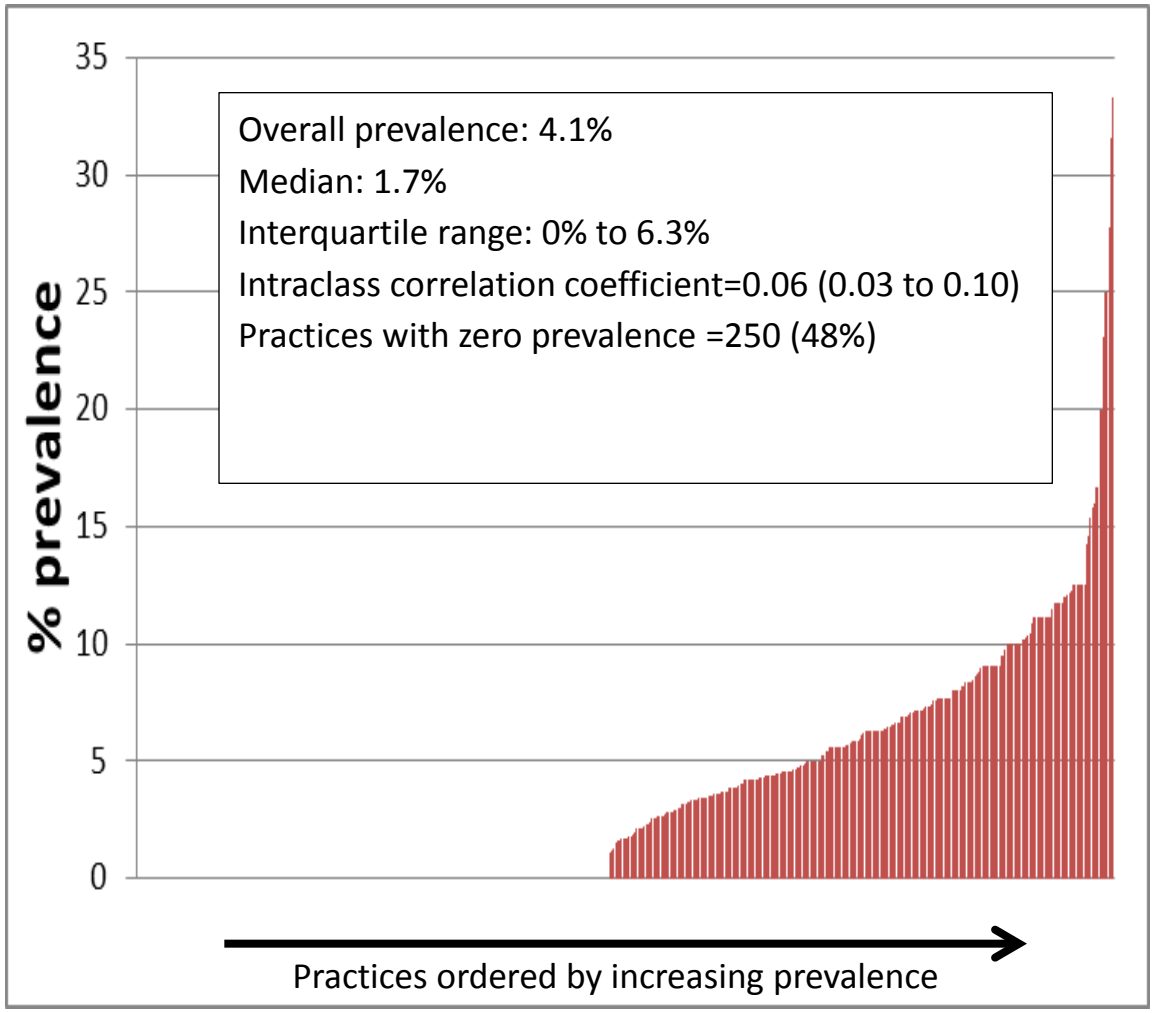
Prevalence of patients with h/o peptic ulcer and prescribed NSAIDs by practice



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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

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Prescribing Safety Indicators


Research

Rachel Spencer, Brian Bell, Anthony J Avery, Gill Gookey and Stephen M Campbell

Identification of an updated set of prescribing-safety indicators for GPs

RESEARCH

OPEN ACCESS

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 Ashcroft[3,5]

Drug Saf (2015) 38:671–682
DOI 10.1007/s40264-015-0304-x

ORIGINAL RESEARCH ARTICLE

Primary Care Medication Safety Surveillance with Integrated Primary and Secondary Care Electronic Health Records: A Cross-Sectional Study

Artur Akbarov[1] · Evangelos Kontopantelis[1,2] · Matthew Sperrin[1] · Susan J. Stocks[3] · Richard Williams[1,3] · Sarah Rodgers[4] · Anthony Avery[4] · Iain Buchan[1,3] · Darren M. Ashcroft[3,5]

Published online: 23 June 2015

Abstract

Introduction The extent of preventable medication-related hospital admissions and medication-related issues in primary care is significant enough to justify developing decision support systems for medication safety surveillance. The prerequisite for such systems is defining a relevant set of medication safety-related indicators and understanding the influence of both patient and general practice characteristics on medication prescribing and monitoring.

