



# Orthopaedics, Trauma and Plastics

Clinical Academic Group

# King's Health Partners

King's Health Partners brings together:

- three of the UK's leading NHS Foundation Trusts
- a world-leading university for health research and education
- nearly 4.8 million patient contacts each year
- 40,000 staff
- nearly 30,000 students
- a combined annual turnover of more than £3.7 billion
- services provided across central and south London and beyond, including nine mental health and physical healthcare hospitals and many community sites
- a comprehensive portfolio of high-quality clinical services with international recognition in cancer, diabetes, mental health, regenerative medicine, transplantation, cardiac and clinical neurosciences
- a major trauma centre and two hyper-acute stroke units

# About King's Health Partners

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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.

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 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](mailto:kingshealthpartners@kcl.ac.uk).

For more information please visit our website at [www.kingshealthpartners.org](http://www.kingshealthpartners.org).

Professor John Moxham  
*Director of Clinical Strategy, King's Health Partners*  
June 2017

# Foreword

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Trauma, Orthopaedic and Plastic Surgery are busy departments and the demand for our services is rising inexorably. The hospitals in our group have served the local population for hundreds of years and have grown to become amongst the largest and most respected units in the country, attracting patients from across the UK and worldwide.

Our clinical work continues to be of the highest standard, as the outcomes data will show. Our units are now running all senior surgical training for the South East region. We attract Clinical Fellows to our Fellowship programme on a national and international level. Furthermore, we provide ongoing teaching and assessment for our undergraduate students embracing the forward-reaching 2020 concept of the King's College London (KCL) Faculty of Life Sciences and Medicine.

Our aim over the past few years has been to use the structure of the AHSC/CAG to help us build on our past successes and develop our services further. A more integrated service will provide many benefits to our patients, not least in terms of clinical outcomes, patient satisfaction and efficiency.

We are also keen to utilise the exceptional knowledge and skills found on the KCL campus to continue building and improving our research programmes. This has already developed the platform for sought-after clinical trials and translational research.

As highlighted here, this is one of the busiest clinical CAGs, serving a large number of patients both locally and nationally. The Musculoskeletal (MSK) Service, including Trauma and Orthopaedics, is one of the biggest in the country. King's Health Partners (KHP) has allowed this large high-quality service to develop, but has also given the impetus to develop extensive teaching, training and research abilities. These will continue to grow as much as the clinical services.

We look forward to a busy and exciting future.

Mr Peter Earnshaw  
*Clinical Director – Surgery, Guy's and St Thomas' NHS Foundation Trust*

Mr Joydeep Sinha  
*Clinical Director – Orthopaedics and Plastics, King's College Hospital NHS Foundation Trust*

# The value of partnership at King's Health Partners

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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 can also achieve better value for money.

## Integrating Mental and Physical Health: our Mind and Body Programme

The mind and body are inseparable, and mental and physical health conditions are often connected. The average life expectancy for someone with a severe mental illness is much shorter than for someone without, contributed to by high rates of smoking, obesity, diabetes or alcohol misuse. Likewise, many people with long-term physical health conditions experience common but debilitating mental health conditions such as depression or anxiety which make their outcomes worse.

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 working to join up and deliver excellent mental and physical healthcare, research and education so that we treat the whole person, by:

1. Scaling integrated mental and physical screening and assessment across KHP, using the 'Integrating Mental and Physical Health: Research, Training & Services' Project (IMPARTS) approach;
2. Creating efficient, effective and integrated stepped care through the provision of new innovative models of care delivery, and supporting the transition into business-as-usual; and
3. Provide high quality mind and body education and training for all KHP staff.

This will not be purely about service delivery, but also the wider infrastructure required to create sustainable change – including supporting staff health and wellbeing, linking IT systems across our partner trusts so that clinicians have access to a person's physical and mental care records, and working with academia, public health and commissioners to consider population health and intelligence.

## 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 initiatives in alcohol clinical services, training and research
- 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 and cost-effectiveness of interventions.

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) and 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 of the relationship between



# Contents

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	The team	<b>08</b>
	Range of services	<b>09</b>
	Aims and ambitions	<b>12</b>
	What are outcomes	<b>13</b>
	Patient experience across the whole CAG	<b>14</b>
	Orthopaedics	<b>17</b>
	Trauma	<b>37</b>
	Plastics	<b>53</b>
	Education and training	<b>66</b>
	Research income over the last 3 years	<b>70</b>

# The team

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**Mr Joydeep Sinha (KCH)**  
CAG Lead  
Clinical Director, Orthopaedics



**Mr Peter Earnshaw (GSTT)**  
CAG Lead  
Clinical Director, Surgery and Orthopaedics

## Orthopaedics

**Mr Patrick Li (KCH)**  
Clinical Lead, Orthopaedics

**Mr Sam Gidwani (GSTT)**  
Clinical Lead, Orthopaedics

**Mr Adil Ajuied (GSTT)**  
Orthopaedic Research Lead

**Miss Ines Reichert (KCH)**  
Orthopaedic Research Lead

**Miss Diane Back (GSTT)**  
Orthopaedics Training  
Programme Director

**Mr Venu Kavarthapu (KCH)**  
Orthopaedics Training  
Programme Director

## Trauma

**Mr Duncan Bew (KCH)**  
Director of Trauma and  
Acute Surgery

**Dr Philip Hopkins (KCH)**  
Trauma Research and  
Development Lead

**Mr Robert Bentley (KCH)**  
SELKam Network Director

## Plastics

**Mr Bill Townley (GSTT)**  
Clinical Director, Plastics

**Prof Jian Fahadi (GSTT)**  
Plastics Research and  
Development Lead

**Mr Mark Ho-Asjoe (GSTT)**  
Plastics Training Lead

# Range of services

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## Orthopaedics

King's Health Partners is rapidly growing into one of London's largest orthopaedic providers. We have specialist interests in:

- hip and knee replacements and revisions, hip resurfacing, treatment of hip problems in young adults, and treatment of sickle cell hip disease
- treatment of acute knee injuries including sports injuries, arthroscopic surgery and ligament reconstruction
- complex spinal surgery
- complex foot and ankle surgery, including ankle replacements and complex deformities
- upper limb surgery, including shoulder replacements, elbow replacements and hand surgery, correction of deformities, limb lengthening and treatment of limb infections
- paediatric orthopaedics, including neonatal hip screening, treatment of clubfoot and other common limb problems, rapid-access

physiotherapy clinic, correction of limb deformities and lengthening, and cerebral palsy

- full trauma service at Guy's and St Thomas' and King's College Hospital
- limb reconstruction
- diabetic foot problems.

## Trauma

London's major trauma system consists of four major trauma networks each with a Major Trauma Centre, one of which is KHP. The system is the first of its kind in England and was set up to give immediate specialist care to the most urgent, life threatening cases, and save more lives. In the last year, around 4,000 people, or around 11 a day, have been treated at the centres where they have 24/7 access to consultants and faster access to diagnostic scans and treatments, increasing their chances of survival and lowering the risk of permanent disability.

Ambulance staff use a trauma triage tool to assess patients to ensure those with the most

severe injuries, classed as major trauma, are taken directly to a major trauma centre for urgent treatment. This may involve bypassing their local hospital so they can immediately receive specialist care with access to CT scans and innovative technology to treat them.

The major trauma networks were set up on the basis of a maximum journey time of 45 minutes. In the last year, the average ambulance journey time for a patient to reach a major trauma centre was 16 minutes.

- Ear reconstruction
- Epidermolysis bullosa
- Facial reanimation
- Cleft lip and palate surgery
- Congenital hand surgery
- Arteriovenous malformations
- General paediatric plastic surgery.

## Plastics

The Plastic Surgery Department is one of the largest units in the country with 22 consultants. We serve both the local population in South East London and act as a tertiary referral centre for complex reconstruction in the South East of England. The unit covers a diverse range of subspecialty interests for both the paediatric and adult population.

Our service includes:

- General plastic surgery
- Hand trauma and soft tissue injuries
- Elective upper limb surgery
- Lower limb trauma
- Reconstruction following skin, breast, head and neck, abdominal and perineal cancers

## Where our main services are



# Aims and ambitions

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## Orthopaedics, trauma, plastics

- enhanced treatment of patients at Major Trauma Centre e.g. orthoplastics/soft tissue cover
- improved performance in treatment of elective patients in all areas of plastics, ENT and orthopaedics, e.g. meeting national targets for joint replacements.

## Significant progress on King's Health Partners' strategic objectives

- the integration of mental and physical health – Integrating Mental and Physical healthcare: Research, Training and Services (IMPARTS) in limb reconstruction
- elderly fragility fracture patients – early dementia assessment

- public health – osteoporosis screening in fragility fracture patients – leading to effective secondary intervention
- exciting developments in education/training including e learning, simulation and robotic training.

## Plans for the next five years

Continue to take forward what has worked well in:

- **enhanced treatment** of patients at MTC – both with national TARN data and local outcome measures, e.g. orthoplastics/soft tissue cover
- **improved performance** in treatment of elective patients e.g. hip and knee replacements at Guy's and St Thomas'; move to day surgery for all upper limb surgery at King's College Hospital
- **exciting developments** in education and training, e.g. King's Health Partners bid for MDECs training in trauma and orthopaedics, similarly in plastics and ENT; take forward developments in simulation training.

# What are outcomes

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## Clinical outcomes

Clinical outcomes are measurable changes in the health or quality of life of patients that result from the care they have received. The constant review of clinical outcomes establishes standards against which we can continuously improve all aspects of clinical practice.

## Performance measures

Performance measurement involves regularly monitoring outcomes and results to generate reliable data on the effectiveness and efficiency of clinical services. Data relates to a specific time period and is measured using specific methods.

## 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 the health system's performance and measure how safe, effective, patient-centred, timely, efficient and equitable the care we provide is.

# Patient experience across the whole CAG

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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 the care we provide.

## CQC Results

### King's College Hospital NHS Foundation Trust

In September 2015, the report by CQC rated King's College Hospital NHS Foundation Trust as requiring improvement overall. King's College Hospital Denmark Hill and Princess Royal University Hospital were both rated as requiring improvement and Orpington Hospital was rated as good. Overall, the Trust was rated as requiring improvement in the safe, effective, responsive and well led domains whilst caring was rated as good.

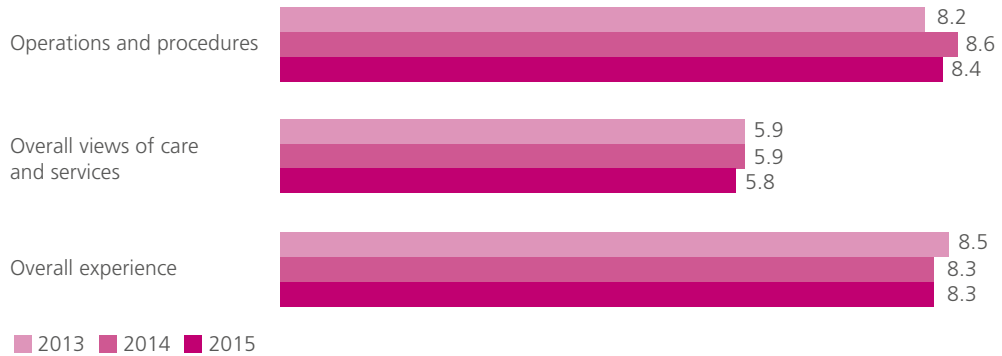
### Guy's and St Thomas' NHS Foundation Trust

In March 2016, the report by CQC rated Guy's and St Thomas' NHS Foundation Trust as good. Overall, the Trust was rated as outstanding in caring, good in the effective, responsive and well-led domains, whilst safe was rated as requiring improvement.



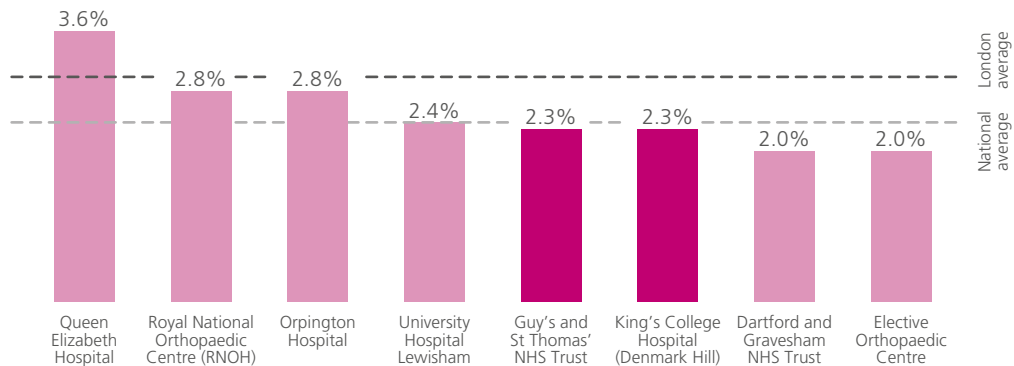
## NHS Adult Inpatient Survey

**Figure 1 |** Results from the NHS Adult Inpatient Survey for KHP



## Readmission Rates

**Figure 2 |** 30-day elective readmission rate for Trauma and Orthopaedics – Hospital Episode Statistics (HES) data (December 2014 – November 2015)



The readmission rates for the KHP hospitals are lower than the national and London average, a reflection of quality in surgical care as well as after care.



Orthopaedics

# Orthopaedics

## Description of the service

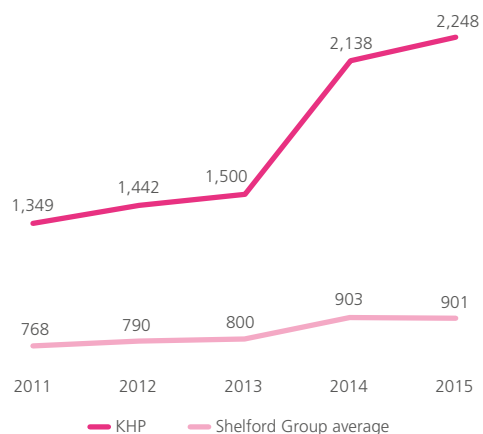
Our orthopaedic departments have rapidly grown into one of London's largest orthopaedic services. We have specialist interests in:

- hip and knee replacements and revisions, hip resurfacing, treatment of hip problems in young adults, and treatment of sickle cell hip disease
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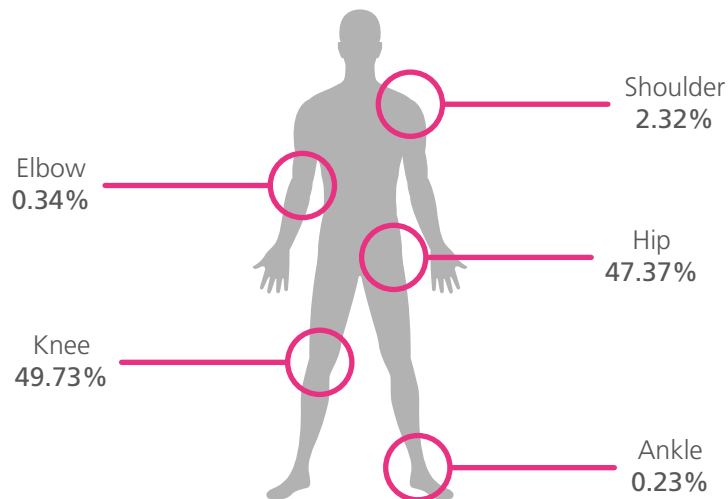
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- full trauma service at Guy's and St Thomas' and King's College Hospital
- limb reconstruction
- diabetic foot problems.

