

A pharmacist-led IT intervention to reduce PIP: the PINCER trial



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The 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

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 Cantrell, Sarah Armstrong, Kathrin Cresswell, Martin Eden, Rachel A Elliott, Rachel Howard, Denise Kendrick, Caroline J Morris, Robin J Prescott, Glen Swanwick, Matthew Franklin, Karen Putman, Matthew Bayl, Aziz Sheikh

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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 allocation was not masked to general practices, pharmacists, patients, or researchers who visited practices to extract data. Primary outcomes were the proportions of patients at 6 months after the intervention who 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 care³ and reports from the USA, the UK, and elsewhere have shown the urgent need to reduce the risk of occurrence of these errors.^{4,5} Although important progress has been made in the implementation of interventions for use in specialist care settings,⁶ particularly in relation to computerised entry of physician orders^{7,8} and computerised decision support,^{9,10} the evidence for primary care—in which most patients are now managed worldwide—is still very weak.^{11,12}

On the basis of systematic reviews of published work^{13,14} and our own research,^{15,16} we identified the drugs most commonly associated with medication errors in primary care.¹⁶ In view of the few known effective interventions, we focused on the identification of the most promising

components of any future intervention.¹⁶ The evidence was strongest for educational outreach¹⁷ and pharmacist-led interventions.¹⁸ Furthermore, most preventable adverse drug events in primary care are attributable to errors in prescription and medication monitoring,¹⁹ and changes in practice enabled by information technology have substantial potential to reduce the frequency of these errors.¹ 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.²⁰ 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.^{21,22}

Informed by the Medical Research Council's framework for complex interventions,²³ we aimed to test

Main research question

Is a pharmacist-led
IT-based complex intervention using
educational outreach and practical support
more effective than simple feedback in
reducing rates of clinically important errors in
medicines management in
general practice?

Overview

- 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

Simple feedback plus educational
outreach and dedicated support
to correct and prevent potentially
hazardous prescribing
(n=36)



PINCER findings

- At 6-months follow-up patients in the PINCER group were
 - 42% less likely to have been prescribed a nonselective NSAID if they had a history of peptic ulcer without gastroprotection
 - 27% less likely to be given a beta blocker if they had asthma
 - Almost 50 % less likely to be prescribed an ACE inhibitor or loop diuretic without appropriate monitoring
 - The intervention also improved composite prescribing and monitoring outcomes
- Using GP computer systems to identify patients at risk, combined with a pharmacist intervention, can substantially reduce medication errors
- There was evidence that the intervention was cost-effective
- The intervention could be rolled out across NHS at low cost to reduce prescribing errors



What next after PINCER?

- We are involved in a substantial body of research that is having an influence on policy and practice
- We now have a great opportunity to develop things further through current opportunities
- PINCER was “proof of principle”
- In terms of taking the PINCER work forward, we now want to focus on:
 - Rollout of the PINCER prescribing safety indicators
 - Which prescribing safety indicators are the most important/most cost-effective
 - Whether the PINCER approach reduces morbidity



Rollout of PINCER indicators

Stage 1: Update PINCER indicators and make them available to general practices in England

- We have worked with Primary Care Information Services (PRIMIS) to update the MIQUEST computer queries used in the PINCER trial and have made them available to general practices in England through the PRIMIS Query Library
- We have developed web-based general practice/CCG views of aggregated anonymised patient level data using CHART online

PRIMIS
Building confidence, knowledge and skills in users of health information in primary care

CHART Online
Analysis and comparison of practice data

What is CHART Online?

Analysis options:

- analyse different key areas depending upon your choice of audit, for example coding of MIs or hospital admission and discharge rates
- analyses can be made at various levels: SHAU regional grouping, PCT/CCG and individual GP practice

Security

- national practice codes are anonymised ensuring confidentiality.
- practices are able to identify their own practice and can choose to grant permission to other individuals
- confidentiality is strictly enforced within CHART Online

Features of CHART Online

- clear, concise charts showing achievement against peers
- daily data refresh – allowing practice to view and compare their data the very next day
- accessible to members of the PRIMIS Hub, including named individuals from primary care organisations and GP practices
- only requires a web browser and internet connection
- secure login using Microsoft web security mechanisms

One program, different views

Dataset: View patient data in Excel spreadsheets and use filters to identify patients most at risk.

View information in a variety of graphs and tables

The CHART Dashboard gives the user factors in one view.

