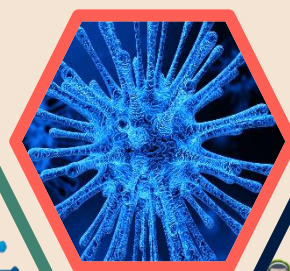




CMSSQ

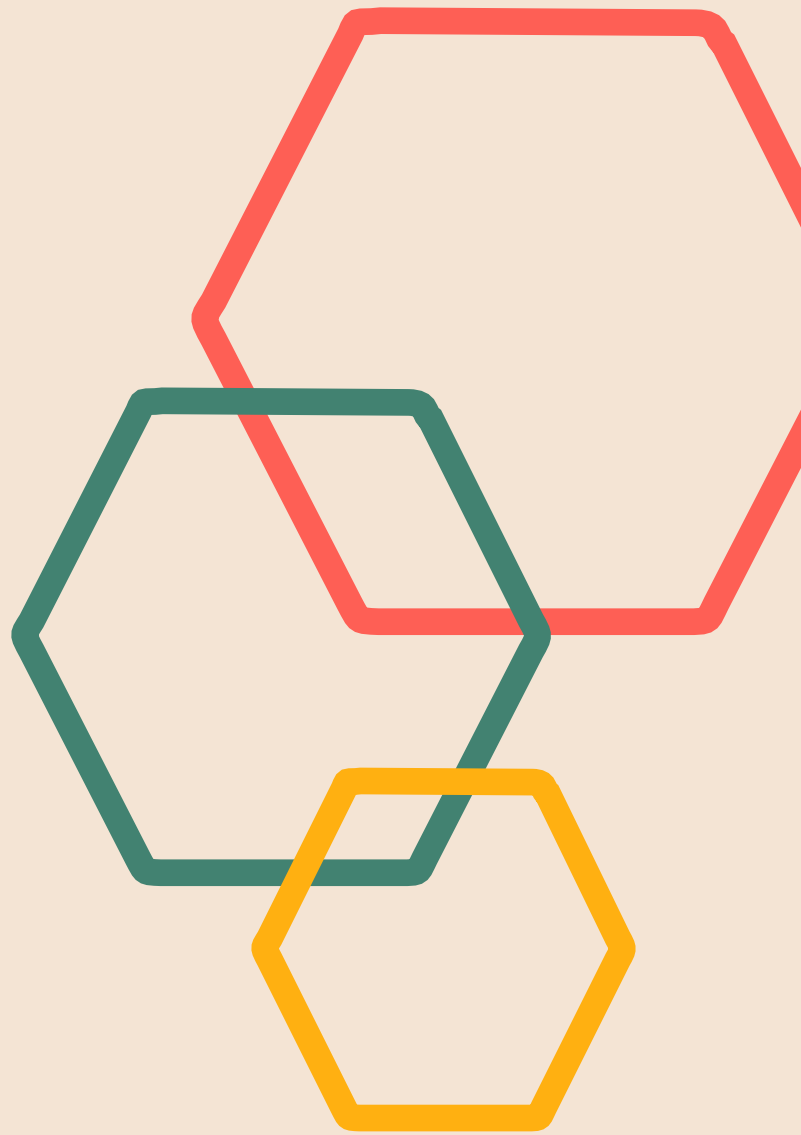
Centre for Medication Safety and Service Quality

Annual Report 2022 – 2023



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Introduction

As well as enjoying the long-awaited arrival of Spring, this is the time of year that those of us in NHS organisations share our annual reports. I therefore have the pleasure of introducing the latest annual report for the Centre for Medication Safety and Service Quality (CMSSQ) at Imperial College Healthcare NHS Trust. This report summarises our work for the period 1st April 2022 to 31st March 2023.

At the CMSSQ, we aim to deliver high quality research relating to medication safety that is:

- **Innovative** – providing new contributions to knowledge;
- **Translational** – applying our research findings and patient safety interventions to the context of service delivery within the NHS;
- **Relevant** to patient care in today's NHS – focusing on medication safety, use of technology, anti-infectives, and the involvement of patients, carers and families in their care.

