**Institution: The University of Manchester**

**Unit of Assessment: 3**

**Title of case study:** Reducing prescribing errors and improving patient safety in primary and secondary health care. (*ICS-06*)

## 1. Summary of the impact

Patient safety research from Manchester Pharmacy School at the University of Manchester (UoM) has reduced prescription errors in primary and secondary care. Pharmacists using our indicators with patients' electronic health records (aimed at preventing drug-related morbidity in general practices) reduced the odds of prescribing and monitoring problems by at least 22%. These indicators are now incorporated into 'medicines optimisation' software for general practice computer systems. The EQUIP study led changes in the recommended design of hospital prescription charts, an annual national assessment of prescribing competence of medical students and the employment of extra hospital pharmacists to prevent the 9% of prescriptions with errors from harming patients.

## 2. Underpinning research

*See section 3 for references [1-6]; see section 5 for corroborating sources (S1-S10); UoM researchers are given in bold. In REF3a and REF5 this case study is referred to as ICS-06.*

The impact is based on research that took place in Manchester from 1996-date, with the first major publication in 1998.

The key researchers were:

- **Peter Noyce** (Professor, 1991-date)
- **Darren Ashcroft** (Senior Lecturer, 2002-2007; Reader, 2007-2010; Professor, 2010-date)
- **Mary Tully** (Lecturer, 1999-2006; Senior Lecturer, 2006-2011; Reader, 2011-date)
- **Penny Lewis** (Research Associate, 2008-2011; Lecturer, 2011-date)
- **Judith Cantrill** (Senior Lecturer, 1993-2001; Professor, 2001-2011)
- **Caroline Morris** (Research Associate, 2000-2006)
- **Martin Eden** (Research Associate, 2004-date)
- **Timothy Dornan** (Professor, 1990-2010; Honorary Professor, 2010-date)

The overarching aim of the research programme was to improve the quality and safety of prescribing by doctors in primary and secondary care. The key stages of the research were:

**Primary Care Research**

1. Following research with colleagues in the Department of Health funded National Primary Care Research and Development Centre on the prevalence of inappropriate long-term prescribing in primary care, **Cantrill** and her team developed indicators to assess the appropriateness and quality of long-term prescribing in primary care [1].
2. Professor Doug Hepler was a visiting Professor of Pharmacy at the University of Manchester (2000-2003), and spent part of 2000 on sabbatical from University of Florida working with the Manchester team. This resulted in the generation of additional indicators aimed at preventing drug-related morbidity [2]. The team then developed innovative methods for extracting data on these indicators from general practice computer systems.
3. In 2009, the Manchester team designed an intervention based on their indicators, which was evaluated in a cross university research programme called PINCER (with the Departments of General Practice at the Universities of Nottingham and Edinburgh). The study involved 72 general practices as part of a multicentre cluster randomised controlled trial. The trial looked at the impact of an intervention by pharmacist-led information technology to reduce medication errors. It was the first randomised controlled trial in the UK to demonstrate that pharmacists working in general practices can reduce the number of prescribing errors and improve patient safety. It was conducted under the Patient Safety Research Programme, funded by the Department of Health [3].

**Secondary Care Research**

1. The development of comparable indicators in secondary care by **Tully**, in 2005, led to a programme of work specifically looking at prescribing errors in hospital practice.
2. The Manchester team conducted the EQUIP study (*Errors – Questioning Undergraduate Impact on Prescribing*) from 2007 to 2009 [4]. This was the largest ever study to investigate the prevalence and causes of prescribing errors in the hospital setting. It concentrated on the interplay between the educational backgrounds of first year foundation trainee (FY1) doctors and factors in their practice environments. Two systematic reviews [5,6] published by the Manchester team in 2009, highlighted not only the high prevalence of errors but also the lack of robust research on causes.
3. Using the Trusts' own clinical pharmacists to collect the data, the Manchester team found an error rate of 9% of medication orders across 19 acute NHS Trusts in the north-west of England. They identified the complex systems involved in causing errors, many of which related to the health care environment within which the doctors worked. The first year trainee doctors often lacked contextual, rather than basic, knowledge and had difficulty framing clinical problems rather than lacking specific drug knowledge [4].

