Institution: University of Nottingham

Unit of Assessment: UoA2

Title of case study: Implementing strategies for reducing prescribing errors in general practices

1. Summary of the impact (indicative maximum 100 words)

Our research has: i) increased public and professional knowledge and understanding of the prevalence, nature and causes of prescribing errors in general practices; ii) led the General Medical Council to recommend improvements to GP education and training; iii) led to the Royal College of General Practitioners to revise its curriculum to increase the emphasis on safe prescribing; iv) led one of the major GP computer system suppliers to make safety improvements; v) identified an IT-based intervention that is effective at reducing prescribing errors; vi) led to the roll-out of the intervention in over 800 general practices.

2. Underpinning research (indicative maximum 500 words)

The PRACtICe study (2010-11)[1,2,3] has provided much-needed evidence on the prevalence and causes of prescribing errors in general practices, while the PINCER trial (2006-10)[4] has demonstrated an effective method for reducing the prevalence of errors.

The aim of the PRACtICE study was to determine the prevalence and nature of prescribing errors in general practice; to explore the causes, and to identify defences against error. The methods included: 1) Two systematic reviews; 2) Retrospective review of unique medication items prescribed over a 12 month period to a 2% random sample of patients from 15 general practices in England; 3) Interviews with 34 prescribers 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. Prescribing or monitoring errors were detected in one in twenty of all prescription items. The following factors were associated with increased risk of prescribing or monitoring errors: male gender, age less than 15 years or greater than 64 years, number of unique medication items prescribed, and being prescribed preparations in certain therapeutic areas.
A wide range of underlying causes of error was identified. In particular, a lack of focus on therapeutics and safe prescribing skills was highlighted in GP training, and deficiencies were found with 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.

A number of strategies were identified for reducing prescribing errors in general practices and these 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 [4]).

The aim of the PINCER trial was to determine the effectiveness, costs/benefits and acceptability of a complex pharmacist-led IT-based intervention compared with simple feedback in reducing rates of prescribing and monitoring errors in general practice.
PINCER was a cluster randomised controlled trial which incorporated a health economic analysis, embedded longitudinal qualitative analysis, and process analysis of pharmacists' interventions. The control practices received computer-generated simple feedback for patients at-risk of hazardous prescribing. The intervention practices received feedback, educational outreach and dedicated support from a pharmacist.

Seventy-two practices were randomised. At 6 months follow-up, patients in the intervention group were up to 50% less likely to have one of a range of 10 prescribing or monitoring errors. Economic modelling showed that the PINCER intervention increased health gain at a cost per QALY well

below the National Institute for Health and Care Excellence (NICE) threshold.

University of Nottingham colleagues involved in the PINCER trial were Tony Avery (chief investigator) Sarah Rodgers (trial manager), Sarah Armstrong (trial statistician), Denise Kendrick and Rachel Elliott (health economist). Professor Avery also led the PRACtICe study, and other University of Nottingham colleagues involved were Sarah Armstrong and Raj Mahta (statisticians). The PINCER trial involved in the universities of Manchester and Edinburgh; the PRACtICe study involved University College London, and the universities of Hertfordshire and Reading.

3. References to the research (indicative maximum of six references)

This section should provide references to **key** outputs from the research described in the previous section, and evidence about the quality of the research.

1. Avery A, Barber N, Ghaleb M, Dean Franklin B, Sarah Armstrong S, Crowe S, Dhillon S, Freyer A, Howard R, Pezzolesi C, Serumaga B, Swanwick G, Talabi O. 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 (PDF Supplied)
2. Avery A, Ghaleb M, Barber N, Dean Franklin B, Sarah Armstrong S, Serumaga B, Dhillon S, Freyer A, Howard R, Talabi O, Mehta RL. The prevalence and nature of prescribing and monitoring errors in English general practice – a retrospective case note review. British Journal of General Practice 2013; 63(613):e543-e553 doi: 10.3399/bjgp13X670679 (PDF Supplied)
3. Slight SP, Howard R, Ghaleb M, Barber N, Dean Franklin B, Avery AJ. The causes of prescribing errors in English general practices: a qualitative study. British Journal of General Practice 2013; Published online 30th September 2013: e713-e720 doi: 10.3399/bjgp13X673739 (PDF Supplied)
4. Avery AJ**,** Rodgers S, Cantrill JA, Armstrong S, Cresswell K, Eden M, Elliott RA, Howard R, Kendrick D, Morris CJ, Prescott RJ, Swanwick G, Franklin M, Putman K, Boyd M, Sheikh A. 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 (PDF Supplied)

Details of grants:

The grant for the PINCER trial was awarded to Professor Avery, University of Nottingham.
The grant title was: Cluster randomised trial evaluating the effectiveness of a pharmacist-led intervention vs. simple feedback in reducing rates of hazardous prescribing in general practices (The PINCER Trial).
The funder of the study was the Department of Health.
The period of the grant was 2006-2010.
The value of the grant was £643,690.

The grant for the PRACtICE study was awarded to Professor Avery, University of Nottingham.
The grant title was: Investigating the prevalence and causes of prescribing errors in general practice.
The funder of the study was the General Medical Council (GMC).
The period of the grant was January 2010-October 2011.
The value of the grant was £101,380.

