

Pharmaceutical Sciences

Clinical Academic Group



About King's Health Partners

King's Health Partners Academic Health Sciences Centre brings together one of the world's top research-led universities, King's College London, and three of London's most prestigious and highly regarded NHS Foundation Trusts – Guy's and St Thomas', King's College Hospital and South London and Maudsley.

Our partnership provides a powerful combination of complex clinical specialties that cover a wide range of physical and mental health conditions and a breadth of research expertise that spans disciplines from medicine and biomedical sciences to the social sciences and humanities.

There are three parts to our mission: excellence in research, education and clinical care.

To support our mission, we are delivering programmes of work to:

- Join up mental and physical healthcare so that we treat the whole person, mind and body
- Increase the value of the care we provide and the outcomes we achieve for our patients and service users

- Integrate care across local primary, secondary and social care services to make it easier for people to get the care and support they need
- Improve the public health of our local community by tackling inequalities and supporting people to live healthy lives
- Bring together our collective strength and expertise in a range of specialist areas to deliver world-leading care, research and education

We are uniquely structured to deliver our mission for excellence. Our 21 Clinical Academic Groups (CAGs) bring together all the clinical services and staff from the three trusts with the relevant academic departments of King's College London.

Foreword



At King's Health Partners we are committed to improving outcomes for our patients and service users and achieving maximum value for money in everything we do. We believe that being open and transparent about the care and outcomes we deliver results in a culture of improvement across our partnership.

This is why we are publishing a series of outcomes books that will help patients, service users, carers, referring clinicians and commissioners to make better informed decisions, and our staff to drive up the quality of the care we provide. The books report key outcomes for treatments provided by our 21 clinical academic groups (CAGs). CAGs form the building blocks of our Academic Health Sciences Centre. By bringing together our clinical and academic staff across teaching, training and research, we can use their combined expertise to achieve better outcomes for our patients and service users.

Our books are designed for a clinical and lay audience and contain a summary of patient volumes and measures (e.g. length of stay, re-admissions, patient experience), clinical outcomes, educational activities, technological and research innovations and publications. They also focus on other important measures, such as staff satisfaction and wellbeing.

The primary purpose of King's Health Partners is to improve health and wellbeing locally and globally. We must deliver this goal in a challenging economic environment with rising demand for, and costs of, healthcare. We will only achieve sustainable health improvement if we strive always to increase value. We define value in terms of outcomes that matter to patients, over the full cycle of care, divided by the cost of producing those outcomes. By publishing outcomes books we have more information to support us measuring the value of the healthcare we provide.

Our goal is to increase the depth and breadth of reporting each year. Books will be updated regularly to demonstrate progress against our mission to achieve world-class research, education and clinical care. We hope you find these data valuable. Please send comments and suggestions to us at kingshealthpartners@kcl.ac.uk

For more information please visit our website at www.kingshealthpartners.org

Professor John Moxham, Director of Clinical Strategy, King's Health Partners

April 2016



Foreword from the Pharmaceutical Sciences Clinical Academic Group

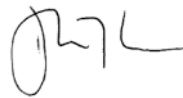


The importance of medicines in healthcare cannot be overstated – most forms of treatment involve the taking of medicine at some point. It is likewise crucial that we assure the patient is given the right medicine in the right form at the right time. The structure of our clinical academic group (CAG) draws together all aspects of the use of medicines, from drug discovery through first-in-man studies, formulation technology and prescribing safety to post-marketing pharmacoepidemiology and therapeutic drug monitoring. Our CAG has dissolved artificial boundaries between research, practice, teaching and training and between the NHS and academia. Clinicians teach. Researchers practise. Teachers research. Clinical practice is informed by our research. Our research is governed by the needs of practice. Our teaching and training are predicated on the latest research and current practice.

Since the setting up of Pharmaceutical Sciences Clinical Academic Group (PSCAG) in 2009, the experiences of staff and students within the CAG have changed radically and for the better.

The real beneficiaries of our new ways of working are, nonetheless, our patients, who safely receive the right medicine in the right formulation at the right time.

**Professor David Taylor, CAG Lead,
Director of Pharmacy and
Pathology at South London and
Maudsley NHS Foundation Trust,
Professor of Psychopharmacology
at King's College London**





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The value of partnership at King's Health Partners

King's Health Partners aims to create a centre where world-class research, education and clinical practice (the 'tripartite mission') are brought together for the benefit of patients.

We want to make sure that the lessons from research are used swiftly, effectively and systematically to achieve better patient outcomes, improve public health and join up health and care services for people with physical and mental health problems.

By working together in this way, integrating care across different organisations and sectors, we can not only improve the health of the people we care for, but we can also achieve better value for money.

Integrating mental and physical health

The mind and body are inseparable, and mental and physical health conditions are often connected.

The average life expectancy for someone with a long-term mental health illness is much shorter than for someone without, often due in part to smoking, obesity, diabetes or alcohol misuse. Likewise, many people with long-term physical health conditions suffer from depression or other mental health conditions.

Despite this, health services separate care into physical and mental and often fail to share patient information.

At King's Health Partners we are working to overcome these barriers by treating the whole person. We are committed to caring for vulnerable patients with both physical and mental ill health

in an integrated manner with better, faster diagnosis and treatment because we know that addressing mental ill health improves physical health outcomes and vice versa.

Right across our partnership, we are committed to joining up and delivering excellent mental and physical healthcare, research and education so that we treat the whole person, by:

- Screening all patients with chronic physical diseases for mental health conditions, and using the learning from this to improve the care we provide
- Improving our understanding of the physical health needs of people with severe mental ill health
- Addressing the traditional distinctions between the mind and body in research and education allowing us to train students and staff to deliver more integrated care
- Better organising and expanding current training provision for physical and psychiatric comorbidity
- Working with our local commissioners to find new ways of paying for integrated services
- Linking IT systems across our partner trusts so that clinicians have access to a person's physical and mental care records
- Investing in innovative programmes such as IMPARTS (Integrated Mental and Physical Healthcare: Research, Training and Services) and 3DfD (3 Dimensions of care for Diabetes)

- Recognising the importance of employee mental and physical health and wellbeing.

Public health

Public health is one of our biggest challenges. At the root of much of the ill health in south London is a high incidence of smoking, alcohol abuse and obesity. With our health and social care partners, we are developing strategies to tackle these public health priorities. We are also developing plans for a new Institute for Urban Population Health, a collaboration with local partners to bring about transformational change to health in local communities. We want to achieve a measurable improvement and impact on health gain and local management of physical and mental health problems through new evidence based interventions.

Alcohol strategy – key aims

- Developing appropriate resources for clinical staff and patients
- Developing and implementing training for all staff on harmful drinking supporting early identification and intervention
- Establishing ourselves as a centre of excellence for integrated research, training and practice in the management and prevention of alcohol misuse
- Attracting funding for future alcohol clinical, training and research initiatives

- Monitoring the impact of the strategy on indicators of alcohol related harm

Tobacco strategy – key aims

- Supporting all clinical sites to be smoke-free
- Developing an informatics structure for routinely and systematically recording smoking status
- Support, referrals and treatment uptake for smoking cessation across the partnership
- Co-producing clinical care pathway for nicotine dependence treatment
- Developing and implementing training packages for smoking cessation interventions for all our healthcare professionals
- Monitoring the impact of our smoking cessation strategy in relation to knowledge and uptake of skills by staff, uptake of smoking interventions, outcomes of interventions, user satisfaction, prevalence of smoking, cost-effectiveness of interventions

of the relationship between clinical and biological data, extending at one end to clinical decision support embedded in electronic medical records (EMRs), sharing of clinical data to enhance care and outcomes, through to research recruitment and participation, with strong patient engagement throughout. We have developed a clear strategy and action plan to maintain and develop leadership in the field of informatics.

Systems have been developed to enable electronic healthcare records to be shared across our partner organisations and with other healthcare organisations. Our work includes the award-winning 'MyHealthLocker' programme, the Clinical Record Interactive Search (CRIS), King's Health Partners Online and the Local Care Record. We are working with patients to make electronic patient information available in an anonymised format between partner trusts, primary care and social care. Together we have a powerful information resource for both practitioners and researchers.

Informatics

Informatics is at the heart of our plans to join up care, research and education. Data is one of our most important assets at King's Health Partners. We are proud of our ability to control information systems for the purpose of data creation, curation and analysis with strong and transparent information governance processes throughout. This control enables our exploration



Introduction

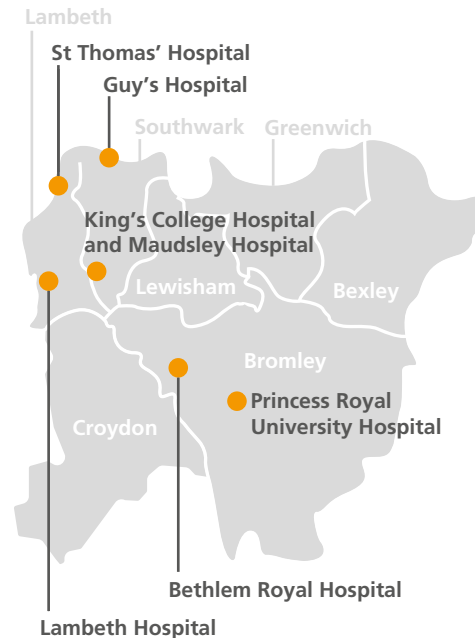
The Pharmaceutical Sciences Clinical Academic Group (PSCAG) incorporates more than 1,800 staff and students and is the only CAG to include staff from all four organisations within King's Health Partners.

We are unique as the world's only formal healthcare/academic partnership in pharmaceutical sciences. We have a shared:

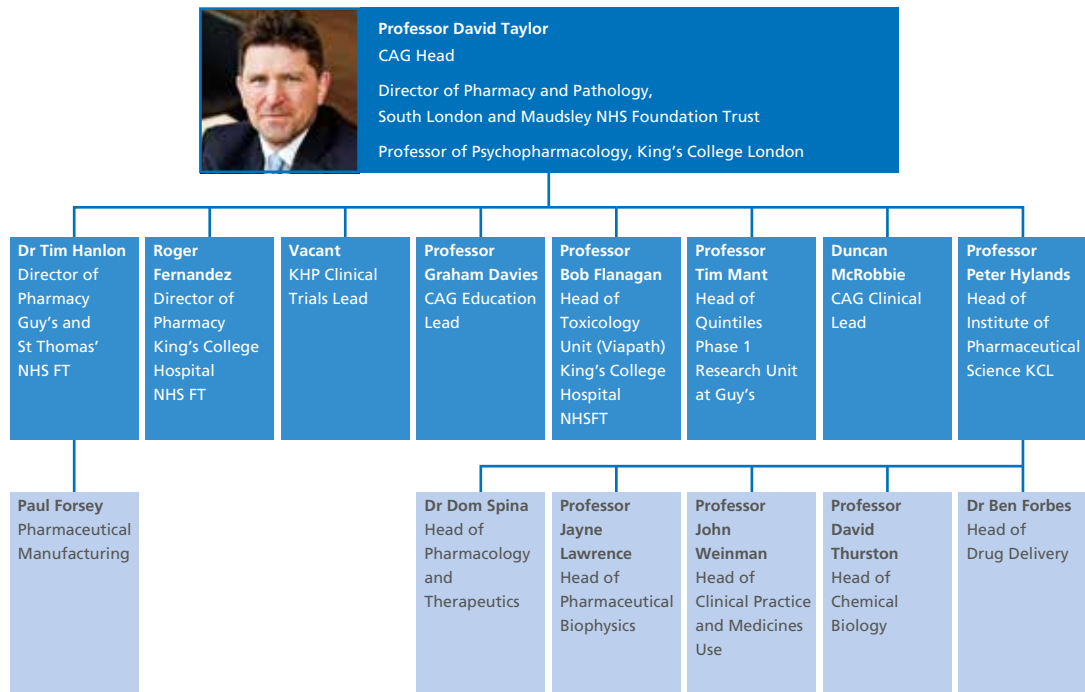
- Research strategy centred on medicines optimisation
- Healthcare/academic education and training strategy
- Management structure

Our aim is to integrate the work of staff across all partner organisations to improve practice, research and education. Our key strategic objective is to assure translation of research findings related to drugs and medicines into practice as quickly as possible. Our CAG includes a variety of professional groups, including pharmacists, pharmacy technicians, scientists, healthcare professionals, undergraduate and postgraduate students and administrative and support staff.

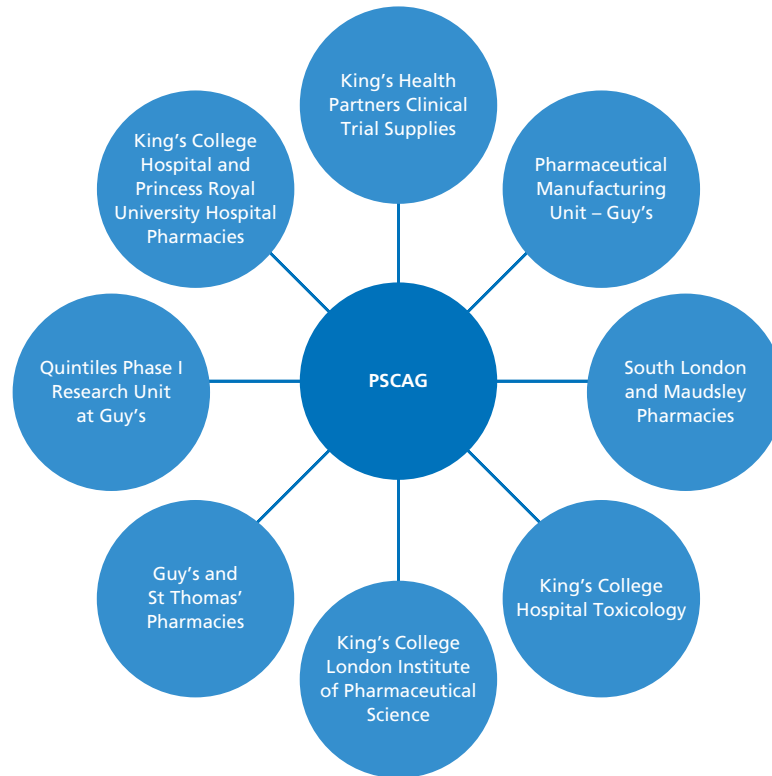
Where we provide our services from



Structure of the Pharmaceutical Sciences CAG



Pharmaceutical Sciences Clinical Academic Group key areas



Range of services

The single most frequent intervention in healthcare is giving a person a medicine.

Duncan McRobbie, Associate Chief Pharmacist –
Clinical Services, Guy's and St Thomas' NHS Foundation Trust

The pharmacy departments of King's Health Partners provide dispensing services and a full clinical pharmacy service to wards and departments. Working within a multidisciplinary team with other healthcare professionals, they ensure a patient's medicines are optimised to their individual needs and that governance processes, in terms of both clinical safety and cost, are in place for the safe and effective use of medicines. Each department employs a number of highly-specialist pharmacists, essential as medicines and prescribing becomes more complex.

Pharmacy services have a wide remit when someone is admitted to hospital

- They ensure that current medicines are accurately transcribed onto the prescription chart; that new medicines do not interfere

with old medicines; that old medicines do not interfere with a current medical condition; that the right medicine is received; that the patient is satisfied with their medication

- They help to monitor how the medication is working; provide verbal communication, allow the patient to ask questions; provide written material, including information on an individual drug and how it might interact with other medications the patient is taking
- On discharge, pharmacy services provide take-home written material and pre-discharge consultation; pass patient medication information to primary care providers; provide a patient information helpline to help with taking medication, mitigating adverse effects and provide logistical information such as where to obtain medication

Guy's and St Thomas' NHS Foundation Trust

The pharmacy department includes specialist pharmacists supporting the South East London Cancer Network. It incorporates both sterile and non-sterile manufacturing units and holds two regional pharmacy specialities: medicines

information and pharmacy quality assurance. It follows a service model whereby more junior pharmacists provide care for straightforward patients and more complex patients are assigned to a senior pharmacist for review. Overall, more than 400 staff are employed. The drugs budget is £110m.

