Institution: University of Reading

Unit of Assessment: 3 Pharmacy

Title of case study: Identifying strategies for reducing prescribing errors in general practice

1. Summary of the impact. Two major national studies, conducted by staff in the Unit and colleagues from a number of other institutions, provide the most comprehensive estimate to date of the prevalence of prescribing errors in general practice in England. These studies identified a number of strategies for reducing these prescribing errors that have been endorsed by the General Medical Council (GMC). Other impacts from these studies include increased public understanding and debate through media coverage, changes to GP education to be implemented by the Royal College of General Practitioners (RCGP), improvements to computerised prescribing decision support for general practitioners and increased awareness of the medication safety role of primary care pharmacists.

2. Underpinning research. The PINCER trial (2006-10) and the PRACtICe study (2010-11) were led by Prof. Anthony Avery (University of Nottingham). **Dr Rachel Howard** (Lecturer in Pharmacy Practice, University of Reading, appointed 2006) was one of only two other co-applicants named on both study grant applications. Other colleagues involved include:

- University of Nottingham: Dr Sarah Armstrong (PINCER and PRACtICe); Dr Denise Kendrick, Dr Sarah Rodgers, Prof Rachel Elliott, Prof Julia Hippisley-Cox, Martin Franklin, Dr Matthew Boyd (PINCER); Dr Sarah Crowe, Dr Brian Serumaga, Dr Olanrewaju Talabi (PRACtICe).
- University of Manchester: Prof Judy Cantrill, Prof Martin Marshall, Martin Eden (PINCER)
- University of Otago, New Zealand: Dr Caroline Morris (PINCER)
- University of Edinburgh: Prof Aziz Sheikh, Prof Robin Prescott, Dr Kathrin Cresswell (PINCER)
- Vrije Universiteit, Belgium: Dr Koen Putman (PINCER)
- UCL School of Pharmacy Prof Nick Barber and Bryony Dean Franklin (PRACtICe),
- University of Hertfordshire: Prof Soraya Dhillon and Dr Maisoon Ghaleb (PRACtICe),
- Nottingham University Hospitals NHS trust: Dr Anette Freyer (PRACtiCe)

The aim of the PRACtICe study was to determine the prevalence and nature of prescribing errors in general practice; to explore the causes of these errors; and to identify defences against errors. Despite the introduction of electronic prescribing into UK general practice, medication errors remain a significant problem, accounting for more than 4% of hospital admissions. Prior to the PINCER trial there was no evidence for effective strategies to reduce harm from medication errors in primary care.

The study used a mixed methods approach that included: two systematic reviews, a retrospective review of unique medication items prescribed over a 12 month period to patients from 15 general practices in England, interviews with 34 prescribers regarding 70 potential errors, 15 root cause analyses, and six focus groups involving 46 primary health care team members.

The study involved examination of 6,048 unique prescription items for 1,767 patients (2% of patients registered with participating general practices).Prescribing or monitoring errors were detected for one in eight patients, involving 5% of all prescription items. Most of the errors were of mild to moderate severity, with one in 550 items being associated with a severe error.

In 2011, 933.2 million prescription items (excluding dressings and appliances) were dispensed in England[1]. Therefore, the error rates identified in the PRACtICe study could equate to 46.6 million prescription items with errors and 1.7 million prescription items with severe errors that could result in death or permanent disability. The proportion of errors that result in negative outcomes is currently unknown, but medication errors are estimated to cause approximately 4%[2] of non-elective hospital admissions. If these could be reduced by 50% through changes to prescribing practices in primary care then 106,000 hospital admissions could be avoided (based on 5.3 million

emergency admissions in England 2010-11)[3]. The cost of a hospital admission has been estimated to be between £1993 and £3181[4]; therefore, the cost savings to the UK National Health Service (NHS) of avoiding these admissions could be as much as £337.2 million per year.

The following factors were associated with increased risk of prescribing or monitoring errors in the PRACtICe study: male gender of patient, age of patient less than 15 years or greater than 64 years, number of unique medication items prescribed and being prescribed preparations in specified therapeutic areas, such as cardiovascular disease or infections. Prescribing or monitoring errors were not associated with the grade of GP or whether prescriptions were issued as acute or repeat items.

A wide range of underlying causes of error were identified. In particular, a lack of focus on therapeutics and safe prescribing skills in GP training was highlighted. In addition, deficiencies were found in the design of computerised prescribing systems in general practices. Also, general practices did not have reliable systems for detecting and correcting errors once they had occurred.