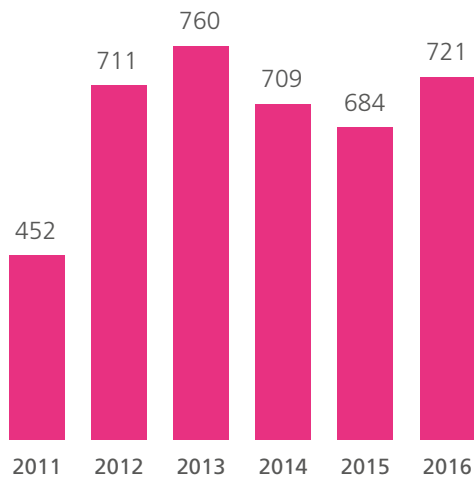
**Figure 3 |** Total number of completed hip, knee, ankle, elbow and shoulder operations, as recorded in the National Joint Registry (2011–15)



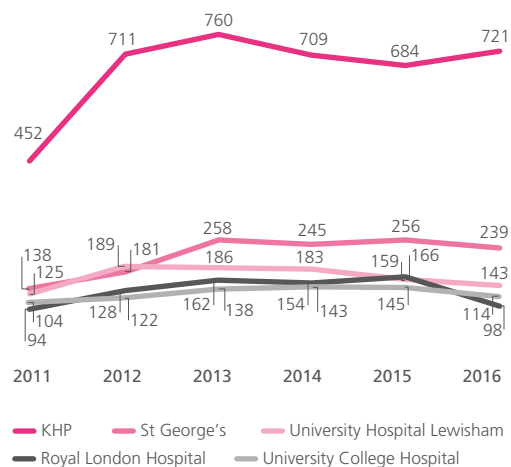
**Figure 4** | Percentage breakdown of total operations as recorded in the National Joint Registry (2011–16)



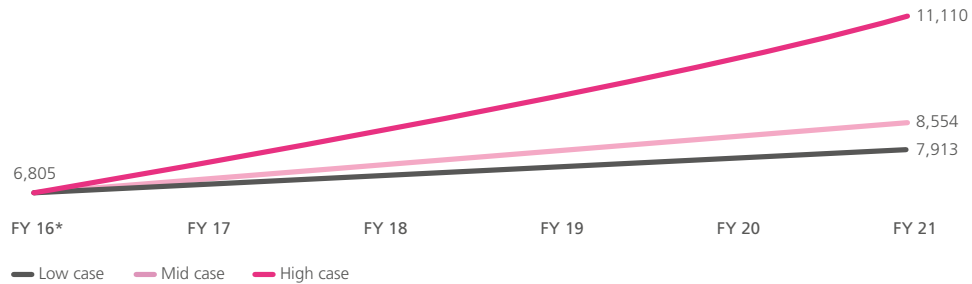
**Figure 5** | Number of hip fracture admissions at KHP as recorded in the National Hip Fracture Database (2011–16)



**Figure 6** | Number of hip fracture admissions at KHP compared to other Trusts as recorded in the National Hip Fracture Database (2011–16)



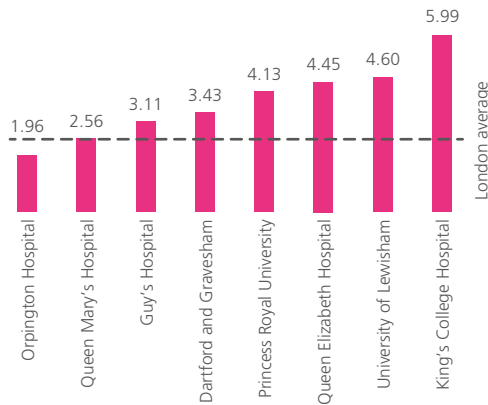
**Figure 7 |** Projected South East London (SEL) Trauma & Orthopaedic Activity



\*Source: Orthopaedic related activity data is provided by the SEL Commissioning Support Unit (CSU) for the period Jan–Dec 2015. These data are used as a proxy for FY16 from which demographic and non-demographic growth is applied until FY21. Please note: The activity shown above is for all orthopaedic activity conducted by SEL providers, these are: Dartford, Orpington, Princess Royal University, King's, Queen Mary's, Queen Elizabeth, Lewisham, Guy's and St Thomas' hospitals.

## Clinical outcomes

**Figure 8 |** Average length of stay for Elective Trauma & Orthopaedics – HES data (September 2014 – August 2015)

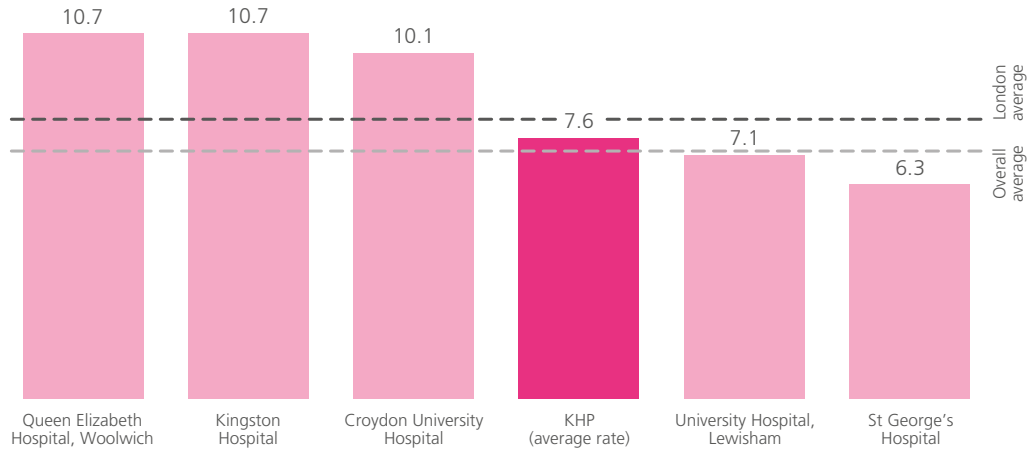


The average length of stay (LOS) is higher at King's College Hospital than all the other local hospitals due to the complexity of cases, which mostly consist of hip, knee or spine surgery. The patients treated tend to be higher risk, and are therefore more likely to have increased mortality rates and multiple co-morbidities.

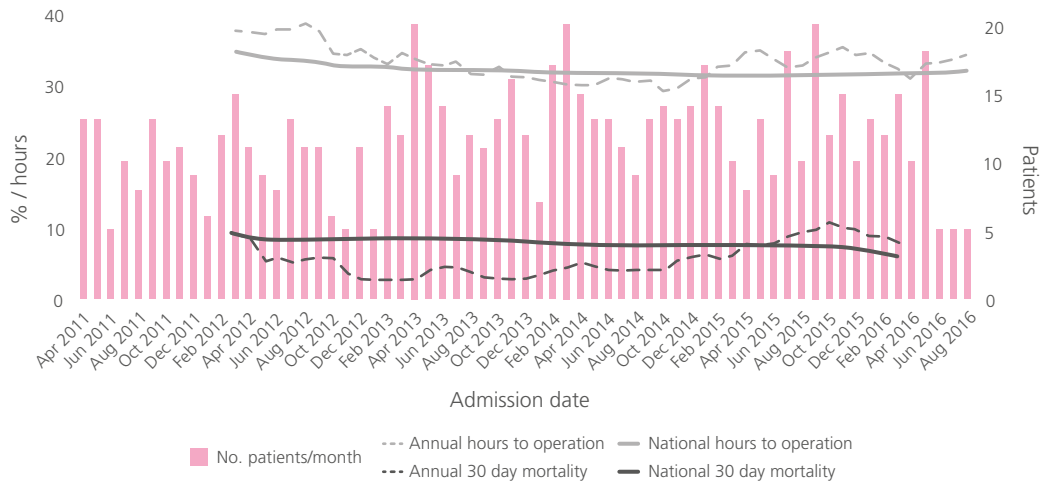
**Figure 9 |** Average overall hospital length of stay (days) as recorded in the National Hip Fracture Database (2014–15)



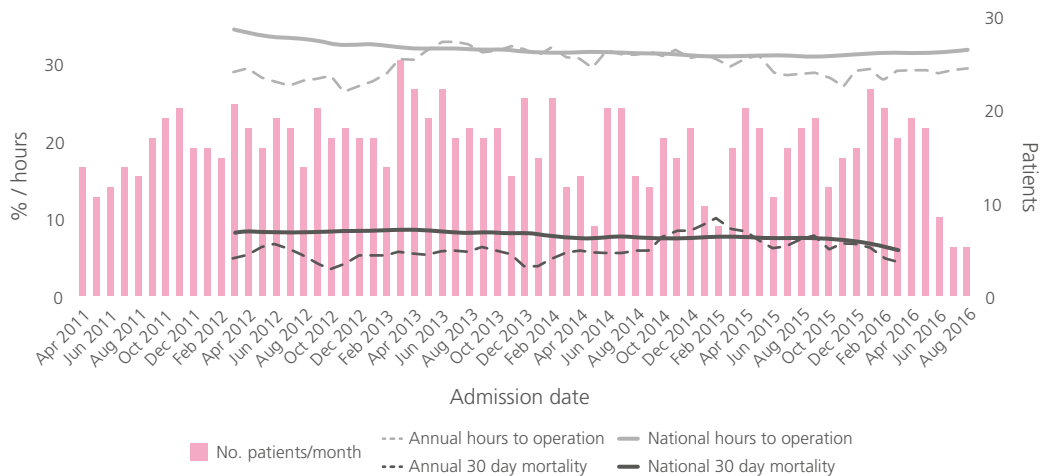
**Figure 10 |** Average adjusted 30-day mortality rate for hip fractures (%) in 2015 compared to other south London Trusts as recorded in the National Hip Fracture Database



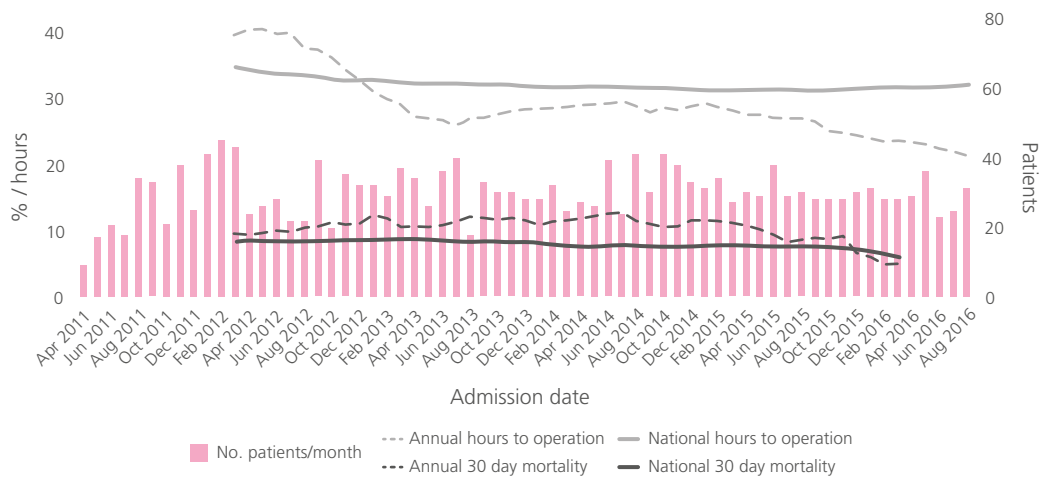
**Figure 11 |** National Hip Fracture Database – overall performance chart for King's College Hospital (August 2011 – August 2016)



**Figure 12 | National Hip Fracture Database – overall performance chart for St Thomas' Hospital (August 2011 – August 2016)**



**Figure 13 | National Hip Fracture Database – overall performance chart for Princess Royal University Hospital (August 2011 – August 2016)**



## Hip & knee risk adjusted 90-day mortality (April 2003 – July 2015)

This shows 90-day mortality following hip and knee surgery for KHP hospitals, based on the type of patients the hospitals have seen.

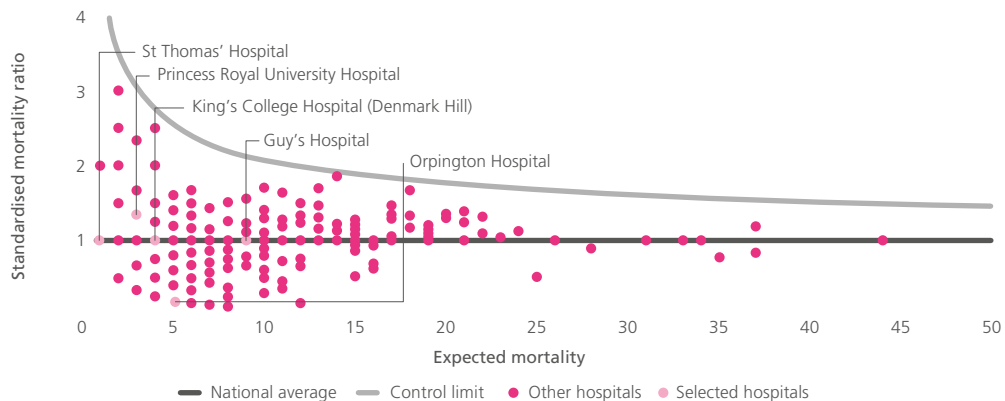
The hospitals are highlighted as orange triangles in the chart below. Progression along the horizontal axis (x axis) means that the hospital has done more cases and/or cases at a higher mortality risk, such as older patients. Progression along the vertical axis (y axis) means the hospital has had more deaths.

The vertical axis figures are presented as a standardised mortality ratio. This means the values do not represent percentages of patients

who have died, but they represent the proportion of deaths compared to the national average. The data is also 'risk adjusted' to take account of the fact that different hospitals may operate on more higher-risk or lower-risk patients e.g. because of demographics in the patient population they work with.

- Hospitals on the central (green) horizontal line (at national average ratio figure of 1) have had exactly the average expected mortality
- Hospitals either side of the central green line but below the upper red line have had a level of mortality that is within the expected range
- Any hospitals that appear above the top red line which represents a Control limit (99.8%) have a mortality rate that is higher than expected.

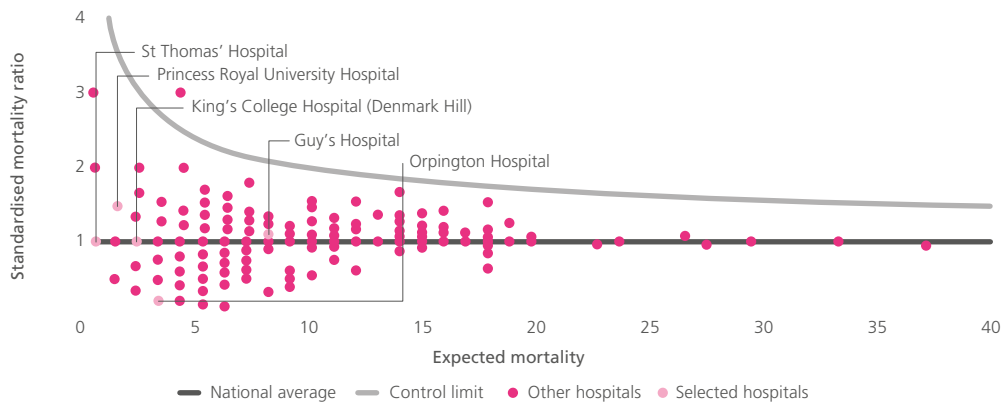
### Hip



The overall 90-day mortality rate following primary hip replacement surgery is approximately 0.4%.



## Knee



The overall 90-day mortality rate following primary knee replacement surgery is approximately 0.3%.

## Research and development

### Research and development – Orthopaedic & Trauma surgery

Orthopaedic, Trauma and Plastic Surgery at KHP is committed to continuous research and development for better patient care. Each team contributes regularly to the body of clinical research evidence. Furthermore there is a drive to advance knowledge and spearhead innovation.

#### Guy's and St Thomas' Hospital

At the Guy's campus, the CAG has continued to grow its research portfolio over the course of the last five years. This has included both

internal departmental projects within the various subspecialties of trauma and orthopaedics, as well as extra departmental collaborations both in other clinical specialities and basic science.

Examples of collaborators include the Rayne Institute of regenerative medicine at KCL, the biomechanics department at Imperial College London, and the Department of haematology and haemophilia at KCL.

An example of a research work stream demonstrating both collaboration and translational practice is our Xenografts soft tissue work. This began with a biomechanical study comparing the mechanical properties of the chosen Xenograft, to the current non-autogenous standard.

This was followed by a review of the literature and a number of presentations and publications. KHP teams are now the lead UK investigators for an international multinational phase 1, first in man, commercial trial and are planning the first implantation in the first quarter of 2017.