Highlights from the past year include:

- We were key partners in the successful application for funding to be the **NIHR North West London Patient Safety Research Collaboration**, hosted at Imperial College Healthcare NHS Trust in partnership with Imperial College and UCL. This will run for five years from 1 April 2023.
- We published **22 peer-reviewed papers**, 6 other publications, and presented 16 conference abstracts; **five of these abstracts won prizes**.
- **Three new grants** were awarded. Six funded grants and fellowships reported in previous years are ongoing;
- We welcomed **two new members of staff**, Adrian Hire and Zoe van Zuylen, as well as hosting **two rotational pharmacists** as part of our objective to build research capacity among pharmacy professionals.



Professor Bryony Dean Franklin, Director

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Abbreviations

AHSC	Academic Health Science Centre
BMJ	British Medical Journal
CDRF	Clinical Doctoral Research Fellowship
CMSSQ	Centre for Medication Safety and Service Quality
HEE	Health Education England
HPRU	Health Protection Research Unit in Healthcare Associated Infections and Antimicrobial Resistance at Imperial College London
ICHT	Imperial College Healthcare NHS Trust
NIHR	National Institute for Health Research
NMAHPPs	Nurses, Midwives, Allied Health Professionals, Healthcare Scientists, Pharmacy Staff, Psychologists
NWL	North West London
PSTRC	Patient Safety Translational Research Centre
PPI	Patient and Public Involvement
PPIE	Patient and Public Involvement and Engagement
UCL	University College London
UKCPA	UK Clinical Pharmacy Association

The CMSSQ

The Centre for Medication Safety and Service Quality (CMSSQ) was set up in June 2000 as a joint initiative between the [Pharmacy Department at Imperial College Healthcare NHS Trust \(ICHT\)](#) and [University College London \(UCL\) School of Pharmacy](#). At UCL School of Pharmacy, we are linked to the Research Department of Practice and Policy and more specifically, the research cluster for [pharmacoepidemiology and medication safety](#).

We are a partner organisation within the [National Institute for Health Research Imperial Patient Safety Translational Research Centre \(NIHR Imperial PSTRC\)](#) and the [NIHR Health Protection Research Unit \(HPRU\) in Healthcare Associated Infection and Antimicrobial Resistance at Imperial College](#). We work closely with other research groups within ICHT, UCL and Imperial College London. For example, we are part of the [Healthcare Professional Academic Group at Imperial College](#), which seeks to grow the number of clinical academic leaders in nursing, midwifery, pharmacy, healthcare science and the allied health professions. We see ourselves as “embedded researchers” within the healthcare setting providing a unique privilege in linking research and practice.

Strategic Objectives

- To be an internationally recognised medication safety research centre;
- To lead inter-disciplinary research related to the quality and safety of medication use;
- To obtain research grants in collaboration with our partners;
- To influence patient safety policy and practice;
- To publish in peer-reviewed journals and disseminate our findings widely;
- To drive capacity-building in health services research.

Our team

Director



Professor Bryony Dean Franklin is Director of the CMSSQ, Executive Lead Pharmacist for Research at ICHT, Professor of Medication Safety at UCL School of Pharmacy, and a Visiting Professor within Imperial College London Department of Medicine. Professor Franklin has been involved with medication safety research for more than 25 years, and has published widely on methods for studying errors, and their frequency and causes. Her clinical background includes being a critical care and antimicrobial specialist pharmacist. She teaches on a variety of undergraduate and postgraduate courses at UCL, as well as leading research in patient safety. She is Co-Editor-in-Chief of the journal *BMJ Quality and Safety*.

Research Team

Dr Adrian Hire is a research pharmacist who joined the CMSSQ in 2022 as lead for medication safety research. He has had previous experience of working in hospital and community settings, and obtained a PhD from the University of Manchester in 2017. Since joining the team, Adrian has been involved in a project evaluating a prescribing tool for newly-qualified medical staff (the 'Dr-Card'), and a systematic review examining inequalities and inappropriate prescribing.