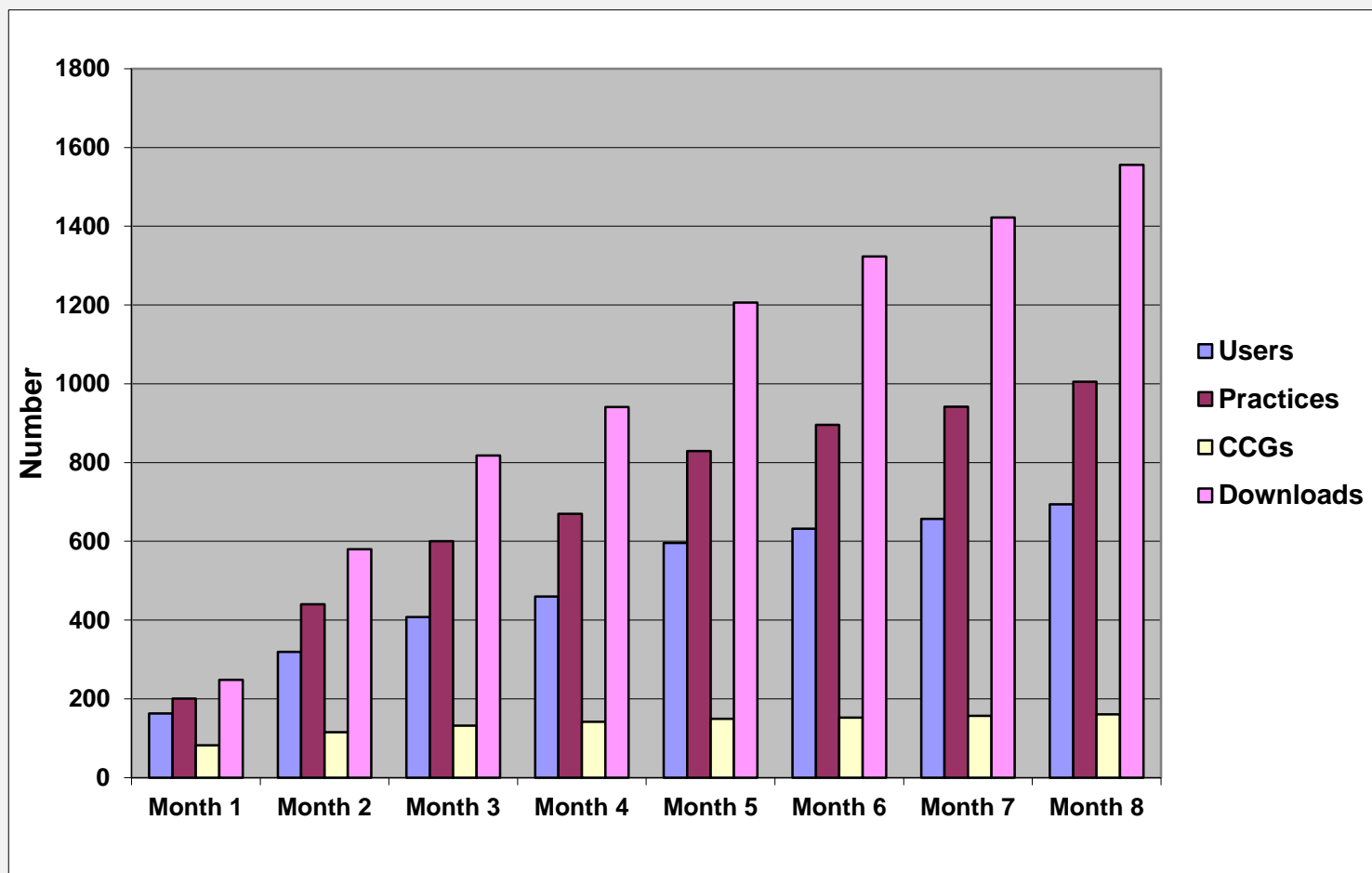
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PINCER Query Library downloads



General Practice view

Data extracted on 27/01/13 using Reference date 30/11/12

PRIMIS **CHART**

PINCER QUERY SET

PEPTIC ULCER, NSAID AND PPI

PATIENTS AT RISK 3

(hover over figure for full description)