Objective The aim of the study was to investigate the feasibility of linked primary and secondary care electronic health record data for surveillance of medication safety, examining not only prescribing but also monitoring, and associations with patient- and general practice-level characteristics.

Methods A cross-sectional study was conducted using linked records of patients served by one hospital and over 50 general practices in Salford, UK. Statistical analysis consisted of mixed-effects logistic models, relating prescribing safety indicators to potential determinants.

Results The overall prevalence (proportion of patients with at least one medication safety hazard) was 5.45 % for prescribing indicators and 7.65 % for monitoring indicators. Older patients and those on multiple medications were at higher risk of prescribing hazards, but at lower risk of missed monitoring. The odds of missed monitoring among all patients were 25 % less for males, 50 % less for patients in practices that provide general practitioner training, and threefold higher in practices serving the most deprived compared with the least deprived areas. Practices with more prescribing hazards did not tend to show more monitoring issues.

Conclusions Systematic collection, collation, and analysis of linked primary and secondary care records produce plausible and useful information about medication safety for a health system. Medication safety surveillance systems should pay close attention to patient age and polypharmacy

Key Points

Linked primary and secondary health care data are important for comprehensive medication safety surveillance.

Medication prescribing and monitoring should be treated as different statistical processes.

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)

Latest PINCER Query Library

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

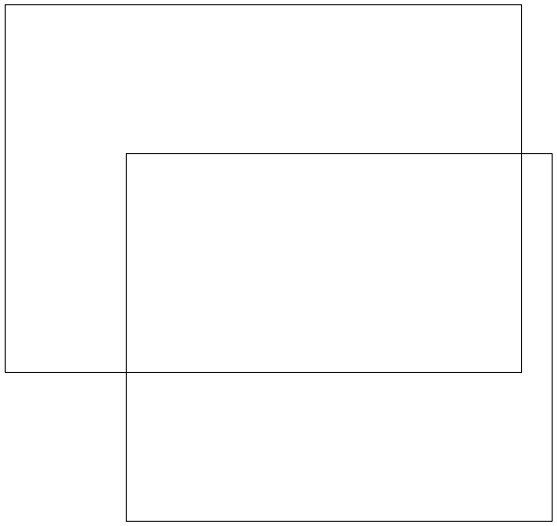
Query J: Prescription of antipsychotics for >6weeks in a patient aged ≥65 years with dementia but not psychosis

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

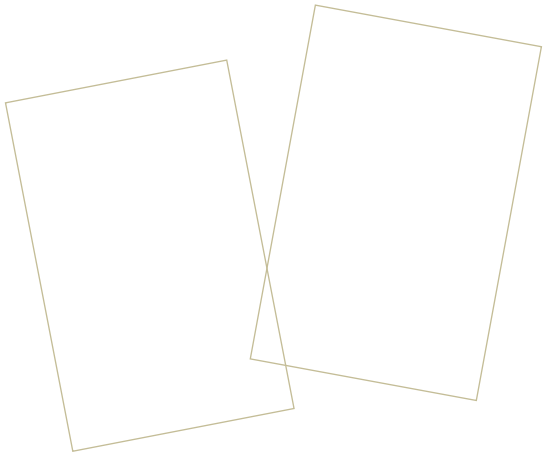


1. CHART software installed on GP practice computer
   http://www.nottingham.ac.uk/primis/tools-software/chart/chart.aspx

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



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PRIMIS

CHART
care and health analysis in real time

The University of Nottingham
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PINCER QUERY SET

PEPTIC ULCER, NSAID AND PPI

PATIENTS AT RISK *(hover over figure for full description)*	3

FURTHER DETAILS

			Prescribed NSAID in the last 6 months		Not prescribed NSAID in last 6 months
Patients aged 18 or over with a Peptic Ulcer Read code that is dated over 6 months ago (All these patients can be seen on the datasheet)	339	equals	7	plus	332
	100.00%		2.06%		97.94%
	↓		↓		↓
	OF WHICH				
	equals ↓		equals ↓		equals ↓
Prescription of PPI dated within the last 6 months	83	equals	4	plus	79
	100.00%		4.82%		95.18%
	plus		plus		plus
No prescription of PPI dated within the last 6 months	256	equals	3	plus	253
	100.00%		1.17%		98.83%

These patients can be indentified by using preset filter 1 on the datasheet

Patients with Peptic Ulcer AND who have no prescription of PPI in the last 6 months	256
Of which have a prescription for NSAID in the last 6 months.	3
Percentage	1.17%