### King's College Hospital

King's College Hospital has a strong research tradition and our research set-up follows two main strands:

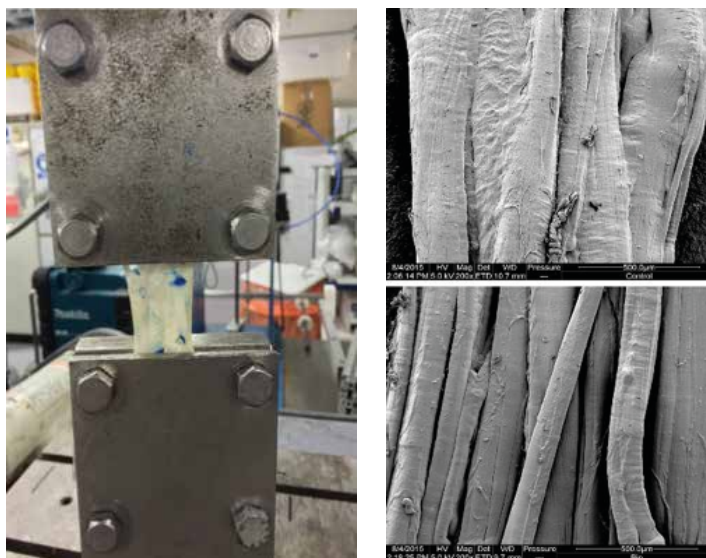
1. Clinical Trials of high standard on the National Institute of Health Research (NIHR) portfolio

2. Translational research, peer-reviewed and funded by external funding bodies, in co-operation with basic scientists

Individual consultants publish regularly on novel surgical techniques and treatment of their patients using validated outcome data. The upper limb team and the orthopaedic diabetic foot team hold regular research meetings to discuss progress.

A number of consultants act as regular reviewers for national and international journals as well as serving on national committees (e.g. BORS – Reichert) and editorial boards (e.g. BJR – Reichert).

**Figure 14 |** Mechanical testing of the graft (left) and electron microscopy of xenografts (right)



### Orpington and PRUH

The addition of the Princess Royal University Hospital (PRUH) and Orpington Hospital for high volume elective surgery has provided more opportunities to expand clinical research and take on additional studies.

### Funded studies on the NIHR portfolio

We have developed a robust framework to conduct and contribute to a number of multi-centre clinical studies. These are 'interventional' studies comparing specific surgical treatment options in randomised-controlled trials. Recruitment and patient experience has been very positive. In June 2016, we have been joined by a full-time Research Associate who looks after the studies on the NIHR portfolio. He is strongly supported by Miss Ines Reichert PhD who is the R & I lead and Mr Joydeep Sinha who is the NIHR Lead for Surgery for the South London CLRN.

A selection of studies:

1. **PROFHER – a national trial to establish if surgery is really better than non-operative treatment for patients with proximal humerus fractures. UK lead: A Rangan, Middlesborough, KHP lead: J Sinha, A Tavakkolizadeh;** Reference: Surgical vs nonsurgical treatment of adults with displaced fractures of the proximal humerus: the PROFHER randomized clinical trial. Rangan A, Handoll H, Brealey S, Jefferson L, Keding A, Martin BC, Goodchild L, Chuang LH,

Hewitt C, Torgerson D; **PROFHER Trial Collaborators.** JAMA. 2015

2. **Limb reconstruction and psychological impact – an important study to look at the human cost impacting patients with severe lower limb deformity requiring limb reconstruction – Leads Prof Hotopf, G Groom, S Phillips;** Reference: Mental disorder in limb reconstruction: Prevalence, associations and impact on work disability. Rayner L, Simpson A, Matcham F, Shetty S, **Lahoti O, Groom G,** Hotopf M.; J Psychosom Res. 2016

Recently completed:

1. **WOLLF – A clinical trial looking at the difference a negative pressure dressing would make in patients with open fractures of the lower limb; UK lead: Prof Matt Costa, Warwick, KHP lead: A Tavakkolizadeh;** King's was amongst the top three recruiting hospitals
2. **FASHION – a clinical trial to establish the value of arthroscopic surgery for patients with hip pain due to impingement with a specific physiotherapy program; UK lead Prof D Griffin, Warwick; KHP lead: V Kavarthapu;** Reference: Protocol for a multicentre, parallel-arm, 12-month, randomised, controlled trial of arthroscopic surgery versus conservative care for femoroacetabular impingement syndrome (FASHIoN). Griffin DR1, Dickenson EJ2, Wall

PD2, Donovan JL3, Foster NE4, Hutchinson CE2, Parsons N2, Petrou S2, Realpe A2, Achten J2, Achana F2, Adams A2, Costa ML2, Griffin J2, Hobson R2, Smith J2; FASHIoN Study Group, BMJ Open. 2016

Ongoing at present:

3. **BOSS – this is a national observational study collecting all children nationwide who suffer from these rare conditions of the hip (Perthes and Slipped Upper Femoral Epiphysis); UK lead: Dan Perry, Liverpool**
4. **UKSTAR – a clinical study comparing two different treatment options for patients with Achilles tendon rupture who are treated non-operatively; UK lead: Prof Matt Costa, Oxford; KHP lead: Ines Reichert; KHP recruited the first UK patient**
5. **WHIST – a clinical trial which already recruits a high volume of patients. The study tests a new suction dressing for wound healing in lower limb trauma; UK lead: Prof Matt Costa, Oxford; KHP lead: P Harnett, I Reichert**

To come:

6. **WHITE – an observational study on the clinical outcome of patients after hip fracture, UK lead: Prof Matt Costa, Oxford. An ideal study to be performed across sites (PRUH and KCH)**

### **Opportunities for our trainees**

Trainees are encouraged to recruit patients to the NIHR portfolio trials and the successful recruitment will be recognised with a certificate. We encourage our trainees to be GCP trained and take on the 'Trainee Principal Investigator' role on specific studies. Research leaders in Trauma & Orthopaedic Surgery visit KHP regularly to introduce trials and discuss research methodology.

### **Industry-sponsored studies on the NIHR portfolio**

We recognise the advantages of working closely with cutting-edge industry and vice-versa. The application of strict research criteria at KHP makes this a win-win scenario. We have engaged with two international bone stem cell therapy trials (blind randomised control) led by BoneTherapeutics, Belgium which have been adopted on the NIHR portfolio. We have been approached by Avita Medical to take part in a study assessing skin cover in diabetic patients. We are also working with BoneSupport, Sweden, on a forthcoming international trial on open fracture treatment. PREOB – Osteoblasts for the treatment of avascular necrosis of the hip (the patient's own cells will be differentiated in culture to osteoblasts), UK lead Prof A McCaskie, Cambridge; KHP lead: Ines Reichert, Patrick Li.

Ongoing:

1. **PREOB – a clinical trial to establish the benefit of osteoblasts (young bone cells)**

**for the treatment of avascular necrosis of the hip. This is a devastating condition of the hip often affecting young patients (the patient's own cells will be harvested and differentiated in culture to osteoblasts), UK lead Prof A McCaskie, Cambridge; KHP leads: Ines Reichert and Patrick Li**

2. **Regenercell – a clinical trial to research the use of stem cells (harvested from the patient's skin) to cover open wounds in the diabetic foot, KHP lead: Mr Nav Cavale, Consultant Plastic Surgeon**

Coming soon:

3. **ALLOB – Ethics approval has been obtained for this study which will test the advantage of adding osteoblasts to the treatment of delayed union of long bones – a pool of differentiated young bone cells will be used, akin to a blood transfusion, UK lead: Ms Ines Reichert, King's College Hospital**
4. **FORTIFY – an international study to establish if a bone-inducing substitute loaded with antibiotics is of benefit in patients with severe open fractures, UK lead Mr Nima Heidari, Royal London Hospital; KHP leads: Paul Harnett, Ines Reichert**

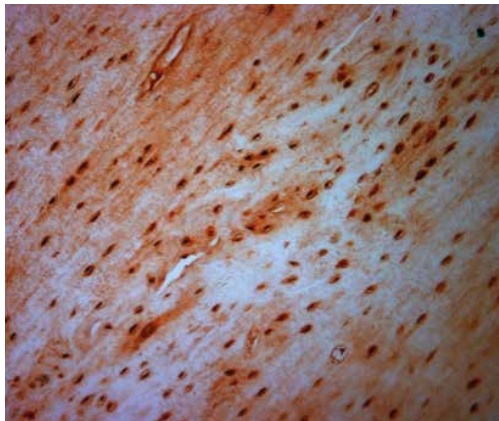
### **Translational research: Bone and Joint Group**

We have a strong interest in the exchange of basic scientists and clinicians for clinically relevant research. Our Bone and Joint Group was initiated by Mr Joydeep Sinha and is continued by Ms Ines Reichert between scientists at the Dental Institute, Guy's Campus, and Orthopaedic Surgeons. The group has been awarded start-up funding by KHP for an Away Day and since meets regularly to discuss relevant scientific developments and proposals for clinically relevant research. Internal and external guest speakers attend regularly. Funding has been attracted from peer-review bodies including ORUK. One of the projects conducted by an orthopaedic trainee was awarded a prize at the annual BORS 2012 meeting. The group has contributed to a Symposium 'Mind the Gap – treatment of non-union fractures' at the international CORS 2013 meeting.

An important aspect of our work is to understand the effect of comorbidities on bone and bone healing. We have obtained permission from the national Ethics Committee to investigate bone biopsies of diabetic patients to understand the biology better. The sclerostin study is underway to study this powerful bone-regulating molecule and further studies are in the pipeline.

1. **Sclerostin Study – Does Sclerostin, a potent bone regulating molecule, contribute to the pathogenesis of Diabetic bone?** A joint study with UCLH, UCL and the Royal Veterinary College, Funded by Joint Action, BOA (£75,000); adopted on the national portfolio, UK lead: Ines Reichert, King's College Hospital.

**Figure 15** | Expression of sclerostin, a powerful regulating molecule, in bone, 20x magnification



**Dr Nina Petrova PhD, Diabetic Foot team,** has been awarded a collaborative grant with us by Diabetes UK to continue her work on osteoclast, bone-removing bone cells, in diabetic bone.

**Anatomy:** We regularly use the opportunities provided at the anatomy facilities on the Guy's Campus for anatomical studies. Going 'back-to basics' provided by the variations of human anatomy affords the surgeon with a rich opportunity for study. Reference – example:

**Variations of the extensor pollicis brevis tendon and its insertion: a study of 44 cadaveric hands,** Kulshreshtha R, Patel S, Arya AP, Hall S, Compson JP, *J Hand Surg Eur Vol.* 2007; An analysis of acromioclavicular joint morphology as a factor for shoulder impingement syndrome, Colegate-Stone TJ, Tavakkolizadeh A, Sinha J, *Shoulder Elbow.* 2014.

## Value based health care (VBHC)

The value based health care (VBHC) agenda aims to re-orientate the healthcare delivery system. It also forms one of the pillars to the KHP clinical strategy. The basic approach is to centre the pathway on the patient and condition rather than the department or locus of care. All stakeholders in the pathway are aligned to provide the best value care possible rather than accept fragmented pathways with inconsistency. To achieve the desired outcomes, care pathways and quality standards are standardised. Value in healthcare is defined as outcomes relative to the costs it takes to deliver those outcomes. The outcomes measured are those that matter to the patient and are over the whole pathway. The consistent focus on outcomes drives constructive change to the care pathway. A clear and standardised pathway can then be formulated. This detailed mapped process allows costs to be calculated.

### **Increasing value: The King's College Hospital Experience**

*British Journal of Healthcare Management*, 2016  
Toby Colegate-Stone, Adel Tavakkolizadeh, John Moxham, Joydeep Sinha

The increasing trauma demands imposed by our population require innovative practice. A day surgery trauma service is a pragmatic response for those patients with less severe, more ambulatory trauma, whose surgery has a lower risk profile. By using the principles set out in the value based healthcare (VBHC) agenda, such a re-orientation of service offers

opportunities in improving outcomes and reducing costs. This study assessed the impact of the day surgery trauma service in its current activity, the outcomes generated, its potential development and its fiscal footprint. The average patient satisfaction was very good with 92% preferring their surgery performed as day surgery rather than as an inpatient. Day surgery was noted to have a higher run rate of cases per unit of time, lower costs and subsequently a better margin generation per minute. The additional annual surplus generated by performing a single whole day trauma list in day surgery was approximately £293,000. By focusing on the needs of the patients and placing them at the centre of service re-design, constructive change is seen to be possible. The day surgery trauma service can be shown to deliver higher value care. Triaging the locus of surgery in this way helps to get patients to the best place for the best outcome.

### **Improving value in care for patients with hip fractures- moving to a value based healthcare model**

Patients who have fractured neck of femurs (NOF) represent a high-risk group. They have complex physiological and social care needs and their fragility often amplifies their acute vulnerability. NHS Digital data indicates fractured neck of femur (NOF) patients to have the second highest 30-day mortality rates following emergency admissions, just after stroke patients. It is a common injury with significant fiscal consequences. The UK annual number

of patients with NOF fractures is projected to rise to 101,000 by 2020. This is matched with an increasing annual expenditure of £2.2 billion by 2020.

An integrated practice unit for patients with NOF fractures was established. The aim being to manage this cohort on a condition rather than departmental basis and wrap the complex multidisciplinary care that they require about them. A new standardised pathway was formed to comply with national guidelines. Key performance indicators have improved, including time to admission to specialist ward, time to surgery, 30-day mortality and length of stay.

Re-orientating the service towards the needs of patients with NOF fractures is seen to have a positive impact on their outcomes. To achieve this an understanding of the most critical points along the care pathway is important, as is an appreciation of how the backend of the pathway can impede the front. Improved outcomes have been realized through this VBHC approach with the result of higher value care being delivered. This is supported by lower mortality rates and length of stay. An additional effect of this process has been to reduce costs and increase value. This condition-based approach helps to demonstrate how better care can be more cost effective.

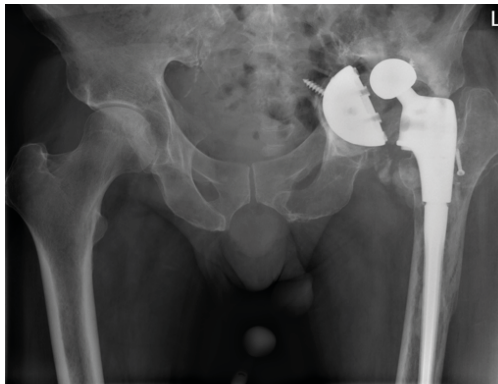
## Opportunities/benefits for our patients

Recent research has shown that patients enjoy taking part in clinical research and also appreciate being treated in a research-active department. Some patients are seeking treatment at our department to have the chance to take part in specific trials. In particular, PREOB, the stem cell therapy study for osteonecrosis of the hip, has found interest well beyond the catchment area of King's Health Partners.

## Innovations in orthopaedics

“The Future is Here”

**Figure 16** | Failed hip replacement



The increasing use of 3D printing has seen a step change in the management of complex joint reconstruction such as the case illustrated here:

A patient was referred with a failing hip after many years. His hip was x-rayed (see left), and using 3D printing, a 3D model (see below) was generated from the raw pre-operative CT images.

Consultant Orthopaedic Surgeon, Mr Zameer Shah carried out the Surgery with help from Consultant Radiologist, Dr Amanda Isaac who assisted with the Imaging process and the 3D printing.

Following the Surgery, the patient has recovered well and is able to weight bear and mobilise, pain free.

**Figure 17** | 3D model reproduction



These highly accurate true life models allow for enhanced visualisation and physical interaction. Every step of the surgical technique can be envisaged, reducing operative time, improving implant positioning and stability and leading to better outcomes.



This improved surgical technique reduces the number of incisions required and overall theatre time, directly impacting on the quality of patient care, and to a reduction in theatre costs.

### Limb salvage diabetic foot deformity corrective surgery

**Figure 18 |** A midfoot, deformed by diabetic charcot osteoarthropathy. Although clinically still 'foot-shaped', the advanced bone and joint destruction is visible on the radiograph



King's Diabetic Foot Clinic has developed an innovative surgical approach for the management of severe diabetic Charcot feet. Our surgical treatment helps patients who would otherwise envisage amputation. Whilst a young and healthy patient has a good chance to adjust well to

an amputation this is a devastating consequence for a patient with severe diabetes.

**Figure 19 |** Pre and post-operative radiographs of a combined hind- and midfoot reconstruction of a more complex deformed foot, often a 2-stage procedure



Professor Michael Edmonds, Consultant endocrinologist, leads the overall clinical multi-disciplinary team and has been very effectively joined by Mr Kavarthapu, Consultant Orthopaedic Surgeon, who spear-heads the surgical orthopaedic service in the unit. Our recently published studies confirm improved medium-term clinical patient outcome compared with previously published data. Indeed even a single-stage correction of deformity using an intramedullary hindfoot arthrodesis nail is a good form of treatment for patients with severe Charcot hindfoot deformity, ulceration and instability. This surgery has been performed successfully in our cohort of twenty patients – provided a multidisciplinary care plan is delivered. This treatment is only possible with immense attention to detail, in particular in a close working relationship with the Diabetic Foot team as well as Microbiology. Most importantly there has been no loss of limb in these patients.