FURTHER DETAILS

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

100.00%

equals

↓

OF WHICH

↓

equals

Prescribed NSAID in the last 6 months

7

2.06%

plus

↓

equals

Not prescribed NSAID in last 6 months

332

97.94%

Prescription of PPI dated within the last 6 months

83

100.00%

equals

↓

plus

↓

equals

4

4.82%

plus

↓

plus

↓

equals

79

95.18%

No prescription of PPI dated within the last 6 months

256

100.00%

equals

↓

plus

↓

equals

3

1.17%

plus

↓

plus

↓

equals

253

98.83%

These patients can be identified 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%

MIQUEST response file PEPREPA.CSV was created on 30/11/12 using Refdate 30/11/12

PINCER PEPREPA: Peptic Ulcer REPORT (Pseudonymised)

Reference	Age	Sex	Live	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	Inhibitor	Intercor
64725898CO	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	
E5EFAF886E	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	J11a	24/02/09	J11a	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	J121a	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		
4AAB8CC852	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		
6A0E22007F	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	J14C1	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	J13a	09/08/00	J13a	09/08/00	2ck	10/09/12			NSAID prescribed but PPI not prescribed	1	1
DD19099DF4	73	M	L	10/06/02	J11a-1	08/02/94	J11a-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	
CD01B90098	61	M	R	07/08/02	J1202	01/01/82	J1202	01/01/82			a6c3	17/10/12	NSAID not prescribed and PPI prescribed		
7A5C4644A9	85	F	R	15/08/03	J11	05/07/08	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	Live	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	Inhibitor	Intercor
66FDE559CA	39	M	R	23/05/02	J13a	09/08/00	J13a	09/08/00	2ck	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	282	14/11/12			NSAID prescribed but PPI not prescribed	1	1
580D37D359	53	M	R	25/01/11	J12a	01/01/05	J12a	01/01/05	282	25/06/12			NSAID prescribed but PPI not prescribed	1	1

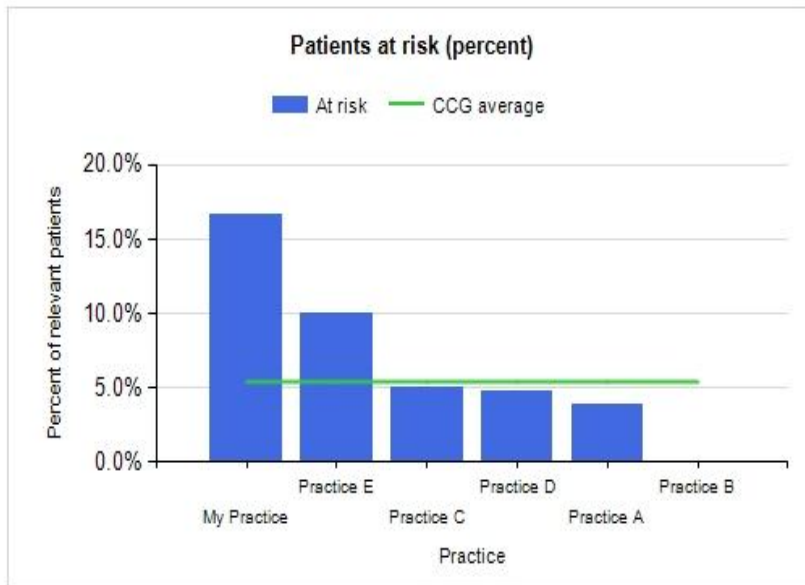


General practice/CCG view

PINCER Results - all practices in NHS South Weatherfield CCG

(Currently registered patients only)

Peptic ulcer, NSAID and PPI



Click on a bar to see results for all PINCER queries for one practice

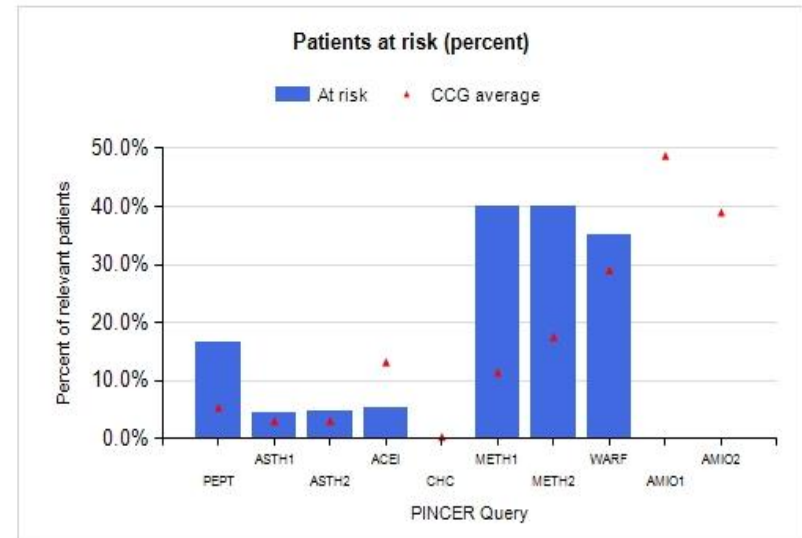
PINCER Results - all Queries

(Currently registered patients only)