King's College Hospital NHS Foundation Trust

The pharmacy department employs 250 staff (including 115 pharmacists), has a drug expenditure of £95 million a year and covers 1,500 beds across two sites. It includes an aseptic unit and a clinical trials supplies unit. It:

- Supports electronic prescribing and medicines administration (EPMA), which is used throughout King's College Hospital
- Includes specialities in liver, neurosciences, trauma and haematology

South London and Maudsley NHS Foundation Trust

The pharmacy department employs 60 staff and has a drug expenditure of £7m per year. It provides dispensing services from the Maudsley, Lambeth and Bethlem Royal hospitals and a clinical pharmacy service to 1,000 inpatients and 3,000 community patients.

The Medicines Information Centre at the Maudsley is the national centre for information on psychotropics. It produces the Maudsley Prescribing Guidelines (MPG) for prescribing advice

in many countries. There have been 12 editions of the MPG and it has sold 250,000 copies in eleven languages.

Institute of Pharmaceutical Science (IPS)

Staff in the IPS at King's College London have considerable research strengths in drug delivery and formulation science, pharmacology and clinical pharmacology, analytical science and medicinal chemistry (including molecular modelling). In total, 105 staff are employed in IPS funded by a recurring budget of £3.3m.

We have expertise in formulating drugs as medicines for administration to patients.

Ben Forbes, Reader in Pharmaceutics, IPS

Research centres around the following themes: clinical practice and medication use; drug delivery (e.g. dermal, transdermal, pulmonary, gastrointestinal); synthetic chemistry (drug discovery); chemical biology; pharmaceutical biophysics; and pharmacology and therapeutics (lung biology, pulmonary pharmacology, blood brain barrier). Staff within the Institute also provide substantial teaching to undergraduate programmes and postgraduate taught programmes. Currently, IPS staff supervise 115 PhD students, 12 of whom are NHS staff from within our CAG.

Viapath Toxicology Unit (King's College Hospital)

The Toxicology Unit, based at King's College Hospital, provides a specialised drug and elemental analysis service to King's Health Partners and other organisations such as mental health trusts. Services include therapeutic drug monitoring, pathology and trace element and toxic metal detection and measurement.

Manufacturing Unit at Guy's – commercial and clinical opportunities

The Guy's Hospital site houses a state-of-the-art pharmaceutical production facility that provides a range of services tailored to the specific needs of patients both for the NHS, commercial clients and contract manufacturing. The unit manufactures a wide range of formulations including ointments, creams, injections, sterile and topical pharmaceutical products, requiring compliance with good manufacturing practice (GMP) principles. The unit serves a crucial role in developing and testing medicines formulated from pure substances derived from drug discovery endeavors and also in reformulating existing pharmaceutical products. Services are geared towards both research and local patient requirements. King's Health Partners is unique among UK Academic Health Science Centres (AHSCs) in having its own in-house formulation and manufacturing unit – the essential link between drug discovery and medicines use and testing.

Quintiles industry collaboration

We have a close working relationship with industry partners Quintiles. Until recently, the Quintiles Drug Research Unit (GDRU) at Guy's carried out commercially-sponsored Phase I/II studies of investigational drugs, including first-in-man studies. Quintiles GDRU is a global company with offices in over 50 countries and headquarters in North Carolina, USA.

Quintiles GDRU has over 20 years' experience in translational medicine and has performed 'first in human' studies with over 400 new small molecules and biologics.

The unit was recognised internationally for its expertise in preclinical and regulatory strategy combined with innovative Phase 1 study design.

Since its inception, Quintiles GDRU has established a collaboration with senior clinical and academic staff from King's College London and Guy's and St Thomas', in order to obtain specialist advice and practical, expert input covering many therapeutic areas. This has involved consultants in allergy, anaesthetics, cardiology, dermatology, immunology, respiratory medicine, gastroenterology, haematology, microbiology, nephrology, neurology, psychiatry, rheumatology and urology.

King's Health Partners clinicians and academics continue to work closely with Quintiles on pioneering drug research.



Service developments

Acute services

Guy's and St Thomas' has applied for a wholesale dealer licence, which will allow it to sell products to other pharmacies. The Good Manufacturing Process (GMP) unit has, partly as a consequence, increased its income. Cross-CAG working has brought about the development of new formulations of tetrahydrocannabinol (THC), Cannabidiol (CBD), psilocybin and naloxone, amongst others.

Mental health services

Integrated medication guidelines

Our CAG has worked closely with CAGs across King's Health Partners and helped to develop integrated medication guidelines. These have been approved for use by primary and secondary care in both the south east London region and Croydon. We have developed guidelines on:

- The use of donepezil, galantamine, rivastigmine and memantine drugs in Alzheimer's disease

- Shared prescribing guidelines – lisdexamfetamine for the treatment of attention deficit hyperactivity disorder (ADHD) in children and methylphenidate and atomoxetine to treat ADHD in adolescents
- Shared care guidelines for aripiprazole and paliperidone long-acting injection

CAG-wide developments

Patient safety – Medicines reconciliation (ensuring continuity of prescribing on admission)

The PSCAG has completed a two-year programme to establish medicines reconciliation across trusts. In total, medicines reconciliation has been implemented on all inpatient units as scheduled. Significant clinical interventions continue to be made through this process (ensuring patients receive the right doses of the right drugs). As with all other trusts, quarterly reports are sent to the relevant clinical commissioning groups through the trust contracts teams.



Service highlights

Our CAG is a unique organisation, being the only specialist pharmaceutical sciences CAG in the world. It is the world's largest single organisation dedicated to pharmacy-related practice and research. The services we provide and the world class research and training we produce already benefit our patients:

- We have a King's Health Partners-wide clinical trials supplies service which holds a database of all non-commercial drug-related trials across our organisations
- We produce clinical guidelines for medicine use within the trusts' service models, written and updated through a continuous consultative process with medical and nursing colleagues
- We have adopted the specialist clinical pharmacist and consultant pharmacist model across all trusts
- We have combined medicines information services across King's Health Partners: Guy's medicines information for general enquiries, South London and Maudsley medicines information for mental health

- Our CAG has 'bench to bedside' expertise in drug discovery, development, testing, formulation, toxicology and clinical use
- We publish UK-leading research in clinical pharmacy and world class research in pharmaceuticals, pharmacology and other related disciplines
- We are ranked first in the UK for 'research power' (Research Excellence Framework – REF 2014)

World ranking of Pharmacy at King's College London

According to the QS World University rankings by subject in 2015 and 2016, King's College London is ranked as one of the top ten in the field of pharmacy and pharmacology. The overall score takes into consideration academic and employee reputation, citations per paper and H-index citations.

Figure 1 | Pharmacy and pharmacology world rankings 2015

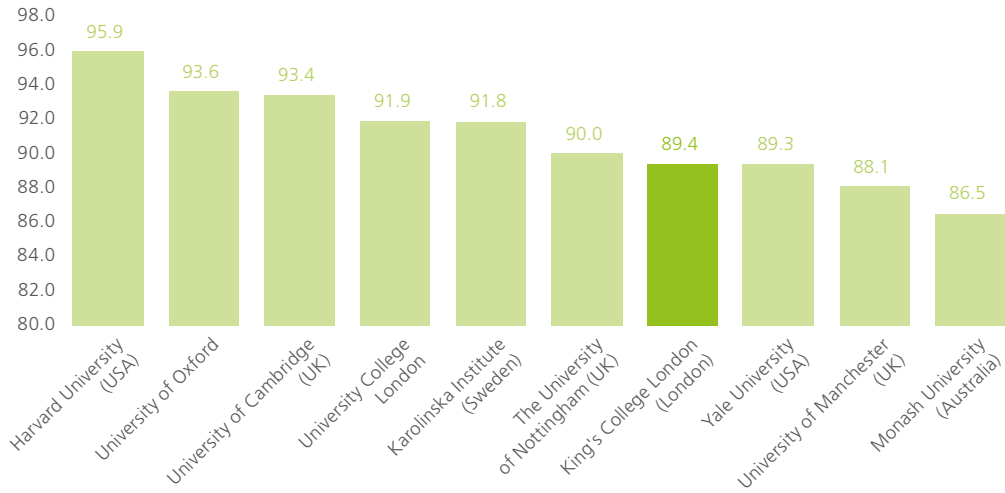
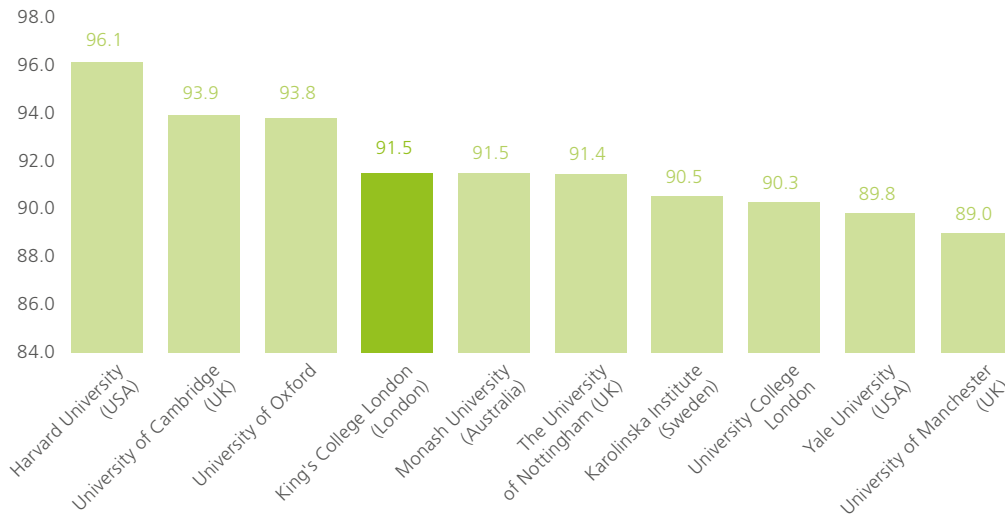


Figure 2 | Pharmacy and pharmacology world rankings 2016



KCL is firmly established as one of the top ten universities in the world for pharmacy and pharmacology, being ranked 7th in 2015 and then 4th in 2016. These rankings take into account research performance for hundreds of universities. Our ranking in the world for Pharmacy and Pharmacology is substantially higher than for KCL as a whole.

The impact of our research in terms of ranking – Research Excellence Framework (REF)

The Research Excellence Framework is the successor to the Research Assessment Exercise, a method of assessing the research of British higher education institutions.

In December 2014, the results of the REF 2014 evaluation exercise were published. They showed that 91% of our research measured collectively by output, impact and environment, was ranked as either world-leading or internationally excellent within REF unit of assessment 3 (allied health professions, dentistry, nursing and pharmacy) to which the Institute of Pharmaceutical Science (as the research arm of our CAG) had contributed. Overall this analysis showed that, based on 'power', a measure taking into account both the quality of research and the number of researchers assessed, King's College London was ranked first in the UK within this unit of assessment.

Maudsley Prescribing Guidelines

The Maudsley Prescribing Guidelines in Psychiatry, also known as the MPG, is a highly successful and internationally-respected publication used throughout the UK and the English-speaking world. Since its inception in 1993, The Maudsley Prescribing Guidelines in Psychiatry has grown in size and reputation and is now the leading psychiatric text for prescribing to patients diagnosed with a mental health disorder.

Figure 3 | The Maudsley Prescribing Guidelines in Psychiatry – first edition published in 1994, fifth edition published in 1999 and twelfth edition published in April 2015



The first edition of the MPG consisted of just eight pages of photocopied text. It was aimed at providing evidence-based prescribing guidance for our prescribers in what was then the Bethlem and Maudsley NHS Trust. Evidence-based medicine came late to mental health and the MPG was one of the first publications to take a systematic approach to prescribing. The second, third and fourth editions were each in-house publications but the content had grown, with the fourth edition (1997) running to 80 pages. The publisher Martin Dunitz printed and distributed the fifth edition, the first MPG to be sold outside its clinical base. Later came the merging of the MPG with prescribing guidelines produced by Carol Paton at Bexley Hospital and its expansion to encyclopaedic dimensions. There have now been twelve editions of the MPG and eleven different language versions (including Italian, Polish and Turkish). The current edition is being translated into Cantonese and Japanese, opening-up a much wider market in the Far East.

The Medicines Information Centre at the Maudsley

The NHS UK Medicines Information Service (UKMi) is the national body for medicines information. It oversees all medicines information provided by NHS bodies and aims to support the safe, effective and efficient use of medicines by the provision of evidence-based information and advice on their therapeutic use. The Medicines Information Centre at the Maudsley took on the role of national centre for information on psychotropic drugs in 1996. Today, the department receives over

200 complex queries each month with around two thirds originating within King's Health Partners and the remainder from across the UK.

Acute services highlights

- Electronic prescribing and medicines administration (EPMA) at King's College Hospital and Guy's and St Thomas'
- Seven day working for pharmacy staff implemented across emergency medical, surgical and cardiovascular pathways at Guy's and St Thomas'
- Evelina Children's Hospital pharmacy team won the Improving Safety in Medicines Management award at the Patient Safety and Care Awards (2015) for developing a safer way of giving children morphine pain relief



(From left to right) Jenni Middleton (editor of Nursing Times), Helen Gordon (chief executive of the Royal Pharmaceutical Society), Steve Tomlin (consultant pharmacist for children's services at Evelina Hospital and a member of the winning team) and Alastair McLellan (editor of Health Service Journal) at the 2014 Patient Safety and Care Awards.

- Services audited and accredited as part of the Organisation of European Cancer Institutes (OECI) 2015
- The model of antimicrobial stewardship is used across services – which involves the appropriate use of antibiotics
- High levels of pharmacy interventions across the CAG to prevent errors, patient harm and improve clinical outcomes
- Partnership with Sainsbury's to implement Sainsbury's Local at Guy's and King's College Hospitals



Pharmaceutical Sciences CAG aims and ambitions

Across the whole of our CAG, our key aims are to develop:

- The concept of the 'King's pharmacist', a lifelong development process
- The integration of pharmaceutical sciences with Phase 1 research and toxicology
- Capacity to engage in projects across the primary/secondary care interface in line with the Five Year Forward view
- A wide-ranging programme of NHS staff undertaking PhDs at King's College London

Our plans and priorities across all our pharmacy services are to:

- Generate income through conferences and internships
- Increase the number of NHS PhD programmes
- Improve research publication and impact

- Integrate community pharmacy from our local area
- Increase recognition of clinical academics and their work across traditional boundaries
- Improve undergraduate student satisfaction
- Collaborate and work closely with other clinical academic groups
- Introduce electronic prescribing across the CAG
- Introduce mental health liaison pharmacy service to all NHS units (to support integration of the care of "Mind and Body")
- Introduce medical liaison pharmacists to South London and Maudsley
- Lead the development of GP-based clinical pharmacists

- Prioritise medicines safety assurance and learning to protect patients from potential prescribing errors

Aims and ambitions for acute services

Cancer pharmacy services

From a supply perspective, our priority is to minimise waste through the use of 'dose-banded' products, to maximise the efficiencies in this team. Dose banding determines a standard, prepared dose of chemotherapy based on predefined ranges.

From a clinical perspective, our pharmacist team is fully integrated into the patient pathway to clinically check systemic anti-cancer therapy (SACT) prescriptions and to signpost the supply process for patients. The team acts as an expert resource for the managed entry of new cancer medicines and their funding. Key to the development of pharmacy support to these areas will be integration of the oncology pharmacy team and the surgical and medical (e.g. haematology pharmacy) teams, to ensure that an appropriate service is provided to all wards and services in trusts across the week.