Strategies that were identified for reducing prescribing errors in general practice include improvements to GP training, improvements to GP computer systems and the introduction of better systems for detecting and correcting errors (as demonstrated in the PINCER trial).

The aim of the PINCER trial was to determine the effectiveness, costs/benefits and acceptability of a pharmacist-led IT-based intervention compared with simple feedback in reducing rates of potentially hazardous prescribing and medicines management in general practice.

PINCER was a cluster-randomised controlled trial that incorporated a health economic analysis, embedded longitudinal qualitative analysis and process analysis of pharmacists' interventions. The control group of general practices received simple computer-generated feedback for patients at risk of hazardous prescribing, while the intervention group received feedback, educational outreach and dedicated support from a pharmacist.

Seventy-two general practices were randomised. At 6 months follow-up, patients in the intervention group were significantly less likely to have received one of three types of potentially hazardous prescription (such as patients with asthma who had been prescribed a beta-blocker). If decision makers are willing to pay up to £75 over a 6 month period in order to avoid an error, then PINCER has a 95% probability of being cost effective. As it was effective for all types of error and all examples of error which could be operationalised, it is reasonable to expect that the intervention would be transferable to other prescribing errors. Also, since the trial included a range of practice types (single-handed through to large practices) in a range of areas (urban through to rural) it is also reasonable to assume that the intervention would be transferable to other practices.

1. The Health and Social Care Information Centre. Prescriptions dispensed in the community 2001-2011. Available from www.hscic.gov.uk

2. Howard RL et al. Which drugs cause preventable admissions to hospital? A systematic review. British Journal of Clinical Pharmacology 2007; 63:136-147; DOI: 10.1111/j.1365-2125.2006.02698.x

3. The Health and Social Care Information Centre. Hospital Episode Statistics, Admitted Patient Care - England, 2010-11. Available from www.hscic.gov.uk

4. Geue C et al. Spoilt for choice: implications of using alternative methods of costing hospital episode statistics. Health Economics 2012; 21:1201-16; DOI: 10.1002/hec.1785

3. References to the research References to the research which has led to the impact include outputs which are of at least 2* quality

Slight S et al. A qualitative study exploring the causes of prescribing errors in English general practices. Br J Gen Pract 2013; (DOI: 10.3399/bjgp13X673739) (abridged text, in print: Br J Gen Pract 2013; 63: 534–535)

Avery AJ et al. The prevalence and nature of prescribing and monitoring errors in English general practice – a retrospective case note review. Brit J Gen Pract 2013; DOI: 10.3399/bjgp13X670679

(abridged text, in print: Br J Gen Pract 2013; 63: 413-4)

Howard R et al. (on behalf of the PINCER Trialists). 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 (PINCER trial). Int J Pharm Pract 2013; DOI: 10.1111/ijpp.12039. 18 views and 2 downloads from ResearchGate (correct on 17/9/13)

Sadler S et al. (on behalf of the PINCER Trialists). Training pharmacists to deliver a complex information technology intervention (PINCER) using the principles of educational outreach and root cause analysis. Int J Pharm Pract 2013; DOI: 10.1111/ijpp.12032. 22 views and 2 downloads from ResearchGate (correct on 17/9/13)

Avery A et al. Investigating the prevalence and causes of prescribing errors in general practice: The PRACtICe Study (PRevalence And Causes of prescrIbing errors in general practiCe). London: General Medical Council, 2012. (259-page project report). Report available at: http://www.gmc-uk.org/about/research/12996.asp

Cresswell et al. 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. Trials. 2012 Jun 8;13:78. DOI: 10.1186/1745- 6215-13-78

Reported in the formal and informal media ca. 120 times; cited in literature 7 times.

Avery AJ et al. A pharmacist-led information technology intervention for medication errors (PINCER): a multicentre, cluster randomised, controlled trial and cost-effectiveness analysis. The Lancet 2012; 379(9823): 1310-1319 doi:10.1016/S0140-6736(11)61817-5. **Cited in literature 9 times**.

The PRACtICe study grant (Sponsor: General Medical Council; value £101,380; Jan 2010-Oct 2011, PS024) was awarded to Prof. Avery with Dr Rachel Howard as a named co-applicant.

The PINCER trial grant (Sponsor: Dept. of Health; value £643,690; 2006-2010, CT4086) was awarded to Prof. Avery with Dr Rachel Howard as a named co-applicant.