My GP Surgery

NHS South Weatherfield CCG

[View as table](#)



Click on a bar to see results for all practices in NHS South Weatherfield CCG

General practice/CCG view

PRIMIS

CHART Online

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

PINCER Results - all queries
(Currently registered patients only)

GP Surgery 1

NHS South Weatherfield CCG

View as chart

Up to all practices

PINCER Query <small>Click on query to view evidence base</small>	Patients at risk	Percent at risk	Trend	CCG Average	Quartile
Peptic ulcer, NSAID and no PPI	3	3.8	↓	5.4	1
Asthma (all) and β-blockers	47	2.9	↓	3.1	1
Asthma (unresolved) and β-blockers	47	2.9	↓	3.1	1
ACEI, loop diuretics and no monitoring	8	2.2	↓	13.2	1
Thrombosis and CHC	1	0.4	–	0.3	3
Methotrexate and no FBC	0	0.0	–	11.5	1
Methotrexate and no LFTs	2	6.5	↓	17.6	1
Warfarin and no INR	1	0.8	–	29.1	1
Lithium and no level recording	5	29.4	↑	34.0	1
Amiodarone and no TFTs, no thyroxine	2	40.0	↓	48.8	2
Amiodarone and no TFTs, with thyroxine	2	40.0	↓	39.0	2

Rollout of PINCER indicators

Stage 2: Develop further query libraries

- We are working with PRIMIS to develop further query libraries based on 56 RAND approved prescribing safety indicators developed for the RCGP
- We have conducted an E-Delphi exercise to identify potential harm and likelihood of hazardous prescribing for the 56 indicators
- We have identified 15 of the most important indicators (in terms of severity and frequency) from this exercise (PINCER+)

Rollout of PINCER indicators

Stage 3: Pilot the prescribing safety indicator query libraries

- We are about to start piloting the acceptability, technical feasibility, reliability, and validity of the prescribing safety indicators in one Clinical Commissioning Group (CCG)
- We plan to explore the prevalence of “at-risk” patients for the 15 most important RCGP indicators using an analysis of the QResearch database
- We are collaborating with the University of Manchester to apply the prescribing safety indicators in the Salford integrated (primary & secondary care) healthcare dataset and Clinical Practice Research Datalink (CPRD)
- We are working with PRIMIS to facilitate a PINCER rollout in N. Ireland



Rollout of PINCER indicators

Stage 4: Economic modelling

- We have just received further funding from the NIHR School for Primary Care Research to model the cost effectiveness of different prescribing safety indicators to identify those indicators that are likely to be the most cost-effective





PINCER resources

- eLearning materials developed as a result of the PINCER study: <http://www.pulse-learning.co.uk/commissioning-modules/commissioning/how-we-reduced-prescribing-errors-with-pharmacists-support>
- Details showing how general practices can download the computer queries used in the PINCER trial: Rodgers S. *New PINCER Query Library Tool to support safer prescribing*. *Prescriber* 2013; 24(6): 11-14 (19 March 2013) DOI: 10.1002/psb.1027 <http://onlinelibrary.wiley.com/doi/10.1002/psb.1027/pdf>
- Rodgers S. Five steps to reducing prescribing errors using PINCER. *Pulse Today* 12 February 2013 <http://www.pulsetoday.co.uk/your-practice/practice-topics/it/-five-steps-to-reducing-prescribing-errors-using-pincer/20001835.article>
- To download queries go to: <http://www.primis.nottingham.ac.uk/index.php/news/hot-news/813>



PINCR publications

Trials

Study protocol

Protocol for the PINCR 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

Anthony J Avery¹*, Sarah Rodgers², Judith A Cantill³, Sarah Armstrong¹, Rachel Elliott², Rachel Howard², Denise Kendrick¹, Caroline J Morris⁴, Scott A Murray⁵, Robin J Prescott⁶, Kathrin Cresswell⁷ and Aziz Sheikh⁸

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Abstract

Background: Medication errors are an important cause of morbidity and mortality. The aims of this study are to determine the effectiveness, cost effect and acceptability of a pharmacist-led information-technology-based complex intervention with simple feedback in reducing proportions of patients at risk from potential medicines management in general (family) practice.