**3. References to the research**


1. **Campbell SM, Cantrill JA**, Roberts D. (2000). Prescribing indicators for UK general practice: Delphi consultation study. *British Medical Journal*, 321, 425-428 DOI: 10.1136/bmj.321.7258.425
2. **Morris CJ, Cantrill JA**, Hepler C.D, **Noyce PR**. (2002). Preventing drug-related morbidity - determining valid indicators. *International Journal for Quality in Health Care*, 14[3], 183-198. DOI: 10.1093/oxfordjournals.intqhc.a002610
3. Avery AJ, Rodgers S, **Cantrill JA**, Armstrong S, Cresswell K, **Eden M**, et al. (2012) A pharmacist-led information technology-enabled intervention for reducing medication errors (PINCER): a multi-centre cluster randomised controlled trial and cost-effectiveness analysis. *Lancet*, 379, 1310-9. DOI:10.1016/S0140-6736(11)61817-5
4. **Dornan T**, **Ashcroft D**, Heathfield H, **Lewis P**, Taylor D, **Tully M**, **Wass V**. (2009) An in-depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study. Report to GMC. http://www.gmc-uk.org/FINAL_Report_prevalence_and_causes_of_prescribing_errors.pdf_28935150.pdf
5. **Lewis PJ**, **Dornan TL**, Taylor D, **Tully MP**, **Wass V**, **Ashcroft DM**. (2009). Prevalence, incidence and nature of prescribing errors in hospital inpatients: a systematic review. *Drug Safety*, 32(5), 379-89 DOI: 10.2165/00002018-200932050-00002
6. **Tully M**, **Ashcroft D**, **Dornan T**, **Lewis P**, Taylor D, **Wass V**. (2009). The causes of and factors associated with prescribing errors in hospital inpatients: a systematic review. *Drug Safety*, 32(10), 819-36. DOI: 10.2165/11316560-000000000-00000


**4. Details of the impact** *See section 5 for numbered corroborating sources (S1-S10).*

**PRIMARY CARE PROGRAMME**

**Impact from drug related morbidity indicators**

Preventable drug related morbidity (PDRM) indicators developed by **Cantrill** have been translated and applied in several international healthcare settings including the US, Canada, New Zealand, Italy, Spain and Portugal to extend the scope of practice of pharmacists in improving patient safety (S1,S2). Building on the findings from the PINCER study, a set of prescribing safety indicators have also been developed in collaboration with the Royal College of General Practitioners (RCGP), which are suitable for use in the revalidation of GPs (S3).

Ridge (Chief Pharmaceutical Officer at the Department of Health) has described how the PDRM indicators have been incorporated into 'medicines optimisation' software for general practice computer systems in the UK by, for example, First Databank, Eclipse and PRIMIS, acknowledging that "*it is clear this work would not have been possible without the foundations developed in Manchester by Cantrill et al.*" (S4).

Building on Manchester's expertise in translational patient safety research, the National Institute for Health Research (NIHR) has provided core funding of £6.3m (2012-2017) which has established a

translational centre at Manchester focussed on improving patient safety in primary care. **Ashcroft** is leading the medication safety theme, developing and evaluating an integrated safety management system to improve medication safety in community pharmacies and general practices, including implementation of the PDRM indicators into general practice computer systems to improve patient safety (S5).

**SECONDARY CARE PROGRAMME**

**Impact on patient safety**

Manchester's EQUIP study found that doctors rotating between different hospitals during their training faced inconsistency in the design of prescription charts contributing to the causes of prescribing errors. A report to develop and disseminate standards for design of in-patient prescription charts was commissioned by the Department of Health and the NHS Medical Director (S4). The report (S6) stated in its foreword that this was commissioned because *"the [EQUIP] report considered that the design of prescription charts was one of the primary causes of prescribing errors and that a standard drug prescription chart should be introduced across the NHS".* These standards are being used to revise the All-Wales prescription chart, and have been recommended for use in all Trusts by the Medical Director of NHS England (S7). Introduction of a national prescription chart in Australia reduced prescribing errors per admission by one third. There were 15 million admissions to hospital in 2011-12 in England, with one or more prescribing errors in approximately 45%. Even a conservative 10% reduction in these errors would translate into safer prescribing for hundreds of thousands of people.

