

## Impact case study (REF3)

<b>Institution:</b> University of Strathclyde		
<b>Unit of Assessment:</b> A3 Allied Health Professions, Dentistry, Nursing and Pharmacy		
<b>Title of case study:</b> Safer use of high-risk medicines through data-driven quality improvement initiatives		
<b>Period when the underpinning research was undertaken:</b> 2010 - 2020		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g. job title):</b>	<b>Period employed by submitting HEI:</b>
Marion Bennie	Professor	01/10/2010 – present
Emma Dunlop	Research Associate	06/04/2010 – present
Natalie Weir	Research Associate	16/10/2018 – present
Tanja Mueller	Research Associate	01/10/2017 – present
Rosemary Newham	Research Fellow	11/10/2010 – present
Samantha Alvarez-Madrado	Research Associate	06/01/2014 – 11/11/2018
Chris Robertson	Professor	01/01/2002 – present
Kim Kavanagh	Senior Lecturer	01/10/2006 – present
<b>Period when the claimed impact occurred:</b> 2016 – July 2020		
<b>Is this case study continued from a case study submitted in 2014?</b> No		
<b>1. Summary of the impact</b>		
<p>Research led by Bennie on high-risk medicines (HRM) has shaped healthcare systems, providing clinicians with information to improve patient care. The team's evaluation of the Scottish Patient Safety Programme – Pharmacy in Primary Care (SPSP-PPC) guided national policy including a Scottish Government commitment to support the safer use of medicines. This led to service redesign initiatives, which were implemented by all Scottish pharmacies to embed safe working practices and reduce risk concerning HRM. The initiatives have also been adopted by 55 New Zealand pharmacies. The Strathclyde research also informed a service review by the Scottish Government, which included new HRM measures in its 2018 National Therapeutic Indicator report, influencing Prescribing Action Plans within all 944 General Practices in Scotland. As a result, 30% fewer patients <math>\geq 65</math> years were exposed to HRM combinations since 2018.</p>		
<b>2. Underpinning research</b>		
<b>Context</b>		
<p>Medicines can reduce mortality and morbidity, but are not without potentially harmful side effects. UK studies show 6.5% of hospital admissions are attributed to adverse effects of high-risk medicines (HRMs), which in Scotland equates to an estimated 61,000 admissions each year. HRMs, including anticoagulants and non-steroidal anti-inflammatory drugs (NSAIDs), carry a risk of harming patients, most commonly due to gastric irritation and bleeding. Risks are greater for older patients who are more likely to be suffering from multiple conditions and using multiple medicines – factors which can exacerbate the adverse effects of HRMs. To reduce the harm from HRMs, patients and healthcare practitioners must be informed about their safe use.</p>		
<b>Key research insights</b>		
<p>Since 2010, research led by Professor Bennie has informed national Scottish policies by focussing on two key areas: i) gathering and curating real world data intelligence on use of HRM, and ii) designing and testing new quality improvement (QI) programmes for General Practitioners and community pharmacists to enhance the safe and effective use of medicines.</p>		
<b>i) Real world data intelligence on HRM use</b>		
<p>NHS Scotland invested in a new integrated clinical system enabling a nation-wide prescribing dataset to capture all individual-level prescribing and dispensing of medicines in primary care. This enabled Bennie's team, for the first time in Scotland, to investigate individual patient-level HRM prescribing over a 10-year period across the entire Scottish population of 5.5 million and to use</p>		

this to improve prescribing practice [R1]. The Strathclyde team led the preparation and presentation of the data to permit effective messaging to clinicians and to allow varied stakeholders to use the data for healthcare studies [R1, R2]. Before this research, those seeking to quantify individual drug exposure across populations spent significant time transforming data into a usable format, often with variable and poorly documented methods. Now, using the natural language processing algorithm [R2] which takes a zero assumptions approach, structured output from free-text dose instructions (estimated at 100 million items annually) is generated efficiently to allow users maximum flexibility to derive drug exposure information appropriate to their area(s) of study. Since 2018, researchers can request details on dose instruction translation through the eDRIS service run by NHS Public Health Scotland.