Methods: Research subject group: "Acute" patients registered in two geographical regions in England. Design: Parallel group pragmatic cluster randomised trial.

Interventions: Practices will be randomised to either: (1) Computerised intervention comprising of computer-generated feedback dedicated support.

Primary outcome measures: The proportion of patients in each practice intervention:



Description and process evaluation of pharmacists' interventions in a pharmacist-led information technology-enabled multicentre cluster randomised controlled trial for reducing medication errors in general practice (PINCR trial)

Rachel Howard¹, Sarah Rodgers², Anthony J. Avery³ and Aziz Sheikh⁴ (on behalf of the PINCR trialists)
¹School of Pharmacy, University of Reading, Reading, ²Division of Primary Care, University of Nottingham, University Park, ³Division of Primary Care, Nottingham University Medical School, Queen's Medical Centre, Nottingham and ⁴Centre for Population Health Sciences, The University of Edinburgh, Edinburgh, UK



Background: Medication errors are an important cause of morbidity and mortality. The aims of this study are to determine the effectiveness, cost effect and acceptability of a pharmacist-led information-technology-based complex intervention with simple feedback in reducing proportions of patients at risk from potential medicines management in general (family) practice.

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Interventions: Practices will be randomised to either: (1) Computerised intervention comprising of computer-generated feedback dedicated support.

Primary outcome measures: The proportion of patients in each practice intervention:

Introduction

An estimated 16.5% of patients in primary (ambulatory) care are estimated to experience preventable adverse drug events (1). Preventable adverse drug events are associated with hazardous medicines management and their incidence can

Cresswell et al. *Trials* 2012, 13:78
<http://www.trialsjournal.com/content/13/1/78>



RESEARCH

An embedded longitudinal multi-faceted qualitative evaluation of a complex cluster randomized controlled trial aiming to reduce clinically important errors in medicines management in general practice

Kathrin M Cresswell¹, Stacy Sadler²*, Sarah Rodgers³, Anthony Avery⁴, Judith Cantill⁵, Scott A Murray⁶ and Aziz Sheikh⁷ On behalf of the PINCR Evaluation Team

Abstract

Background: There is a need to shed light on the pathways through which complex interventions mediate their effects in order to enable critical reflection on their transferability. We sought to explore and understand key stakeholder accounts of the acceptability, likely impact and strategies for optimizing and rolling-out a successful pharmacist-led information technology-enabled (PINCR) intervention, which substantially reduced the risk of clinically important errors in medicines management in primary care.

Methods: Data were collected at two geographical locations in central England through a combination of one-to-one longitudinal semi-structured telephone interviews (one at the beginning of trial and another when the trial was well underway), relevant documents, and focus group discussions following delivery of the PINCR intervention. Participants included PINCR pharmacists, general practice staff, researchers involved in the running of the trial and patients.

Research Paper

telephone interviews and 4 were collected from six pre-recorded meetings from 34 GP practices. The interviews explored the perceived importance of a pharmacist-led face-to-face contact and relationship design role as a key element of development pathways.

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

Anthony Avery, Sarah Rodgers, Judith A Cantill, Sarah Armstrong, Kathrin Cresswell, Martin Eden, Rachel Elliott, Rachel Howard, Denise Kendrick, Caroline J Morris, Robin Prescott, Glen Stewart, Matthew Fossells, Martin Patten, Matthew Boyd, Aziz Sheikh

Background: Medication errors are common in primary care and are associated with considerable risk to patient health. 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 medication 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 to a web-based randomisation service in blocks sizes of two or four to one of two groups. The practices were allocated to either computer-generated simple feedback for at-risk patients (family or a pharmacist-led information technology intervention (PINCR)), composed of feedback, educational outreach, and dedicated support.