Zoe van Zuylen is a Women's Health Pharmacist currently seconded to the Research Team for a project exploring medication delivery to inpatient wards. She is interested in medication use in pregnancy, particularly around adherence to postnatal venous thromboembolism. She is the Education Lead on the UKCPA Women's Health Committee and has produced educational content for the Royal Pharmaceutical Society.

Calandra Feather is a health services researcher in the CMSSQ and honorary clinical research fellow at Imperial College. Calandra's PhD is using utilised mixed methods to evaluate prescribing practice, indication documentation, and use of an indication-based, patient-specific prescribing tool. Calandra recently published her systematic review in *BMJ Quality and Safety*. As a former paediatric intensive care nurse, Calandra is keen to develop, evaluate and implement interventions to support safer and more efficient medication practices.



Shahd Abdelaziz is an early career research pharmacist who has worked on three research and service evaluation projects this year for the CMSSQ. Combining her background as a clinical pharmacist, passion for research, and interest and current work in patient safety, she is currently undertaking the MSc in Patient Safety at Imperial College. Shahd is mainly using qualitative methods and is an advocate for patient and public involvement and engagement in research.



Rabia Hussain (left) and **Ellie Merchant** (right) are clinical pharmacists who each joined the CMSSQ for six months as part of their junior pharmacist rotations. They each helped with projects the CMSSQ team was working on at the time, and have now progressed to becoming senior clinical pharmacists in clinical trials and dispensary management, respectively.



Two consultant pharmacists are employed at ICHT: a consultant pharmacist for infectious diseases (**Mark Gilchrist**), and a consultant pharmacist for anticoagulation (**Frances Akor**). A key part of their role is to conduct research into the relevant area of clinical practice; the CMSSQ is able to support this as needed.

Other research-active pharmacy staff affiliated with the CMSSQ include, among others, pharmacists **Richard Wilson, Daniel Murphy, Poonam Lumb, Neil Tickner** and **Simone Brackenborough**. The number of research-active ICHT pharmacy staff demonstrates our culture of innovation, research and development as part of professional practice. Our students are listed separately on page 11.

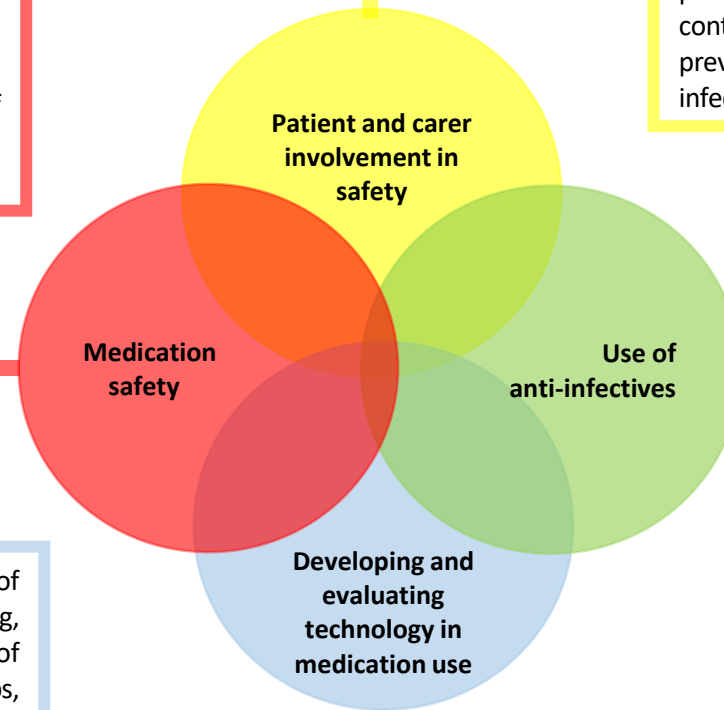
The CMSSQ research team, together with current students, hold a fortnightly online journal club where recent publications relating to patient safety and health services research are discussed, together with peer review of each other's current work. Other members of ICHT and UCL School of Pharmacy staff are very welcome to attend.