Cardiovascular pharmacy services

The cardiovascular team has fully integrated with the community team, enabling streamlined management across the pathway.

Our priorities in 2016/17 are:

- Full implementation and evaluation of extended services that have been developed in 2014/2015
- Develop masterclasses and internships to raise the profile of this area, develop staff in specialists roles and support income generation
- Continue to integrate community services, now the cardiovascular team has integrated and continue to work with primary care through the community heart failure service
- Integrate long term conditions services to focus on patients, not conditions, for example integration with diabetes and chronic obstructive pulmonary disease (COPD)

Children's pharmacy services

Children's services are developing at a rapid rate across King's Health Partners and strategically, managerially and clinically making huge demands of our pharmaceutical services.

Our priorities for 2016/17 include:

- Development of a children's medicines centre – multidisciplinary and integrated with King's College London and led by pharmacy
- Review of atomisation (process of reducing to a fine spray) and medicines management – Omnicell medications management system (a ward-based system for automated

dispensing), ePrescribing, bar-coding and smart-pumps

- Integrated local child health, currently focused on services with asthma and epilepsy
- Area prescribing committee – large remit affecting shared care, repatriation of supply of medicines and overarching review of unlicensed medicines purchase and supply
- Establishment of a paediatric clinical research facility to add to and enhance the growing number of clinical trials taking place within the Evelina London Children's Hospital
- Pharmacies moving to a full seven-day service

Cellular/regenerative pharmacy services

Our key priorities in cellular and regenerative pharmacy in 2016/17 are:

- Input on the good manufacturing practice (GMP) side
- Directorate research and development (R&D) lead involved nationally
- Explore opportunities to develop pharmacogenomics programme
- Pharmacy oversight of clinical trials involving cell therapies

Aims and ambitions for mental health pharmacy

We are already established as one of the world's most important centres for pharmacoepidemiological studies in mental health and we aim to consolidate our position using database facilities unique to South London and Maudsley. For example, Clinical Record Interactive Search (CRIS) and the JAC pharmacy management system.



We will also continue our programme of quality improvement in relation to prescribing.

Aims and ambitions for community pharmacy

Our main strategic discussion in this area has been how the various sectors within pharmacy, primary care, community care and hospital care can be better integrated. This follows on from initial work we undertook within Southwark and Lambeth Integrated Care (SLIC) that concentrated on long

term conditions, particularly older people with multiple long term conditions. SLIC helped the health and social care organisations and people of Lambeth and Southwark to work better together to improve people's outcomes and experiences, through the development of integrated care.

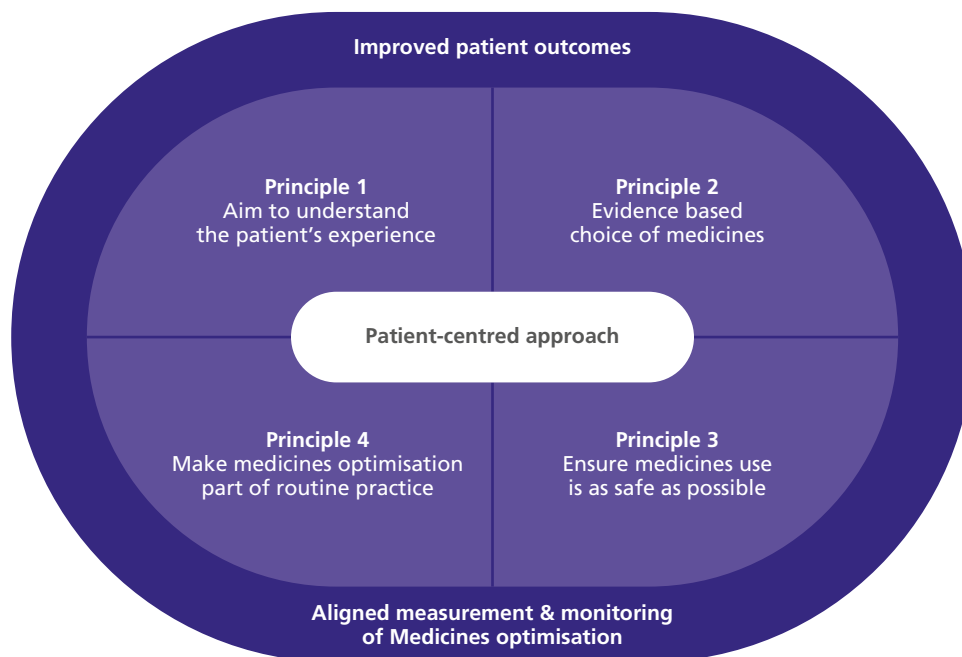
Medicines optimisation

Our CAG is working closely with community colleagues to ensure pharmacy services meet the needs of the local population through medicines optimisation, which helps the right patients get the right medication at the right time.

Medicines optimisation is a complex process of ensuring the safe, effective and economic use of drugs in individual patients. It has several components including the publication of guidelines and treatment pathways, advising prescribers, employing specialist pharmacist prescribers and advising patients directly.

These principles form the foundation of the National Institute for Health and Care Excellence (NICE) medicines optimisation guidance published in March 2015.

Figure 4 | Principles of medicines optimisation

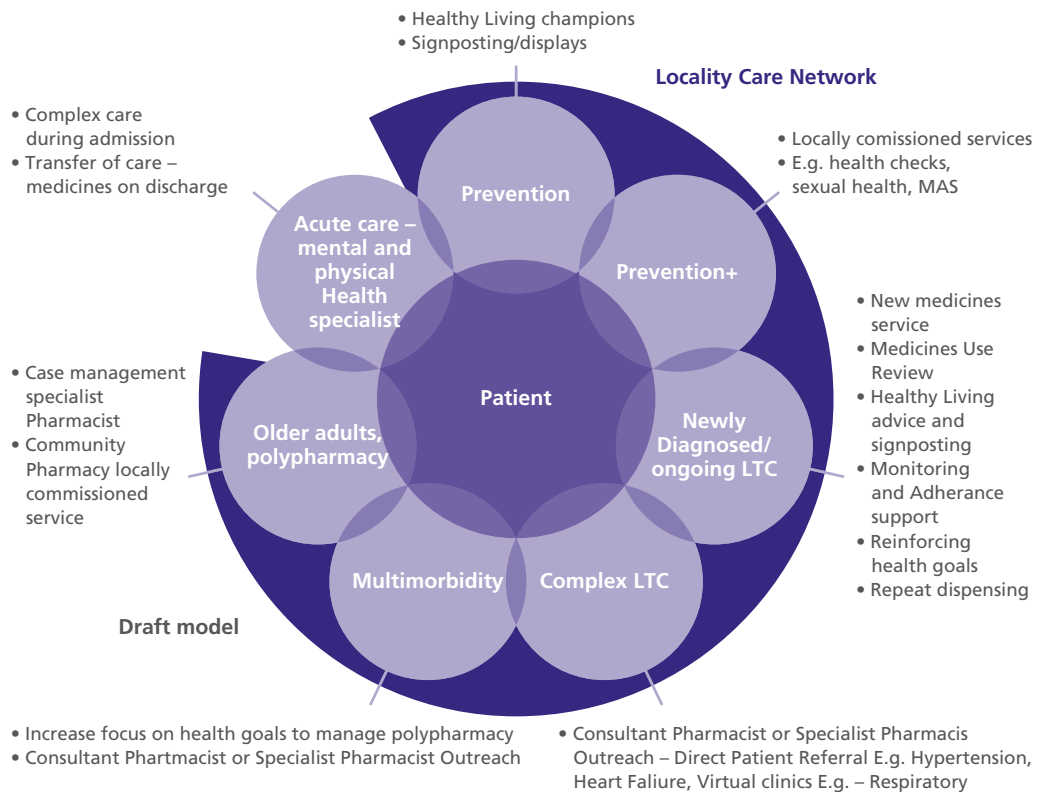


Long term conditions

Our pharmacy professionals, across all the sectors (academia, primary care and secondary care), believe there is a unique opportunity in the local areas we serve in south east London to deliver the

medicines optimisation agenda for the benefit of patients and the NHS more widely through the better use of resources in the management of long term conditions.

Figure 5 | Medicines optimisation in the community



We already have services in the community, such as outreach clinics and various community and @Home services. The @Home service provides

high-quality, safe, acute treatment and monitoring in a patient's usual place of residence, by preventing unnecessary hospital admissions and

supporting advanced hospital discharge. We are also seeking to better use our consultant and specialist pharmacists to help support patients and fellow clinicians within primary and community care. We already have consultant pharmacists locally in:

- Cardiovascular services
- Older people services
- Children's services
- Palliative and end-of-life care services
- Infectious diseases services
- Medicines safety

The specialties missing from the above list that are a priority for development across the PSCAG are:

- Diabetes
- Respiratory medicine
- Musculo skeletal

The work with the @Home service last winter would also suggest that much could be gained with more formal integration of the pharmacy team supporting the service with the specialist pharmacists within the hospital.

Key to all of this is communication, both within multidisciplinary teams but also at the various stages where care is delivered across a growing number of clinical settings. The National Institute for Health and Care Excellence (NICE) Medicines Optimisation Guidance stresses the clinical importance of quality information at transfer of care. Clinical Commissioning Groups have already

indicated they will use local Commissioning for Quality and Innovation (CQUIN) to drive this forward in 2016/17. Including community pharmacists in transfer of care information will be essential and finding solutions will be a high priority. Reducing risk of harm at transfer of care is also a goal for our CAG within the 'Sign up to Safety' programme.

Emergency services

Our key priorities for pharmacy emergency services in 2016/17 are working with the emergency department team to increase pharmacists' role in identifying and resolving medicines-related issues for patients attending the emergency department.

We want to ensure patients are discharged safely with information promptly provided to them and their primary care provider.

Elective and ambulatory care

Our key priorities for pharmacy in elective and ambulatory care in 2016/17 are:

- Work with directorates in our hospital trusts to ensure a full and robust service with an increase in seven-day working
- Continue to provide a robust outpatient service through our contract with Sainsbury's
- Work with Sainsbury's to improve the homecare service for patients
- Support the junior doctor workforce, through developing the role of pharmacists

Special projects across the Pharmaceutical Sciences CAG

Staff in our CAG have worked towards improving the quality of prescribing and medicines use. The examples in this section represent a small proportion of the programmes we have put into practice.

Reducing the rates of prescribing high-dose antipsychotics and polypharmacy – 2006 to date

Background

Antipsychotic drugs are effective in the acute and long term management of schizophrenia, psychosis and bipolar disorder. There is no conclusive evidence that high doses of antipsychotics are more effective than standard doses.

The survey

In 2006, South London and Maudsley NHS Foundation Trust participated in a national survey of prescribing antipsychotic medications, organised by the Prescribing Observatory for Mental Health (POMH-UK). In total, 32 trusts submitted data for 3,492 patients, 314 of whom were from South London and Maudsley. Nearly 60% of South London and Maudsley patients for whom data were submitted were prescribed a high-dose antipsychotic, compared with 35% in the national sample. Of the trusts that participated, with the exception of one, South London and Maudsley had the highest rate of high-dose prescribing.

Results of the survey were disseminated widely across the trust. Discussions about the need for a change in practice were encouraged at all levels and amongst all clinical professions within the trust. Prescribing of 'as required' antipsychotic medications was identified as a large proportion

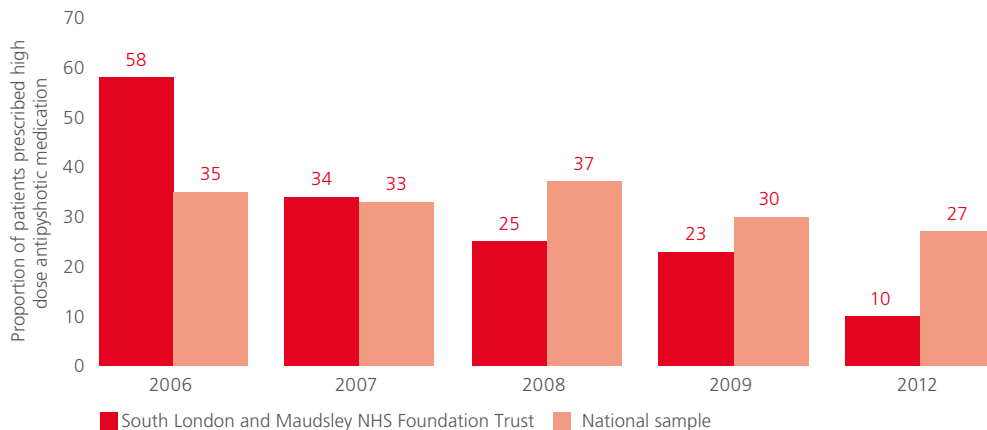
of high-dose prescribing. Pharmacy set about designing and implementing a quality improvement programme.

What changes were made

The following change interventions were introduced between October 2006 and March 2012:

- October 2006: restrictions on the routine prescribing of 'as required' antipsychotic medications were proposed by pharmacy, and agreed by the trust executive and trust clinical directors. Guidance on the use of 'as required' antipsychotic medications was issued
- October 2006 to March 2012 – pharmacy identified all regular prescriptions of high-dose antipsychotics. Medication was reviewed by pharmacy and the prescriber, and where possible alternative treatment options were introduced
- Guidance on the use of 'as required' medications was implemented
- January 2009 – pharmacy, through the executive performance review process, set a target for all trust directorates to reduce the rate of prescribing of high-dose antipsychotics on individual units to below 20% by the end of 2009. Rates of high-dose prescribing were compared across the trust. Prescribing practices were examined on units with disproportionately high rates of high-dose prescribing
- April 2009 – trust inpatient prescriptions were updated to include a warning that all 'as required' medications must be reviewed at least once a week

Figure 6 | Rate of prescribing of high dose antipsychotics – national comparison



- Re-audit 1 (March 2007) Thirty two trusts submitted data for 3,271 patients, 264 of whom were from South London and Maudsley
- Re-audit 2 (March 2008) Thirty two trusts submitted data for 1,965 patients, 299 of whom were from South London and Maudsley
- Re-audit 3 (March 2009) Thirty five trusts submitted data for 4,269 patients, 249 of whom were from South London and Maudsley
- Re-audit 4 (March 2012) Forty eight trusts submitted data for 5,079 patients, 315 of whom were from South London and Maudsley
- Rates of high-dose prescribing in South London and Maudsley are now amongst the lowest in the UK

Impact of a pharmacy-led intervention aimed at improving physical health monitoring for inpatients prescribed an antipsychotic 2010–2015

Reflections from the pilot

- A change from established practice is often met with initial resistance
- The need for change and any proposed changes in practice should be discussed widely within the organisation
- Incremental improvements in practice should be noted. Absolute targets of 100% achievement are often seen as difficult to achieve
- Benchmarking is useful for identifying outlying practice
- Persistence with an improvement programme can continue to produce a sustained change, until a change in culture is established

Background

The life expectancy of patients with schizophrenia is markedly lower than that of the general population. Many commonly-used antipsychotic drugs are associated with metabolic adverse effects such as weight gain, insulin resistance and diabetes and dyslipidaemia (an abnormal amount of lipids such as cholesterol in the blood).

It is widely accepted that patients prescribed an antipsychotic should have their physical health monitored, at least annually. National Institute for Health and Care Excellence (NICE) guidance for schizophrenia recommends that all patients when admitted to an inpatient unit should have their plasma glucose, lipids, weight and ECG recorded.