**ii) Designing and testing new QI programmes for Scottish primary care**

The real world data referred to above were used to provide feedback to frontline clinicians in General Practices and community pharmacies. This enabled them to make better informed decisions about HRM prescribing and advice to patients on their use.

General practice setting: In 2010, Bennie's team, in collaboration with Prof Guthrie's team at the University of Dundee, brought together a group of Scottish clinicians to derive consensus on which HRMs to target, resulting in the selection of NSAIDs and anticoagulants [R3]. Using an established 'feedback intervention' model for encouraging behavioural change, the team designed an intervention protocol with the aim of providing tailored information to General Practitioners to help them make more knowledgeable decisions about HRM prescribing [R3]. The resulting 'Effective Feedback to Improve Primary Care Prescribing Safety' (EFIPPS) trial tested the intervention protocol in 262 General Practices within a pragmatic three-arm cluster randomised trial [R3]. The trial featured an educational intervention (in all 3 arms), feedback of performance for targeted indicators (arms 2 & 3), and a theory-informed behaviour change intervention (arm 3 only). The findings identified a 12-14% reduction in HRM prescribing among practices that received feedback (arm 2&3) compared to a simple educational intervention (arm 1) [R4]. This demonstrated that a relatively simple, easy-to-deliver and nationally scalable provision of feedback performance on prescribing safety could effectively reduce usage of HRM.

Community pharmacy setting: Strathclyde's research on HRM use in community pharmacies [R5, R6] was undertaken as part of the 'Scottish Patient Safety Programme – Pharmacy in Primary Care' (SPSP-PPC) initiative, established in 2014. Recruiting 29 community pharmacies from across Scotland, the SPSP-PPC explored the use of:

- An iterative learning model, the Breakthrough Series Collaborative model, and the capacity for a QI approach in community pharmacies.
- A safety climate questionnaire (SafeQuest-CP), designed at Strathclyde, to measure staff perceptions of the safety of the pharmacy setting.
- NSAID and warfarin HRM care bundles. The NSAID care bundle comprised two elements: the 'NSAIDs' Communication Care bundle' focussed on patient education, and the 'NSAIDs' Safer Care bundle' focused on the pharmacists' clinical assessment.

The Strathclyde team provided leadership in the design, validation and testing of all interventions, led the programme evaluation, and informed the national implementation strategy [R5, R6]. SafeQuest-CP was developed based on responses from 250 pharmacy staff, resulting in a 30 item questionnaire exploring the safety climate factors of 'leadership', 'teamwork', 'safety systems', 'communication', and 'working conditions' [R5]. SafeQuest-CP raises awareness of the importance of safety and facilitates action plans for improvement in Scottish community pharmacies [R5]. Additional research explored the scope to successfully integrate HRM care bundles within Scottish community pharmacies. Quality improvement process mapping techniques were used within participating pharmacies, supplemented by a case study validation exercise [R6]. The findings highlighted the core steps to delivering the HRM care bundles and positively identified that they can be successfully integrated into routine pharmacy practice. The

findings of both studies [R5, R6] demonstrated the capacity for community pharmacies to deliver safety-focused initiatives.