4. Details of the impact

The GMC-funded PRACtICe study has provided the best evidence to date on the prevalence, nature and causes of prescribing errors in general practices, while the PINCER trial has produced one of the only successful interventions to reduce prescribing errors in primary care. Before the PRACtICe study, the existing estimate of prevalence and type of prescribing errors in General Practice was: Shah et al. A survey of prescription errors in general practice. Pharm J 2001; 267: 860-2. This study is both out of date (it pre-dates the wide-spread adoption of electronic prescribing in general practice) and did not use the gold standard methodology used in the PRACtICe study. As a result, recommendations arising from the PRACtICe study are supported by the GMC and have been taken up by organisations including the RCGP and TPP, a major supplier of GP computer systems.

The PRACtICe study report was launched at a major press conference at the Wellcome Trust on 1st May 2012. The findings of the study received substantial media coverage [a], including two front-page headlines (*The Daily Telegraph* and *The Daily Express*) and articles in all the major national newspapers, radio coverage on several hundred radio stations and web coverage on several hundred websites. **Dr Howard** was interviewed by Heart Thames Valley Radio, and has ongoing contact with BBC Radio Berkshire who continue to be interested in the progress made in developing safeguards. Prof. Avery was interviewed on the BBC Radio 4 Today Programme and BBC Radio 2 Jeremy Vine show, and Prof. Rubin (President of the GMC) appeared on the BBC One Breakfast TV programme. This coverage, and in particular the interviews, raised public awareness and debate around the problems of prescribing errors in general practice and helped to enhance public understanding of the issue. An article in the *Daily Mail* also explained what patients can do to help reduce their chances of experiencing a prescribing error. **Dr Howard** delivered an invited lecture in July 2013 to 150 non-medical prescribers on lessons to be learned from both

PRACtICe and PINCER, further increasing dissemination of the results to a wider body of healthcare professionals.

The PRACtICe study report has clearly influenced the GMC [b], which has discussed the outcomes of the research with organisations that have a remit for quality assurance (including other professional and systems regulators), patient safety and the provision of medical education and training. This has included the RCGP and General Pharmaceutical Council. The study team have influenced the RCGP by working closely with them and presenting the PRACtICe study findings and recommendations at a RCGP Curriculum Group meeting in June 2012. As a result, the following changes are taking place:

(1) Additional learning outcomes are being added to the RCGP curriculum [c] with respect to therapeutics and safe prescribing skills; these were ratified by the GMC and were implemented in August 2013;

(2) eLearning packages have been developed and are expected to be launched in December 2013. They will be supported by a series of articles in INNOvait [d], the journal of GP registrars;

(3) The assessment of therapeutics and safe prescribing skills is being strengthened in the Membership of the Royal College of General Practitioners examination.

Indicators of hazardous prescribing developed for the PINCER trial have been available to general practices across England through Primary Care Information Services since February 2013. So far, the PINCER trial indicators have been downloaded by 800 general practices. The trial has significantly influenced policy development at the Department of Health [e].

The PRACtICE report suggested various ways in which prescribing safety features of GP computer systems could be improved. A number of changes have been introduced into the very widely used *SystmOne* GP computer system (TPP) as a direct consequence of the PRACtICE findings [f].

The main beneficiaries of the impact of both studies are GPs, both individually and via their representative bodies (RCGP and GMC), practice pharmacists (who have access to the PINCER trial indicators to help facilitate their medicines safety roles) and ultimately patients. The changes to the RCGP training programmes and examinations, in particular, will help reduce the likelihood of medication errors reaching patients in the primary care setting. The main evidence to date of the extent of the impact described is from media coverage, changes being made to the RCGP curriculum, nation-wide release of the PINCER query library [g] and changes that have been made to the *SystmOne* GP computer system. These impacts have occurred in 2012-13.

5. Sources to corroborate the impact

a. The research was showcased in many media outlets including The Guardian, The Times, The Daily Express, Radio 4, etc. A summary of media reports is available upon request.

b. Letter from Chair of the General Medical Council about impact of PRACtICe study on GMC (*)

c. RCGP changes to curriculum and assessments can be found on http://bit.ly/1g3xFU1 and http://bit.ly/1asCqSg and evidence of the influence of the PRACtiCE study on those changes can be found in the minutes of the 18th meeting of RCGP Curriculum Development Group (*)

d. InnovAiT Vol. 6, No. 8, produced following the PRACtICe study http://ino.sagepub.com/content/6/8.toc

e. Letter from the Chief Pharmaceutical Officer for England detailing policy impact of both the PINCER trial and the PRACtICe study. (*)

f. *Pulse* article about the changes to the TPP SystmOne GP clinical system http://bit.ly/18kfwMG

g. PRIMIS announcement of release of PINCER query library: http://bit.ly/17I3QVm

(*) Documents available upon request