Physical health monitoring in mental health services has historically been poor. Previous audits have shown low rates of monitoring of plasma glucose and lipids. A National Audit of

Schizophrenia found the monitoring of glucose and lipids in patients prescribed an antipsychotic was lower at South London and Maudsley than in the average national sample. Previous attempts at improving physical health monitoring in South London and Maudsley had limited success.

The survey

In 2010, the pharmacy department conducted a trust-wide survey of the physical health monitoring of inpatients prescribed an antipsychotic. A third of inpatients had no evidence in their notes of testing for plasma glucose and lipids. Results of the survey were disseminated widely across the trust. Discussions about the need for a change in practice were encouraged at all levels and amongst all clinical professions within the trust. Information bulletins were sent to clinicians. Physical health monitoring was designated an area for improvement to be monitored through the trust performance review process. No change was implemented in trust procedures for ordering blood tests.

A subsequent audit in 2011 showed some improvement. The overall rate of monitoring, however, remained low. Just over half of the patients sampled had evidence of the recommended testing.

The first intervention October 2013

Pharmacy introduced an intervention aimed at improving the monitoring of plasma lipids and glucose for inpatients prescribed an antipsychotic. The intervention, a change in procedure, was designed jointly with the pathology department and was subsequently approved by the trust Drugs and Therapeutics Committee.

November 2013 First re-audit (pre-intervention)

In the first two weeks of November, all inpatients prescribed an antipsychotic were identified from prescription charts on inpatient units. The notes of these patients were scrutinised for evidence of a test for plasma glucose and lipids during the current admission.

The second intervention

Where one or more of the tests was missing, pharmacy ordered these directly from pathology. The consultants of the patients for whom tests were needed were contacted to obtain their permission for pharmacy to order the tests. Phlebotomy request forms were completed by pharmacy for each patient and sent to the wards.

Blood tests were offered to patients with completed phlebotomy request forms. If a test was not possible, for example the patient had been discharged before the test was offered or where a patient refused the test, the reason for

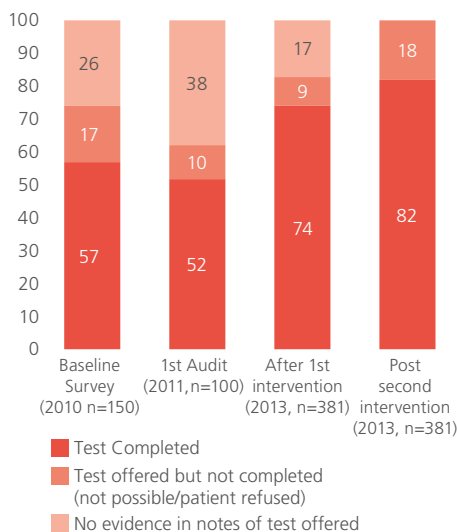
non-completion was documented by phlebotomy on the test request form.

December 2013 Post-intervention

Pharmacy checked the notes of all patients for whom a test was requested for evidence of the test having been completed. Where the test results were not evident in the patient notes, pharmacy checked the original phlebotomy request form to determine whether the test had been offered, and any reason for the test not being completed.

Results

Figure 7 | First re-audit and post-intervention



Reflection

- Previous efforts at improving physical health monitoring in South London and Maudsley focused largely on the education of junior doctors and designing systems to prompt junior doctors to order tests
- A change from the established trust procedures for ordering blood tests had not previously been considered
- It is possible to improve practice across an organisation if there is a willingness to innovate and change. This project highlighted the need to evolve and adapt the roles of professions to ensure best outcomes for patients



Quality of care outcomes

We aim to ensure that all patients get the most effective care in a timely and efficient manner. 'Quality of care' is a guiding principle in assessing how well the health system is performing in its mission to improve the health of patients. The quality of care outcomes we collect assess our health system's performance and measures how safe, effective, patient-centred, timely, efficient and equitable the care we provide is.

We focus on improving the system rather than blaming individuals.

Alice Osborne, Consultant Pharmacist

Patient safety with regard to medicines is of paramount importance at King's Health Partners and, as such, we have staff dedicated to just this discipline. Our key measure is medication errors but this measure is made unreliable by variation in reporting. Our primary aim is to encourage error reporting so that lessons can be learned. Our secondary aim is to reduce

reported errors year-on-year without change in reporting efficiency.

Prescribing interventions

The interventions made by pharmacy staff contribute to the safe and effective use of medicine on wards across King's Health Partners.

A recent report from the General Medical Council (GMC), the EQUIP Study, showed that nearly 9% of prescriptions in a selection of UK hospitals contained an error when written.

At Guy's and St Thomas' NHS Foundation Trust, pharmacy staff visit the wards in order to facilitate the supply of medicines and play a key role in ensuring the safe and effective use of medicines.

Interventions monitoring is defined as the number of times a member of the pharmacy staff interact with other members of the clinical team or the patient to improve the efficacy of medication use or to reduce the risk of medication use.

During the week of data collection (November 2014) 2,799 interventions were recorded

- 87% of the interventions made were accepted, 9% were for information only and 1% were unclassified. 3% of the interventions were discussed but rejected by members of the clinical team
- Pharmacy staff identified safety (30%) and efficacy (46%) as the most important reasons that required them to make the intervention. Concordance (patient adherence) (12%), cost effectiveness (3%) and reduced length of stay (4%) made up the remainder
- Adding drug (32%), changing dose (20%), stopping a drug (12%) made up the majority of interventions
- 44% of all interventions were made on known high risk drugs. However, other drugs accounted for 1,571 interventions
- 1,029 medicine reconciliations (assuring medicines prescribed before admission were accurately reflected in post admission prescribing) were undertaken, of which 40% required input from the pharmacy to ensure accuracy. In total 772 individual changes were made to medicines at the MR stage
- 1,099 clinical screens were undertaken at the admission process of which 41% required pharmacist input to ensure the medicines were optimised

- 1,484 patients own drugs (PODs) were evaluated for suitability of which 11,185 were used. This equates to 42% of all medicines prescribed on admission
- 2,870 clinical screens were undertaken of inpatients charts and 830 clinical screens of TTOs were undertaken, resulting in 1,639 contributions to clinical care
- 830 electronic discharge prescriptions were screened of which 58% required pharmacist input to ensure the medicines were optimised. In total 1,196 individual changes were made to medicines at the discharge stage
- Patient education was provided on 1,012 occasions and staff information on 765 occasions

Table1 | Potential consequence of Guy's and St Thomas' (GSTT) interventions (per week)

	Expected % of each consequence (from EQUIP)	Real Numbers applied to Guy's and St Thomas' data set*
Potentially lethal	2%	56
Potentially serious	5%	140
Potentially significant	53%	1,483
Minor	40%	1,120

*If we assume 2% of all interventions prevented potentially lethal outcomes, this represents 56 occasions during one week at GSTT.

A significant proportion of pharmacists' efforts are direct and indirect interventions throughout the patient's stay. In a teaching hospital where turnover of junior medical staff poses obvious, unavoidable difficulties, pharmacists provide an invaluable consistency of approach. The contributions made by pharmacists serve a number of functions encompassing medicines management issues, promoting patient safety and experience and attempts to meet directorate/trust targets.

The actions taken reflect the breadth of activity carried out by pharmacy staff in ensuring the safe and effective use of medicines. Despite the fact that guidelines exist for the majority of high risk drugs, 44% of the interventions were for these classes of drugs. This indicates that providing guidance alone is not sufficient to ensure safety and accuracy.

Extrapolating the data collected equates to over 150,000 interventions per year. Along with all the other activities undertaken, one intervention is made for every 20 minutes of clinical time across the trust. This suggests that clinical pharmacy services at Guy's and St Thomas' have the potential to reduce harm and reduce cost that would be incurred if medication risks remained undetected.

Apart from the direct interventions recorded, the pharmacy department contributes significantly to the safe use of medicines in a number of other ways. Pharmacists are involved in the development, implementation and audit

of medicine-related guidelines, and have an increasing involvement in the formal education of undergraduate and postgraduate medical staff.

Tables 2–5 | Breakdown of intervention data November 2014

Outcome	Number	%
Accepted	2,441	87%
Advice only	255	9%
Discussion but intervention not accepted	88	3%
Not classified	15	1%
Total	2,799	

Outcome	Number	%
Compliance concordance	329	12%
Cost effectiveness	86	3%
Efficacy	1,300	46%
Reduce length of stay	118	4%
Safety in reaction to adverse drug reactions	115	4%
Safety to prevent adverse drug reactions	851	30%
Total	2,799	

Outcome	Number	%
Change dose/frequency	568	20%
Change in duration	148	5%
Change in formulation	186	7%
Change in route	214	8%
Discharge planning	1	0%
Drug added	892	32%
Drug stopped	338	12%

Outcome	Number	%
Ensure clarity/legality of Rx	298	11%
Monitor effect/toxicity	7	0%
Swap drug	147	5%
Total	2,799	

Type of drug involved	Number	%
Antibiotics	421	15%
Anticoagulants	305	11%
Cardiac meds	245	9%
Gentamicin	20	1%
Insulin	35	1%
Opioids	143	5%
Vancomycin	32	1%
Other	1,598	57%
Total	2,799	

Improving the safety of Gentamicin and Vancomycin prescribing

Study

Pharmacy staff at King's College Hospital have shown that gentamicin and vancomycin dose calculators significantly improve the prescribing of initial doses of these agents.

Gentamicin and vancomycin are narrow-therapeutic-index antibiotics with potential for high toxicity, requiring dose individualisation and

continuous monitoring. Clinical decision support (CDS) tools have been effective in reducing gentamicin and vancomycin dosing errors. Online dose calculators for these drugs were implemented in a London National Health Service hospital. This study aimed to evaluate the impact of these calculators on the accuracy of gentamicin and vancomycin initial doses.

The study used a pre-post-intervention design. Data were collected using electronic patient records and paper notes. Random samples of gentamicin and vancomycin initial doses administered during the eight months before implementation of the calculators were assessed retrospectively against hospital guidelines. Following implementation of the calculators, doses were assessed prospectively. Any gentamicin dose not within $\pm 10\%$ and any vancomycin dose not within $\pm 20\%$ of the guideline-recommended dose were considered incorrect.

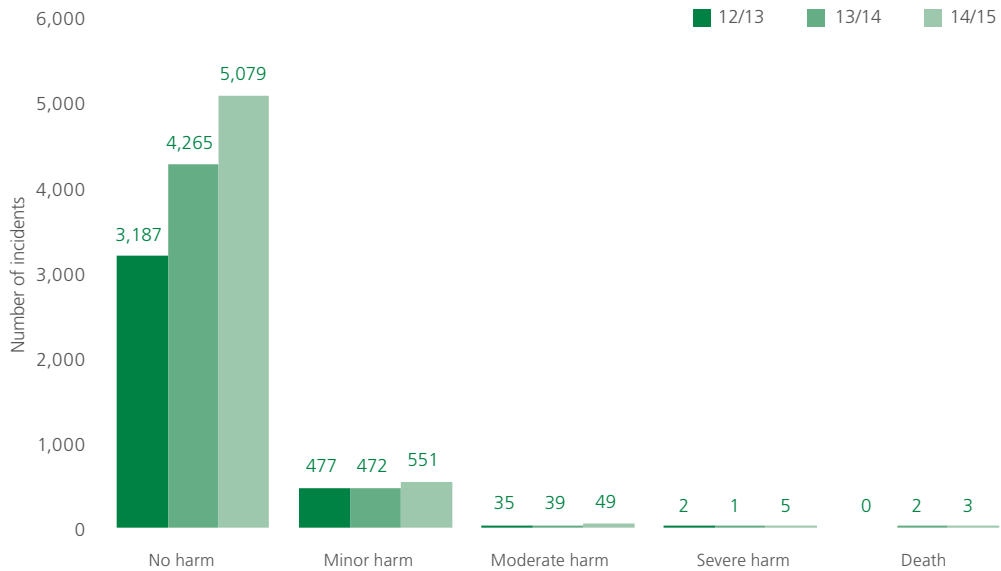
The intranet calculator pages were visited 721 times (gentamicin=333; vancomycin=388) during the two-month period following the calculator's implementation. Gentamicin dose errors fell from 61.5% (120/195) to 44.2% (95/215), $p < 0.001$. Incorrect vancomycin loading doses fell from 58.1% (90/155) to 32.4% (46/142), $p < 0.001$. Incorrect vancomycin first maintenance doses fell from 55.5% (86/155) to 33.1% (47/142), $p < 0.001$. Loading and first maintenance vancomycin doses were both incorrect in 37.4% (58/155) of patients before and 13.4% (19/142) after calculator implementation, $p < 0.001$.

This study suggests that gentamicin and vancomycin dose calculators significantly improved the prescribing of initial doses of these

agents. Therefore, healthcare organisations should consider using such CDS tools to support the prescribing of these high-risk drugs.

Medication errors

Figure 8 | Medication incidents for the acute trusts over the last three years by severity



Changes in recorded incidents may reflect changes in actual frequency and in reporting rates. Thus an increase may reflect improved reporting.

The following graphs show how South London and Maudsley compare to other mental health trusts for errors reviewed by the trust medication safety officer and the medicines safety committee.

Figure 9 | Total medication errors compared to other London mental health trusts (October 2014 – March 2015)

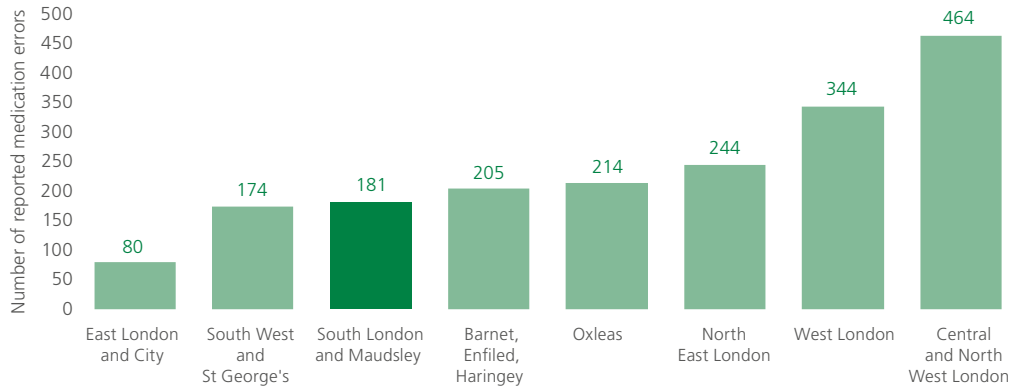


Figure 10 | Medication errors as a proportion of total reported errors (October 2014 – March 2015)



Delayed or missed medicine doses

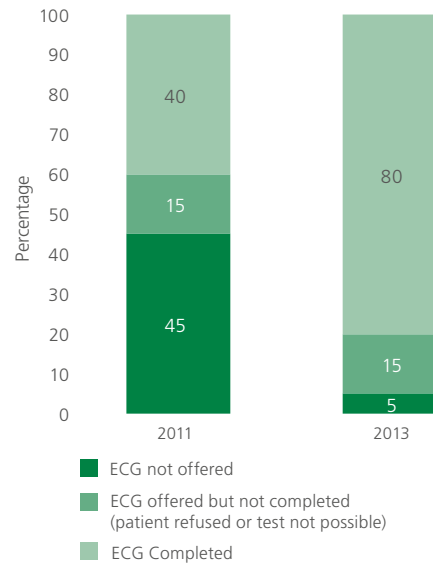
We are working to reduce to zero the number of delayed or missed doses of medicine to inpatients. In February 2010, the National Patient Safety Agency (NPSA) issued guidance on 'reducing harm from omitted and delayed medicines'. All doses of medicines prescribed for an inpatient must be administered without delay to the patient, unless there is a valid reason for the dose being delayed or omitted.

The administration box for each prescribed dose must be either signed by the person who administered the dose or annotated with a valid reason for the dose being missed.