Research themes

The CMSSQ has a significant research output, with a focus on medication safety. Our research is therefore closely aligned with the strategic direction of the Research Department of Practice and Policy at UCL School of Pharmacy, the NIHR Imperial PSTRC, and with national and international research agendas. Our research falls into four overlapping research areas:

In 2017, The World Health Organization identified 'Medication Without Harm' as the theme for its third Global Patient Safety Challenge, and highlighted that everyone, including patients and healthcare professionals, have a role to play in ensuring medication safety. Three key action areas were identified: polypharmacy, high-risk situations and transitions of care; work from the CMSSQ team has been cited in the technical reports produced for each of these.

This includes non-adherence to medication, which may be both the response to, and cause of, errors and other types of medication-related harm. Many patients and carers are also willing and able to contribute to their own safety in relation to preventing errors and healthcare associated infections; our work contributes to this field.



ICHT has long been recognised as a leader in this field, in particular with respect to the role of pharmacists and multi-disciplinary teams in improving anti-infective use. Our partnership with the NIHR Health Protection Research Unit (HPRU) in Healthcare Associated Infections and Antimicrobial Resistance at Imperial College London, continues to provide opportunities for collaboration in addressing healthcare associated infections and antimicrobial resistance as patient safety issues.

There is ongoing interest in the potential impact of technologies such as electronic prescribing, barcoding, automation, decision support systems, and the use of multiplatform (smartphone/tablet/computer) apps, together with increasing recognition that unintended consequences, and new types of error can also occur. Such technologies also affect how health care professionals work and may increase or decrease efficiency. A significant proportion of our research relates to this area.

Grants awarded

Members of the CMSSQ were listed on three new grants awarded this year (Table 1). Four other funded grants and two fellowships reported in previous years are ongoing or finished in the last year (Table 2). Two further grant applications were submitted during the past year but were unsuccessful. Four further applications have been submitted with the outcome awaited.

CMSSQ investigator	Project title	Funder	Date of award	Start date	End date
Grants					
Bryony Dean Franklin (Director)	NIHR Patient Safety Research Collaboration	NIHR	December 2022	April 2023	March 2028
Bryony Dean Franklin (Co-applicant)	NIHR Incubator for the Pharmacy Profession	NIHR	March 2023	TBC	March 2026
Bryony Dean Franklin (Co-applicant)	Developing a predictive real-time warning system for avoiding patients and healthcare staff harm after medication safety incidents	Academy of Finland	April 2022	April 2022	March 2027

Table 1: New grants obtained during the past year.

Grants awarded

CMSSQ investigators	Project title	Funder	Date of award	Start date	End date
Grants					
Bryony Dean Franklin (Co-applicant)	Getting prescription medications right at home, in hospital & hospice: An Activity Theory analysis to improve patient safety and confidence in palliative care	Marie Curie	January 2020	April 2021	October 2023
Bryony Dean Franklin (Theme lead)	HPRU in Healthcare Associated Infections and Antimicrobial Resistance	NIHR	November 2019	April 2020	March 2025
Bryony Dean Franklin (Co-applicant)	'On-demand' Computerised Decision Support in Paediatric Emergency Drug administration	NIHR – i4i	January 2018	June 2018	July 2022
Bryony Dean Franklin (Theme lead)	NIHR Imperial Patient Safety Translational Research Centre	National Institute for Health Research	February 2017	August 2017	March 2023
Fellowships					
Daniel Murphy (Bryony Dean Franklin as supervisor)	Funding to undertake MSc in Genomic Medicine	HEE	August 2021	September 2021	August 2023
Angela Burgin (Bryony Dean Franklin as clinical advisor)	The EIPresMO Study –Electronic Prescribing and Medicines Optimisation in the hospital setting: What helps and hinders patient conversation?	NIHR CDRF	June 2021	September 2022	August 2025

Table 2: Ongoing grants and fellowships that remained active during the past year.

Research students

MPhil, PhD and postgraduate fellowship students

We have five full time and part time MPhil / PhD students within the Centre at present, conducting a wide range of studies focused on different aspects of medication safety and technology evaluation (Table 3).

