



London Acute Kidney Injury Network



London
Strategic Clinical Networks

London AKI Network Update

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On behalf of London AKI Network





Kidney function

Kidney function is critical to health and survival.

The kidneys excrete waste products and chemicals (including drugs), regulate body fluid, maintain acid-base balance and control blood electrolyte levels. They achieve this by closely regulating the volume and composition of urine. In addition the kidneys have several endocrine functions - they activate vitamin D (needed for calcium balance), facilitate red cell formation (through the secretion of erythropoietin) and regulate blood pressure (through the production of renin).

To function the kidneys need adequate renal blood flow and oxygenation. The parenchyma or 'substance' of the kidneys must be healthy, rather than damaged or inflamed by disease processes. Finally, the kidneys must be able to drain urine freely through a functioning urinary tract.

What is acute kidney injury?

Acute kidney injury (AKI) is a sudden loss of kidney function. This condition was formally known as acute renal failure, or acute kidney failure.

This condition may be caused by a number of acute insults including systemic sepsis, drug toxicity, obstruction to drainage of the kidneys and specific renal diseases such as glomerulonephritis. AKI is often preventable or treatable. Background co-morbidities such as diabetes, chronic kidney disease and vascular disease are all risk factors.

The kidneys precisely regulate the volume and composition of body fluids, removing waste products from the circulation. AKI can therefore result in serious complications as hyperkalaemia, pulmonary oedema, uraemia and acidosis.

AKI is diagnosed and staged according to internationally agreed criteria known as the KDIGO classification. This classification has been endorsed by NICE, the UK Renal Association and the AKI National Programme ('Think Kidneys'). The KDIGO diagnostic and staging system for AKI is shown here: <http://londonaki.net/downloads/LondonAKInetwork-TeachingMaterials.pdf> and is explained in video form here: <http://londonaki.net/academy/online-learning-videos/index.html>



Why is acute kidney injury important?

Acute kidney injury (AKI) is a common, serious, costly condition. The incidence of acute kidney injury is rising.

Epidemiological analysis has demonstrated a strong association between the development of acute kidney injury and hospital mortality. The development of severe AKI has been shown to be one of the strongest predictors of inpatient death, representing a stronger risk factor than the need for artificial ventilation.

A recent analysis has shown that for AKI recorded Nationally through coding on HES (that, due to under-representation in coding constitutes only the most severe AKI cases) 28.11% of patients with AKI died before discharge. These patients were 10 times more likely to die during hospitalisation than patients without AKI.

A review of more than 80,000 hospital admissions in 3 London hospitals has demonstrated a mortality risk for all AKI - ascertained by analysis of pathology results, not just the most severe forms visible in coding - of 14% in the over 65 age group, this rising to 35% when biological parameters of dehydration are also present (*Nangalia et al, under peer review*). Kerr et al and other have found similar 'all AKI' mortality rates.

The number of excess deaths associated with AKI has been estimated at 40,000 per annum for England and therefore 10,000 per annum for London. An NCEPOD enquiry into National AKI deaths, '*Adding insult to Injury*', reported that around 20% of AKI cases were preventable. As such around 2,000 deaths in London may be due to preventable AKI. The mortality benefit achievable through enhanced care for all, including non-preventable AKI, may be far higher.

London AKI Network data has shown that, of patients requiring acute dialysis for AKI in renal units, 15% are deceased at 3 months while a further 40% require long-term dialysis. As such 480 patients per annum enter long-term dialysis after surviving AKI in London. This is consistent with a National estimate of 1369 long-term dialysis entrants for AKI per annum for England. Both these figures exclude patients with CKD stages 4-5 prior to their AKI episode, so may underestimate the total contribution of AKI to the prevalence of long-term dialysis dependence.

A single episode of severe AKI has been shown, through multivariate analysis, to confer an 8-fold risk of developing end-stage kidney disease and a 30 fold risk of developing CKD. This, in turn, confers life-long risk of morbidity, mortality (particularly and progression to dialysis dependence.