ECG for patients on antipsychotics

It is critical to ensure that all inpatients prescribed an antipsychotic are offered an ECG on admission to a South London and Maudsley inpatient unit. Results of the most recent physical health monitoring audit showed a marked increase in the proportion of patients offered an ECG during their inpatient admission (95% in November 2013 vs 55% in September 2011).

Figure 11 | ECG monitoring 2011–13



Prescribing and electronic prescribing

Electronic prescribing

Our CAG has led on the implementation of electronic prescribing and medicines administration (EPMA) on the King's College Hospital Denmark Hill site. Starting in 2008, EPMA has been successfully rolled out to over 60 wards and departments and now covers 84% of all inpatient beds. The roll out to outpatients commenced in 2014 and eight clinics now have the system.

The use of EPMA has significantly improved medication safety and enhanced patient care. Future plans include further roll out to the emergency department, remaining outpatient clinics and implementation on the Princess Royal University Hospital (PRUH) site in Bromley, as well as the development and utilisation of system enhancements like clinical decision support for prescribers. EMPA has also been introduced at Guy's and St Thomas' hospitals.

Pharmacy discharge prescribing

At King's College Hospital, pharmacists' writing of discharge prescriptions – a process known as drug listing – is now common practice in all clinical areas. Pharmacists, rather than doctors, write more than 80% of all discharge prescriptions. This means that patients do not have to wait for their medicines when they are ready to go home.

A comparison of nearly 3,000 prescriptions containing 27,000 individual items revealed that doctors were nearly 40 times more likely than pharmacists to make mistakes when prescribing for discharge. Overall, 32% of doctor's prescriptions contained an error compared with only 2% of those written by pharmacists. Serious errors likely to result in patient harm were also much more common in prescriptions written by doctors.

Safe insulin prescribing and administration

Following investigation of a substantial insulin overdose, King's College Hospital Pharmacy Medication Safety Team evaluated the applicability

of the insulin 25/50 rule to reduce the risk of hypoglycaemia as a result of wrong dose insulin errors. This rule, which was developed in Australia, is a prompt for our pharmacy staff to check doses of short-acting and pre-mix insulins greater than 25 units and doses of intermediate and long-acting insulins greater than 50 units. As a result, this rule has been incorporated into an alert within the EPMA. At the same time, insulin syringes have been standardised to 50 units/0.5ml size to limit the doses which can be drawn up in a single syringe.

Detecting hypoglycaemia using electronic trigger drug alerts

The Pharmacy Medication Safety Team, working together with the EPMA team have designed a daily report to list details of 'trigger' drugs administered to inpatients at King's College Hospital. The report is used to identify patients administered glucagon to aid identification of severe hypoglycaemic events. Electronic records of patients are retrospectively reviewed by pharmacists to ensure these events have been detected and acted on by non-specialist teams. Where necessary referrals are made to the multidisciplinary diabetes team for expert input. Application of the tool has identified 20% more hypoglycaemic events than standard detection and referral systems. This is an example of our collaborative multidisciplinary team working to promote safe care of patients with diabetes.

Ensuring accurate allergy status documentation

It is important that patients do not inadvertently receive medicines to which they are known to be allergic. Clinicians must therefore, be aware of any drug allergies before prescribing dispensing or administering medication. A patient's drug allergy status must be clearly recorded on their prescription and in their medical notes.

SLAM pharmacy conducts an annual audit of the documentation of drug allergies on prescriptions and in electronic patient notes. Results of the 2015 audit showed an improvement in the recording of drug allergies on patients' prescriptions (100% in 2015 vs 95% in 2014) and in patients' medical notes (89% in 2015 vs 31% in 2014).

A project is currently underway in SLAM to improve further the documentation of drug allergy status in patients' medical records. In addition, as part of medicines reconciliation pharmacy update information about patients' drug allergies. Pharmacy does not supply medication from a prescription unless the allergy section is complete.

Identifying inappropriate prescribing in elderly patients

Pharmacists from King's College Hospital used a screening tool to assess inappropriate prescribing prevalence rates in older patients.

The Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP) classifies 65 common drug issues found to contribute to inappropriate prescribing in the elderly. International studies using STOPP criteria indicate high potentially inappropriate medication (PIM) prevalence rates; however, no studies have been conducted in older patients in UK hospitals. Published literature has not assessed whether prescribers attempt to minimise the potential risk of PIMs by putting in place follow-up or review plans.

The objectives of this study were (1) to determine prevalence and types of PIMs in older people admitted to and discharged from a UK hospital; and (2) to determine how often PIMs prescribed on discharge are accompanied by a plan for follow-up.

Methods

This was a retrospective, non-randomised study conducted in the Specialist Health and Ageing Unit (HAU) of a 950-bed acute hospital trust in England, UK. The subjects were patients aged ≥ 65 years admitted to the HAU in June and July 2011. Data were obtained by applying STOPP criteria to electronic admission and discharge medication lists. Parametric and non-parametric tests were performed to assess variables and to detect differences between groups. A PIM index was calculated by dividing the total number of PIMs by the total number of medications.

Medication lists for 195 patients were assessed. Median age was 85.5 years. The median number of admission medicines was nine. A total of 66 patients (34 %) were prescribed more than ten

medications. The median number of discharge medicines was ten, with 80 patients (41%) prescribed more than ten medicines. Admission PIM prevalence was 26.7% (95% CI 20.5–32.9; 52 patients, 74 PIMs). The most common PIM categories on admission were central nervous system (CNS) and psychotropic drugs, drugs adversely affecting patients at risk of falls and drugs acting on the urogenital system.

The likelihood of having a PIM on admission was doubled in patients receiving more than ten medications compared with those taking fewer (odds ratio 2.3 [95% CI 1.2–4.4]; $p = 0.01$). Discharge PIM prevalence was 22.6% (95% CI 16.7–28.5; 44 patients, 51 PIMs). PIMs reduced significantly on discharge ($p = 0.005$). The most common discharge PIMs were drugs adversely affecting patients at risk of falls, CNS and psychotropics, urogenital drugs and cardiovascular agents. Advice for general practitioners to monitor medication was documented on the discharge summary of three patients.

An index was developed, based on the ratio of PIMs to medication totals. The PIM index complements the assessment of PIM prevalence and allows comparison of prescribing appropriateness between populations and between studies by taking into account the total amount of prescribed medication. Despite an increase in medication prescribed, the PIM index (rate) decreased from 0.043 on admission to 0.027 at discharge.

Supporting smoke-free

As NHS trusts in King's Health Partners have moved over to smoke-free status, our CAG has played a central role in assuring a successful transition. This included developing a formulary of nicotine replacement therapies (NRT), ensuring adequate supplies of these products and training nursing and medical staff in their use under a PSCAG-designed protocol. We also produced written guidance on the effects of stopping smoking on the metabolism of prescribed drugs. In Guy's and St Thomas', pharmacists helped smokers stop by giving VBA (very brief advice) and by counselling on NRT options.

In South London and Maudsley, our CAG audited the effect of going smoke-free on patients receiving clozapine – a drug whose metabolism is accelerated by smoking. To our surprise, we found that going smoke-free had no effect on plasma clozapine concentrations. Further investigation revealed that none of these patients had actually stopped smoking but were regularly leaving hospital grounds to smoke – an important finding in itself.



Patient experience

Collecting and analysing data about patients' experiences of healthcare is essential to achieving high quality care. Across King's Health Partners, we are committed to using patient experience data to improve the quality of care we provide.

Care Quality Commission Patient Survey results

A survey carried out in 2014 looked at the experiences of over 59,000 people who were admitted to an NHS hospital. Between September 2014 and January 2015, a questionnaire was sent to 850 recent inpatients at each trust. The following figures compares the results to other Trusts.

Figure 12 | Comparison between South London and Maudsley and other mental health trusts 2015

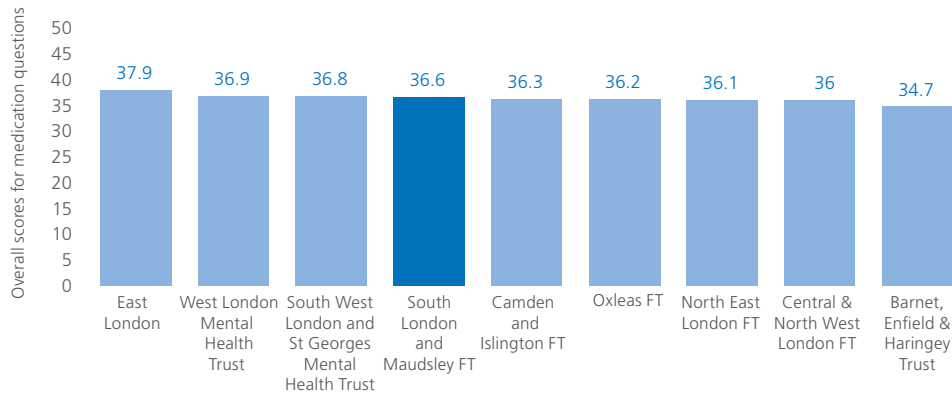
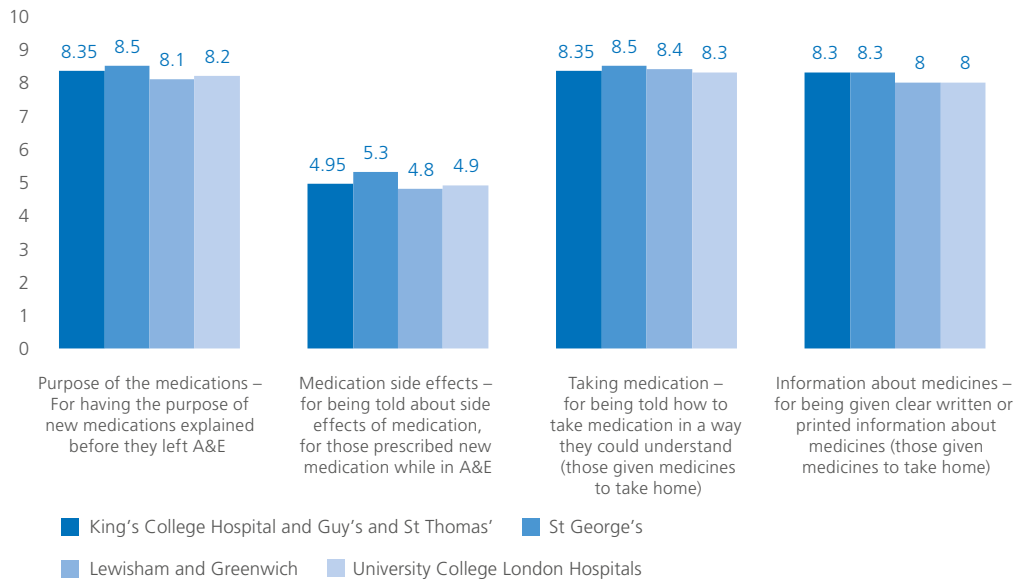


Figure 13 | Comparison between King's College Hospital and Guy's and St Thomas' and other acute trusts 2015





Education and training

Clinical academics

Our CAG has established a clear career structure for clinical staff involved in teaching and research. Our programme of clinical academic appointments involves the formal recognition of the contribution of NHS staff members to the academic work of King's College London. There are currently over 40 clinical academics in the CAG, ranging from clinical lecturer to clinical reader each working across boundaries between the NHS and academia.

A pharmacy degree is polyvalent; you can go into community or hospital pharmacy, into academia, or into industry including pharmacovigilance or regulation.

Gino Martini, Professor of Integrative Pharmacology

CAG members contribute to dedicated pharmacy programmes at both the undergraduate and postgraduate level, to modules in areas such as teaching safe prescribing to final year medical students and continuing professional development for healthcare professionals.

Academic programmes

Our CAG contributes to undergraduate pharmacy teaching, thus ensuring that learning is relevant to current professional practice. As well as bringing their own expertise, many of our CAG members who teach also invite guests from industry and healthcare so students can see the end result of their studies.

Undergraduate

- BSc: Pharmacology, Pharmacology with Molecular Genetics
- MPharm: Pharmacy
- MSci: Integrated Pharmacology and Physiology for Research
- Pharmaceutical Sciences CAG members contribute to teaching undergraduate nursing, medical and pharmacy students

Postgraduate

- MSc: Biopharmaceuticals; Clinical Pharmacology; Drug Development Science; Drug Discovery Skills; Pharmaceutical Analysis and Quality Control; Pharmaceutical

Technology; Pharmacology Translational Medicine

- MSc/PG Dip/PG Cert: Clinical Pharmacology; Drug Development Science; Pharmacy Practice; Translational Medicine
- PG Dip/PG Cert: Advanced Human Pharmacology
- PhD programmes including joint PhD programme in Pharmaceutical Science with the Department of Pharmacy at the University of California San Francisco

Postdoctoral research programmes

- This includes the CW Maplethorpe Postdoctoral Fellowships for Pharmaceutical Education and Research and Quintiles-funded studentships

Continuing professional development (CPD)

- CPD ensures that staff are competent to deliver services and have demonstrable skills to carry out their role

Independent prescribing course for pharmacists and nurses

- Postgraduate certificate accredited by the Nursing and Midwifery Council and General Pharmaceutical Council

Modular advanced professional training in pharmaceutical medicine

- Four- or five-day workshops, some of which (*) are accredited by the Faculty of Pharmaceutical Medicine of the Royal College of Physicians, aimed at those who will become principle investigators looking at new drugs
- Developed following the 2006 Northwick Park disaster with the developmental immunomodulatory drug TGN1412 where six volunteers were hospitalised, four with multiple organ failure
- Workshops: Absorption, Distribution, Metabolism, Excretion (ADME); Advanced Clinical Pharmacology*; Clinical Drug Development*; Drug Development Pharmacology*; Drug Development Statistics and Data Management; Drug Discovery and Development; Drug Regulatory Affairs*; Drug Safety and Ethics; Exploratory Drug Development*; Healthcare Market Place*; Pharmacoeconomics; Pharmacokinetics and Pharmacodynamics; Practical Clinical Pharmacology; Preclinical Science

King's Health Partners pharmacy training

- Pre-registration year: around a third are selected from King's College London's undergraduate courses

- Up to half from the pre-registry pharmacy year go on to become junior pharmacists at King's Health Partners
- Junior pharmacists rotate around various areas within pharmacy, such as clinical services, medicines information services, technical services and dispensing services, so they get a breadth of pharmacy practice before specialising

Future Learn online open course in medicines adherence (www.futurelearn.com/courses/medicinesadherence)

- Two-week course designed for healthcare professionals with a role or interest in supporting patients with long term conditions
- Videos, patient scenarios and discussions are used to explore non-adherence, factors that influence medicines use and approaches to aid adherence

Pharmaceutical sciences e-learning

We have produced a range of specialty modules available for online learning via a PC or mobile phone.

Medicines adherence in diabetes

This e-learning module explores the challenges of non-adherence in diabetes and demonstrates

approaches that community pharmacists and other healthcare professionals can use to effectively engage patients in patient-centred consultations about the self-management of medicines.

Enquiries about medicine safety during pregnancy

This interactive scenario provides practice responding to enquiries about the safety of medicines during pregnancy. It is designed for trainee and student pharmacists and any other health professional training to prescribe medicines.

Pharmacy diagnostic calculation test

This quiz is designed to test the accuracy and confidence of drug dose calculations.

iRx Formulary: mobile app for medicines information

The iRx is an app for smartphones and tablets that helps students and trainees learn how to use medicines safely and effectively. It contains a formulary of over 200 commonly-prescribed medicines and allows users to add text, images, web links and voice recordings as they build up their knowledge.

Infections mobile app

This free app provides fast and convenient access to a wide range of clinical guidelines and infection tools, enabling users to quickly select the right antibiotic at the right dose, whilst minimising the risk of side effects.