The unit regularly welcomes visitors nationally and from abroad to learn about the KCH approach. The team has been invited to contribute to a high-profile Symposium at the forthcoming European Orthopaedic Research Society meeting, Munich 2017. Furthermore we conduct a yearly European meeting, The Multidisciplinary and Surgical Reconstruction of the Charcot Foot ([www.kingsdfc.org.uk](http://www.kingsdfc.org.uk)).

### References

Modern Orthopedic Inpatient Care of the Orthopedic Patient With Diabetic Foot Disease. Bateman AH, Bradford S, Hester TW, Kubelka I, Tremlett J, Morris V, Pendry E, Kavarthapu V, Edmonds ME., *Int J Low Extrem Wounds*. 2015.

The medial column Synthes Midfoot Fusion Bolt is associated with unacceptable rates of failure in corrective fusion for Charcot deformity: Results from a consecutive case series. Butt DA, Hester T, Bilal A, Edmonds M, Kavarthapu V, *Bone Joint J*. 2015.

Outcome of one-stage correction of deformities of the ankle and hindfoot and fusion in Charcot neuroarthropathy using a retrograde intramedullary hindfoot arthrodesis nail. Siebachmeyer M, Boddu K, Bilal A, Hester TW, Hardwick T, Fox TP, Edmonds M, Kavarthapu V., *Bone Joint J*. 2015.

Undiagnosed severe sleep apnoea and diabetic foot ulceration – a case series based hypothesis: a hitherto under emphasized factor in failure to heal. Vas PR, Ahluwalia R, Manas AB,

Manu CA, Kavarthapu V, Edmonds ME, *Diabet Med*. 2016.

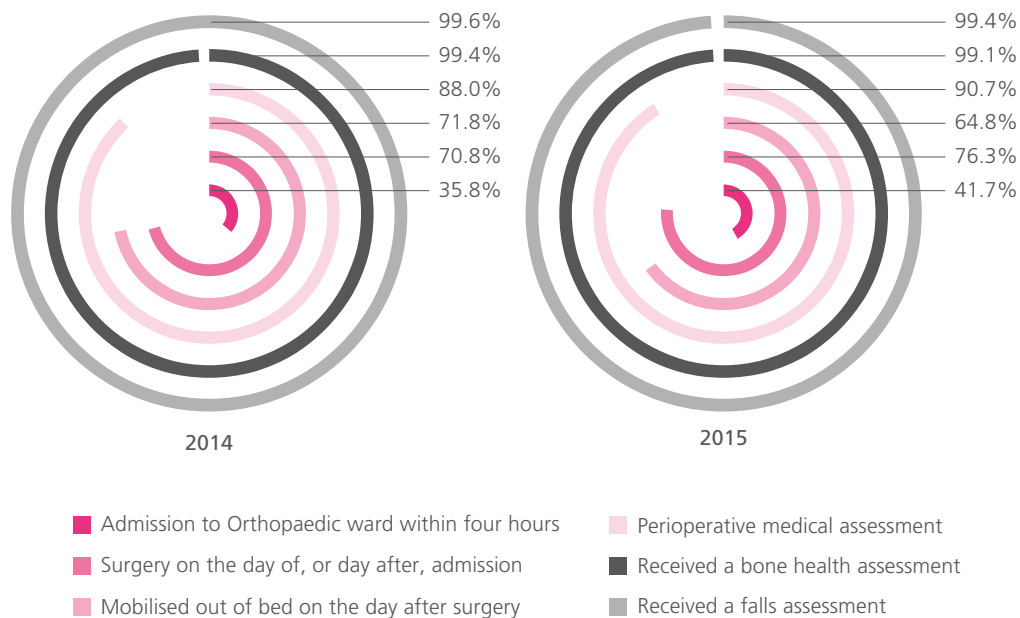
Transformation of the multidisciplinary diabetic foot clinic into a multidisciplinary diabetic foot day unit: results from a service evaluation. Manu CA, Mustafa OG, Bates M, Vivian G, Mulholland N, Elias D, Huang DY, Deane C, Cavale N, Kavarthapu V, Rashid H, Edmonds M., *Int J Low Extrem Wounds*. 2014.

## Quality of care and other performance measures

### Blue Book standards (audit of hip fracture care)

Fragility fractures and their care are a challenge to our health care system. The National Hip Fracture Database (NHFD) is a clinically-led, web-based audit of hip fracture care and secondary prevention, with eligible hospitals in England, Wales and Northern Ireland now regularly uploading data. Participation in the NHFD enables hip fracture care to be audited against six standards defined by the collaboration of the British Orthopaedic Association and the British Geriatrics Society. The standards reflect good practice at key stages of hip fracture care and widespread compliance with them improves the quality and outcomes of care and also reduces costs.

**Figure 20** | Outcomes for the best matched questions similar to the blue book standards in previous NHFD audits



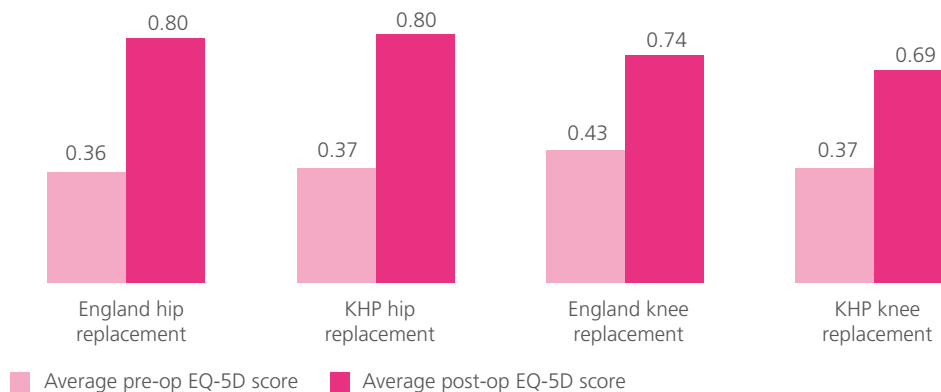
### Patient reported outcome measures (PROMs)

Patients undergoing elective inpatient surgery for hip and knee replacements are asked to complete questionnaires before and after their operations to assess improvement in health as perceived by the patients.

**EQ-5D** is a standardised instrument for use as a measure of health outcome. Applicable

to a wide range of health conditions and treatments, it provides a simple generic measure of health for clinical and economic appraisal. The maximum summary index score is 1, which indicates the best health. It is primarily designed for self-completion by respondents and is ideally suited for use in postal surveys, in clinics and face-to-face interviews. It is cognitively simple, taking only a few minutes to complete. Instructions to respondents are included in the questionnaire.

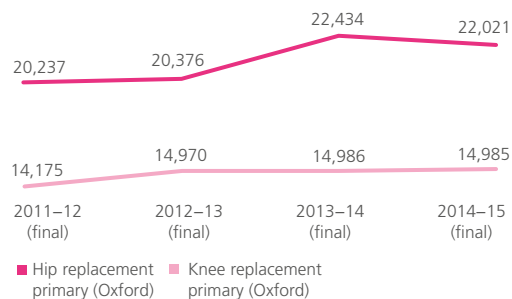
**Figure 21 | 4 year comparison for primary hip and knee replacement**



**Oxford Hip/Knee Score**

This is a 12-item patient-reported outcome specifically designed and developed to assess function and pain after total knee replacement (TKR) surgery (arthroplasty). It is short, reproducible, valid and sensitive to clinically important changes.

**Figure 22 | Four year comparison for primary hip and knee replacement**



**Copeland's Risk Adjusted Barometer (CRAB)**

CRAB is an innovative system for assessing, monitoring and improving the quality of care in hospitals.

Using a pioneering methodology that has been three decades in the making, clinical outcomes are adjusted for the case-mix complexity of every patient treated. This creates a true picture of consultants' practice, adjusting for presenting risk, operation complexity and intra-operative complications. It prevents harmful misuse of crude mortality statistics and helps to identify best practice. It can also provide feedback to improve clinical cost effectiveness by identifying the best configuration of facilities and weeding out unnecessary or inappropriate treatments.

The CRAB methodology is based on the POSSUM system which is the clinical audit system of choice recommended by the Royal College

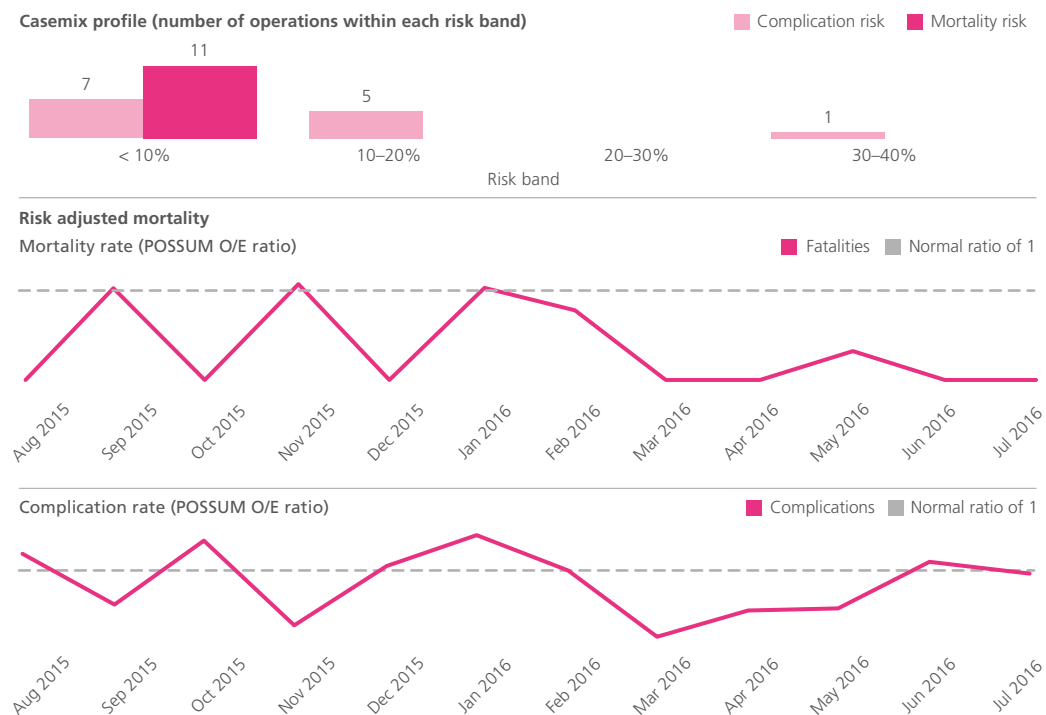
of Surgeons of both England and Scotland, NCEPOD, the Vascular Society of Great Britain and Ireland, the Association of Coloproctology of Great Britain and Ireland and the Association of Upper Gastrointestinal Surgeons.

CRAB provides a wide range of reports based on extensive data captured before or at the time of operation documenting the patient's condition. For each case, the risk of mortality or morbidity is calculated using POSSUM algorithms and the

raw data may be reviewed by looking at individual cases in the risk report.

At KHP, CRAB provides regular detailed analysis down to individual consultant and patient level that helps monitor consultant performance, the quality of patient care and specific risk of each and every patient. The resulting benefits are both clinical and financial, with complaints and litigation proven to be reduced after CRAB's installation and adoption.

**Figure 23 |** Examples of analysis provided in the CRAB report at GSTT (01/05/2016–31/07/2016)





Trauma

# Trauma

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## Description of the service

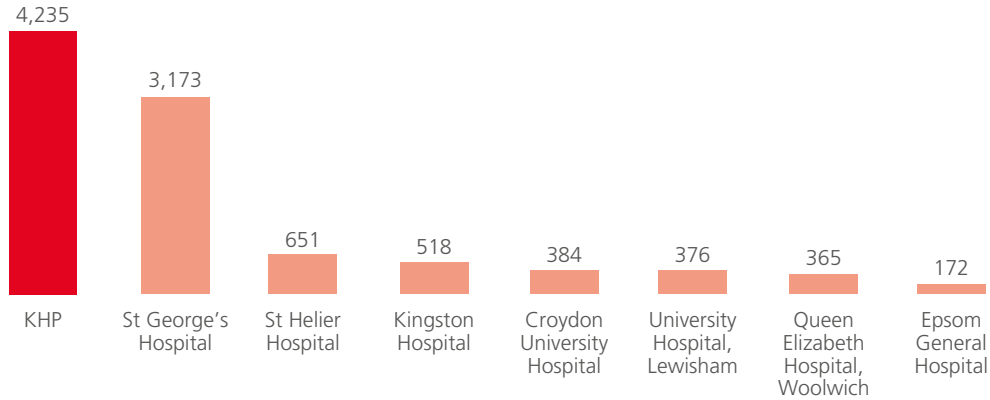
### KHP Major Trauma Centre helping to save lives

London's major trauma system consists of four major trauma networks each with a Major Trauma Centre. The four major trauma centres in London are King's College Hospital, Royal London, St George's, and St Mary's hospitals. The system is the first of its kind in England and was set up to give immediate specialist care to the most urgent, life threatening cases and save more lives. In the last year, around 4,000 people, or around 11 a day, have been treated at the centres where they have 24/7 access to consultants and faster access to diagnostic scans and treatments, increasing their chances of survival and lowering the risk of permanent disability.

The networks were set up on the basis of a maximum journey time of 45 minutes. In the last year, the average ambulance journey time for a patient to reach a major trauma centre was 16 minutes.

In October 2016, King's College Hospital opened its new helipad that will help save thousands of lives, and help the hospital serve its trauma population of 4.5 million people across South East London and Kent. The new helipad will speed up the time it takes helicopters to transfer critically-ill patients to King's College Hospital and reduce 'landing-to-resus' transfer times to just five minutes.

**Figure 24 |** Total eligible cases for the calculation of survival rates (between Jan 2013 and December 2016) compared with other South London Trusts as recorded in the Trauma Audit & Research Network (TARN)



## Research and Development

### Anaesthetics, Critical Care, Emergency Medicine and major Trauma (ACET) critical care translational research group

The CAG has developed a research team structure including establishing a hub research office; a secure research storage room; research governance and reporting and participation. This has included award winning recruitment to national studies and publication from in house

research projects on end-of-life care, ventilation, quality of care, and imaging.

This group currently consists of seven research nurses, 2 PhD Fellows and 2 research fellows. They have developed a novel collaborative interface, along with Dr Jeff Keep (Emergency Medicine) and Dr Gudrun Kunst (Anaesthetics) that has linked research groups in emergency medicine, trauma and anaesthetics, aligned with CRN Division 6. Within this group, nurses have presented at international critical care conferences at least twice a year for the last six years.

### Injury Prevention Initiatives

Mr Duncan Bew is also founding Trustee of Growing Against Violence (GAV) an evidence based primary preventative educational charity



which provides a safeguarding curriculum to over 500 schools in and around London. It provides a continuum of engagement, with age appropriate sessions delivered universally to students in school years 6 through to 10 (age range approx. 10–15). In total, GAV has delivered education and training to over 115,000 students and is the largest educational intervention of its type in Europe to reduce youth violence.

GAV works for public benefit to reduce the impact of gangs, peer on peer abuse and both gang and group behaviour on the lives of young people and, by extension, their families and communities. It is based on the principles of 'protection', 'prevention' and 'partnership'. GAV is now endorsed by the Royal College of Surgeons, Royal College of Paediatrics and Child Health and NHS England and Public Health England and is a key partnership in the strategy for the Mayor's Office for Policing and Crime (MOPAC).

The charity has received a South London Healthcare award and we recently presented our data to the select committee on sexual harassment in schools and contributed to the children's commissioners' report:

**Growing Against Gangs and Violence:  
Findings from a process and outcome  
evaluation**

*Psychology of Violence*, 2016

Densley, J., Adler, J., Zhu, L., Lambine, M.

**Objective:** This study has assessed program efficacy of Growing Against Gangs and Violence (GAGV), a primary prevention partnership with

the U.K. Metropolitan Police Service (MPS), delivered in London schools with the aim of reducing gang involvement, delinquency, and violent offending and improving young people's confidence in police. GAGV is partially derived from an American program, Gangs Resistance Education and Training (GREAT).