### 3. References to the research (Strathclyde affiliated authors in **bold**; FWCI as at 02/02/2021)

- R1 Bennie M**, Malcolm W, McTaggart S, **Mueller T.** (2020) Improving prescribing through big data approaches – Ten years of the Scottish Prescribing Information System, *British Journal of Clinical Pharmacology*, 86: 250– 257. DOI: [10.1111/bcp.14184](https://doi.org/10.1111/bcp.14184)
- R2** McTaggart S, Nangle C, Caldwell J, **Alvarez-Madrado S**, Colhoun H, **Bennie M.** (2018). Use of text-mining methods to improve efficiency in the calculation of drug exposure to support pharmacoepidemiology studies. *International Journal of Epidemiology*, 47(2):617-624. DOI: [10.1093/ije/dyx264](https://doi.org/10.1093/ije/dyx264) [REF2; FWCI: 1.65]
- R3** Barnett KN, **Bennie M**, Treweek S, **Robertson C**, Petrie DJ, Ritchie LD et al. (2014) Effective feedback to improve primary care prescribing safety (EFIPPS) a pragmatic three-arm cluster randomised trial: designing the intervention (ClinicalTrials.gov registration NCT01602705), *Implementation Science*, 11;9:133. DOI: [10.1186/s13012-014-0133-9](https://doi.org/10.1186/s13012-014-0133-9)
- R4** Guthrie B, **Kavanagh K**, **Robertson C**, Barnett K, Treweek S, Petrie D, Ritchie L, **Bennie M.** (2016) Data feedback and behavioural change intervention to improve primary care prescribing safety (EFIPPS): multicentre, three arm, cluster randomised controlled trial, *The British Medical Journal*, 354:i4709. DOI: [10.1136/bmj.i4079](https://doi.org/10.1136/bmj.i4079) [REF2; FWCI: 4.17]
- R5 Newham R**, **Bennie M**, Maxwell D, Watson A, de Wet C, Bowie P. (2014) Development and psychometric testing of an instrument to measure safety climate perceptions in community pharmacy. *Journal of Evaluation in Clinical Practice*, 20(6):1144-52. DOI: [10.1111/jep.12273](https://doi.org/10.1111/jep.12273)
- R6 Weir NM**, **Newham R**, **Dunlop Corcoran E**, **Ali Atallah Al-Gethami A**, **Mohammed Abd Alridha A**, Bowie P, Watson A, **Bennie M.** (2017) Application of process mapping to understand integration of high risk medicine care bundles within community pharmacy practice. *Research in Social and Administrative Pharmacy*, 14(10):944-950. DOI: [10.1016/j.sapharm.2017.11.009](https://doi.org/10.1016/j.sapharm.2017.11.009)

**Notes on the quality of research:** All articles are published in peer-reviewed journals. This research was supported with competitively-won funding:

- **Bennie M.** Community Pharmacy Safety Culture Application, *NHS Education for Scotland*, 01/03/2012-30/09/2013, GBP27,900.
- Guthrie B, **Bennie M**, **Robertson C.** et al. Efficient feedback to improve Primary Care Prescribing Safety (EFIPPS) Application, *Chief Scientist's Office*, 01/08/2011-30/11/2014, GBP224,512 (Strathclyde GBP56,343).
- Bowie P **Bennie M**, **Newham R**, Watson A. Scottish Patient Safety Programme – Pharmacy in Primary Care, *Greater Glasgow NHS*, 01/04/2014-31/03/2021 (Strathclyde GBP68,400).
- Morris A, Pell J, Ford I, Sutherland F, Colhoun H, **Bennie M**, et al. *The Scottish eHealth Informatics Research Consortium*, *MRC*, 01/03/2013-30/09/2018, GBP4,032,595 (Strathclyde GBP255,477).

### 4. Details of the impact

From its inception, the research described in section 2 was designed and conducted with real world impact in mind. The Strathclyde researchers worked closely with Scottish health policy makers to inform current strategy on prescribing HRM, and with NHS Healthcare Improvement Scotland, which supports national quality improvement (QI) initiatives and sponsored the SPSP-PPC initiative. The research has been directly incorporated into national strategy, service delivery and system monitoring, improving how clinicians prescribe and review their use of HRMs and how patients are informed about HRMs as they engage with clinicians in the primary care setting.