The healthcare cost incurred through coded episodes for AKI in London was £16M for 2012-2013. A further £750,000 in cost was incurred through the acute dialysis tariff (*London Renal Strategic clinical Network analysis*).

The bulk of the healthcare cost associated with AKI care does not, however, have coding visibility. One reason for this is that AKI episodes are often secondary are not grouped to an AKI HRG. A recently published analysis - commissioned by NHS Kidney Care and utilising pathology data for AKI diagnosis - has shown that the true costs of AKI care are far higher. From this analysis if one assumes a quarter of English AKI to be in London, 208,000 admissions in London have AKI incurring (just for patients not grouped to the AKI HRG LA07) an additional 0.6M bed days. 40,000 of these bed days are in critical care. Total inpatient expenditure for AKI care in London is therefore estimated to be £250M per annum.

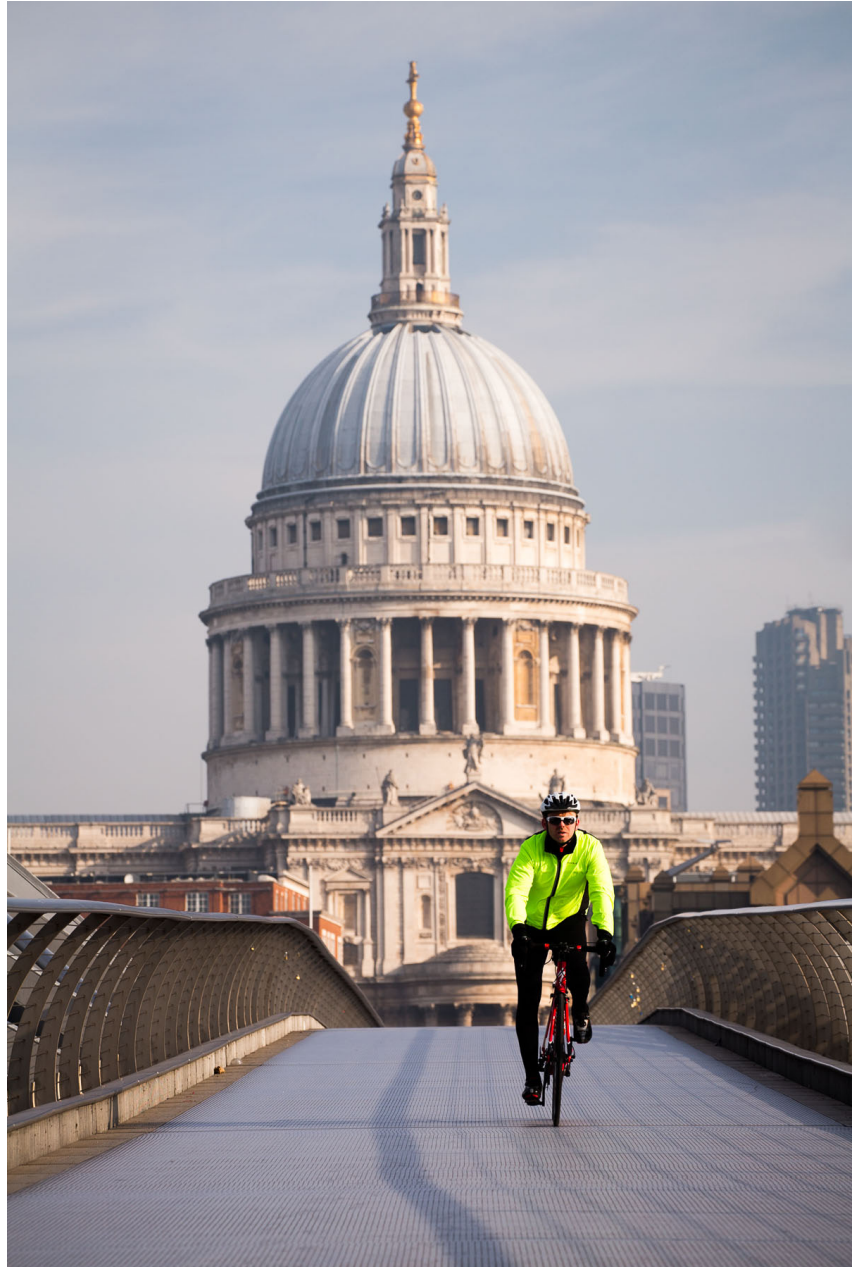
The same authors, using a Markov model, estimated subsequent lifetime costs incurred for treatment of patients who have survived acute kidney injury in a single year (2010-2011). The costs for London are estimated at *44.75M for lifelong therapy of a single years AKI cohort*. This is based on subsequent costs of CKD and dialysis resulting from the AKI episodes. The lifetime QALY loss was estimated at 1.4 per inpatient with AKI (*Reference 3*).