Reference	Age	Sex	Active	Registered Date	Earliest PU Code to 6M ago	Earliest PU Date to 6M ago	Latest PU Code to 6M ago	Latest PU Date to 6M ago	Latest NSAID Code 6M-0M	Latest NSAID Date 6M-0M	Latest PPI Code 6M-0M	Latest PPI Date 6M-0M	Category	Stimulator	Simulator
64725898CD	81	M	R	06/10/98	J12	09/07/01	J12	01/08/01			a6b1	07/11/12	NSAID not prescribed and PPI prescribed		
D3207A5971	78	M	R	01/03/99	J12	21/12/76	J12	21/12/76					NSAID not prescribed and PPI not prescribed	1	
E5EFAF8B6E	73	M	R	20/04/99	J13	01/10/65	J13	01/10/65			a6b7	09/10/12	NSAID not prescribed and PPI prescribed		
6985970E3E	76	M	L	23/06/10	J1210	01/05/99	J1210	01/05/99					NSAID not prescribed and PPI not prescribed	1	
09CF9D9E94	69	M	L	19/02/09	J11	01/01/62	J11	01/01/62					NSAID not prescribed and PPI not prescribed	1	
C487D710EA	61	M	L	02/12/99	J11z	24/02/09	J11z	23/11/09					NSAID not prescribed and PPI not prescribed	1	
3A54091579	89	M	R	09/12/99	J1202	05/03/47	J1202	05/03/47					NSAID not prescribed and PPI not prescribed	1	
2D20158743	85	F	R	09/12/99	J13	08/05/52	J121z	09/02/67					NSAID not prescribed and PPI not prescribed	1	
29E0A658FC	83	M	R	10/07/00	J12	01/01/88	J12	01/01/88			a6hz	19/10/12	NSAID not prescribed and PPI prescribed		
4AA86CC852	54	F	R	12/10/00	J12	29/04/09	J12	29/04/09			a6c2	22/10/12	NSAID not prescribed and PPI prescribed		
DCCA249407	81	F	R	20/11/00	J12	04/07/63	J12	04/07/63			a6b1	05/09/12	NSAID not prescribed and PPI prescribed		
B696907C06	69	M	R	05/03/01	J1212	01/01/75	J1212	01/01/75					NSAID not prescribed and PPI not prescribed	1	
8197041D56	47	M	R	16/05/01	J13	30/06/11	J13	24/01/12			a6b1	29/10/12	NSAID not prescribed and PPI prescribed		
6A0E220D7F	92	F	R	28/08/01	J11	01/01/03	J11y	17/05/04			a6b1	05/11/12	NSAID not prescribed and PPI prescribed		
1DA12F4845	92	F	R	24/04/02	J121y	10/07/81	14C1	12/03/02			a6c2	12/11/12	NSAID not prescribed and PPI prescribed		
5E479C1016	62	M	R	20/12/01	J12	01/01/79	J12	01/01/79			a6c2	27/11/12	NSAID not prescribed and PPI prescribed		
B15A81CF36	85	F	R	09/01/02	J12	15/07/11	J12	15/07/11			a6c2	08/10/12	NSAID not prescribed and PPI prescribed		
7A8DA856FA	36	M	L	29/01/02	J123	08/01/04	J123	08/01/04					NSAID not prescribed and PPI not prescribed	1	
66FDE559CA	39	M	R	23/05/02	J13z	09/08/00	J13z	09/08/00	J2ck	10/09/12			NSAID prescribed but PPI not prescribed	1	1
DD19099DF4	73	M	L	10/06/02	J11z-1	08/02/94	J11z-1	11/07/94					NSAID not prescribed and PPI not prescribed	1	
ADED58E61D	96	F	D	23/07/02	J12	01/01/63	J12	01/01/63					NSAID not prescribed and PPI not prescribed	1	
CDD1B9D098	61	M	R	07/08/02	J1202	01/01/82	J1202	01/01/82			a6c3	17/10/12	NSAID not prescribed and PPI prescribed		
C45C464AA9	85	F	D	15/08/02	J11	05/02/08	J11	05/10/10					NSAID not prescribed and PPI not prescribed	1	

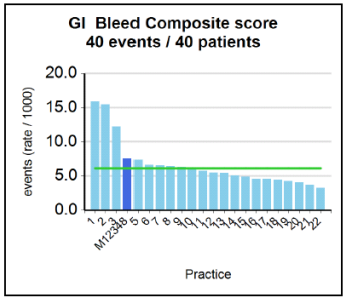
MiQUEST response file PEPREPA.CSV was created on 27/01/13 using Refdate 30/11/12

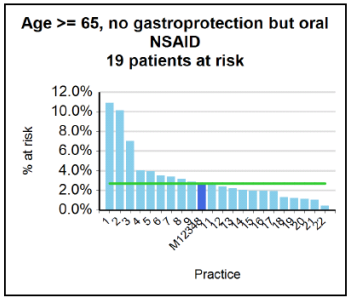
PINCER PEPREPA: Peptic Ulcer REPORT (Pseudonymised)