#### Influencing Scottish healthcare policy

As members of the SPSP-PPC Programme Board, the Strathclyde team informed the design of the programme and evaluated its findings [R5, R6]. The Programme Board outputs were shared with the Scottish Government Medicines Policy Division, with the Strathclyde team presenting findings and evidence-based proposals to inform Scottish Government negotiations with the

community pharmacy representative body. In this way, the Strathclyde research contributed to an expanding QI programme across all 1,257 community pharmacies in Scotland, including a Quality Improvement Methodology Payment to all Scottish community pharmacy contractors (annualised non-recurring pool of GBP2,000,000) and significant changes to the community pharmacy contract, which serves as the agreement of services between community pharmacies and the Scottish Government [S1a]. These changes included the requirement for all community pharmacies in Scotland to participate in SafeQuest-CP (developed by the Strathclyde team) and the implementation of the NSAIDs Communication Care and NSAIDs Safer Care bundles [S1a], as informed by the research [R5, R6]. Attesting to this, Scotland's Chief Pharmaceutical Officer stated: *'the national implementation strategy of quality improvement measures within the community pharmacy setting was directly informed by Strathclyde's research findings.'* [S1b]

The work of the SPSP-PPC, together with the key results of the Strathclyde team's evaluation, featured in *'Achieving Excellence in Pharmaceutical Care, 2017'* [S2, p.26], as an approach to improve the safety and reliability of health care. This document contains a Scottish Government commitment to *'provide the focus, resources and tools to support the safer use of medicines'* in part by *'making quality improvement an integral component of community pharmacy funding'* and by introducing *'a programme of continuous improvement'* [S2, p.52], as advocated by Bennie's team [R5, R6].

### **Improving healthcare practice in Scotland and internationally**

#### ***i) National and international implementation of QI measures within the community pharmacy setting***

As a direct result of the Strathclyde team's evaluation of the SPSP-PPC, in 2016 the Scottish Government announced continuous Quality Improvement (QI) as an ongoing element within the community pharmacy contract and made significant changes in line with this [S1a]. The requirement for all community pharmacies to participate in SafeQuest-CP, a tool designed and validated by the Strathclyde team [R5], ensures pharmacy staff reflect on and discuss how prescriptions can be dispensed safely to minimise errors and potential patient harm. Similarly, the inclusion of the NSAIDs Safer Care bundle prompts pharmacists to conduct patient needs assessments and identify 'high risk' patients along with potential interventions when processing a prescription for NSAIDs, and the NSAIDs Communication Care bundle supports the pharmacy team to deliver key messages to patients being dispensed or purchasing NSAIDs [S3]. As the underpinning research had demonstrated the core steps to delivering the HRM care bundles [R6], the Strathclyde research team collaborated with NHS Education for Scotland to inform their implementation strategy, including co-designing a webinar [S4, S5] and hard copy resources, such as a guidance booklet and an awareness poster [S3]. Early adopters who participated in the SPSP-PPC pilot work encouraged new adopter pharmacies and facilitated nationally coordinated 'training-the-trainers' events [S1a]. The NSAIDs Communication Care bundle has since been implemented in all dispensing general practices and all community pharmacies in NHS Scotland [S1a]. National implementation of the NSAIDs Safer Care bundle began formally in March 2019 [S1a], supported by the NHS Education for Scotland webinar [S4] which was well received. As commented by the PG Pharmacy Dean, NHS Education for Scotland, the webinar was *'essential to support the pharmacy teams' effective implementation of the NSAIDs care bundle in community pharmacies across the whole of Scotland'* and was *'made available to all community pharmacy staff and accessible at any time'* [S5]. The care bundle is now widely used by pharmacists to improve the clinical care of patients who take NSAIDs in addition to other medication. Highlighting the significance and novelty of these changes, Scotland's Chief Pharmaceutical Officer stated: *'national training resources co-designed with the Strathclyde team were developed... to include a focus on QI activities for the first time in Scotland.'* [S1b]

The SPSP-PPC programme has now been used as the basis of an evolving programme in Auckland, New Zealand. As stated by the Pharmacist and Project Manager, Quality Use of Medicines Team, *'The University of Strathclyde's involvement in the development and evaluation*

of the care bundles and a Safety Climate Survey ... informed various decisions and influenced the community pharmacy service delivery within Auckland from 2017 onwards' [S6]. By 2020, 55 community pharmacy teams in Auckland had adopted the NSAIDs care bundle [S6], demonstrating its international relevance and adaptability to suit various healthcare systems.