Pre-registration training for pharmacists

This learning material supports trainee pharmacists through their pre-registration year, from an initial introduction to performance standards through to the exam and applying for Band 6 jobs within the NHS.



Institute of Pharmaceutical Science

Academics in the Institute of Pharmaceutical Science (IPS) provide substantial teaching in a wide range of undergraduate and postgraduate-taught courses. There are delivered within the following Teaching departments:

- Pharmacy
- Pharmacology
- Biochemistry
- Physiology

The IPS is recognised by both the private and public sector for the quality of its graduates, as well as its commitment to *in vivo* sciences and the suite of specialist courses at MSc level, including the long-established MSc programmes in Pharmaceutical Analysis and Quality Control, Pharmaceutical Technology and Biopharmaceuticals.

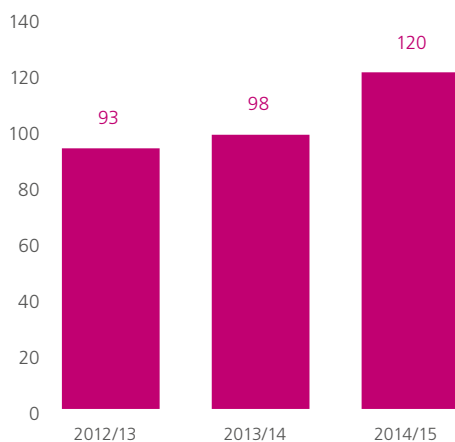
A number of other new courses in pharmaceutical medicine, some of which have been approved by the Royal College of Physicians' Faculty of Pharmaceutical Medicine, have recently been introduced. These can be taken as standalone short courses, as part of the Faculty of Pharmaceutical Medicine's 'Pharmaceutical Medicine Specialty Training' or 'Certificate/ Diploma in Human Pharmacology' or as part of a King's College London postgraduate award in Drug Development Science, Clinical Pharmacology or Translational Medicine.

The IPS has recently become the only London-based member of the Europe-wide PharmaTrain to deliver excellence in training in drug development science across Europe – this places the IPS at King's College London as the leading player in this area. In addition, there is a range of well-established certificate and diploma programmes for pharmacists working in primary care, including an independent prescribing course. Academics

within IPS also supervise a wide range of PhD projects.

IPS has a growing number of PhD students (as shown in Figure 14) which reflects the reputation of IPS/our CAG as a centre for learning and research and has largely been enabled by co-opting PhD supervisors from our NHS partners: Guy's and St Thomas', King's College Hospital and South London and Maudsley.

Figure 14 | Number of Institute of Pharmaceutical Science PhD students over the last three years



Postgraduate Professional Programmes

The CAG delivers a postgraduate Masters in Pharmacy Practice programme to enable pharmacists to effectively develop and deliver

modern patient-centred pharmaceutical services within the primary care and community setting. Typically, each year around 15–20 pharmacists register for this module-based programme allowing individuals to graduate with a certificate, diploma or masters in line with professional interest, service need or for continuing professional development purposes. It is delivered on a part-time flexible basis and is competency-based, designed to meet the needs of pharmacists keen to develop their clinical knowledge and skills. The programme has a particular focus on the teaching of consultation skills to support pharmacists to deliver effective behaviour change techniques and is taught by clinical experts drawn from King's Health Partners and beyond, as well as experienced academic staff to effectively combine university-based study days with work-based learning.

The CAG also delivers, either as a stand-alone module or as part of the PG Dip or MSc, a module to allow pharmacists to gain prescribing status. The PG Practice Certificate in Independent Prescribing (60 credits) is accredited by the General Pharmaceutical Council (GPhC) and is delivered as a blended learning programme, combining guided learning, workshops and practice-based activity to deliver core prescribing competencies. Typically, around 45 pharmacists successfully complete the module each year and are registered with the GPhC as prescribers.

Student feedback

Student ratings of our teaching are a vital aspect of our reputation and our ranking amongst UK universities. The following is the average score

out of 100 for all respondents. The score for each graph heading shows the average score for the series of questions that fall under it.

Figure 15 | Feedback scores from Pharmacy students

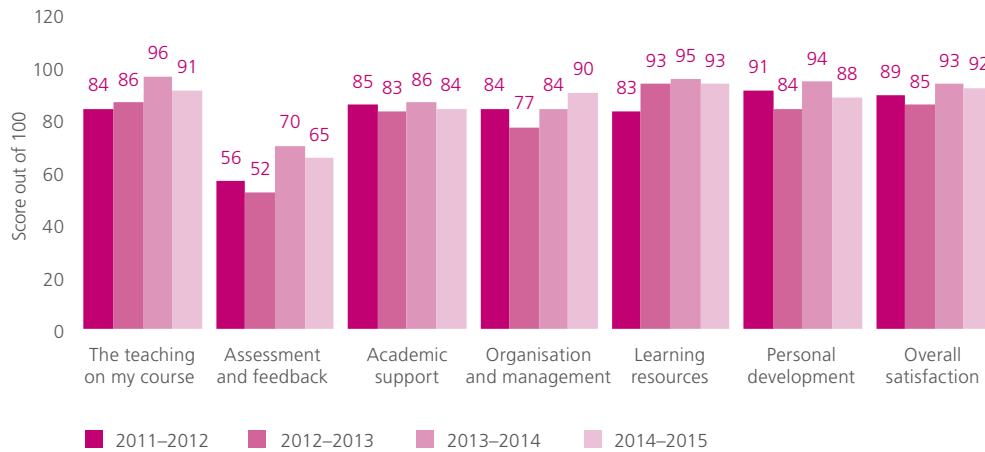
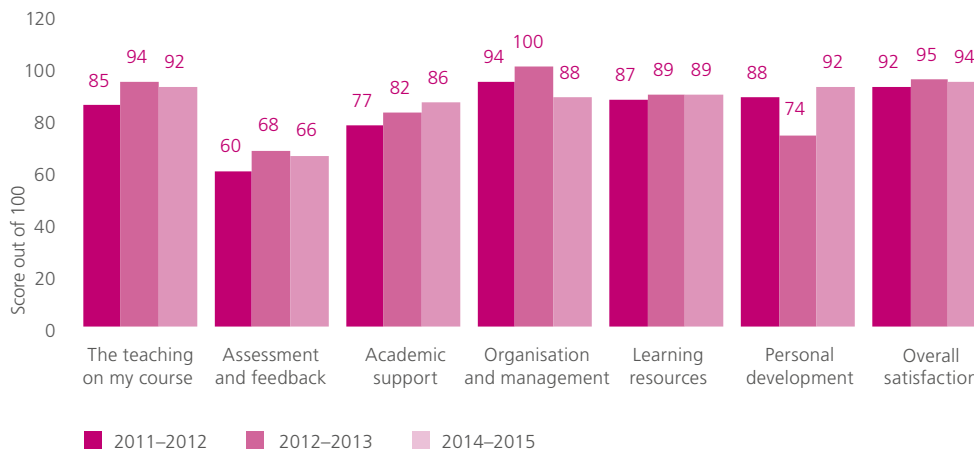


Figure 16 | Feedback scored from Pharmacology and Therapeutics students



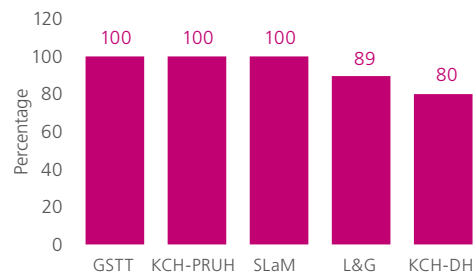
*No results for 2013/14 due to low numbers of students

Pass rates for students in pharmacy and pharmacology

On graduating, students study and work for a further year before taking the General Pharmaceutical Council (GPhC) examination to register as a pharmacist.

- Students from King's College London (KCL) were 3rd in the UK on the pre-registration pass rate in 2015/16. This translates to an 86% pre-registration pass rate
- King's Health Partners also has a high pre-registration pass rate, as shown below

Figure 17 | Showing the percentage completed assessments 2014/15



L&G is Lewisham and Greenwich, not part of King's Health Partners but part of the rotation.

Figure 18 | The General Pharmaceutical Council (GPhC) Pass rates by University 2013

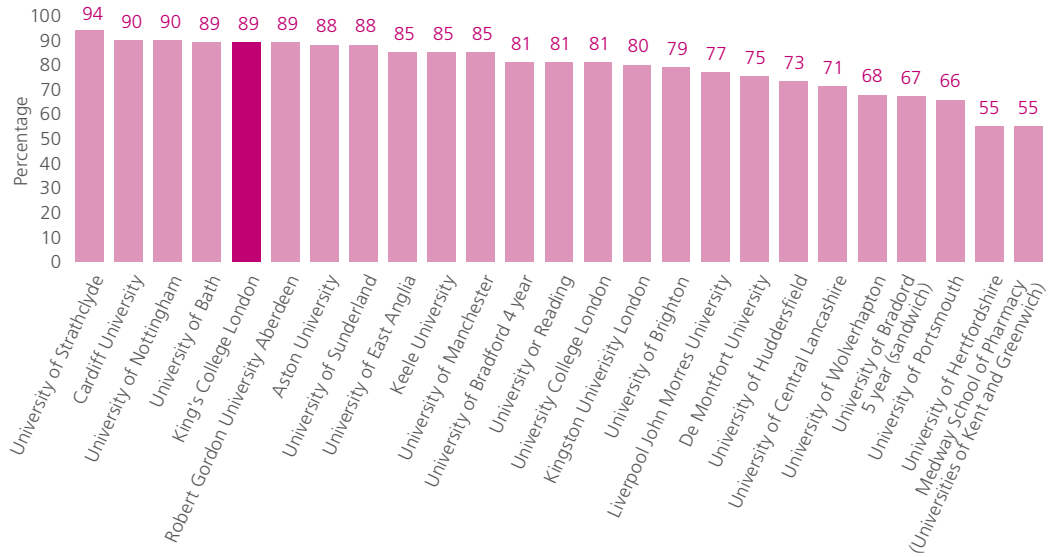


Figure 19 | The General Pharmaceutical Council (GPhC) Pass rates by University 2014

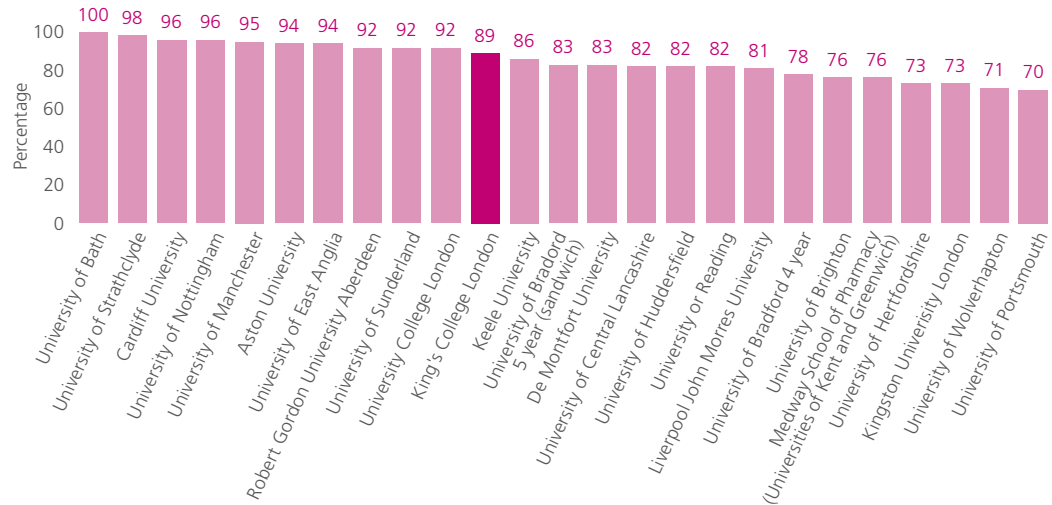
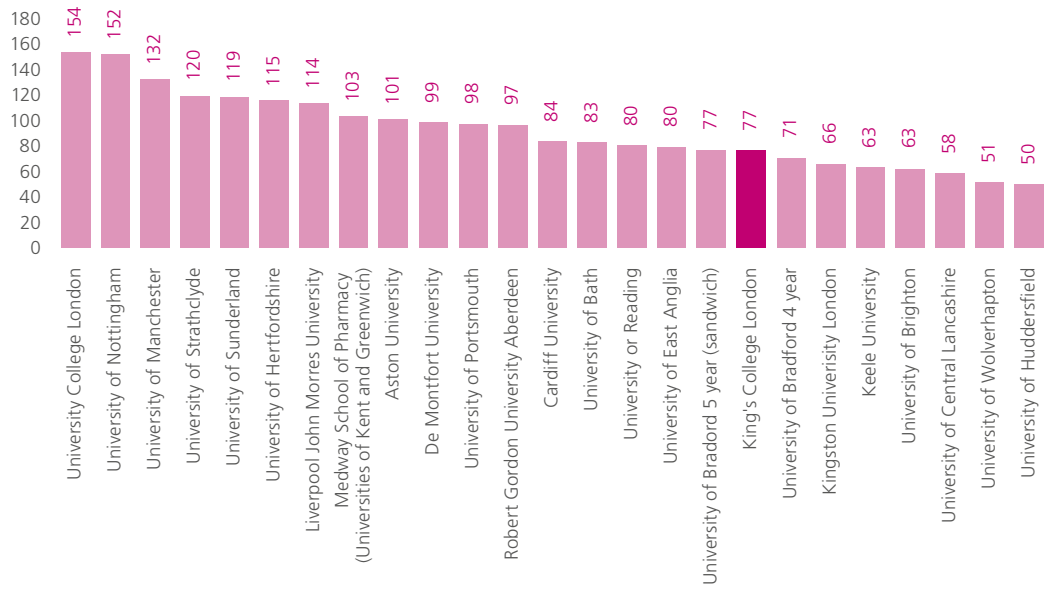


Figure 20 | Average student numbers over 2013 and 2014



Academic research and innovations

Our CAG is world-leading in research and innovation. Some examples of our output are set out below. A key feature of our work is to put research findings into practice.

Responsible respiratory prescribing (RRP) team

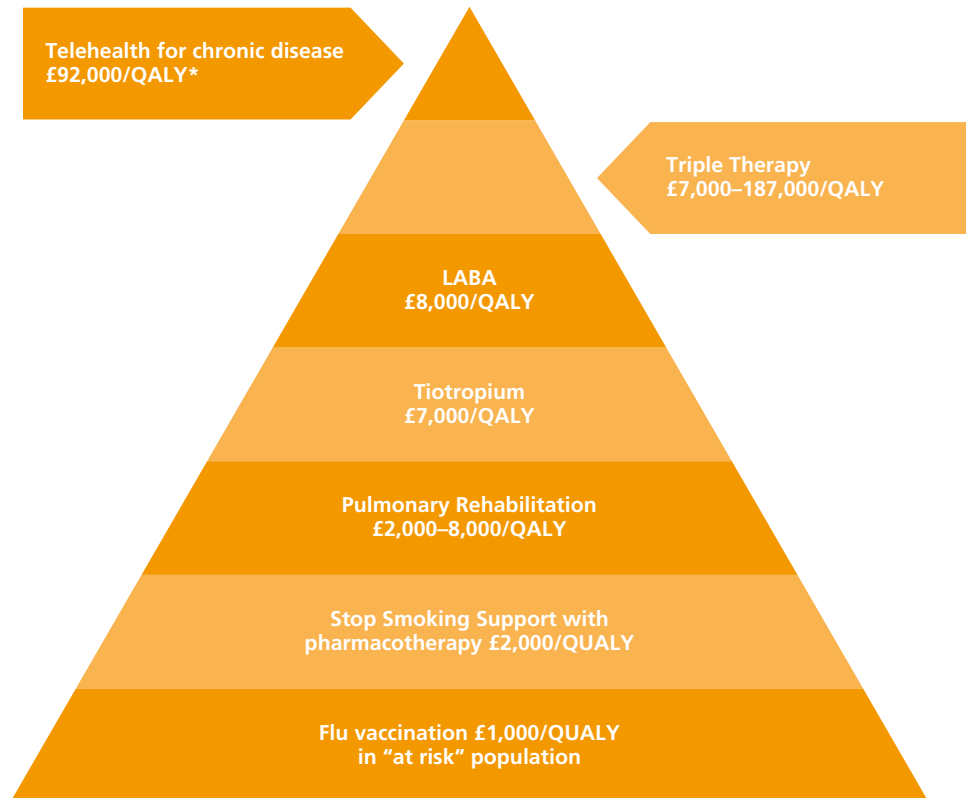
Lambeth and Southwark are the ninth and twelfth most-deprived boroughs in London, with higher-than-London-average smoking rates and chronic obstructive pulmonary disease (COPD) mortality rates.