**Method:** A qualitative process evaluation and randomized control trial (RCT) outcomes study were undertaken.

**Results:** Findings indicate GAGV personnel were keen to enhance program fidelity and process implementation. The RCT did not demonstrate a statistically-significant program effect. However, effect sizes (ESs) indicate the program was effective in reducing levels of gang membership and the frequency and variety of delinquency and violence in the short- and longer term. More robust evidence indicated GAGV also improved students' attitudes toward police and reduced their adherence toward street code.

**Conclusions:** The use of cohort- (not individual-) level data and missing data in the one-year follow-up make it difficult to draw reliable and robust conclusions. However, results are encouraging. Several recommendations are suggested for GAGV, including curriculum design, regular evaluations and expanding to include more schools.

## Important Service Developments in Critical Care at KCH

1. Membership of the 'Over the theatre' ICU project board which developed the business case, design, build and transition plans for creating a new critical care centre, linked to a helideck and new imaging/theatre complex. The project is now funded at £75 million.
2. Co-authorship of the successful clinical information business case to support the planned 112 critical care beds within KCH, visiting many international and national ICUs to look at the interface between clinical – ICU operations – and clinical information systems.
3. Initiation and co-authorship of the shortlisted application to NHS England for Health technology funding, half of which will go to develop open source resources and portal access for groups such as general practitioners and patients/relatives and mapping to Trust wide electronic systems. This project will be funded at £2.4 million.
4. Chief editor of the internal training guidebook. This provides medical and nursing staff with a bespoke summary of the nature and operational structure of critical care at KCH in parallel with an up-to-date summary of the critical care evidence base. This is a 600-page document which

has taken five years to complete. To our knowledge, this provides a novel, real-time, inter-professional resource.

5. Between 2007 and 2013 reviewed all deaths in KCH's intensive care on a monthly basis and developed a quality matrix for end-of-life care. The output from this also informed the electronic deceased patient summary.
6. Set up of safety & performance meeting to feedback risk analyses; standardised mortality ratio, score card data and service developments to interprofessional team. Includes improvements in reporting mortality data. These data have been key in multiple service developments, including those focussed on new-build.
7. Support/development of the ICU audit team, including better embedding the interprofessional use of Medtrack (internal ICU information system); the submission of high quality data to ICNARC (Intensive Care National Audit and Research Centre) and multiple publications from the audit team.
8. Set up KCH's critical care units ICU Pathfinder Group: Ex-patient, relative and public panel that reviews ICU strategy and operations

Indeed, our vision is for the continued development of "King's Institute of Trauma" or "KIT" supported by the three pillars of Clinical Practice: Teaching, Training, and Research.

## Clinical outcomes

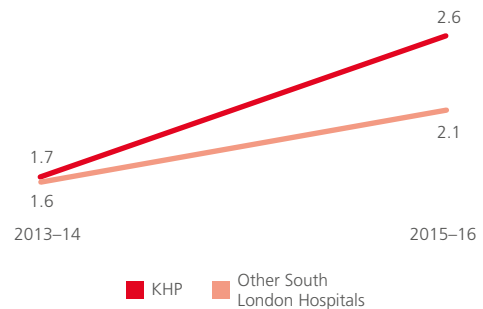
Survival rates for patients who have been admitted to hospital with major injury



Injury is a major cause of death and disability in this country. Preventing the incident is obviously important and other groups continually work towards this end. However, when someone is injured it is natural for patients and their families to want to know that they will receive the best possible care in hospital. On the Trauma Audit & Research Network website, results are presented as rates of survival, rather than rates of death. This is the same approach that is used to present rates of survival for cancer patients and those who have had heart surgery.

All the information below has been taken from the Trauma Audit & Research Network in July 2016. The South East London, Kent and Medway Trauma Network was the lead nationally in terms of actual patient survival rates against predicted rates.

**Figure 25 |** Average rate of survival 2013–14 compared to 2015–16 (additional survivors per 100 patients) at KHP compared to other South London hospitals as recorded in the Trauma Audit & Research Network (TARN)



**Table 1** | The rates of survival for patients who have been injured and treated at different hospitals across South London – total data between Jan 2013 and Dec 2016 (ordered by highest survival rate) as recorded in the Trauma Audit & Research Network (TARN)

Hospital	Total eligible cases between Jan 2013 and Dec 2016	Expected survivors	Actual survivors	Difference*	Adjusted difference**	Percentage survivors
University Hospital, Lewisham	376	350	365	4.0	4.4	97.1
Queen Elizabeth Hospital, Woolwich	365	345	350	1.3	0.5	95.9
Croydon University Hospital	384	368	370	0.4	0.1	96.4
St Helier Hospital	651	614	624	1.4	1.8	95.9
Kingston Hospital	518	485	488	0.4	0.7	94.2
KHP	4,235	3,931	3,984	1.3	0.0	94.1
Epsom General Hospital	172	152	159	3.6	1.5	92.4
St George's Hospital	3,173	2,885	2,900	0.5	0.5	91.4

\*This is a measure of unexpected survivors or deaths that can be used to highlight parts of the trauma care system that requires improvement (in the case of additional deaths) or establish as best practice (additional survivors).

\*\*This is a measure of unexpected survivors or deaths with a statistical adjustment to allow for different mixes of patients at each hospital.

## Other performance and quality of care measures

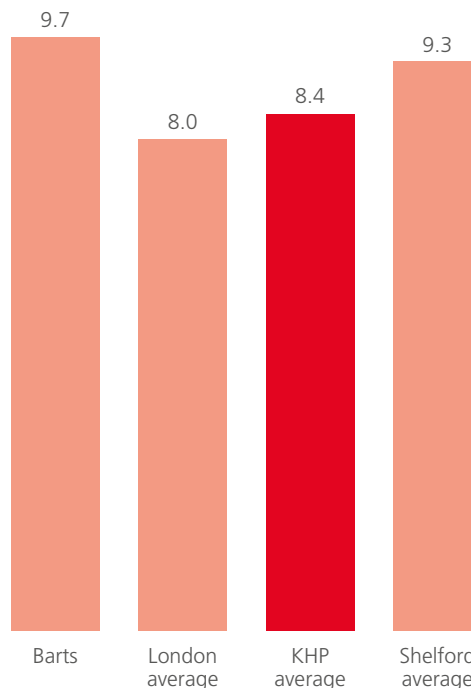
The Trauma and Orthopaedics service use an internal database created by informatics which holds data on benchmarking used for internal business planning and looking for further development opportunities. The information has been used by KHP to help form the business plan for the department and also to make cost savings. The following are some of the key performance measures recorded which are benchmarked against other similar services.

This also includes the Shelford Group, which is an informal organisation of leading English University Teaching Hospitals made up of the following:

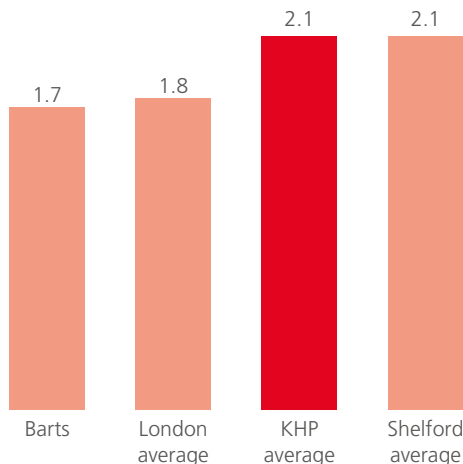
- University Hospitals Birmingham NHS Foundation Trust
- University College London Hospitals NHS Foundation Trust
- Sheffield Teaching Hospitals NHS Foundation Trust
- Oxford University Hospitals NHS Trust
- Newcastle upon Tyne Hospitals NHS Foundation Trust
- **King's College Hospital NHS Foundation Trust (KHP)**

- Imperial College Healthcare NHS Trust
- **Guy's and St Thomas' NHS Foundation Trust (KHP)**
- Central Manchester University Hospitals NHS Foundation Trust
- Cambridge University Hospitals NHS Foundation Trust

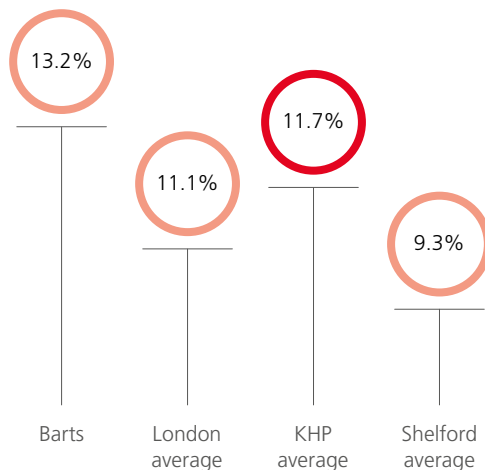
**Figure 26 |** Length of stay for trauma (including major trauma) and orthopaedics compared to other Trusts (2014–15)



**Figure 27** | New to follow up ratio compared to other Trusts (2014–15)



**Figure 28** | Did not attend (DNA) rates compared to other Trusts (2014–15)



## Research in focus

### London Major Trauma System: Management of elderly major trauma patients

*NHS England; London Operational Delivery Networks, 2017*

London Elderly Trauma group: Woodgate, A., Cole, E., **Ahliwalia, R.**, **Bew, D.**, Boyden, G., Chikusu, C., Davies, J., Donegan, L., Durkin, R., Fertleman, M., **Hartnett, P.**, Hicks, D., Hounsom, L., Ingham, F., **James, D.**, Johar, A., Lee, C., Marroney, N., Obaray, S., **Osborne-Smith, V.**, Parrot, R., Purcill, R., Radford, N., **Reichert, I.**, Richardson, D., **Tippett, J.**, Vowles, J., West, A., Wilson, M.

**Executive summary:** There are 11.5 million people aged 65 or over living in the UK. This is the fastest growing age group, and the Office for National Statistics (ONS) estimates that by 2040 one in four people in the UK will be aged 65 or over. The ageing of the population has meant that the incidence of traumatic injury in the elderly is rising in both absolute numbers and as a percentage of national trauma admissions annually. The Trauma Audit Research Network (TARN) data highlights that major trauma patients in the England and Wales are becoming more elderly, and that low-level falls are a leading cause of severe injury.

All elderly major trauma patients should receive the same standards of care as for any adult major trauma patient. Trauma networks should ensure that geriatricians are involved in the development and/or review of local elderly trauma policies and guidance. All staff working with elderly trauma

should be trained to understand the effects of altered physiological reserve and increased comorbid diseases common in older patients. Trauma courses and orientation programmes at major trauma centres (MTCs) and trauma units (TUs) should include the principles of assessing and managing elderly injured patients.

A pan London elderly trauma group, comprising of multi-disciplinary professionals with interest and expertise in managing older injured patients, convened in 2016 to develop clinical guidelines and commissioning standards specifically for elderly major trauma. This report summarises the work of the group and aims to improve recognition of injury, clinical management, outcomes and the patient and family experience. Admission pathways for MTCs and TUs are supplemented with ageing-specific suggestions for the clinical management of elderly major trauma. Guidance in this report should be used in conjunction with the existing local policies, NICE guidance NG39, Major trauma: Assessment and initial management and Trauma Quality Improvement Network System (TQuINS) standards.

A clear message from the group was that elderly trauma patients with multiple injuries are often only identified retrospectively and that prospective recognition of multiple injuries is key to improving overall care and outcomes. To this end, a suggested ED screening tool (which will require validation) is discussed.

### **Acute Porphyria Presenting as Major Trauma: Case Report and Literature Review**

*Journal of Emergency Medicine*, 2016

Norton, J., Hymers, C., Stein, P., Jenkins, J. M., Bew, D.

**Background:** Acute porphyria is historically known as 'the little imitator' in reference to its reputation as a notoriously difficult diagnosis. Variegate porphyria is one of the four acute porphyrias, and can present with both blistering cutaneous lesions and acute neurovisceral attacks involving abdominal pain, neuropsychiatric features, neuropathy, hyponatremia, and a vast array of other nonspecific clinical features.

**Case report:** A 40-year-old man presented to the Emergency Department (ED) as a major trauma call, having been found in an "acutely confused state" surrounded by broken glass. Initial assessment revealed: hypertension, tachycardia, abdominal pain, severe agitation, and confusion with an encephalopathy consistent with acute delirium, a Glasgow Coma Scale score of 13, and head-to-toe "burn-like" abrasions. Computed tomography was unremarkable, and blood tests demonstrated hyponatremia, acute kidney injury, and a neutrophilic leukocytosis. The next of kin eventually revealed a past medical history of variegate porphyria. The patient was experiencing an acute attack and received supportive management prior to transfer to intensive care, subsequently making a full recovery.

**Why should an emergency physician be aware of this?:** This case highlights the importance of recognizing acute medical conditions in patients thought to be suffering from major trauma. Acute porphyria should

be considered in any patient with abdominal pain in combination with neuropsychiatric features, motor neuropathy, or hyponatremia. Patients often present to the ED without any medical history, and accurate diagnosis can be essential in the acute setting to minimize morbidity and mortality. The label of the major trauma call must be taken with great caution, and a broad differential diagnosis must be maintained throughout a diligent and thorough assessment.

**Can contrast-enhanced ultrasonography improve Zone III REBOA placement for prehospital care?**

*Journal of Trauma and Acute Care Surgery*, 2016  
Chaudery, M., Clark, J., Morrison, J.J.,  
Wilson, M.H., Bew, D., Darzi, A.

**Background:** Torso hemorrhage is the primary cause of potentially preventable mortality in trauma. Resuscitative endovascular balloon occlusion of the aorta (REBOA) has been advocated as an adjunct to bridge patients to definitive hemorrhage control. The primary aim of this study was to assess whether contrast-enhanced ultrasonography can improve the accuracy of REBOA placement in the infrarenal aorta (Zone III).

**Methods:** A fluoroscopy-free 'enhanced' Zone III REBOA technique was developed using a porcine cadaver model. A 'standard' over-the-wire Seldinger technique was used, which was enhanced with the addition of a microbubble contrast medium to inflate the balloon, observed with ultrasonography. Following this, attending- and resident-level physicians were randomized into two groups. They were taught either the enhanced with ultrasonography guidance (Group A)

or the standard measuring length of catheter insertion (Group B) technique as part of a human cadaver trauma skills course. Outcomes assessed included time (seconds) from insertion to inflation, accuracy and missed targets. The results were assessed by three endovascular experts.

**Results:** There were 20 participants who performed REBOA with Group A (51 [31]) being significantly faster than Group B (90 [63]) ( $p = 0.003$ ) and more accurate ( $p = 0.023$ ) with no missed targets. Group B had five missed targets, the most common error being inflation within Zone II.

**Conclusion:** For Zone III REBOA, the contrast-enhanced ultrasonography technique is faster and more accurate than the standard technique. This may have value in time-critical and austere environments. Clinical studies are now required to evaluate this approach further.

**An urban trauma centre experience with abdominal vena cava injuries**

*South African Journal of Surgery*, 2016  
Hampton, B., Bew, D., Edu, S., Nicol, A.,  
Naidoo, N., Navsaria, P.H.

**Background:** The aim of the study was to present the surgical management of injuries to the abdominal vena cava (AVC) and to identify clinical and physiological factors and management strategies which affect the outcome.

**Methods:** A retrospective review was conducted of AVC injuries in patients attending the trauma centre at Groote Schuur Hospital, Cape Town, from January 2003 to December 2011. Demographic data, mechanism and agent of injury, level of injury, physiological parameters, associated injuries, trauma scores, management



strategy, morbidity and mortality, and length of hospital stay were taken from the trauma centre's operative databank at Groote Schuur Hospital.

**Results:** 35 patients with AVC injuries were identified. There were 33 penetrating injuries (94%). Gunshot wounds accounted for 28 of them (85%). There were 19 (54%) infrarenal, 9 (26%) juxtarenal, three (7%) suprarenal and four (11%) retrohepatic AVC injuries. Most patients were treated with ligation (66%). There were 17 (49%) deaths. There were significant differences in the preoperative systolic blood pressure ( $p = 0.044$ ), number of red cell units transfused ( $p = 0.001$ ), serum lactate ( $p = 0.007$ ), arterial pH ( $p = 0.002$ ) and preoperative temperature ( $p = 0.000$ ) between the survivors and non-survivors. There was also a significant difference in ligation versus repair between the two groups ( $p = \leq 0.000$ ). There was no difference in the injury severity, level of injury and the number of associated injuries between survivors and non-survivors.