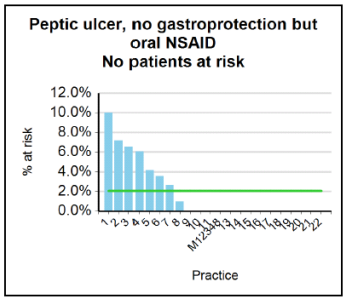
Reference	Age	Sex	Active	Registered Date	Earliest PU Code to 6M ago	Earliest PU Date to 6M ago	Latest PU Code to 6M ago	Latest PU Date to 6M ago	Latest NSAID Code 6M-0M	Latest NSAID Date 6M-0M	Latest PPI Code 6M-0M	Latest PPI Date 6M-0M	Category	Stimulator	Simulator
66FDE559CA	39	M	R	23/05/02	J13z	09/08/00	J13z	09/08/00	J2ck	10/09/12			NSAID prescribed but PPI not prescribed	1	1
A1EB2EBAE8	52	M	R	02/03/12	J11	01/01/84	J11	01/01/84	J282	14/11/12			NSAID prescribed but PPI not prescribed	1	1
580D37D359	53	M	R	25/01/11	J12z	01/01/05	J12z	01/01/05	J282	25/06/12			NSAID prescribed but PPI not prescribed	1	1

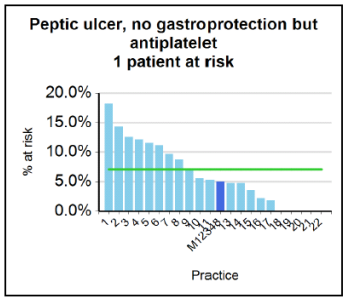
Practice position in the CCG for each analysis

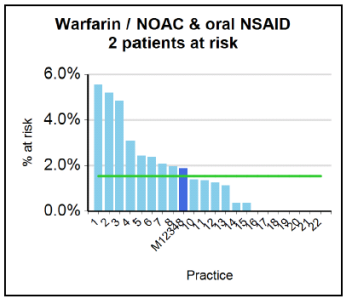
Sort order: event rate or % at risk

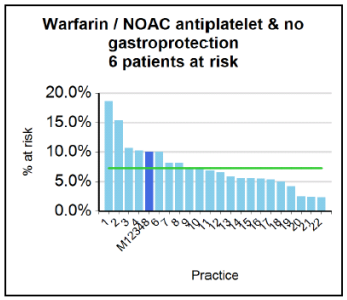






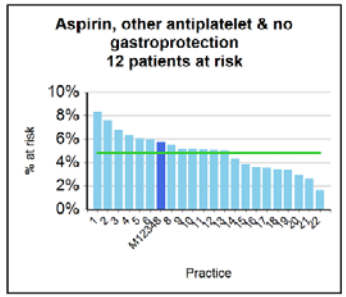


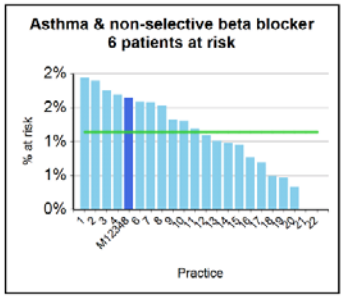


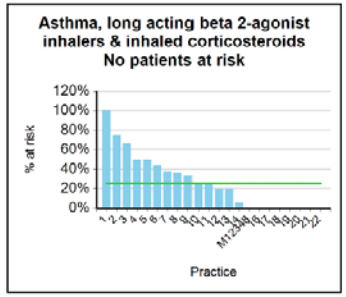


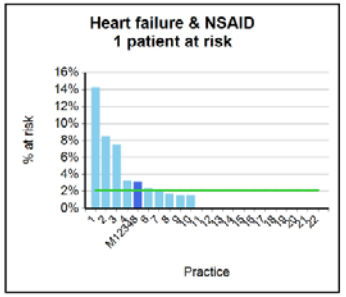
Practice position in the CCG for each analysis