Student	CMSSQ supervisor(s)	Project title and University	Dates
<i>In progress</i>			
Pollyanna Kellett	Bryony Dean Franklin (second supervisor)	Resilience in nurses' use of medication administration technologies (working title) (PhD; University of Leeds)	Started March 2017. Part time. Ongoing
Calandra Feather	Bryony Dean Franklin (second supervisor)	The impact of patient-specific decision support within electronic prescribing systems (PhD; Imperial College)	Started 2019. Full time. Ongoing
Nouf Alaboud	Bryony Dean Franklin (second supervisor)	The impact of electronic prescribing system factors and data integration on medication-related clinical decision making and prescribing workflow (PhD; UCL School of Pharmacy)	Started September 2020. Full time. Ongoing
Nouf Alsalem	Bryony Dean Franklin (primary supervisor)	Use of handheld medication records to support patient safety (PhD; UCL School of Pharmacy)	Started September 2021. Part time. Ongoing
Tugce Haykir	Bryony Dean Franklin (primary supervisor)	Stewardship of high-risk drugs - What can we learn from antimicrobial stewardship programmes? (PhD; UCL School of Pharmacy)	Started January 2022. Full time. Ongoing

Table 3: PhD and Postgraduate Fellowship students under CMSSQ supervision.

Postgraduate Masters students

We provide supervision to ICHT staff, UCL School of Pharmacy students, and Imperial College students conducting postgraduate Masters degrees in a range of topics related to medication safety. For example, **Shahd Abdelaziz** and **Daniel Murphy** are both doing postgraduate MSc courses at present.

Visiting students

We have traditionally hosted a small number of visiting undergraduate, postgraduate and postdoctoral students who complete internships and sabbaticals with us and assist with a range of audit, research and service development projects. We were not able to do this for the past few years due to the COVID-19 pandemic, but are delighted to have been able to do so again this year. Specifically, we welcomed the following:

- **Charlotte Koldewejj**, PhD student, Radboud University Medical Centre, The Netherlands
- **Olga Tchijevitch**, PhD student, University of Southern Denmark, Denmark
- **Beatriz Fonseca**, Undergraduate pharmacy student, University of Lisbon, Portugal
- **Valeria Laboy Collazo**, Undergraduate pharmacy student, University of North Carolina, USA
- **Sophia Mortha**, Undergraduate pharmacy student, University of North Carolina, USA

Research highlights

Medication Safety

Working with a range of international collaborators, we conducted a Europe-wide survey of medication safety practices in European critical care units, on behalf of the European Association of Hospital Pharmacists.

We are working with collaborators at the University of Bath and UCL to analyse medication incidents reported to the National Reporting and Learning System in which local or national guidelines may have contributing to medication errors. This will form the basis of future work exploring the value of user-testing of prescribing guidelines.

As part of a team at UCL School of Pharmacy, we are exploring next steps in some work to explore how best to prioritize hospital inpatients for different levels of clinical pharmacy services. We have conducted two patient / public focus groups to explore public perspectives on this topic and to shape our work.

We are conducting a systematic review to explore the relationship between socioeconomic status and potentially inappropriate prescribing in older people. It is hoped this will inform strategies to address the risks and inequalities associated with inappropriate prescribing.

We have submitted a grant application to explore the effectiveness and cost-effectiveness of second-person checking of administration of injectable medication to hospital inpatients, the outcome for which is awaited.

Patient and carer involvement in medication safety

We carried out a preliminary evaluation at ICHT to understand how to better involve and communicate with hospital inpatients' informal carers, particularly surrounding medication management (the 'CLISMM' study). The findings were used to support submission of a grant application to test a discharge medicines management intervention for older people who have informal carers helping with their medicines.

A study looking at how the information surrounding hospital inpatients' allergies, intolerances, and sensitivities is collected and documented in their health records is in progress. The 'MANADR' study aims to increase understanding on why sometimes patients with known ADRs still receive the causative medication(s), and why healthcare staff sometimes believe patients have histories of ADRs when this is not the case.

Research highlights

Development and evaluation of technology

We have completed the first stage of a study exploring use of behavioural insights to increase nurses' use of barcode medication administration in hospital inpatients. Our intervention led to a statistically significant 23.1% increase in scan rates on intervention wards compared to control wards. Next steps are to roll out and evaluate the interventions more widely.