**Conclusion:** AVC injuries are associated with high mortality. Patients presenting with clinical and physiological evidence of shock and who require 'damage control' surgery are more likely to suffer a worse outcome, particularly when multiple physiological derangements are present. Patients who died often have severe associated injuries.

### **The Impact of a Pan-regional Inclusive Trauma System on Quality of Care**

*Annals of Surgery*, 2016

Cole, E., Lecky, F., West, A., Smith, N., Brohi, K., Davenport, R.; ELoTS Study Collaborators.

**Background:** Inclusive trauma systems ensure access to quality injury care for a designated population. The 2007 National Confidential Enquiry into Patient Outcome and Death (NCEPOD) found quality deficits for 60% of severely injured patients. In 2010, London implemented an inclusive trauma system. This represented an opportunity to evaluate the impact of a pan-regional trauma system on quality of care.

**Methods:** Evaluation of the London Trauma System (ELoTS) utilized the NCEPOD study core methodology. Severely injured patients were identified prospectively over a three-month period. Data were collected from prehospital care to 72h following admission or death. Quality, processes of care, and outcome were assessed by expert review using NCEPOD criteria.

**Results:** Three hundred and twenty one severely injured patients were included of which 84% were taken directly to a major trauma center, in contrast to 16% in NCEPOD. Overall quality improved with the proportion of patients receiving "good overall care" increasing significantly [NCEPOD: 48% vs ALL-ELoTS: 69%, RR 1.3 (1.2 to 1.4),  $P < 0.01$ ], primarily through improvements in organizational processes rather than clinical care. Improved quality was associated with increased early survival, with the greatest benefit for critically injured patients [NCEPOD: 31% vs All-ELoTS 11%, RR 0.37 (0.33 to 0.99),  $P = 0.04$ ].

**Conclusion:** Inclusive trauma systems deliver quality and process improvements, primarily through organizational change. Most improvements were seen in major trauma centers; however, systems implementation did not automatically lead to a reduction in clinical deficits in care.

**National early warning score at Emergency Department triage may allow earlier identification of patients with severe sepsis and septic shock: A retrospective observational study**

*Emergency Medicine Journal*, 2016

Keep, J.W., Messmer, A.S., Sladden, R., Burrell, N., Pinate, R., Tunnicliff, M., Glucksman, E.

**Background:** Severe sepsis and septic shock (SS) are time-critical medical emergencies that affect millions of people in the world. Earlier administration of antibiotics has been shown to reduce mortality from SS; however, the initiation of early resuscitation requires recognition that a patient may have sepsis. Early warning scores (EWS) are broadly used to detect patient deterioration, but to date have not been evaluated to detect patients at risk for SS. The purpose of our study was to look at the relationship between the initial national EWS (NEWS) in the emergency department (ED) and the diagnosis of SS.

**Methods:** We performed a retrospective, single-centre, observational study in the ED of an urban university hospital with an annual attendance of 140 000 patients. We aimed to include 500 consecutive non-trauma adult patients presenting to the ED with Manchester Triage System (MTS) category 1–3. The final diagnosis was taken from either the ED medical records or the hospital discharge summary. For all NEWS, the sensitivity and specificity to detect patients with SS was calculated.

**Results:** A total of 500 patients were included, 27 patients (5.4%) met the criteria for SS. The area under the curve (AUC) for NEWS to identify patient at risk for SS is 0.89 (95% CI 0.84

to 0.94). A NEWS of 3 or more at ED triage has a sensitivity of 92.6% (95% CI 74.2% to 98.7%) and a specificity of 77% (95% CI 72.8% to 80.6%) to detect patients at risk for SS at ED triage.

**Conclusion:** A NEWS of three or more at ED triage may be the trigger to systematically screen the patient for SS, which may ultimately lead to early recognition and treatment.

**Traumatic intra-abdominal hemorrhage control: Has current technology tipped the balance toward a role for prehospital intervention?**

*Journal of Trauma and Acute Care Surgery*, 2015

Chaudery, M., Clark, J., Wilson, M H., Bew, D., Yang, G-Z., Darzi, A.

**Background:** The identification and control of traumatic hemorrhage from the torso remains a major challenge and carries a significant mortality despite the reduction of transfer times. This review examines the current technologies that are available for abdominal hemorrhage control within the prehospital setting and evaluates their effectiveness.

**Methods:** A systematic search of online databases was undertaken. Where appropriate, evidence was highlighted using the Oxford levels of clinical evidence. The primary outcome assessed was mortality, and secondary outcomes included blood loss and complications associated with each technique.

**Results:** Of 89 studies, 34 met the inclusion criteria, of which 29 were preclinical in vivo trials and five were clinical. Techniques were subdivided into mechanical compression, endovascular

control and energy-based hemostatic devices. Gas insufflation and manual pressure techniques had no associated mortalities. There was one mortality with high intensity focused ultrasound. The intra-abdominal infiltration of foam treatment had 64% and the resuscitative endovascular balloon occlusion of the aorta had 74% mortality risk reduction. In the majority of cases, morbidity and blood loss associated with each interventional procedure were less than their respective controls.

**Conclusion:** Mortality from traumatic intra-abdominal hemorrhage could be reduced through early intervention at the scene by emerging technology. Manual pressure or the resuscitative endovascular balloon occlusion of the aorta techniques have demonstrated clinical effectiveness for the control of major vessel bleeding, although complications need to be carefully considered before advocating clinical use. At present, fast transfer to the trauma center remains paramount.

#### **A cross-sectional study of knife injuries at a London major trauma centre**

*Annals of the Royal College of Surgeons of England*, 2014

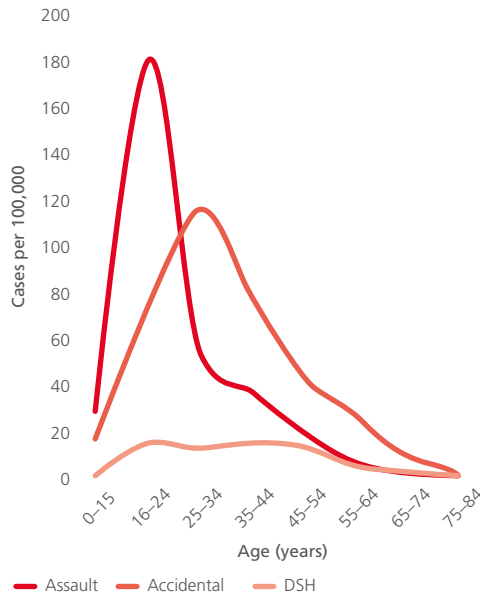
Pallett, J.R., Sutherland, E., Glucksman, E., Tunnicliff, M., Keep, J.W.

**Background:** No national recording systems for knife injuries exist in the UK. Understanding the true size and nature of the problem of knife injuries is the first stage in reducing the burden of this injury. The aim of this study was to survey every knife injury seen in a single inner city emergency department (ED) over a one-year period.

**Methods:** A cross-sectional observational study was performed of all patients attending with a knife injury to the ED of a London major trauma centre in 2011. Demographic characteristics, patterns of injury, morbidity and mortality data were collected.

**Results:** A total of 938 knife injuries were identified from 127,191 attendances (0.77% of all visits) with a case fatality rate of 0.53%. A quarter (24%) of the major trauma team's caseload was for knife injuries. Overall, 44% of injuries were self-reported as assaults, 49% as accidents and 8% as deliberate self-harm. The highest age specific incident rate occurred in the 16–24 year age category (263/100,000). Multiple injuries were seen in 19% of cases, of which only 81% were recorded as assaults. The mean length of stay for those admitted to hospital was 3.04 days. Intrathoracic injury was seen in 26% of cases of chest trauma and 24% of abdominal injuries had a second additional chest injury. **Conclusions:** Violent intentional injuries are a significant contributory factor to the workload of the major trauma team at this centre. This paper contributes to a more comprehensive understanding of the nature of these injuries seen in the ED.

**Figure 29** | Age specific incident rates of knife injuries including accidental, assault and deliberate self-harm injuries (DSH)



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Plastics

# Plastics

## Description of the service

King's Health Partners are one of the largest plastic surgery departments in the UK, working closely with the King's Major Trauma Centre.

Our service covers:

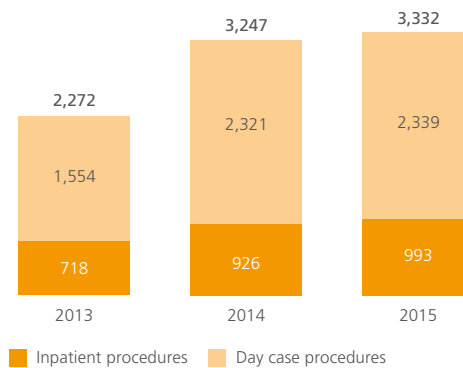
- general plastic surgery
- trauma and soft tissue injuries
- lower limb trauma
- hand surgery
- reconstruction following skin, breast, head and neck and perineal cancers
- ear reconstruction
- epidermolysis bullosa
- facial reanimation
- trauma
- paediatric plastic surgery

- treatment as an inpatient or day case.

We provide clinics in St Thomas' Hospital, Guy's Hospital and Evelina London Children's Hospital. We also hold clinics in:

- King's College Hospital
- Queen Elizabeth Hospital
- Bromley Hospitals.

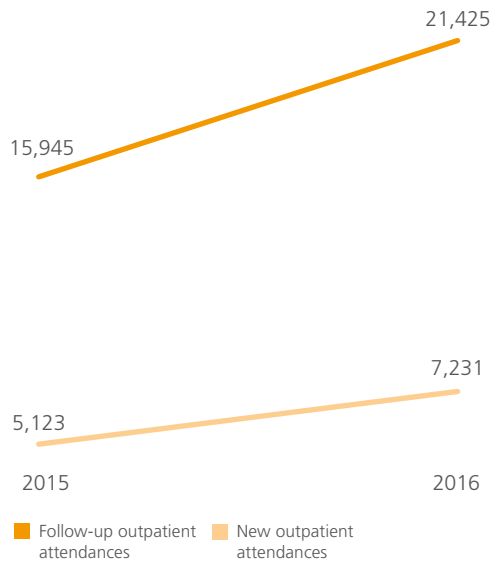
**Figure 30 |** Total number of plastic surgery procedures (2013–15)



The plastics department has continued to expand offering care to a network of hospitals,

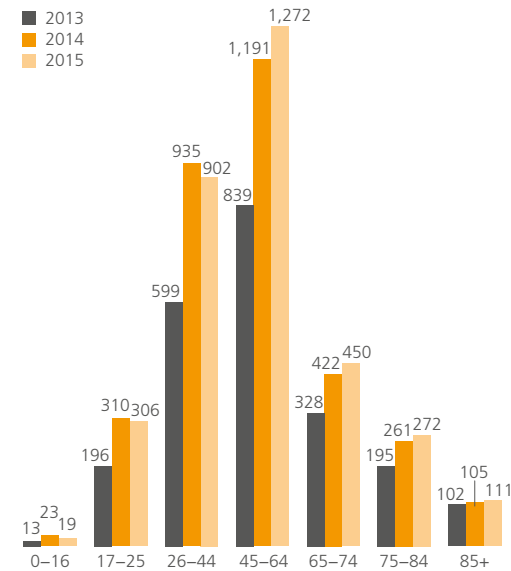
which is demonstrated through the increase in total number of procedures. The plastics department has recently developed a procedure room which offers patients the opportunity to receive minor procedures without the need to be treated in a theatre environment. This has improved theatre productivity and improved patient experience by offering patients a "see and treat service" on the same day.

**Figure 31 |** Outpatient attendances in 2015–16



Through the expansion of the hub and spoke model of the plastics department, the team have been able to offer a range of plastics expertise appointment at networked hospitals, increasing the number of patients seen year on year.

**Figure 32 |** Total number of plastic surgery procedures by age (2013–15)

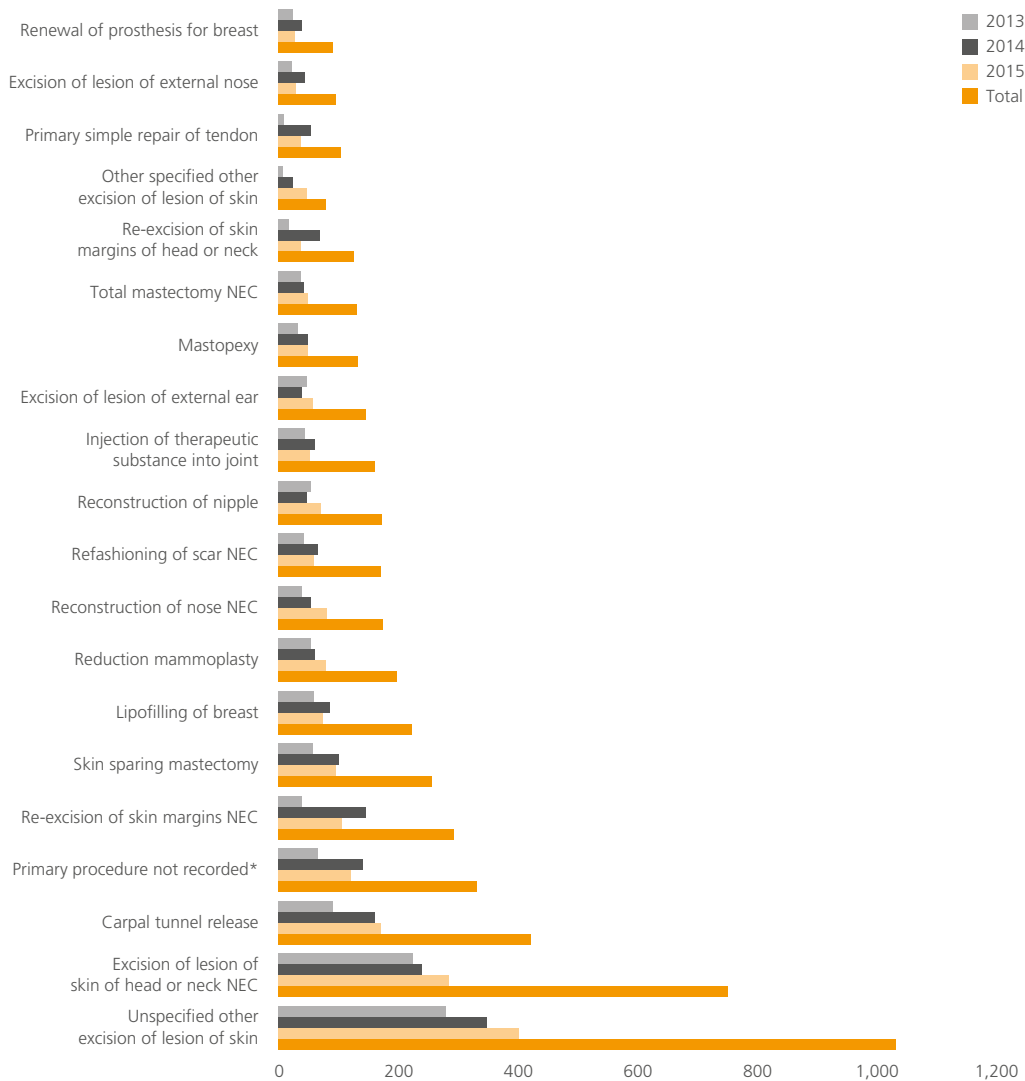


The graph demonstrates that the highest volume of procedures performed was for 45–64 year olds. This is related to the predominate procedures in plastics being skin cancer and breast cancer reconstructions which occur in this age bracket.

The top 20 procedures show the diversity of the plastics department, ranging from skin cancer treatments to breast cancer reconstruction operations to expansions in our head and neck reconstruction service.