**Impact on medical training**

The EQUIP study found that prescribing errors resulted from a lack of training in practical prescribing and failures to link theory with practice. This supported the General Medical Council (GMC) giving evidence to the House of Commons Health Select Committee inquiry on patient safety. It had been assumed that errors would be reduced by increasing pharmacology in the educational curriculum. Our research demonstrated that errors were caused, instead, by the impact of busy and stressful working environments or unfamiliarity of the system the doctor was working in (S8). The GMC thus revised their core guidance for medical education (*Tomorrow's Doctors),* to recommend that formal prescribing skills training and practical experience in the NHS be provided for medical students (S8).

The EQUIP recommendation also led directly to the development of a new national assessment of prescribing competence for all medical students in the UK before they graduate from medical school as part of a collaborative project by the British Pharmacological Society and the Medical Schools Council (S9) and funded by the Department of Health (S 4). This was piloted during 2010-2012, and has subsequently been rolled out to all Medical Schools in the UK. Several thousand medical students graduate annually and start work as first-year junior hospital doctors, when they will write 35% of all hospital prescriptions during 15 million admissions in England alone. Any reduction in their 9% error rate will translate into a significant improvement in the safety of prescribing for many people.

**Impact on pharmacists**

The Chair of the Association of Teaching Hospital Chief Pharmacists has described how large teaching hospitals across the UK used the findings of the EQUIP study in business cases to get additional funding for pharmacist posts (S10). Pharmacists are responsible for checking prescriptions and are a key organisational defence to prevent the prescribing errors described above from harming patients. At Sheffield Teaching Hospitals NHS trust, for example, the number of patients receiving medicines reconciliation from pharmacists increased from under 40% in 2009 to 60% by 2011; at University Hospital of South Manchester, services to admission wards were extended to a full seven days per week. This is important as the Manchester researchers found that the odds of prescribing errors occurring on admission were almost twice that of later in a patient's stay. These additional pharmacists are also carrying out an increased level of education for final year medical students and junior doctors. Even where hospitals have not been able to get additional staff, existing pharmacists were redeployed to provide these services (S10).

## 5. Sources to corroborate the impact


S1 Gianino MM, Foti G, Borghese R, Lorelli S, Siliquini R, Renga G. Indicators for preventable drug-related morbidity: practical application in home-base care. Pharmacoepidemiology and Drug Safety 2008; 17: 501-510.

S2 Letter from the Professor of Public Health, University of Arizona and recent past president (2009-2012) of the Canadian Society of Hospital Pharmacists, *which describes how our PDRM indicators have been used in the US, Canada, New Zealand, and Spain to enhance the scope of practice of pharmacists and improve patient safety*.

S3 Avery AJ, Dex GM, Mulvaney C, Serumaga B, Spencer R, Lester H, Campbell SM. Development of prescribing-safety indicators for GPs using the RAND Appropriateness Method. British Journal of General Practice 2011; 61 (589):526-36. *This paper demonstrates how the indicators that we developed, which describe a pattern of prescribing that may put patients at risk of harm, were included in a set of indicators to be used to assess the quality of prescribing of GPs nationally.*

S4 Letter from the Chief Pharmaceutical Officer at the Department of Health, *which describes how the preventable drug-related morbidity indicators have been incorporated into the national medicines optimisation programme*

S5 Press release for NIHR patient safety centre (http://www.dh.gov.uk/health/2012/03/patient-safety-research/)

S6 Academy of Medical Royal Colleges. Standards for the design of hospital in-patient prescription charts http://www.aomrc.org.uk/component/content/article/226.html *This report cited the EQUIP study as the reason for having developed these standards.*

S7 Routledge, P. A. (2012), A national in-patient prescription chart: the experience in Wales 2004–2012. British Journal of Clinical Pharmacology, 74: 561–565. *This paper states how the All Wales in-patient prescription chart is being revised in accordance with the standards presented in Source (6) and how similar developments in England are recommended.*

S8 Letter from the Chair of the General Medical Council. *This letter describes how the EQUIP study informed the revision of Tomorrow's Doctors and resulted in the General Medical Council recommending the introduction of formal prescribing skills training and assessment for medical students*

S9 http://www.prescribe.ac.uk/psa/ *This website cites the EQUIP study as one main reason for developing the national training and assessment in prescribing skills training for final year medical students*.

S10 Letter from Chair of the Association of Teaching Hospital Chief Pharmacists and Chief pharmacist, University Hospitals Bristol NHS Foundation Trust). *This letter describes how some of their members have used the EQUIP study as part of successful business cases to employ more pharmacists or where they have redeployed existing staff to deliver on EQUIP study recommendations*