London AKI Network data suggests 3,000 critical care beds per annum are utilised for patients who have been accepted by renal units but have not transferred. Failure to effectively deliver this specific aspect of the pathway is alone (using

NHS reference costs of £1213 per critical care bed day) costing the London health economy *£3.6M per annum*. A further £7.2M per annum is consumed for single organ renal support in critical care units for patients not yet accepted for transfer but who may be more cost- effectively managed in renal units. Snapshot data has demonstrated that prevalence of renal support in critical care units in London is three times the National average. If this were merely reduced by 50% from a mean of 70 patients per day to 35 patients per day this would result in a cost saving of £15.5M per annum (*Appendices 5 and 7*).

This data collectively suggests that similar health economic benefits are achievable through more robust delivery of the AKI care pathway including prevention, detection, early therapy, escalation and access to tertiary services.



What are the healthcare needs of AKI patients?

- Patients need to be risk assessed for the possible development of AKI. If there is an increased AKI risk preventive measures should be administered and the patients monitored such that AKI may be detected early.
- When AKI develops appropriate generic care must be administered (e.g. fluid therapy).
- A diagnosis should be reached through clinical assessment and investigation and specific therapy, aimed at treating an underlying cause (e.g. obstruction or nephritis), should be instituted rapidly. Specialist input from nephrology, critical care, urology or diagnostic services may be required and if so should be accessed in a timely way. This may require inter-hospital transfer.
- If generic care and specific therapy does not reverse AKI, supportive care with renal replacement therapy (dialysis) will be required in a kidney or critical care unit.
- Patients suffering from AKI require holistic, multidisciplinary care, with appropriate support and rehabilitation during recovery.
- Many AKI survivors will have lasting kidney damage and require long-term follow up. A minority have severe irreversible kidney failure necessitating ongoing dialysis or transplantation.
- In some patients AKI may be an end of life event and such patients require appropriate palliative care.

London AKI Network

London AKI Network is a collaboration of healthcare professionals and organisations involved in acute kidney care throughout London and its referring regions. We are now part of NHS England London Strategic Clinical networks and report to the London Renal Specialist Clinical Leadership Advisory Group.

Our aim is equitable, high-quality AKI prevention and care in the capital and beyond. We hope to achieve this through the collaborative delivery of AKI care pathways supported by guidelines, standards, education, clinical audit, innovation and research. We believe by working together we will have the resources, manpower, expertise and critical mass to build on our achievements to make further lasting improvements to AKI care in London.

LAKIN is multi-professional and multidisciplinary. We decide policy through consultation and consensus. We are not wedded to top-down solutions and will support clinicians as they lead on the wider application of local innovation and best practice across the network.

AKI represents a major healthcare challenge. It is a common and serious condition. Care may be complex, logistically difficult and resource intensive. We believe AKI warrants a serious, strategic response similar to that afforded to other acute medical conditions such as stroke, myocardial infarction and trauma.



What was wrong with AKI care in London in 2012?

In 2012 we identified the following challenges in AKI management in London.