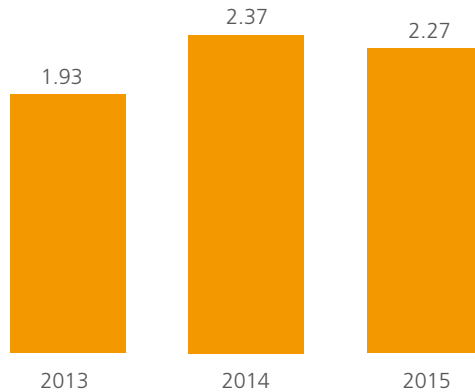
**Figure 33 | Top 20 plastic surgery procedures carried out**



Note: \* = primary procedure not recorded; NEC = not elsewhere classified

## Clinical outcomes

**Figure 34 |** Average length of stay (2013–15)

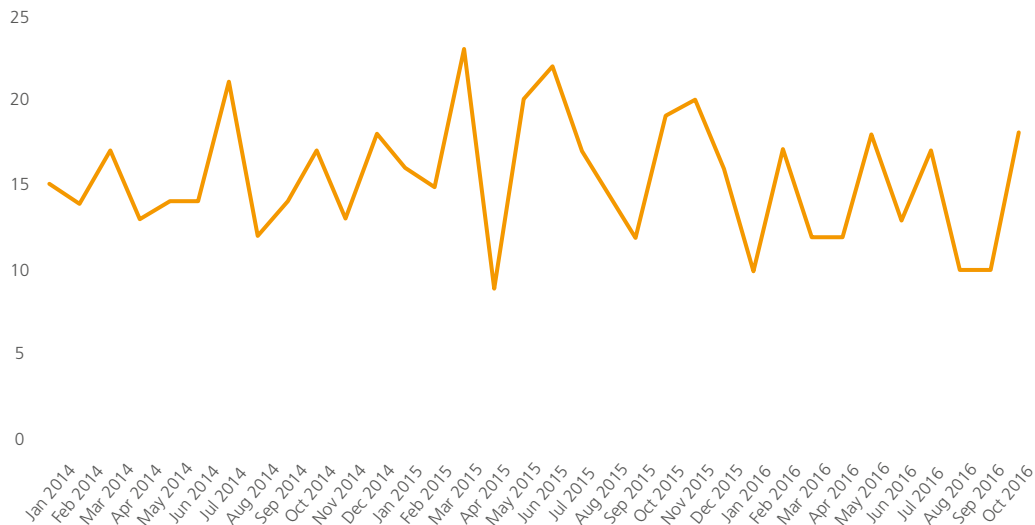


Work has been undertaken in 2015–16 to provide a plastics outreach team – providing support to patients who have recently undergone breast reconstruction, teaching them how to manage their dressings at home with the support of their community nurse and hospital nurse expert.

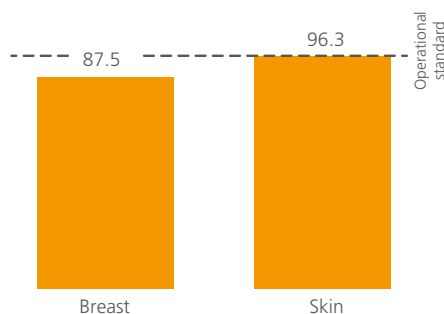
Mortality: Mortality rates are very low; 2 cases in 2013–14, non in 2014–15, and 1 in 2015–16.

The total number of flap procedures performed per month is 15, with a 98% flap survival rate, which is comparable to other high performing units in the country.

**Figure 35 |** Total number of flap procedures performed per month (Jan 2014 – Oct 2016)

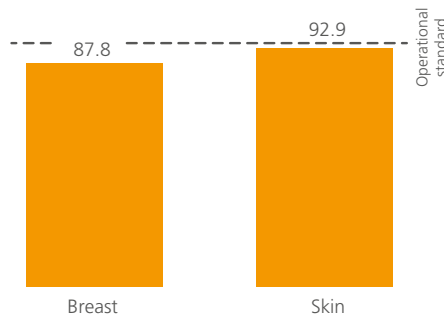


**Figure 36 |** Breast and skin cancer waiting times at GSTT (Oct 2014 – Oct 2016)

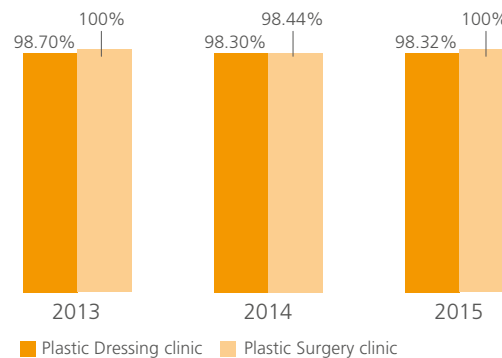


The graph demonstrates that for skin cancer patients the national standard (95% compliance) of providing treatment within 31 days of referral has been met by the skin plastics team. The breast plastics team have not met the standard; this is often due to late referrals to the unit or patients choosing to defer major surgery until they have had a chance to consider the options.

**Figure 37 |** 31-day wait to subsequent treatments for breast and skin cancer at GSTT



**Figure 38 |** Friends & Family Test (FFT) data for Plastics at GSTT (2013–15)



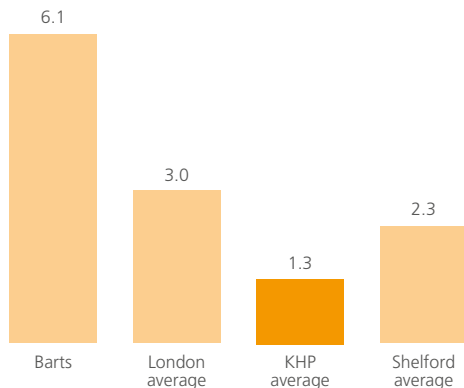
Friends and Family test feedback for plastics demonstrates a very high patient satisfaction score for patients receiving care in both the plastics dressings and plastics surgery clinic.

## Other performance

The Plastics service uses an internal database created by local informatics which holds data on benchmarking for internal business planning and to progress further opportunities. The following are some of the key performance measures recorded, which are benchmarked against other similar services, including the Shelford Group.

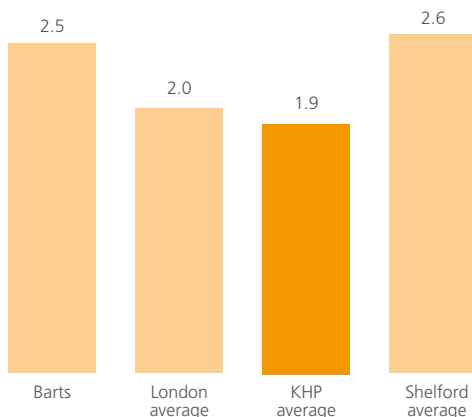
Work has been undertaken at KHP in 2015–16 to provide a Plastics Outreach team in order to reduce patient length of stay.

**Figure 39** | Length of stay compared to other Trusts (2014–15)



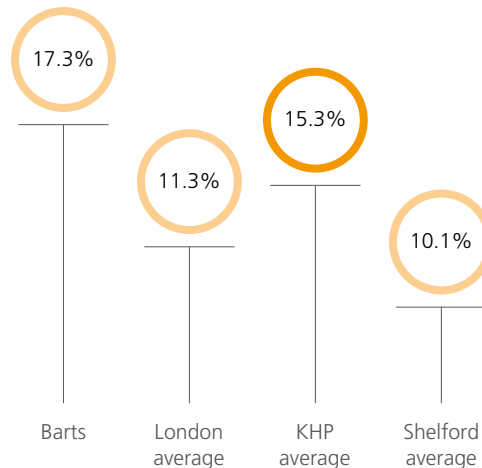
KHP are lower than the average due to the use of a Plastics Outreach team and the strong CNS nursing team who offer telephone and drop-in support to patients.

**Figure 40** | New-to-follow up ratio compared to other Trusts (2014–15)



## Did not attend rates

The DNA rates for plastics is higher than the London average. Work has been undertaken with the tech company Doctor.Dr (a text messaging and integrated hub digital service) to provide patients with information and reminders of their appointments. Since being introduced the DNA rate has decreased by 2% and there is opportunity to provide more information to patients (through interactive web information) to reduce DNA rates further.



## Research in focus

### **Free sural artery perforator flap: An occasional gift in oral cavity reconstruction**

*Head & Neck*, 2016

Pease, N. L., Davies, A., Townley, W. A.

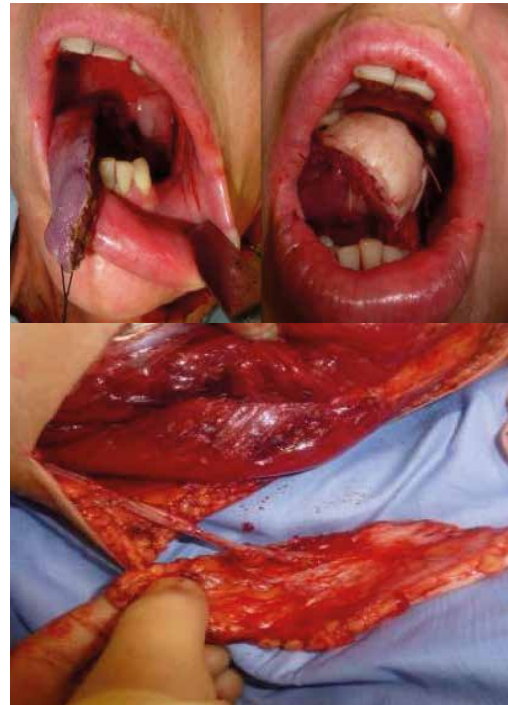
**Background:** The medial sural artery perforator (MSAP) flap is becoming a popular strategy for reconstructing intraoral defects. We present a case in which no MSAPs were present, however, a perforator-based calf flap was successfully raised on the sural artery and used for tongue reconstruction. A corresponding anatomic study was undertaken to establish if this finding was reproducible.

**Methods:** A 58-year-old woman underwent left hemiglossectomy for a squamous cell carcinoma of the tongue. Subsequently, 6 fresh frozen cadaveric limbs were dissected examining the blood supply of the posterior calf skin.

**Results:** The sural artery perforator (SAP) flap successfully reconstructed the defect. Our cadaveric study similarly demonstrated a septocutaneous SAP supplying the posterior calf skin in 1 of 6 limbs.

**Conclusion:** SAPs allow a favorable flap dissection, as opposed to the musculocutaneous course of MSAPs. Our findings provide further evidence of the versatility of the calf donor site.

**Figure 41 |** (A) Flap in situ, based on sural artery perforator from left medial calf; (B) Flap in situ, based on sural artery perforator from left medial calf



### **Evolution from the TUG to PAP flap for breast reconstruction: Comparison and refinements of technique**

*Journal of Plastic Reconstructive and Aesthetic Surgery*, 2015

Hunter, J. E., Lardi, A. M., Dower, D. R., Farhadi, J.

**Background:** Limitations of the transverse upper gracilis (TUG) flap for autologous breast reconstruction include: short pedicle, modest

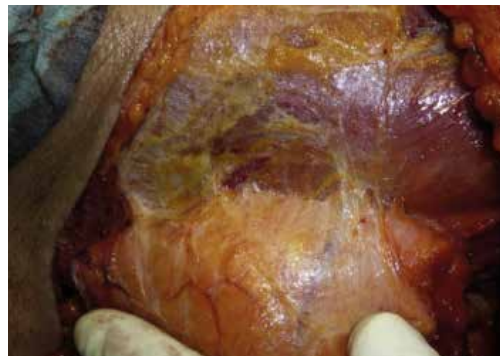
volume, muscle sacrifice and a problematic donor site. The Profunda Artery Perforator (PAP) flap utilises large perforators posterior to the gracilis muscle. We describe preliminary experience of its use and compare it to our large series of TUG flaps.

**Methods:** Our technique has evolved from frog-leg to lithotomy position, and from an antero-posterior to cranio-caudal raise. This allows either the descending branch of the inferior gluteal artery perforators (IGAP) or the TUG flap as alternatives should PAP perforators be unsuitable intra-operatively. A prospective database was utilised to compare TUG and PAP flaps undertaken 2010–2013.

**Results:** 54 TUG and 22 PAP flaps were performed. 4 PAP flaps were converted to IGAP flaps and 1 to TUG intra-operatively. 97% of all flaps were successful. Mean flap weight was 295 g (TUG) and 242 g (PAP). Donor site complications for both series included seroma (4 TUG, 1 PAP) sensory disturbance (2 TUG, 1 PAP) and scar revision (3 TUG, 1 PAP).

**Conclusion:** Our preliminary experience of the PAP flap has not been universally favourable compared to the TUG flap. It is a more challenging flap to raise, which carries with it a learning curve, especially if raised in the supine position; we present our learning points for safer flap harvest, allowing the TUG as a bail out option. The benefits of the PAP include a longer pedicle, without the need to sacrifice muscle; the perforators should have a more defined and larger perfusion zone. The scar is better hidden, but we have not yet proven significant improvements to the donor site compared to the TUG flap.

**Figure 42 |** Intra-operative photograph of PAP raise



**An evaluation of resource utilisation of single stage porcine acellular dermal matrix assisted breast reconstruction: A comparative study**  
*The Breast*, 2014

Kilchenmann, A. J. R., Lardi, A. M., Ho-Asjoe, M., Junge, K., Farhadi, J.

**Objectives:** To evaluate resource utilization of single stage porcine acellular dermal matrix (ADM) assisted breast reconstruction compared with tissue expander (TE), latissimus dorsi flap and implant (LD/I) and latissimus dorsi flap and TE (LD/TE) reconstructive techniques.

**Materials and methods:** Clinical data was collected for length of stay, operative time, additional hospitalisations and operative procedures, and outpatient appointments for 101 patients undergoing unilateral implant based breast reconstruction. Resources utilised by ADM (Strattice Reconstructive Tissue Matrix T) patients were analysed and compared to the resource usage of traditional techniques.

**Results:** 25 patients undergoing single stage ADM (ADM/I) were compared with 27 having TE, 32 having LD/I and 17 having LD/TE reconstructions. Follow up was 24 months. Compared to TE, ADM/I had similar length of stay and operative time, lower rate and number of additional procedures, fewer, shorter re-admissions ( $p < 0.05$ ) and fewer appointments ( $p < 0.05$ ). Compared to LD/TE, ADM/I had shorter length of stay and operative time ( $p < 0.05$ ), lower rate and number of additional procedures, fewer, shorter re-admissions ( $p < 0.05$ ) and fewer appointments ( $p < 0.05$ ). Compared to LD/I, ADM/I had shorter length of stay ( $p < 0.05$ ) and operative time ( $p < 0.05$ ), fewer appointments, similar rate and number of additional procedures but required more and longer re-admissions.

**Conclusion:** In our experience, unilateral single stage ADM/I was associated with fewer resources utilised in comparison with two staged TE and LD/TE reconstructions in both complication-free and complicated settings over a 24-month period, despite requiring aesthetic revision in 60.9% of patients. Compared to LD/I, resource utilisation was commensurate in complication-free and complicated settings.

**Engineered autologous cartilage tissue for nasal reconstruction after tumour resection: An observational first-in-human trial**

*The Lancet*, 2014

Fulco, I., Miot, S., Haug, M.D., Barbero, A., Wixmerten, A., Feliciano, S., Wolf, F., Jundt, G., Marsano, A., Farhadi, J., Heberer, M., Jakob, M., Schaefer, D.J., Martin, I.

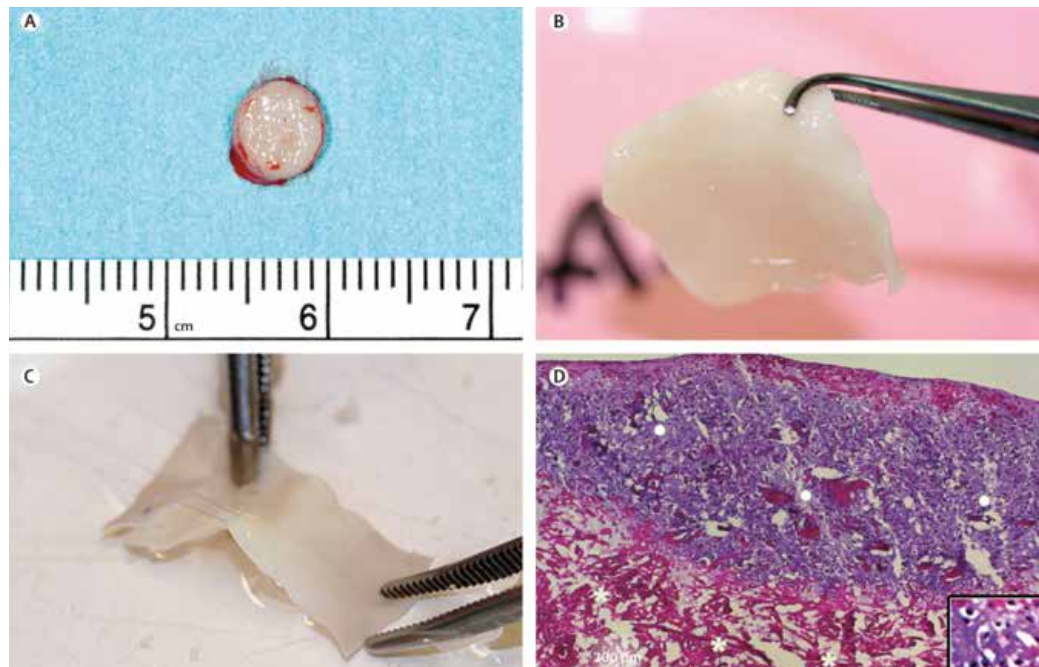
**Background:** Autologous native cartilage from the nasal septum, ear or rib is the standard material for surgical reconstruction of the nasal alar lobule after two-layer excision of non-melanoma skin cancer. We assessed whether engineered autologous cartilage grafts allow safe and functional alar lobule restoration. Methods: In a first-in-human trial, we recruited five patients at the University Hospital Basel (Basel, Switzerland). To be eligible, patients had to be aged at least 18 years and have a two-layer defect ( $\geq 50\%$  size of alar subunit) after excision of non-melanoma skin cancer on the alar lobule. Chondrocytes (isolated from a 6 mm cartilage biopsy sample from the nasal septum harvested under local anaesthesia during collection of tumour biopsy sample) were expanded, seeded, and cultured with autologous serum onto collagen type I and type III membranes in the course of four weeks. The resulting engineered cartilage grafts (25 mm  $\times$  25 mm  $\times$  2 mm) were shaped intra-operatively and implanted after tumour excision under paramedian forehead or nasolabial flaps, as in standard reconstruction with native cartilage. During flap refinement after six months, we took biopsy samples of repair tissues and histologically analysed them. The primary outcomes were safety and feasibility of the procedure, assessed 12 months after reconstruction. At least one year after implantation, when reconstruction is typically stabilised, we assessed patient satisfaction and functional outcomes (alar cutaneous sensibility, structural stability, and respiratory flow rate).