The allocation was masked to researchers and statisticians involved in processing and analysing the data. The allocation was not masked to general practices, pharmacists, patients, or researchers who visited practices to extend data. Primary outcomes were the proportion of patients at 6 months after the intervention who had had any of these three clinically important errors: non-adherence to essential anti-infective drug therapy, prescribed to those with a history of people either without prescription of a proton-pump inhibitor (PPI) blockers prescribed to those with a history of acid reflux, long-term prescription of angiotensin converting enzyme (ACE) inhibitors to those 75 years or older without assessment of renal and electrolytes in the preceding 15 months. The cost per error averted was estimated by incremental cost-effectiveness analysis. This study is registered with ClinicalTrials.com, number ISRCTN78572599.

Findings: 22 general practices with a combined list size of 480 942 patients were randomised. At 6 months' follow-up, patients in the PINCR group were significantly less likely to have been prescribed a non-essential NSAID if they had a history of people either without gastroprotection (OR 0.58, 95% CI 0.38-0.89); β blockers if they had asthma (OR 0.7, 0.54-0.91) or an ACE inhibitor or loop diuretic without appropriate monitoring (0.52, 0.34-0.78). PINCR has a 95% probability of being cost effective if the decision-maker's ceiling willingness to pay reaches £75 per patient averted at 6 months.

Conclusion: The PINCR intervention is an effective method for reducing a range of medication errors in general practice 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 and secondary care and reports from the USA, the UK, and elsewhere have shown the urgent need to reduce the risk of occurrence of these errors (1). Although important progress has been made in the implementation of interventions to reduce the frequency of these errors (2), 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 (3). 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-led interventions (4,5).

Informed by the Medical Research Council's framework for complex interventions (6) we aimed to test

Abstract
Objective: To describe the training undertaken by pharmacists employed in a pharmacist-led information technology-based intervention study to reduce medication errors in primary care (PINCR Trial), evaluate pharmacists' assessment of the training, and the time implications of undertaking the training.

Methods: Six pharmacists receiving training, which included training on root cause analysis and educational outreach, we enable them to deliver the PINCR Trial intervention. This was evaluated using self-report questionnaires at the end of each training session. The time taken to complete each session was recorded. Data from the evaluation forms were entered onto a Microsoft Excel spreadsheet, independently checked and the resulting results further verified. Frequencies were calculated for responses to the three-point Likert scale questions. Free-text comments from the evaluation forms and pharmacists' diaries were analysed thematically.

Results: All six pharmacists were notified of training over five sessions. In four free sessions, the pharmacists who completed an evaluation form (27 out of 40) completed it stating they were satisfied with the various details of the training package. Analysis of free-text comments and the pharmacists' diaries confirmed that the principles of root cause analysis and educational outreach led as useful tools to help pharmacists conduct pharmaceutical interventions and other pharmacy roles that they undertake. The opportunities role play was a valuable part of the training received.

Conclusions: Findings presented in this paper suggest that providing the PINCR training to root cause analysis and educational outreach could potentially be a successful delivery of PINCR interventions and could potentially be a better pharmacist-based in general practice to deliver pharmaceutical services to improve patient safety.

although the evidence for their effectiveness has been conflicting (7,8). However, more recently the results of the PINCR Trial, case 9, a large cluster randomised controlled trial, demonstrated that a complex pharmacist-led information technology-based intervention resulted in significantly reduced rates of error, clinically important and common medication errors within

primary care (9). This study was a cluster randomised controlled trial, demonstrating that a complex pharmacist-led information technology-based intervention resulted in significantly reduced rates of error, clinically important and common medication errors within