There were deficiencies in basic AKI management in general ward and acute areas. This was, in part, reflective of generalised failures in management of the acute illness (identified in NCEPOD 'An Acute Problem'). There were, however, failings in the treatment of isolated acute kidney disease in otherwise stable patients (with, for example, urinary tract obstruction or acute glomerulonephritis). Problems had been identified across the care pathway including aspects of prevention, recognition, diagnostics, therapy, timely referral to specialists and aftercare.

Nephrology services had become centralised, while AKI was widely spread. Nephrology outreach services had often not been configured around delivering specialist advice to acute areas but around, for example, outreach chronic kidney disease programmes. Accessing nephrology advice could be difficult, and there was some evidence of variation in the expectations made of non-specialist teams.

The optimal care pathway had not been previously defined or harmonised across sectors. As the pathway involves interaction between tertiary nephrology services, critical care units and local hospital wards within a sector, such pathways must be agreed regionally and there had previously been no mechanism to address this

There was evidence of inequity. The availability of acute dialysis, diagnostic imaging, nephrology advice or interventional radiology (for relief of urinary tract obstruction) varied greatly across sites.

Emergency transfer from ward areas to the renal unit for diagnostics and treatment might be delayed. This sometimes prevented timely therapy for more mild AKI that required disease-specific therapy.

Step-down and transfer of AKI patients from ITU to kidney units for ongoing dialysis was often delayed, resulting in inappropriate use of critical care beds for single-organ support. The critical care environment, with many patients sedated and ventilated, will not be appropriate for many ambulant, rehabilitating patients having isolated kidney support. In addition critical care beds are costly, there are inevitable capacity issues, and these beds may be needed for other patients.

There had been no clear or standardised audit strategy for AKI and how a sector performs collaboratively in AKI care, indeed standards to audit against had been lacking.

Though national guidelines on AKI (e.g. Renal Association, National Imaging Board) were available, these had often not been effectively operationalised within NHS Trusts.

There appeared to be an educational deficit as regards this condition that affected all disciplines at all levels.

NCEPOD 'Adding Insult to Injury', had increased awareness and led to a response in many hospitals. We had some evidence, however, of uncoordinated initiatives at both sector and hospital level. Not only may this be counterproductive, but leads to an unnecessary duplication of effort. It seemed essential that guideline implementation, education, audit and changes in practice are 'joined-up' and mutually supportive. It is also desirable that learning, best-practice and expertise are shared where possible.

We lacked data on the epidemiology of this condition in London, the resources available, the resources required for more effective care and how these resources should be shared.



London AKI Network development

London AKI Network began as a bottom-up, clinically driven project borne of a need to address problems in AKI care that were apparent in 2012. These are summarized here <http://londonaki.net/network/whats-wrong-with-AKI-care.html>.

We were founded, following pilot work in North Central London, by the seven London renal units in collaboration with their referring acute hospitals and with the support and endorsement of the medical directors of all London Hospitals. Network membership has always been multidisciplinary, comprising acute physicians, intensivists, pharmacists, nephrologists, renal nurses, critical care nurses and trainees. We have had patient membership from the outset.

We were initially sponsored by the London Specialised Commissioning Group, the AKI National Programme (led by Donal O'Donoghue) and NHS kidney Care (led by Beverley Matthews).

The foundational chair of LAKIN is Chris Laing. The co-founders (who are also sub-regional leads) are Bhriugu Sood (St Hellier), Debasish Bannerjee (St George's), Marlies Ostermann (Guy's and St Thomas's), Neill Duncan (West London Renal and Transplant Centre), Hamish Dobbie (Bart's Health), Satish Jayawardene (King's Hospital), Ganesh Suntharalingham (Clinical lead, North West London Critical Care Network), Angela Walsh (Director, North West London Critical Care Network) and Michael Wise (AKI survivor). These co-founders were supported by the LAKIN board and sub-regional committees.

In 2013 LAKIN became part of the NHS England London Strategic Clinical Networks, reporting to the Renal Specialist Clinical Leadership Advisory Group (SCLG). The latter is led by Neil Ashman (renal clinical director for London).