Published local data showed that 35% of patients on primary care COPD registers had not had spirometry (a lung function test) consistent with a COPD diagnosis and that 38% of patients on inhaled steroids were not appropriate for inhaled corticosteroid therapy, with this overtreatment potentially causing an additional twelve cases of pneumonia and wasting over £500,000 per year.

Using the London Respiratory Network COPD value pyramid as a framework (see Figure 22), a King's Health Partners / Lambeth and Southwark responsible respiratory prescribing (RRP) team was established. The team was multi-professional and agreed common messages and an action plan to improve the quality of respiratory care, aligned closely with the medicines optimisation agenda.

The preliminary results of this innovative project have demonstrated that integrated working through virtual respiratory clinics and focusing on RRP offers huge scope to improve value both for patients with long term respiratory disease and for the local health economy. Savings from the pilot project have been re-invested in high-value interventions (e.g. pulmonary rehabilitation). Further roll-out includes planned work on high-quality asthma management and partnerships with practice and community pharmacists through local care networks.

Figure 21 | The London Respiratory Network COPD Value Pyramid



Key: LABA – Long-acting beta agonist; Tiotropium – bronchodilator drug; QALY – Quality Adjusted Life Year; *Not specific to COPD

Name badges for all staff

All partner trusts use name badges which carry the same allergy warning on the reverse. This warning alerts all staff involved in the use of medicines to the dangers of certain drugs in patients allergic to penicillin.

Figure 22 | Allergy warning on reverse of all staff name badges

Contraindicated DO NOT USE	AVOID unless no safe alternative available*	SAFE
Amoxicillin	Ceftriaxone	Amikacin
Augmentin	Cefotaxime	Clarithromycin
Benzylpenicillin	Ceftazidime	Clindamycin
Cefalexin	Ceftazidime	Daptomycin
Co-amoxiclav	Cefuroxime	Doxycycline
Floxacillin	Ertapenem	Gentamicin
Penicillin V	Imipenem/Cilastatin	Linezolid
Phenoxymethylpenicillin	Meropenem	Mertromidazole
Piperacillin/tazobactam	Aztreonam	Netilmicin
Tazocin®		Netilmicin
Ticarcillin		Vancomycin
Timentin®		

*Contraindicated in severe penicillin allergy. See Trust Antibiotic Guideline

This card was issued following several serious adverse events occurring due to a lack of knowledge as to which antibiotics were classified as penicillin's. To our knowledge, there have been no serious adverse events relating to inadvertent penicillin administration since the name badges were issued across King's Health Partners.

Alerts for clozapine patients

Clozapine is a sedative drug that is used to treat schizophrenia. In co-operation with the acute trusts, South London and Maudsley now issues all clozapine patients with a warning card to be presented to medical teams should severe physical illness occur.

Figure 23 | Clozapine Alert Card

Clozapine Alert Card

Name:	NHS Number:
Community mental health team:	
South London and Maudsley medicines information: 020 3228 2317	

Please turn over for information about certain symptoms in patients prescribed clozapine which require immediate attention.

South London and Maudsley NHS Foundation Trust

If the patient presents with any of the following, contact psychiatric liaison service and SLAM medicines information or pharmacy on-call service for advice via **0203 228 6000**.

Chest infection, pneumonia or other life-threatening respiratory infection: consider **WITHHOLDING** clozapine until infection treated.

Chest pain accompanied by shortness of breath, tachycardia, fever, flu-like symptoms, fatigue: exclude myocarditis or cardiomyopathy. **STOP** clozapine if signs of heart failure.

Constipation with or without abdominal pain, distension, tenderness, tachycardia, fever: suspect bowel obstruction/paralytic ileus. **WITHHOLD** clozapine if obstruction suspected.

Fever: rule out neutropenia or agranulocytosis. **STOP** clozapine if WBC <2.5 x10⁹/L or neutrophils <1.0x10⁹/L.

Seizure: consider clozapine-induced seizure. Obtain clozapine plasma concentration. **WITHHOLD** clozapine. Dose adjustment may be necessary.

Psychiatric Liaison telephone numbers:

Guy's and St. Thomas' Hospital:
020 7188 7188 bleep no. **0123**

King's College Hospital:
020 3299 9000 bleep no. **278**

Lewisham Hospital:
020 8333 3478

Croydon University Hospital:
020 3228 0809

The introduction of the card was provoked by reports of repeated inappropriate continuation or withdrawal of clozapine during physical illness.

Cross-clinical academic group (CAG) innovation

Our formulation scientists have begun to work with other CAGs across King's Health Partners in preparing and testing dosage forms of investigational or established drugs. Examples include a new patented sub-lingual formulation of naloxone for out-of-hospital administration; an oral formulation of psilocybin (from magic mushrooms); oral formulations of Tetrahydrocannabinol (THC) and Cannabidiol (CBD) (from cannabis), an oral formulation of MDMA and the early development of a clozapine long-acting implant.

Liaison with other clinical academic groups (CAGs)

We have formally nominated CAG liaison pharmacists who form the link between our CAG and the other 20 CAGs in King's Health Partners. This personal relationship between pharmaceutical specialists and other CAGs helps to promote cross-CAG working and serves to inform other CAGs to expertise available and the range of services that we can provide.

The PSCAG has the expertise of people who want to solve problems and have the time and funding to do so.

Clive Page, Professor of Pharmacology

Institute of Pharmaceutical Science

Expertise at the Institute of Pharmaceutical Science's (IPS) includes drug discovery; the evaluation of novel drugs and their mechanisms of action; formulation science; clinical pharmacology; therapeutics and drug delivery. A wide variety of techniques are utilised from basic cell biology in on-site laboratories to small-angle neutron-scattering experiments at a central European facility in France. Alongside this, as part of King's Health Partners and with close ties to Quintiles, the availability of a patient base to aid research in areas such as medication adherence and clinical studies means investigators at the IPS spans the range of drug development and administration disciplines.

Members of our CAG have a multiplicity of collaborations with industry that have led to the award of research grants, consultancy agreements, CASE studentships, knowledge transfer partnerships and members setting up their own companies.

Specialities within the CAG include:

Clinical practice and medicines use group

- From drug discovery all the way up to medicines use

Medicine design and formulation

Once a molecule exists, how do you put it in a deliverable form and what is the best route for delivery? For instance:

- Our CAG includes researchers expert in formulating inhaled medication, to be delivered both locally in the lung and systemically
- Several drugs now in clinical trials have been taken by our CAG researchers from the initial stages of molecular discovery and progressed through unique in vitro and in vivo models to be suitable for Phase I trials and into clinical development
- We have experts in formulating particulates using lipids, polymers and surfactants (nanomedicines), which aid the delivery of existing medications or can be utilised to create new ones

Medicines optimisation

- Improving medicine use by patients and healthcare professionals
- A focus on polypharmacy (the use of four or more medications by a patient), elderly

people and children as these may be the most affected by adverse drug events and problematic delivery. Even within the controlled hospital environment, about 13% of patients will experience an adverse drug reaction

Medicine adherence

- Around 50% of people at any time do not take their medications as prescribed. Members of the CAG lead research into why people are non-adherent and into ways they can boost adherence
- Current projects include a joint venture between the IPS and King's College Hospital's anticoagulation clinic and the Toxicology Unit looking at how people will adhere to the novel anticoagulants replacing warfarin

Links with industry provides networking for students and staff

- Having members of our CAG who previously worked in industry means they can advise researchers on what a pharmaceutical company looks for when investing in/ producing a medication
- Focus on what is a suitable formulation in terms of development, what industry standards need to be met, there is proper patent protection, what regulatory data is required and in what format

Clinical practice research: service quality evaluation

- We collect data to demonstrate the impact of medicines on patient care, learn from errors and complaints
- We publish on gaps in medicines-related knowledge and share results at research meetings in critical care

Safe use of medicine: research to ensure excellence in clinical service

- Close integration with the Biomedical Research Centre. For example, researchers at Guy's and St Thomas' are part of a five-country, Australian-led study looking at

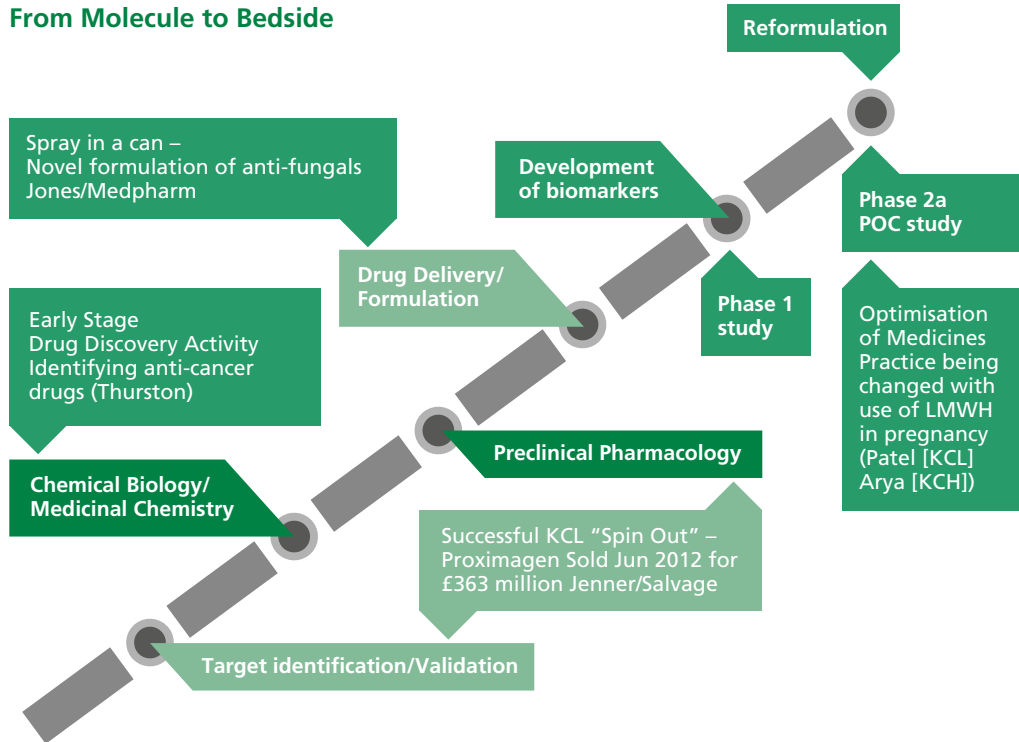
the pharmacokinetics/pharmacodynamics of extracorporeal membrane oxygenation used in patients with respiratory failure in intensive care

A focus on what the risks are for specific patient populations and how the system can be improved to mitigate them

- One current project looks at whether elderly patients can be stratified by risk through identifying factors that would allow them to be flagged and monitored more closely to prevent harm and re-admissions using a tool available wherever the person receives care

Figure 24 | Aspects of the drug development process

From Molecule to Bedside



King's Health Partners clinical trials pharmacies

King's Health Partners clinical trial pharmacies are part of our CAG. They are a collaboration between seven dispensaries and six aseptic units that deliver pharmacy services for over 450 clinical trials. We deliver both commercially-sponsored and non-commercially-sponsored trials across the partnership. We have:

- Developed a King's Health Partners-wide database that records the key time-points for trial set up and will serve as one record for all activity that the PSCAG clinical trials pharmacies supports
- Developed and continue to work on processes that are fit-for-purpose at all sites across King's Health Partners, ensuring efficient processes are in place, whilst meeting regulatory requirements and sharing practice across organisational boundaries
- Established links with other trusts nationally to share best practice
- Strong links with the National Institute of Health Research (NIHR)
- Representation on the National Pharmacy Clinical Trial Academic Group (NPCTAG), part of the Royal Pharmaceutical Society (RPS)
- Close links with the Medicines and Healthcare Regulatory Agency (MHRA)

Our vision

Working in partnership to be a centre of excellence, providing pharmacy services and drug management solutions for world class clinical research. In order to deliver a high quality clinical trial service for:

clinical trial participants, we will:

- Provide a high quality service that meets their need(s) and takes into account their expectations
- Achieve reduced waiting times for dispensed items

clinical researchers, we will:

- Support researchers throughout the research cycle from design to dissemination
- Increase awareness of our role in supporting clinical research

all stakeholders, we will:

- Operate in a way that all sites are ready to be inspected
- Bring transparency about how our clinical trial income is spent
- Provide performance data relating to pharmacy clinical trial services
- Support our staff and ensure they are working to their full potential

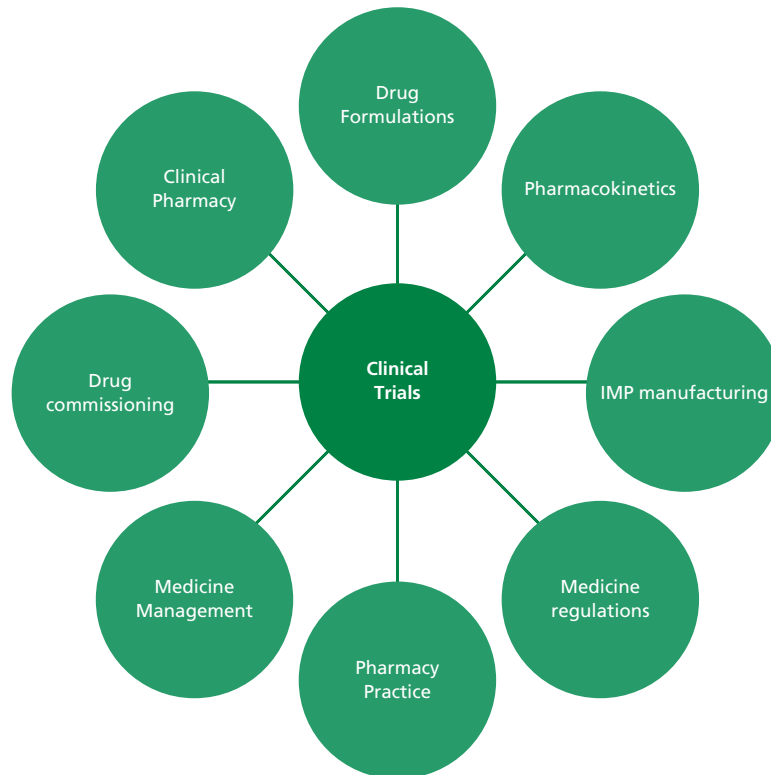
- Run short courses on clinical trial pharmacy services, in collaboration with King's College London

We work closely with Guy's and St Thomas' Pharmaceutical Manufacturing Unit (PMU) and

Guy's and St Thomas' Quality Assurance (QA) who provide advice on good manufacturing practice (GMP) and quality assurance-related matters.