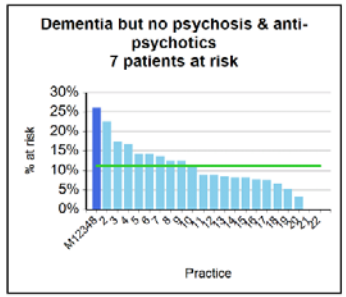
Sort order: % at risk

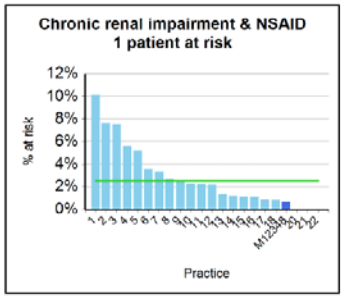












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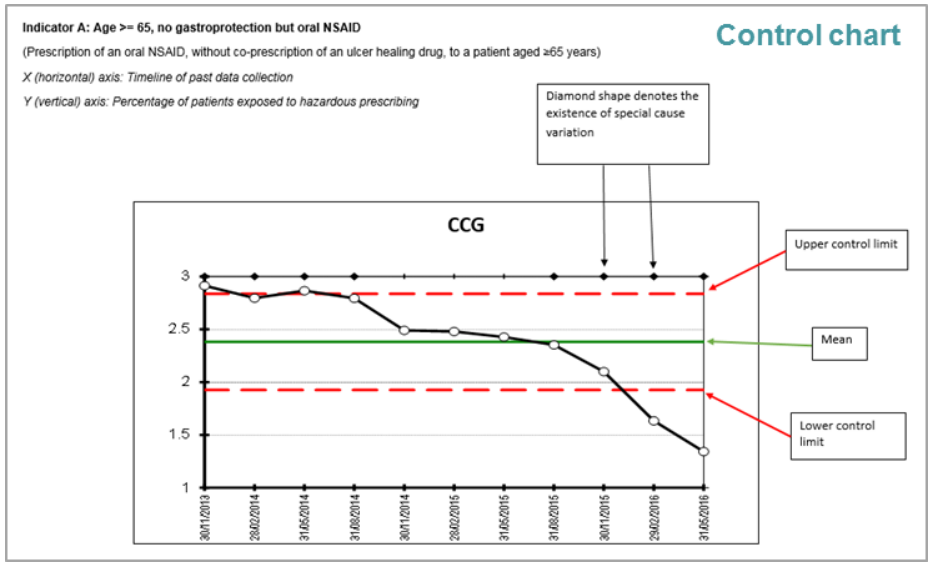
Rollout of the PINCER Intervention

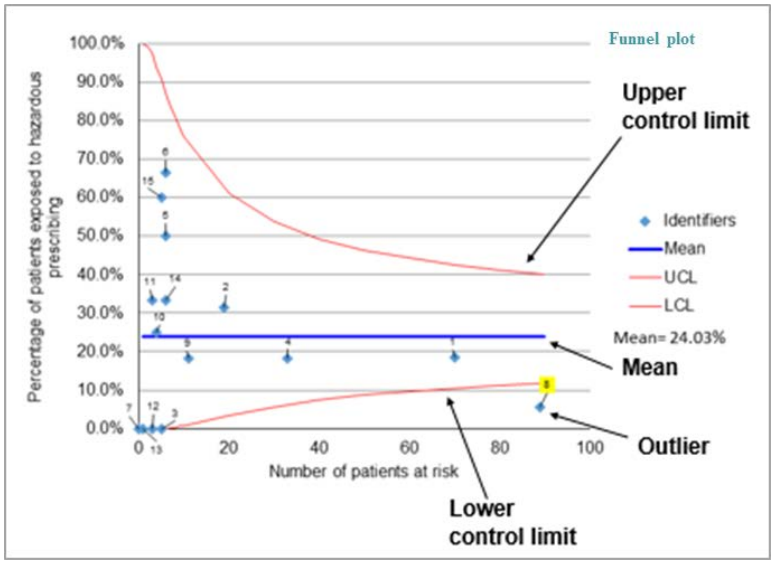
Feedback provided to general practices and CCGs:

- Statistical process control (SPC) charts
- Funnel plots comparing practices within a CCG
- Funnel plots comparing CCGs

Statistical Process Control Charts



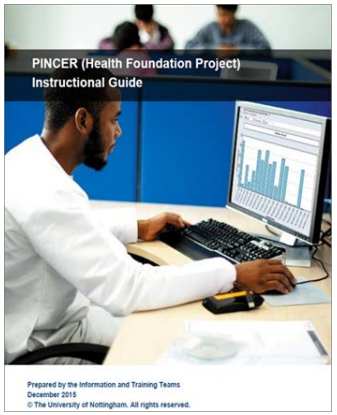
Funnel Plots



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

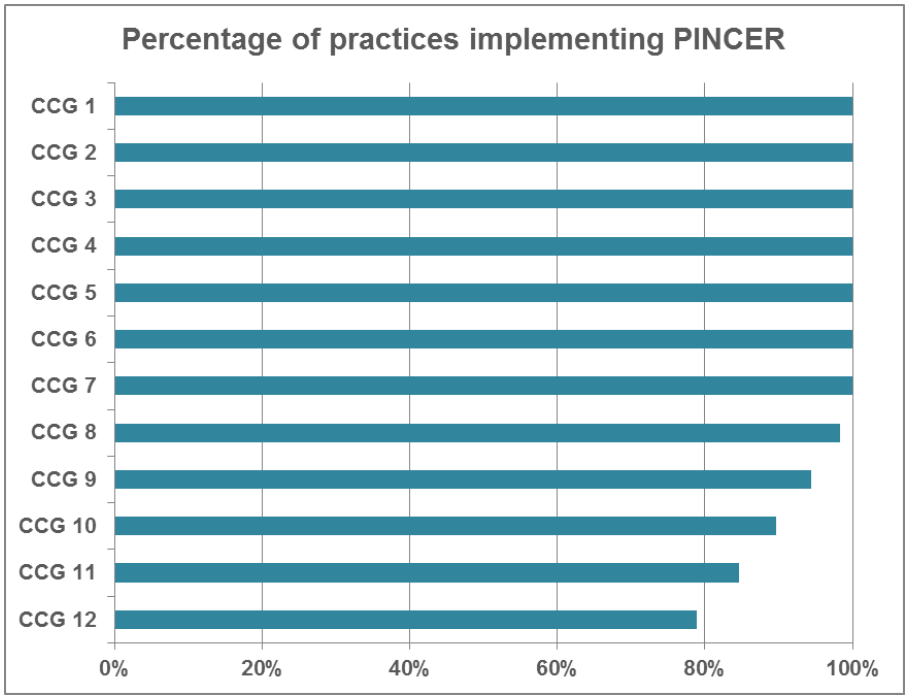
2. The PINCER intervention
   - Evidence base
   - Prescribing safety indicators
   - Root cause analysis
   - Educational outreach



What happened across the East Midlands?