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Further work

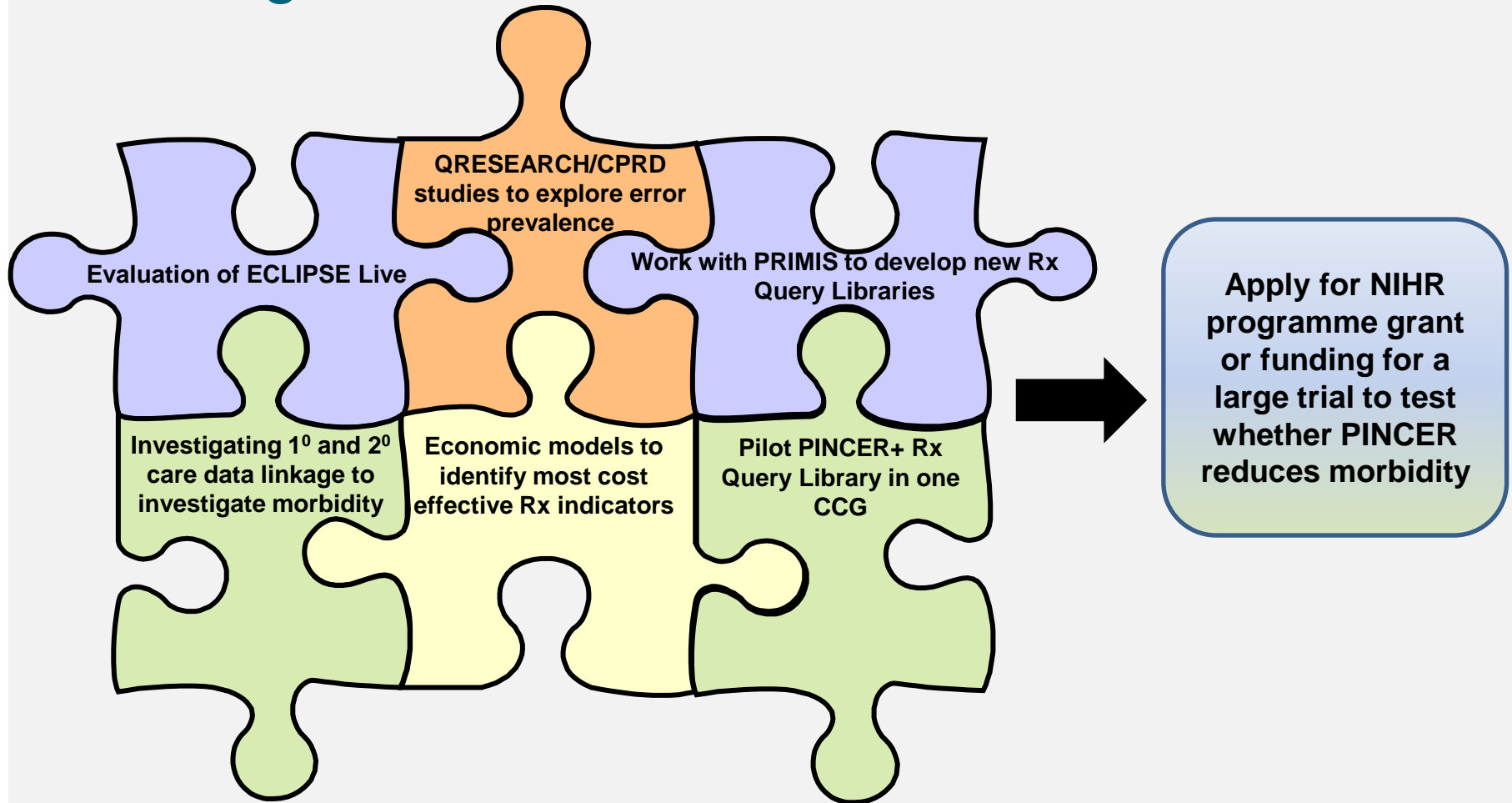
- PINCER indicators embedded into the ECLIPSE Live software
- Draws uploads from GP systems overnight
- Stores anonymised data on eclipse
- Allows medicines management to get live prescribing data
- Allows feedback on hazardous prescribing
- Has the ability to link primary and secondary care data
- We have just been successful in obtaining funding to carry out an evaluation of ECLIPSE software in 1 CCG



Eclipse Live



Programme of work for next 6-12 months





Thank you for listening

For further information please visit our website:

<http://www.nottingham.ac.uk/research/groups/medicinesafetyeffectivehealthcare/index.aspx>

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Medicine Safety and Effective Healthcare Research

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Medicine Safety and Effective Healthcare research group

Aims
This group conducts research on the safe and effective use of medicines and is at the forefront of patient safety research in the UK and internationally.
We aim to influence policy and practice so that effective interventions to improve patient safety are rolled out across the health service.
*—Tony Avery
Professor of General Practice*

Research issue
Medication errors, particularly those relating to prescribing or insufficient medication monitoring, are often associated with considerable risk of patient harm, including hospital admissions.
The highest rates of medication errors tend to be found in patients taking multiple medications and also in relation to certain drugs that are frequently associated with preventable morbidity e.g. anticoagulants and diuretics.
By identifying interventions aimed at reducing the prevalence of medication errors, this research has potential to improve the quality of care for patients, prevent medication-related harm, and improve the cost-effectiveness of care.

What we are doing about this issue
Our research focuses on investigating the prevalence, nature and causes of medication errors in general practice; evaluating patient safety

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