Calandra and Bryony are part of a team developing and evaluating indication-specific computerised decision support as an approach to decrease prescribing errors, funded by a grant from the NIHR i4i Programme. This involves continued collaboration with Dosium, now a spin-out from Imperial College London, together with the British National Formulary. In the past year we conducted an evaluation of current prescribing practice and a user-testing study of the new TouchDose system. Analysis is now underway; results will inform further intervention iterations and strategies for education and implementation.

Work on the Safety and Unintended Consequences of Health Technology (SUCHTech) study continues. Phase 1 is completed, which included identifying and mapping different types of unintended consequences of technologies. This mapping is now being used to develop a framework for predicting, identifying, mitigating and preventing technology-related risks in health care which will then be tested in practice. We presented abstracts based on Phase 1 at three conferences, winning the 'Best Poster' award at one and the 'highest scoring abstract' award at another.

Use of anti-infectives

We are working with Dr Sara Garfield and other colleagues at UCL School of Pharmacy in a study exploring inter-faith interventions to address vaccine hesitancy.

We are supporting work conducted by Amrita Ghataure at Imperial College to explore the management of the recent Group A Streptococcus outbreak and associated shortages of antimicrobials.

PhD student Nouf Alaboud's work includes evaluation of a sepsis scoring system as part of an electronic health record at a large London hospital trust.

Bryony Dean Franklin continues as theme lead for a research theme on 'practice, design and engineering' within the NIHR HPRU in Healthcare Associated Infections and Antimicrobial Resistance at Imperial College.

Publications and peer review

During the past year, 22 peer-reviewed papers were published, as well as 6 other publications, and presented 16 conference abstracts of which five won prizes. These are listed on page 17; research papers were published in prestigious journals such as *BMJ Quality and Safety*, *The Lancet Infectious Diseases* and *BMJ Open*. This brings our cumulative output to **315** peer-reviewed papers, **471** abstracts and **179** other publications since 2000.

Bryony Dean Franklin continues as co-Editor-in-Chief for the journal *BMJ Quality and Safety*, which receives about 2,000 submissions a year, is on the review panel for NIHR Clinical Doctoral Research Fellowship applications, and is a reviewer for *MedRxiv*. Other members of the team also peer review papers submitted to a range of journals.



CMSSQ members at conferences where their abstracts won prizes: (left to right) Calandra Feather at the NWL NMAHPPs Symposium 2022 (best poster), Shannon Nally at the 28th European Association of Hospital Pharmacists Congress 2023 (best poster), Shahd Abdelaziz, Professor Bryony Dean Franklin and Dr Sara Garfield at Health Services Research conference 2022, Shahd Abdelaziz at Joint PSTRC Symposium 2022 (best poster award)

Education and training

The CMSSQ plays a key role in the provision of education both at UCL School of Pharmacy and within ICHT, at both undergraduate and postgraduate levels, and for both taught and research-based higher degrees.

As well as bringing specific expertise in research and medication safety, other teaching at UCL School of Pharmacy utilises the skills and experience of qualified pharmacy staff at ICHT for both undergraduate and postgraduate students. Contributions during the past year include the following:

UCL School of Pharmacy

- We provide teaching each year to the MSc in Clinical Pharmacy, International Practice and Policy, with Bryony Dean Franklin delivering lectures on medication safety .
- Bryony Dean Franklin delivers a course on 'systems, safety and practice' for the undergraduate pharmacy degree, running throughout the four-year MPharm degree. This introduces key aspects of medication safety over a course of five teaching sessions plus a workshop to integrate with professionalism and clinical practice.
- Bryony Dean Franklin and Yogini Jani deliver an option module on Quality Improvement in Pharmacy Practice within the MPharm degree.

- Bryony Dean Franklin and Yogini Jani deliver an option module on Quality Improvement in Pharmacy Practice within the MPharm degree.
- Three undergraduate pharmacy students contributed to CMSSQ research for their final year projects from October 2023 to February 2023, under our supervision.
- Bryony Dean Franklin is now the Sustainability Lead for the MPharm degree at UCL School of Pharmacy.