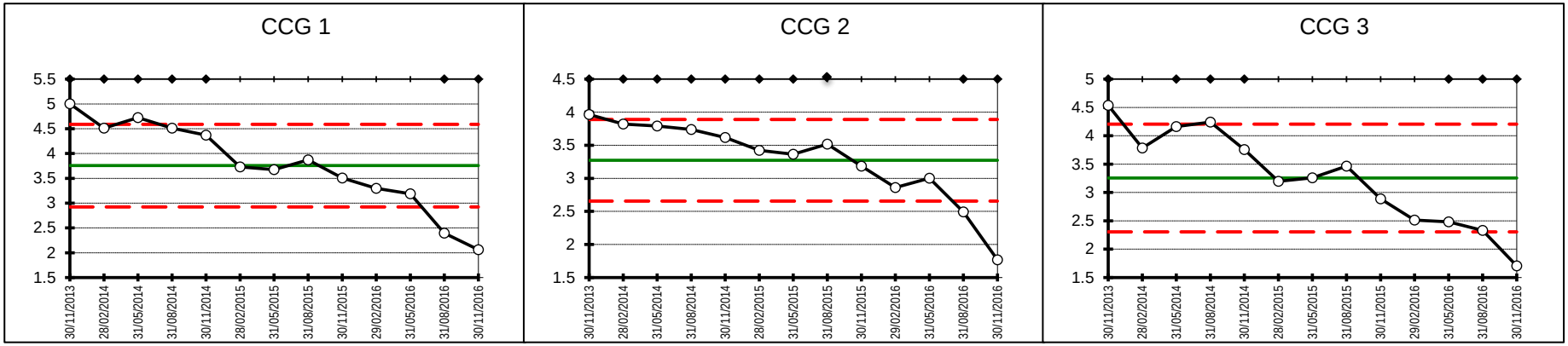
Rollout: September 2015 to April 2017

- 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

JOURNAL OF INNOVATION IN HEALTH INFORMATICS

Research article

SMASH! The Salford medication safety dashboard

Richard Williams

Richard Keers

Wouter T. Gude

Mark Jeffries

Colin Davies

Benjamin Brown

Evangelos Kontopantelis

Anthony J. Avery

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Niels Peek

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 interrogating 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 application 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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OPEN ACCESS

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Data Availability Statement: This is a qualitative study confined to a single locality (Salford UK). Our ethics approval was granted based on the anonymity of the individuals consenting to participate. Participants were drawn from a small group of health care professionals in specific roles, particularly the pharmacists delivering the intervention. Providing additional information beyond the carefully selected anonymised quotations that support the findings in the

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 receiving 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 this affected care practice. 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 respect, improve trust and develop relationships between pharmacists and GPs. Collaboration and

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The Salford Experience: SMASH Process

Primary Care EHR (Salford Integrated record)

↓

EHR is processed against these safety indicators

↑

Prescribing Safety Indicators

→ **An interactive electronic dashboard** ↔ GP Staff

An interactive electronic dashboard ↕ **Clinical Pharmacist**

GP Staff ↕ Actions to resolve safety hazards

Clinical Pharmacist ↔ Actions to resolve safety hazards

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

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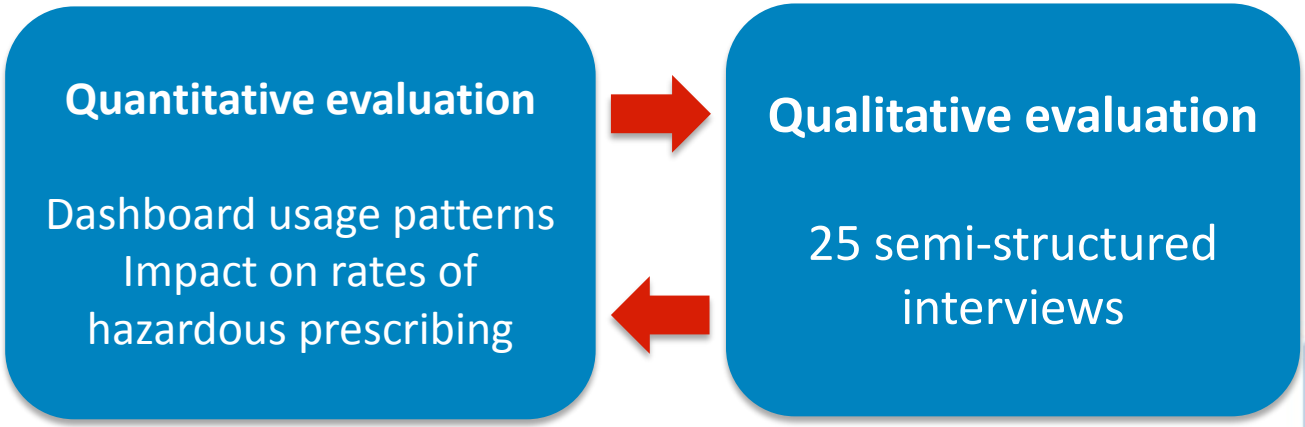
SMASH Intervention