4. Details of the impact (indicative maximum 750 words)

The PRACtICe study has provided the best evidence to date on prevalence, nature and causes of prescribing errors in general practices whilst the PINCER trial has identified a highly successful intervention to reduce prescribing errors in primary care. The main evidence of impact comes from media coverage, changes to the RCGP curriculum, production of learning materials for GPs, developments to the TPP SystmOne GP computer system, and uptake from a release of computer

queries used in the PINCER trial. These have all occurred in 2012-13. The main beneficiaries are patients and members of the public, GPs, pharmacists and the NHS.

Our report on the GMC-funded PRACtICe study was launched at a press conference at the Wellcome Trust in May 2012. The study findings received substantial media interest [A] including front-page headlines in *The Daily Telegraph* and *The Daily Express*; articles in all major national newspapers; Professor Avery being interviewed on the *BBC Radio 4 Today* Programme and *BBC Radio 2 Jeremy Vine show*; and coverage on several hundred radio stations and several hundred websites. This raised public awareness and debate around the problems of prescribing errors in general practice and interviews undertaken by Professors Avery helped improve public understanding of the issue. In an article for the *Daily Mail*, Professor Avery explained how patients can help reduce their chances of having a prescribing error. As a result of this publicity, the *BBC1 Inside-Out* programme commissioned and produced a documentary on prescribing errors in primary care which included Professor Avery explaining the findings from the PRACtICe study. This was broadcast in three regions of England in October and November 2012.

As a result of the publication of the PRACtICE study report, Peter Rubin (President of the GMC) confirmed that in 2012/13, "*We [the GMC] have met with relevant organisations to ensure that the findings [of the study] around a greater role for pharmacists in supporting GPs, the better use of computer systems and the extra emphasis on prescribing in GP training are translated into actions that help protect patients.*" [B] Professor Avery has worked closely with the RCGP since the publication of the report and presented findings and recommendations at an RCGP Curriculum Group meeting in June 2012, and the RCGP National Conference in October 2012. The following impacts have resulted from this [C]: 1) Additional learning outcomes on therapeutics and safe prescribing skills, written by Professor Avery and ratified by the GMC, were added to the 2013 RCGP curriculum [D]; 2) Following a meeting between Professor Avery and RCGP examiners in April 2013, assessment of therapeutics and safe prescribing has been strengthened in the MRCGP examination, e.g. new consultation skills assessments have been developed.

The PRACtICE study report suggested various ways in which the prescribing safety features of general practice computer systems could be improved. In August 2012, the GP periodical *Pulse* reported that TPP SystmOne, "one of the country's biggest GP software providers has implemented a raft of changes to almost 2,000 practice systems in the wake of a GMC-funded study which estimated there are errors in 1 in 20 GP prescriptions nationally" [E]. This has included computerised alerts aimed at ensuring that patients on high-risk drugs receive necessary blood-tests.

As a result of the publication of the PINCER trial in *The Lancet*, general practice organisations and NHS leaders (including the Chief Pharmaceutical Officer) have expressed considerable interest in rolling out the intervention to general practices in England. Since 2012, Professor Avery and colleagues have worked with a University spin out company (PRIMIS) to produce e-learning materials [F] and develop new methods for general practices to download computer queries used in the PINCER trial [G] to identify prescribing errors and prevent patient harm. By July 2013, over 800 general practices had downloaded these computer queries [H] with potential benefits to thousands of patients, and the NHS, from this cost-effective intervention.

Keith Ridge, the Chief Pharmaceutical Officer, stated in 2013 that the PRACtICe Study, "*has brought considerable, and much-needed, recognition of … the problem of prescribing errors … in general practice*" and that he "*and other senior Government and NHS officials and professionals, routinely use this study as justification for policy development and initiatives designed to improve quality and outcome for patients.*" [I] He also stated that PINCER is "*an important step towards improving patient safety and outcomes from medicines prescribing and use, including the development of IT to support clinical decisions.*" [I]

5. Sources to corroborate the impact (indicative maximum of 10 references)

Sources to corroborate the impact include:

A. An electronic file summarising the impact of the study in the media, providing newspaper clippings and details of the study being included in print media, online and on the radio; and audiofiles of Professor Avery being interviewed on BBC Radio 2 and Radio 4.
B. Letter from President of the GMC, on the impact of the PRACtICe study on their policies*.
C. Letter from Chair of College Council, RCGP, on the impact of the PRACtICe study on changes to the RCGP curriculum, development of electronic learning materials, and changes to MRCGP examinations*.
D. Details of changes to the RCGP Curriculum specifically made as a result of the recommendations arising from our GMC-funded report.
E. Evidence presented in *Pulse* detailing the changes made to the TPP SystmOne GP computer systems specifically attributed to the findings of the GMC-funded report: http://www.pulsetoday.co.uk/tpp-upgrades-practice-systems-in-wake-of-gmc-prescribing-error-report/14447023.article (PDF supplied)
F. 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 (PDF/Screenshot provided)
G. Details showing how general practices can download the computer queries used in the PINCER trial:
    a. 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 (PDF Supplied)
    b. 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 (PDF supplied)
H. Log from PRIMIS showing the number and distribution of general practices downloading the PINCER trial computer queries in the first 8 weeks plus cumulative data showing the number of downloads for February – July 2013.
I. Letter from Chief Pharmaceutical Officer, Department of Health, England, on the impact of the PRACtICe study and PINCER trial*. Minutes from RCGP Curriculum Group meeting 15 June 2012 outlining actions to be taken as a result of the recommendations arising from the PRACtICe study report.

*Corroborative factual statements – letters are on file and available on request.