Imperial College

Bryony Dean Franklin contributes to the MSc programmes in Patient Safety and Health Policy at Imperial College, both teaching and assisting with project supervision and marking, as well as conducting early and late stage reviews for PhD students.

Patient and public involvement

We involve patients and the public in our research whenever possible and are increasingly recognised as leaders in this area. Our work on lay involvement in data collection and in the analysis of qualitative data has been shared as examples of good practice locally, nationally and internationally. Most of our funded projects include members of the public on an advisory group or similar. These lay partners include patients, carers and the public. This year we also note with sadness the loss of a key patient/public partner, John Norton, who worked with us on many studies over the years. Our condolences go to his family and friends – it was an immense privilege to have worked with him and he will be deeply missed by all who knew him.

- Two patient/public representatives have been actively involved in the SUCHTech study. Working with the rest of the research team, they have facilitated focus groups discussions and participated in data analysis, as well as advising on the overall project direction.
- Bryony Dean Franklin remains academic champion for patient and public involvement and engagement (PPIE) for the NIHR Imperial PSTRC, which involves championing PPIE and engagement, providing expertise in PPIE in the context of patient safety research and co-chairing the PPIE advisory board.
- Two patient/public representatives were part of the CLISMM service evaluation study team, reviewing and advising on patient and carer facing materials, and on the project as a whole. They are also named co-applicants on the grant that we submitted to the NIHR for the subsequent feasibility study.
- A patient/public representative is part of the team for the MANADR study, exploring how previous reactions to medication are managed in the inpatient setting. They will be involved in reviewing the study material, analysis of the data, and dissemination.
- We presented several planned projects to the NIHR Imperial PSTRC [Research Partners Group](#), gaining valuable insights from a patient and public perspective that we can incorporate into our work.
- Bryony Dean Franklin featured in the Imperial College AHSC Humans of Health Research series, which showcased photographs and interviews with health researchers, and the patients and carers they work with on their projects. A Humans of Health Research roaming portrait exhibition (below) was held at Imperial College's South Kensington campus to celebrate everyone involved.



Photo credits: Jo Mieszkowski, Imperial College London.

Collaboration with other organisations

During the last year we have built on existing collaborations plus developed new links. As well as internal collaborations within UCL School of Pharmacy, ICHT and Imperial College, our external collaborators over the last year have included the following:

Dyson School of Design Engineering
NHS England
Radboud University Medical Centre
Cerner
Trinity College Dublin
Butler University

Helix Centre
Public Health England
University of Oxford
University of Southampton
University of Bath
University of Manchester
University of North Carolina

Reflections, and considerations for the future

We are delighted to report that the CMSSQ's objectives are all being achieved. Specifically, we are recognised internationally as a medication safety research centre, and are leading funded inter-disciplinary research related to the quality and safety of medication use. We are increasingly influencing patient safety policy and practice, and have an impressive ongoing publication record. Our work was featured in one of the Research Excellence Framework Impact Case Studies submitted by UCL School of Pharmacy last year. We are building capacity in health services research and partnering with patients and the public at all stages of our research.

Our outputs remain strong, with numbers of peer reviewed papers remaining high, and numbers of conference abstracts picking up again after COVID-19, with five of our sixteen abstracts winning prizes this last year.

Over the next year we will be focusing on pursuing further grant applications in order to maintain future income, as well as working to translate our research findings into practice and policy. One of our posts will include a specific focus on research capacity building within the pharmacy department at ICHT and we will be specifically seeking to include consideration of equity within all relevant research studies.