- 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



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Glendale Medical Centre

Report date: 15 Nov (Latest)

Comparison date: 16 Oct (30 days ago)

Sort by: Affected patients

Practice summary | Table | Charts

Export

Indicator	Affected patients	% of eligible patients affected	CCG Avg (%)	New cases	Trend	Show on top
Age≥65 no GastProt and NSAID	19	2.04	0.32	3	1	☐
Mtx and no monitoring	12	11.01	2.67	2	-3	☐
GiB/PUD no GastProt and Antiplatelet	8	6.61	2.49	1	-1	☐
Asthma and BB Click to view patients...	8	3.67	1.51	2	0	☐
Aspirin and Antiplatelet	7	3.47	1.11	7	7	☐
CKD and triple whammy	5	2.86	1.30	5	5	☐
Warf/NOAC and NSAID	4	19.05	9.05	1	0	☐
HF and NSAID	3	2.94	2.11	2	-2	☐
LABA and no ICS	2	0.85	1.07	0	2	☐
Amiod and no thyroid test	2	9.09	11.54	4	-3	☐

Asthma and BETA BLOCKER ▾ | Affected patients ▾ | 1 May 2015 ▾ | 30 April 2015 ▾

Patients | Trend | Information

NHS number	Indicators breached	Since
96510	WARF no GP and ASP Asthma and BETA BLOCKER	20 February 2015 16 January 2015
110726	Asthma and BETA BLOCKER	1 May 2011
153980	Asthma and BETA BLOCKER	1 May 2013
51507	Asthma and BETA BLOCKER	20 November 2014
132469	Asthma and BETA BLOCKER	30 July 2013
43458	Asthma and BETA BLOCKER	9 July 2013

Glendale Medical Practice

Report date: 1 May 2015

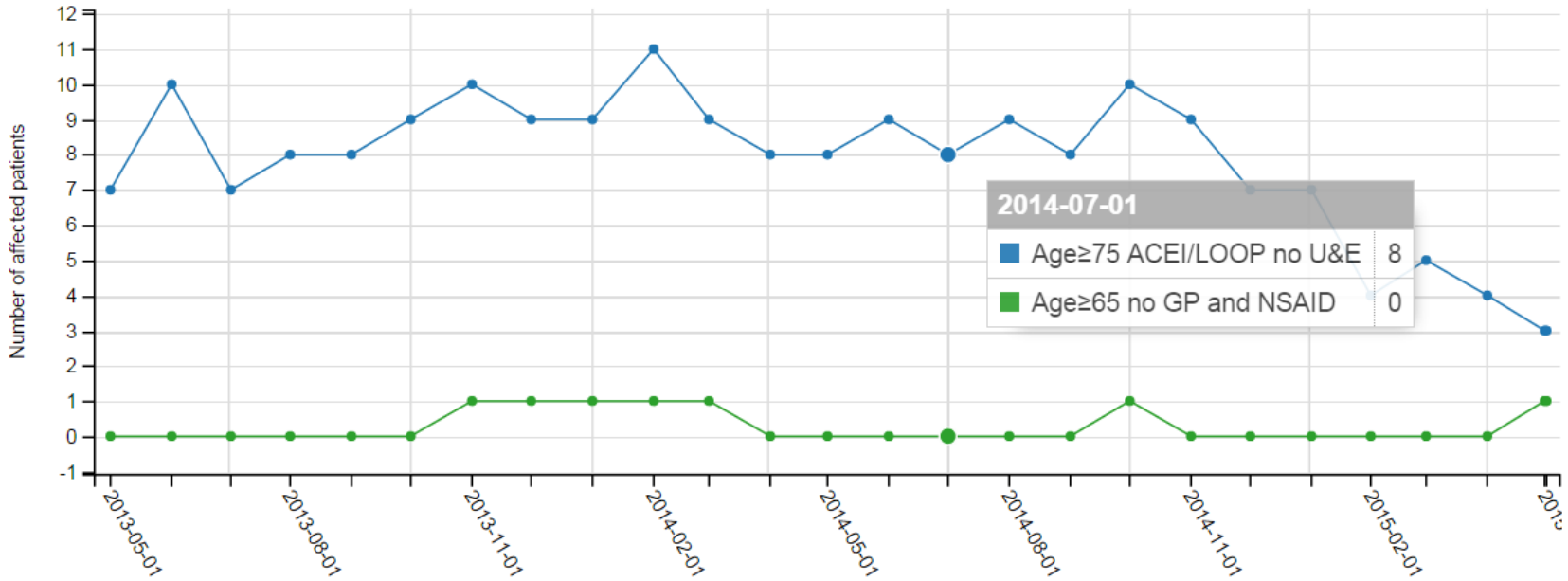
Comparison date: 30 April 2015

Sort by: Affected patients

Practice summary | Table | Charts

Number of affected patients over time

Start date: 1 May 2013 **End date:** 1 May 2015



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 β_2 (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 Medicines[1] 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 β_1- and β_2-adrenoceptors, and are divided into two groups, cardioselective (affinity for β_1), and non-cardioselective (affinity for β_2). The majority show little selectivity for one receptor over the other, except for bisoprolol (14-fold greater affinity for β_1-adrenoceptors) and timolol, sotalol and propranolol (26-fold, 12-fold, and 8-fold greater affinity for β_2-adrenoceptors, respectively).