This provides a complete package of support for the investigator looking to start a Clinical Trial of an Investigational Medicinal Product (CTIMP).

Figure 25 | Pharmaceutical Sciences CAG clinical trials

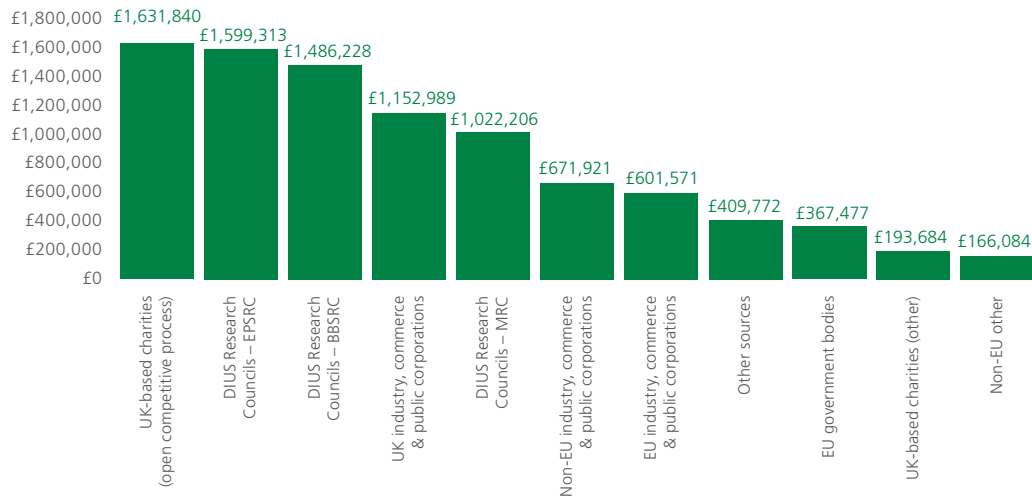


Reproduced with permission from NIHR Clinical Research Network: Children

Services are delivered from the following units within King's Health Partners

Dispensary-based service	Technical services: aseptic dispensing of Investigational Medicinal Product (IMP)
Guy's and St Thomas', including Evelina London Children's Hospital	Guy's and St Thomas', including Radiopharmacy
King's College Hospital, including Princess Royal University Hospital and Caldecot Pharmacy	King's College Hospital, including Princess Royal University Hospital
South London and Maudsley	

Figure 26 | Pharmaceutical Sciences CAG research income





National Patient Safety Agency

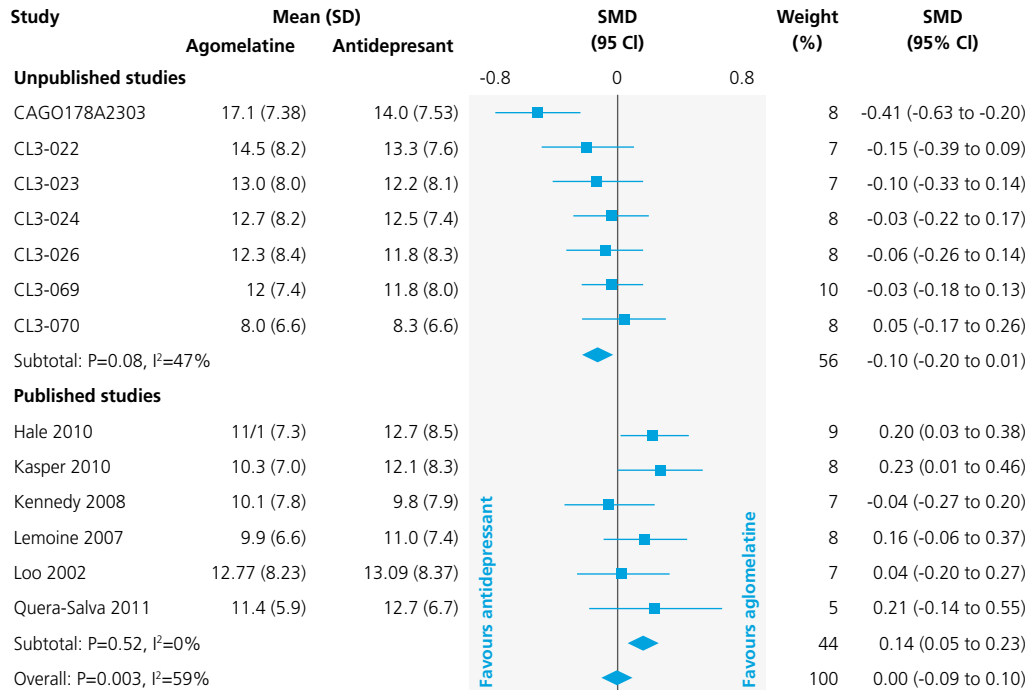
Oral Anticoagulant Therapy

Record book

...booklet... as a record book only. Important information
for patients on anticoagulant therapy is contained in a separate
booklet, which should be obtained from your anticoagulant clinic.

Publications and highlights

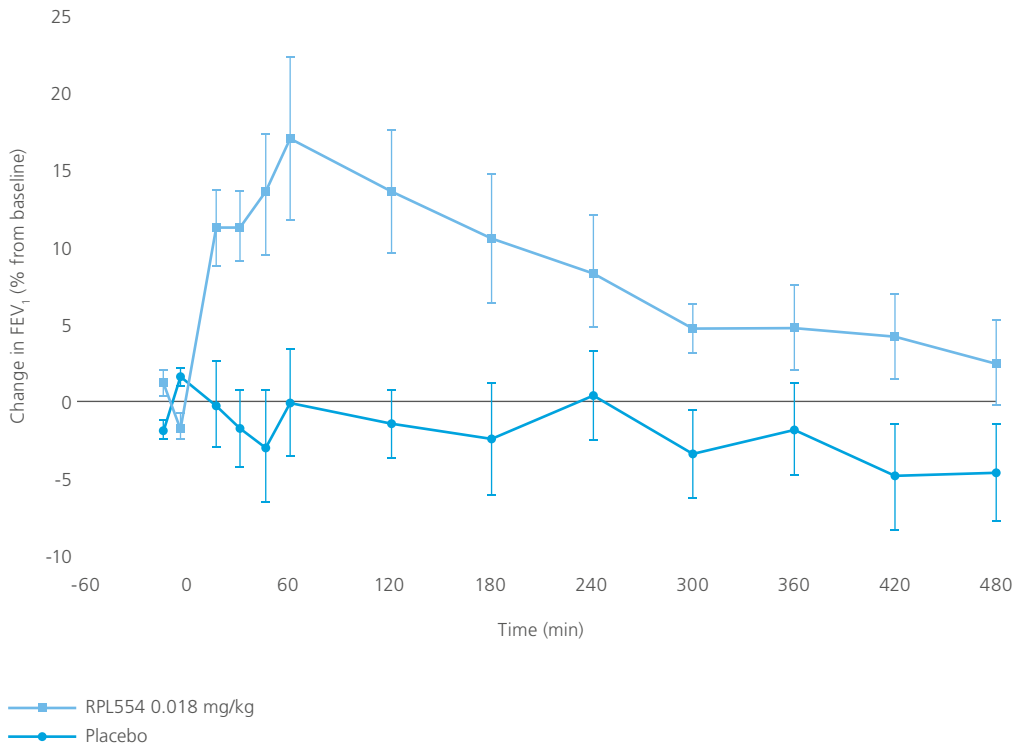
1. A team from South London and Maudsley led by Professor David Taylor published a meta-analysis of trials of the antidepressant agomelatine in the BMJ. Uniquely, this meta-analysis included unpublished trials only obtainable from the manufacturer. The study demonstrated the efficacy of this antidepressant – one with a unique mode of action.



Note: weights are from random effects analysis

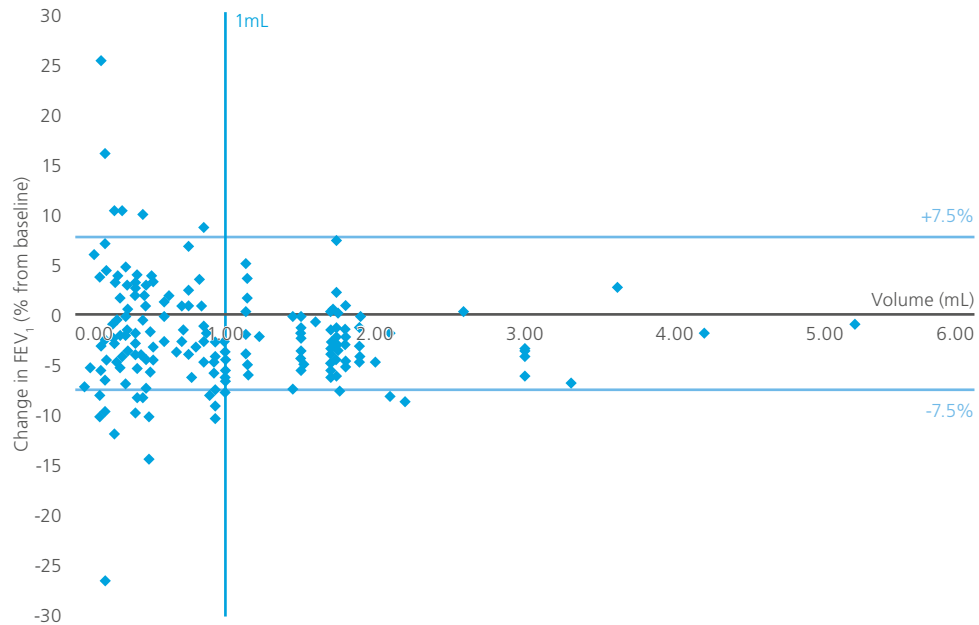
- Clive Page's team reported on outcomes of their self-developed compound RPL554 in asthma and COPD in the journal *Lancet Respiratory Medicine*. This compound has both anti-inflammatory and bronchodilator properties.

Showing change in forced expiratory volume in 1s (FEV₁) after one inhaled dose of RPL554 (0.018 mg/kg) or placebo in patients with middle to moderate chronic obstructive pulmonary disease (study 3).



Source: www.thelancet.com/respiratory Published online October 25, 2013 [http://dx.doi.org/10.1016/S2213-2600\(13\)70187-5](http://dx.doi.org/10.1016/S2213-2600(13)70187-5)

- Pharmacist Sara Arenas-Lopez and colleagues at Guy's and St Thomas' published their findings of the concentrations of morphine in syringe-drivers used for neonates. Measured concentrations deviated substantially from labelled contents presenting significant risk to treated babies. These startling findings led to a wholesale change in practice.



Relationship between concentration deviations observed and volume of morphine withdrawn.

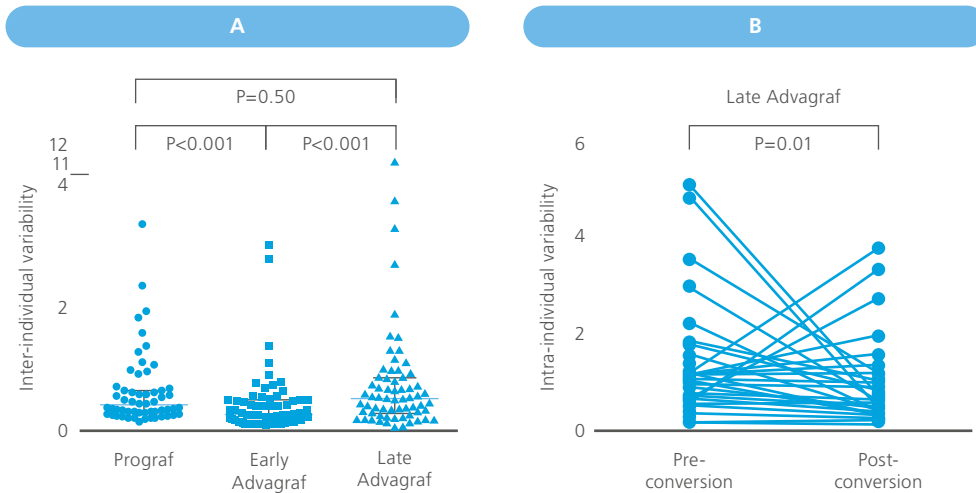
*Outlier result 66.5% deviation not shown in chart (volume of morphine 0.24 mL). BP, British Pharmacopoeia

Source: archdischild-2013-304522

- Pharmacist Aisling Considine and colleagues from the Liver Team at King's College Hospital led on work that highlighted the benefits for rejection rate and renal function of converting to once-daily modified-release tacrolimus late after liver transplantation.

The frequency of treated biopsy-proven acute rejection episodes fell approximately 4-fold after the conversion to modified-release tacrolimus, most notably in the late-conversion cohort, which experienced a high incidence of rejection before conversion. Post-transplant increases in serum creatinine concentrations were smaller after the introduction of modified-release tacrolimus in the late conversion group (0.7 versus 4mg/mL for twice daily tacrolimus over 6 months).

Reduced interpatient variability in tacrolimus concentrations was evident in the early-conversion cohort versus the twice-daily cohort. A decline in inpatient variability accompanied the reduction in acute rejection in the late-conversion cohort.



Key publications

Clinical practice and medicine use (CPMU) Publications

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Accuracy of the concentration of morphine infusions prepared for patients in a neonatal intensive care unit. *Archives of Disease in Childhood*.

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Long-term adherence to a 5 day antibiotic course guideline for treatment of intensive care unit (ICU)-associated Gram-negative infections. *Journal of Antimicrobial Chemotherapy*.

Taylor D, Sparshatt A, Varma S, Olofinjana O. (2014)

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Information about medicines to cardiac in-patients: Patient satisfaction alongside the role perceptions and practices of doctors,

nurses and pharmacists. *Patient Education and Counseling*. 83, 3, p. 360–366.

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Glossary

ADME – absorption, distribution, metabolism and excretion

Antipsychotics – psychiatric medication primarily used to manage psychosis

AMS – acute medication service

Assay – a test to determine the amount of a substance present

Aseptic unit – a sterile environment for drug testing and manufacturing

Atomisation – separating a substance into fine particles

Atypical antipsychotics – group of drugs used to treat psychotic conditions

Biopharmaceuticals – a medicinal product manufactured in, extracted from, or semi-synthesised from biological sources

CASE studentships – collaborative training grants to give students a first rate research training experience

CBD – cannabidiol

CITMP – clinical trial of an investigational medicinal product

COPD – chronic obstructive pulmonary disease

Dose banded – doses of intravenous drugs calculated on an individualised basis that are within defined ranges or bands and are rounded up or down to predetermined standard doses

Dyslipidemia – abnormal amount of lipids in the blood

Elemental analysis – a process where a sample material, such as a chemical compound is analysed for its elemental composition

EPMA – Electronic Prescribing and Medicines Administration

Extracorporeal – a medical procedure performed outside the body

Formulation science – the development of a chemical into a medicine

Glucagon – peptide hormone produced by the pancreas

Hypoglycaemia – deficiency of glucose in the bloodstream

IMP – Investigational Medicinal Product

In vitro – studies of cells or biological molecules outside their biological context

In vivo – studies of the effects of biological entities on living organisms

Lipids – a group of naturally occurring molecules that include fats, waxes, sterols, fat-soluble vitamins

NRCS – National Reporting and Learning Scheme

Omniceil – a method of dispensing drugs to individual patients on wards

Parenteral studies – investigations of injected substances

Polymers – large molecules that are formed when smaller molecules are joined together

QT studies – investigations of electrical conductivity in the heart

RRP – responsible respiratory prescribing

SACT – systemic anti-cancer therapy

Surfactants – a substance which tends to reduce the surface tension of a liquid in which it is dissolved

THC – Tetrahydrocannabinol, the principal psychoactive constituent of cannabis

Pharmacokinetics – the movement of drug into, through, and out of the body

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