#### **ii) National implementation of HRM measures within the General Practice setting**

In 2016, the results of the 'Effective Feedback to Improve Primary Care Prescribing Safety' (EFIPPS) trial [R4] were presented to the policy leaders of NHS Scotland's Effective Prescribing and Therapeutics Branch to explore national adoption of the researchers' proposals within the National Therapeutic Indicators (NTI) report [S8]. The NTI report measures prescribing activity in specified therapeutic areas and compares these measurements across NHS Boards and General Practices, with results published annually. The report is applied by all Scottish NHS Boards as a tool to promote safe, effective and more consistent prescribing, and to identify potential areas requiring attention through their Prescribing Action Plans. In 2018, the HRM measures established and tested within EFIPPS were adopted by NHS Scotland as NTIs [S7] and applied to all 944 General Practices in Scotland [S8]. The 2018 annual report [S7], together with the addition in 2019 of an interactive visualisation tool [S9], allows NHS Boards and Scotland's General Practices to monitor changes in these measures over time [S8]. Furthermore, the HRM measures were incorporated into the Scottish Government's 'Polypharmacy Guidance Realistic Prescribing 2018' as part of the Scottish response to Medication Without Harm, the WHO's third Global Patient Safety Challenge [S8, S10].

#### **Improving patient wellbeing**

As a result of these quality improvement initiatives, patient welfare has been improved due to fewer HRMs being prescribed to patients. For example, the HRM measure 'Acute Kidney Injury' (i.e. percentage of people aged  $\geq 65$  years co-prescribed a NSAID and an Angiotensin-converting-enzyme (ACE) inhibitor/angiotensin receptor blocker and a diuretic) shows that over the period April 2018 to June 2020, there was a 30% reduction in those patients exposed to this HRM combination across Scotland [S8]. Similarly, there has been a reduction of 16% in the volume of NSAIDs prescribed in Scottish General Practices for the period April 2018 to June 2020 [S8]. As summarised by the PG Pharmacy Dean, NHS Education for Scotland, '*robust research led by Professor Bennie had a key influence in driving forward pharmacy services ... ultimately improving patient safety*' [S5].

#### **5. Sources to corroborate the impact**

- S1** (a) Factual statement from Chief Pharmaceutical Officer and Deputy Director, Pharmacy and Medicines Division, Chief Medical Officer Directorate, Scottish Government, dated 2/9/2020.  
(b) Supplementary e-mail statement from Chief Pharmaceutical Officer, dated 14/2/2021.
- S2** Scottish Government (2017) Achieving Excellence in Pharmaceutical Care, pp.24,52.  
<https://bit.ly/3byF5ix>
- S3** Health Improvement Scotland, Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) 'Communication Care Bundle' toolkit. <https://bit.ly/3qa1Gan>
- S4** NES Education for Scotland. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) 'Safer Care Bundle' Webinar. Available from: <https://vimeo.com/323773001/884511cca8>.
- S5** Factual statement from PG Pharmacy Dean, NHS Education for Scotland, dated 15/2/2021.
- S6** Factual statement from Pharmacist and Programme Manager, Quality use of Medicines Team, Waitemata and Auckland District Health Boards, dated 2/12/2020.
- S7** NHS Scotland (2018) National Therapeutic Indicators and Additional Prescribing Measures 2017/18, pp.54-57. <https://bit.ly/3dCyExe>
- S8** Factual statement from Head of Effective Prescribing and Therapeutics Branch, Scottish Government, dated 07/03/2021.
- S9** National Therapeutics Indicator (NTI) programme visualisation tool. <https://bit.ly/3alhziJ>
- S10** Scottish Government (2018) Polypharmacy Guidance Realistic Prescribing, pp 71-76.  
<https://bit.ly/2ZGnSy4>