**Findings:** Between Dec 13, 2010, and Feb 6, 2012, we enrolled two women and three men aged 76–88 years. All engineered grafts contained a mixed hyaline and fibrous cartilage matrix. Six months after implantation, reconstructed tissues displayed fibromuscular fatty structures typical of the alar lobule. After one year, all patients were satisfied with the aesthetic and functional outcomes and no adverse events

had been recorded. Cutaneous sensibility and structural stability of the reconstructed area were clinically satisfactory, with adequate respiratory function.

**Interpretation:** Autologous nasal cartilage tissues can be engineered and clinically used for functional restoration of alar lobules. Engineered cartilage should now be assessed for other challenging facial reconstructions.

**Figure 43 |** From the nasal biopsy to the engineered cartilage graft (A) Macroscopic view of the biopsy sample (6 mm diameter) of nasal septum cartilage; (B) White and glossy appearance of an engineered cartilage graft; (C) Qualitative handling and suturing tests; (D) Haematoxylin and eosin staining of frozen sections to fulfil the release criteria for graft implantation. Asterisks indicate the compact layer of the membrane, which is predominantly cell-free; circles indicate the porous layer of the membrane, including cells and the deposited extracellular matrix. Reproduced from Fulco *et al.*, 2014 [6]





### **IgG4 subclass antibodies impair antitumor immunity in melanoma**

*Journal of Clinical Investigation*, 2013

Karagiannis, P., Gilbert, A.E., Josephs, D.H., Ali, N., Dodev, T., Saul, L., Correa, I., Roberts, L., Beddowes, E., Koers, A., Hobbs, C., Ferreira, S., Geh, J.L.C., Healy, C., Harries, M., Acland, K.M., Blower, P.J., Mitchell, T., Fear, D.J., Spicer, J.F., Lacy, K.E., Nestle, F.O., Karagiannis, S.N.

Host-induced antibodies and their contributions to cancer inflammation are largely unexplored. IgG4 subclass antibodies are present in IL-10-driven Th2 immune responses in some inflammatory conditions. Since Th2-biased inflammation is a hallmark of tumor microenvironments, we investigated the presence and functional implications of IgG4 in malignant melanoma. Consistent with Th2 inflammation, CD22+ B cells and IgG4+-infiltrating cells accumulated in tumors, and IL-10, IL-4, and tumor-reactive IgG4 were expressed in situ. When compared with B cells from patient lymph nodes and blood, tumor-associated B cells were polarized to produce IgG4. Secreted B cells increased VEGF and IgG4, and tumor cells enhanced IL-10 secretion in cocultures. Unlike IgG1, an engineered tumor antigen-specific IgG4 was ineffective in triggering effector cell-mediated tumor killing in vitro.

Antigen-specific and nonspecific IgG4 inhibited IgG1-mediated tumoricidal functions. IgG4 blockade was mediated through reduction of FcγRI activation. Additionally, IgG4 significantly impaired the potency of tumoricidal IgG1 in a human melanoma xenograft mouse model.

Furthermore, serum IgG4 was inversely correlated with patient survival. These findings suggest that IgG4 promoted by tumor-induced Th2-biased inflammation may restrict effector cell functions against tumors, providing a previously unexplored aspect of tumor-induced immune escape and a basis for biomarker development and patientspecific therapeutic approaches.

### **Factors affecting post-operative complications following skin sparing mastectomy with immediate breast reconstruction**

*Breast*, 2011

Davies, K., Allan, L., Roblin, P., Ross, D., Farhadi, J.

**Background:** Skin sparing mastectomy (SSM) followed by immediate breast reconstruction (IBR) is not only oncologically safe but provides also significant benefits both cosmetically and functionally. The superiority of this technique can only be fully established, however, by developing a framework for minimising complications. The present study seeks to elucidate the key factors affecting outcome.

**Methods:** Data for all skin sparing mastectomies with immediate autologous and implant based reconstructions, performed in a three year period (2006–2008) was retrospectively collated. Complications were classified into major and minor. Patients were excluded who had flap loss due to vascular complications.

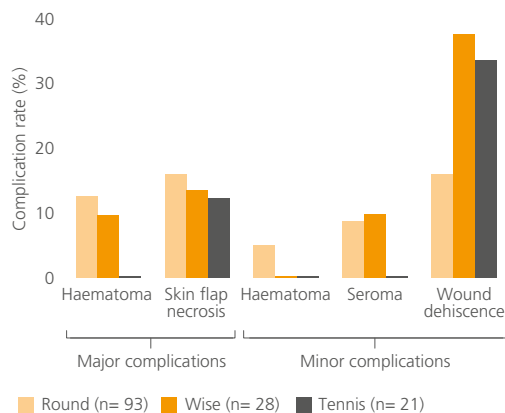
**Results:** The total number analysed was 151. 17.2% had major complications, 23% had minor and 61% had no complications.

The Wise and the 'tennis' incision had significantly higher rates of wound dehiscence

when compared with the periareolar incision ( $p = 0.025$ ,  $p = 0.098$ ). There was no significant difference between diathermy or blade dissection techniques, or the use of subcutaneous adrenaline infiltration. Increasing BMI was associated with increased skin flap necrosis and wound dehiscence, and an excised breast mass of greater than 750 g and a sternal notch to nipple length of greater than 26 cm are also associated with increased flap-related complications ( $p = 0.0002$ ,  $p = 0.0049$ ).

**Conclusion:** Factors such as Wise pattern and 'tennis' incision, BMI and breast mass and sternal notch to nipple length adversely affect skin sparing mastectomy flap morbidity. These factors should be factored in to patient selection and operative planning especially for obese and large breasted women undergoing skin sparing mastectomy with immediate breast reconstruction.

**Figure 44** | Complication rates associated with skin incision pattern highlighting major and minor complications



**Immediate microvascular breast reconstruction after neoadjuvant chemotherapy: Complication rates and effect on start of adjuvant treatment**

*Annals of Surgical Oncology*, 2010

Zweifel-Schlatter, M., Darhouse, N., Roblin, P., Ross, D., Zweifel, M., Farhadi, J.

**Background:** The effect of neoadjuvant chemotherapy on immediate microvascular breast reconstruction is of concern because any complication might delay adjuvant treatment. We sought to determine whether the complication rate is increased and whether the interval between surgery and subsequent treatment is delayed compared with patients without neoadjuvant chemotherapy.

**Methods:** Complication rates and interval from surgery until adjuvant treatment of patients with mastectomy for locally-advanced breast cancer followed by immediate microvascular breast reconstruction (deep inferior epigastric perforator (DIEP) flap, transverse rectus abdominis musculocutaneous (TRAM) flap, superior gluteal artery perforator (SGAP) flap, transverse musculocutaneous gracilis (TMG) flap, or superficial inferior epigastric artery (SIEA) flap) after neoadjuvant chemotherapy were compared with those of patients who underwent immediate breast reconstruction without neoadjuvant chemotherapy.

**Results:** Forty-seven patients with locally-advanced breast cancers who underwent neoadjuvant chemotherapy before mastectomy and immediate microvascular reconstruction and 52 patients without neoadjuvant chemotherapy were identified. 36% of patients with neoadjuvant

chemotherapy had one or more complications compared with 29% of patients without previous chemotherapy, but this difference was not statistically significant. The occurrence of complications in patients with neoadjuvant chemotherapy did not result in a delayed start of adjuvant treatment compared with patients without complications after neoadjuvant chemotherapy (43.6 vs. 44.6 days).

**Conclusions:** Immediate microvascular breast reconstruction after neoadjuvant chemotherapy does not result in an increased complication rate or delay the start of adjuvant treatment, even if complications occur and therefore can be performed safely in patients with locally-advanced breast cancer.

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# Education and training

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Education and training is well-established across the CAG at undergraduate level with the help of the Education Academy and within the Faculty of Life Sciences and Medicine.

The trauma and orthopaedic departments across KCH and GSTT sites provide comprehensive training for Foundation Year and Core trainees.

Following the successful bidding through the Medical and Dental Educational Commissioning (MDEC) process, KCH has been the lead provider for Trauma and Orthopaedics Speciality Training across South East London. Diane Back and Venu Kavarthapu have been appointed as the joint Orthopaedic Training Programme Directors.

## Training

### Orthopaedics training

This is well-established at undergraduate level with the help of the Education Academy and within the Medical School. The Plastics department is involved in the pan-London training programme with the Medical and Dental Education Commissioning stage 2 bidding.

The post-graduate teaching and training is provided according to the national standards.

KCH has an advanced high-fidelity Orthopaedic Simulator and runs simulation training courses nationally. Regional MSc Orthopaedics teaching is predominantly delivered at GSTT.

There have also been developments in the education/training offer for medical/nursing/allied health professionals e.g. Regional Training Programmes; Local Education and Training Board (LETB); MSc; simulation and robotic training.

### King's Trauma Skills Course

We have a twice yearly 'King's Trauma Skills Course' which teaches damage control and major trauma skills in a multidisciplinary setting on fresh frozen cadavers. This was the first multidisciplinary course in the UK to teach using fresh frozen cadavers in conjunction with our network hospitals and the Kent Surrey and Sussex and London Air Ambulance.

Over 200 members of staff have now completed the course, it has been extended to train members of the London Ambulance and South

East coast ambulance services and was cited as an outstanding aspect of our trauma network at peer review.

## King's International Fellowship Programme

An international training fellowship has been set-up at King's endorsed by the Royal College of Surgeons (RCS) with fellowships in Trauma Surgery, Bariatrics and Liver Surgery. The 12–24 month programme offers training and development under the supervision of a leading consultant and an educational supervisor. Candidates sponsored by King's and the RCS receive a certificate of completion from the college president.

## Future plans

The orthopaedic education and training across King's Health Partners will be streamlined and enhanced further, with particular emphasis on Technology Enhanced Learning. We are in the process of developing e-learning modules in orthopaedics for undergraduate and post-graduate trainees. Academic posts will be created in the departments and these trainees will be included in the core educators group to help them develop into future training leads.

## Innovations

The simulation trainers' core group at KCH have developed a 'King's Orthopaedic Trauma Simulator' that can potentially improve competencies in limb trauma surgery. The team is also in the process of developing a 'motion analysis' unit that can help improve the motor skills required in acquiring surgical competencies.

The King's Trauma Surgical Fellowship has combined general surgery and orthopaedic trauma surgery, as is common in Germany and Holland. The first experiences of this innovation at KCH have been positive and constructive.

## Orthopaedic Physician Associates at GSTT

Physician Associates (PA) are a relatively new profession in the UK; however, they have been a part of healthcare teams in a variety of specialties in the United States for over 50 years. PAs are trained using the medical model in an intense postgraduate program usually lasting 2–3 years.

The PA role was introduced to the orthopaedic department at GSTT in August 2015. We started with one PA working in trauma orthopaedics at St Thomas' and now have five PAs in the department. Each PA is paired with an elective orthopaedic team (upper limb, foot and ankle, hips, knees and spine) to provide high-quality

and continuity of care. Their role includes but is not limited to: ward rounds, treatment plans, interpreting tests, diagnosing, care coordination, performing procedures, clinical research audits, M&M presentations, seeing patients in clinic, covering the trauma side when needed and first assist in surgery. As of now their two major limitations in the UK are prescribing and requesting ionising radiation (ex-chest x-ray or CT scan), as they are still seeking statutory registration.

It has now been more than a year since the implementation of the PA role in the department and it has taken off remarkably well. Their training within the orthopaedic department combined with their day-to-day interactions with patients, allied healthcare professionals and the orthopaedic team help to provide effective communication leading to higher quality patient-centred care. Future plans include expanding and recruitment of more PAs to the St Thomas' orthopaedic site, as well as structured training and teaching.

## Key achievements

- Established regional trauma and orthopaedic teaching for specialty trainees across south London and Kent, Surrey and Sussex regions
- Enhanced the trauma and orthopaedic simulation training facilities at KCH site, accessible to all trainees nationally
- Enhanced orthopaedic clinical teaching to the medical students with ward

rounds and bedside clinical teaching, in addition to outpatient and operating room clinical exposure.

## Training and developing the entire workforce using high-quality, easily accessible, online training resources

The current method of teaching is predominantly using lectures, clinical conferences, journal clubs, complex case discussions and problem-solving. Live video conference facilities have recently been introduced at KCH site to make this teaching accessible to the trainees based at other hospital sites of the Trust. High quality, consultant led and interactive teaching sessions are delivered twice weekly aimed at the junior and senior trainees. The trauma and orthopaedic simulation training is open to the nursing, theatre personnel and physiotherapy professionals, in addition to the medical trainees.

## Providing support to improve the overall quality of education and training and increasing learning opportunities for students and trainees

Local and regional faculty groups have been established to constantly evaluate the overall

quality and training and education provided locally and regionally. Feedback from trainees and students is actively encouraged to help constantly improve the teaching and training delivered.

## Extending our education reach at home and abroad, widening access

The trauma and orthopaedic department provides training exposure covering all subspecialty areas apart from tumour surgery. Fellowship training opportunities in some areas are well recognised regionally and nationally.

## Better prevention and management of long term conditions, by delivering multi-professional education and training across care pathways to enhance the delivery of integrated care

King's diabetic foot meetings are recognised nationally in providing training and education on the multidisciplinary management of diabetic foot pathologies. There is emphasis on the prevention and early diagnosis of Charcot arthropathy. These include a separate patient education meeting organised every year. The King's Charcot foot reconstruction meeting is recognised

internationally and is very well known for its multi-professional education.

## Quality of education programmes

The FRCS Orthopaedics teaching courses candidates' feedback has been very positive. We have also put mechanisms in place to capture candidate feedback for all the simulation training sessions. The students' feedback on the weekly teaching sessions has also been positive.

# Research income over the last 3 years

**Table 2 | Commercial income between 2013–16**

R&D ID	Protocol number	Investigator	Study title	Conformation of capacity & capability	Study status	Therapeutic area	Income
KCH2949	000001/BT	Ines Riechert	Phase III, pivotal, multicentre, randomised, double-blind controlled Study to evaluate the Efficacy and Safety of Autologous Osteoblastic Cells (PREOB®) Implantation in Early Stage Non Traumatic Osteonecrosis of the Femoral Head	24/07/2015	Approved – Recruiting Active	Orthopaedics	£3,700.00
GSTFT2951	CLEn-01	Jian Farhadi	The Safety and Performance of the Orbix Breast Lifting System	25/03/2014	Completed – In follow-up	General Surgery	£65,960.00
GSTFT3076	10008	Diane Back	Short, Medium and Long Term Survivorship of Attune™ Primary Total Knee Prostheses				£6,360.00
							<b>£76,020.00</b>



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South London and Maudsley   
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