Publications

Peer-reviewed research papers

Assunção-Costa L, Ribeiro Pinto C, Ferreira Fernandes Machado J, Gomes Valli C, Portela Fernandes de Souza LE, **Franklin BD**. Validation of a method to assess the severity of medication administration errors in Brazil: a study protocol. *J Public Health Res.* 2022 11(2):2623. doi: 10.4081/jphr.2022.2623

Kelly D, Koay A, Mineva G, Volz M, McCool A, McLoughlin E, Ó Conluain R, Sharma M, Kerr A, **Franklin BD**, Grimes T. A scoping review of non-professional medication practices and medication safety outcomes during public health emergencies. *Public Health* 2023; 214: 50-60, <https://doi.org/10.1016/j.puhe.2022.10.026>

Cresswell K, Sheikh A, **Franklin BD**, Hinder S, Nguyen HT, Krasuska M, Lane W, Mozaffar H, Mason K, Eason S, Potts HWW, Williams R, Benefits realization management in the context of a national digital transformation initiative in English provider organizations, *Journal of the American Medical Informatics Association*, Volume 29, Issue 3, March 2022, Pages 536–545, <https://doi.org/10.1093/jamia/ocab283>

Alsaidan JA, Portlock J, Ata SI, Aljadhey HS, **Franklin BD**. Retrospective descriptive assessment of clinical decision support medication-related alerts in two Saudi Arabian hospitals. *BMC Med Inform Decis Mak.* 2022 Apr 15;22(1):101. doi: 10.1186/s12911-022-01838-1. PMID: 35428282

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Sutherland A, Jones MD, Howlett M, Arenas-Lopez S, Patel A & **Franklin BD**. Developing Strategic Recommendations for Implementing Smart Pumps in Advanced Healthcare Systems to Improve Intravenous Medication Safety. *Drug Saf* (2022). <https://doi.org/10.1007/s40264-022-01203-1>

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Rawson T M, Eigo T, **Wilson R**, Husson F, Dhillon R, Seddon O, **Gilchrist, M**. Exploring patient acceptance of research within complex oral and IV outpatient parenteral antimicrobial therapy (COpAT) networks. *JAC-Antimicrobial Resistance* (2022). 4(4). doi:10.1093/jacamr/dlac087

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Arkell P, **Wilson R**, Watkins K, Antcliffe D B, **Gilchrist M**, Wilson M, Holmes A. Application of therapeutic drug monitoring to the treatment of bacterial central nervous system infection: a scoping review. *Journal of Antimicrobial Chemotherapy* (2022), 77(12), 3408-3413. doi:10.1093/jac/dkac332

Bolton W J, Rawson T M, Hernandez B, **Wilson R**, Antcliffe D, Georgiou P, Holmes A H. Machine learning and synthetic outcome estimation for individualised antimicrobial cessation. *Frontiers in Digital Health* (2022). 4, 997219. doi:10.3389/fdgth.2022.997219

Alexander J R, Che Bakri N A, Toke-Bjølgerud E, Edwards A, Vikraman A, Michalsky C, Fossler M, Lemm N-M, Medhipour S, Budd W, Gravani A, Hurley L, Kapil V, Jackson A, Lonsdale D, **Latham V**, Laffan M, Chapman N, Cooper N, Szydło R, Boyle J, Pollock K M, Owen D. The effect of TRV027 on coagulation in COVID-19: A pilot randomized, placebo-controlled trial. *Br J Clin Pharmacol*. 2023; 89(4): 1495- 1501. doi:10.1111/bcp.15618

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Gallagher C T, **Saleem F**. How the United Kingdom's Nursing and Midwifery Council Applies Guidance When Exercising Its Disciplinary Functions. *Journal of Nursing Regulation* (2022), 13(3), pp.52-59. [https://doi.org/10.1016/S2155-8256\(22\)00080-1](https://doi.org/10.1016/S2155-8256(22)00080-1)

Riezk A, **Wilson R C**, Rawson T M, Vasikasin V, Arkel P, Ferris T J, Holmes A H. A rapid, simple, high-performance liquid chromatography method for the clinical measurement of beta-lactam antibiotics in serum and interstitial fluid. *Analytical Methods*, 15(6), 829-836. doi:10.1039/d2ay01276f

Riezk A, Vasikasin V, **Wilson R C**, Rawson T M, McLeod J G, Dhillon R, Holmes A H. Triple quadrupole LC/MS method for the simultaneous quantitative measurement of cefiderocol and meropenem in serum. *Analytical Methods*, 15(6), 746-751. doi:10.1039/d2ay01459a

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