Table 1: Cardioselective and non-cardioselective betablockers

Cardioselective beta-blockers (relative selectivity for β_1-adrenoceptors)[2]	**Non Cardioselective beta-blockers (relative selectivity for β_2-adrenoceptors)[2]**
Acebutolol (2.4)	Labetalol (2.5)

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

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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

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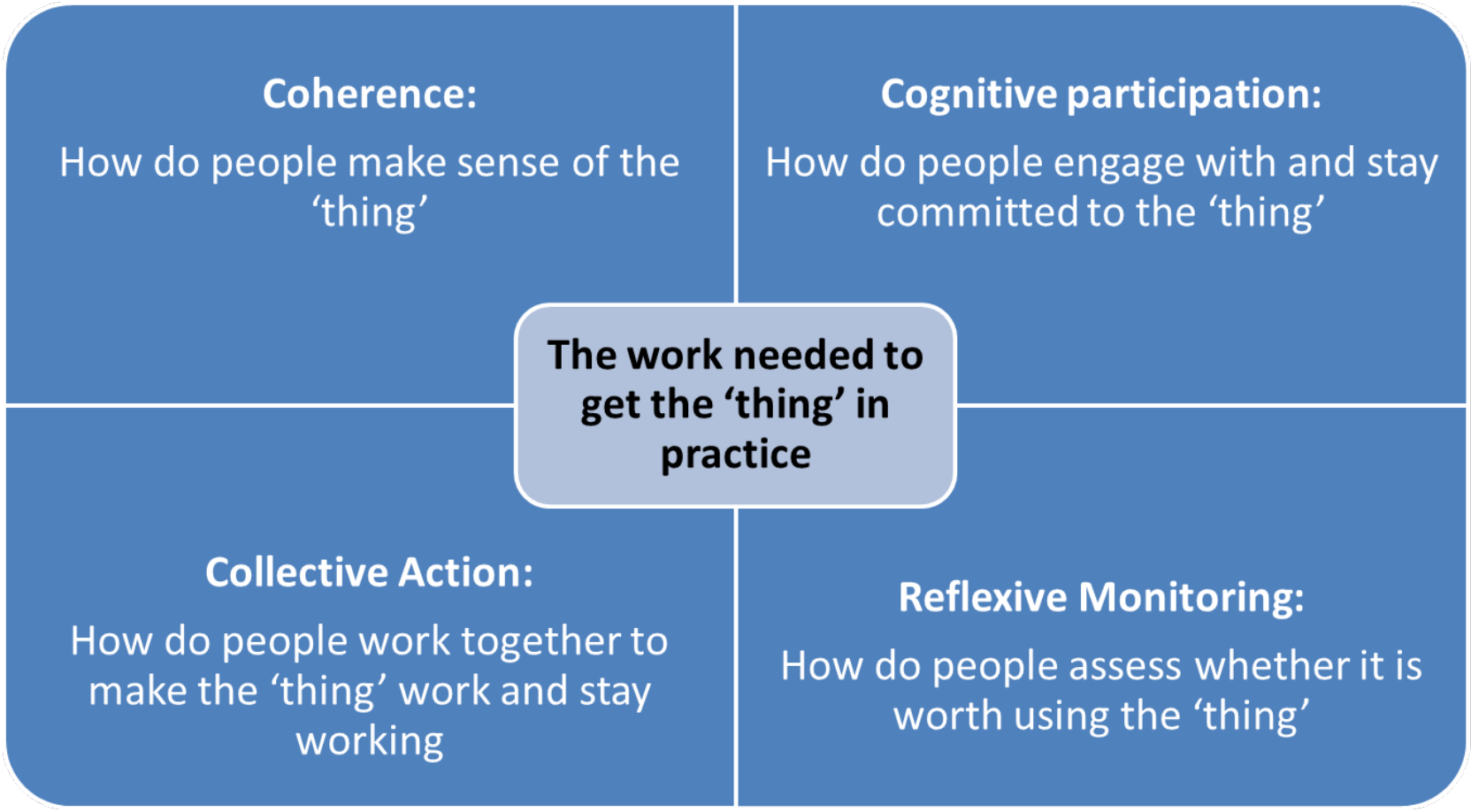
Normalisation Process Theory



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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

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"...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).

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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.

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"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)

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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

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"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)

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Reflexive monitoring

How pharmacists and clinicians reflected upon and appraised the intervention and the potential for sustaining long-term system change

- 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

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"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).

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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

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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

Funded by NIHR

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

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