As of Autumn 2015 there are active regional AKI networks across all of England with similar large-scale AKI collaboratives in Scotland and Wales.

In 2014 NHS England and the UK Renal Registry launched the AKI National Programme 'Think Kidneys' led by Richard Fluck, National clinical director for kidney care. LAKIN works closely with both 'Think Kidneys' and other regional programmes.

Progress and achievements

Building the network and supporting collaboration
LAKIN has recruited a multidisciplinary pan-London board and Trust AKI leads across London (around 80 clinicians in total). This has been essential to agree cross-organizational and cross-disciplinary policies while supporting team-working and sharing of best practice.

Raising awareness, agreeing policy and sharing best practice

LAKIN initiated in March 2012 with a large cross-London launch event with 150 delegates.

Since March 2012 we have held a sequence of around 25 sub-regional committee meetings between AKI providers in 5 London sectors to share best practice and strengthen cross-pathway team-working.

We have supported this sub-regional work with a sequence of pan-London strategy and information-sharing meetings of the LAKIN Board (8 events in total).

We held a LAKIN biochemistry forum in January 2014 to support local implementation of laboratory AKI e-alerting. This successful event, chaired by LAKIN biochemistry lead Anne Dawnay, was attended by more than 20 London biochemists.

We hosted a January 2014 research and innovation forum to promote AKI research collaboration in London.

In October 2015 we held two speciality AKI forums on AKI in HUS and pregnancy. These events were attended by a wide group of clinical stakeholders. Key outputs of these events were agreed London pathways for AKI in HUS and pregnancy.

In November 2014 we held a pan-London sharing best practice and innovation event. This free event, to showcase local and network improvement projects and launch new products booked out to 150 capacity within 2 weeks of advertising resulting in a lengthy waiting list for places.

Improving AKI care through innovation and collaboration

- We developed and implemented a London AKI Pathway and Guideline synthesising various National guidance and ratified by the majority of London Trusts through Trust AKI leads. This has been operationalized through Trust guideline committees. This includes basic AKI bundles, referral and transfer criteria, AKI prevention, perioperative AKI, management of AKI complications and fluid therapy. Of note this was the first regional deployment of a standardised AKI care bundle. This work has been adapted by several other regions and local centres. It has also appeared in several texts and publications and is used as core AKI material in the Oxford Handbook of Nephrology. These pathways are accessible via londonaki.net and our mobile app and are widely viewed in London and beyond. This resource was expanded with new pathways in 2015 and underwent a full update in line with NICE clinical guideline 169 and NICE quality standard 76.
- We have performed pan-London audits on renal unit transfer times, critical care occupancy with AKI, basic AKI care and outcomes after AKI dialysis in renal units.
- We have formally surveyed our organisations to assess levels of organisational compliance and implementation of AKI standards.
- We pioneered an approach of standardised, regional secondary care AKI alert implementation across North Central London, linking to agreed, standardised

guidance. We supported more heterogeneous implementation of e-alerts in 60% of London trusts total, prior to 2014 NHSE alert. This work has been presented at numerous National meetings and published. Our biochemistry lead continues to provide informal advisories to trusts implementing e-alerting. This alert was linked to our online guideline repository. This work is now being transitioned by Trusts in line with the NHS England patient safety alert.

- Implementation of primary care AKI alerting was pioneered in 2012-2015 in North Central London. This project has undergone an evaluation that was recently presented at the European Renal Association. We believe this is the first implementation of community AKI e-alerting in the UK.

Supporting and delivering AKI education

- We have developed a unique online resource for AKI education (londonaki.net). This compiles clinical guidance with online educational materials including an extensive selection of 30 educational videos and numerous presentations. This content aligns with locally adopted clinical policies. This resource was expanded in 2015 to include updates and new pathways.
- In 2012 we launched londonAKI – the worlds first mobile application dedicated to AKI management. In 2015 this was expanded in content and launched in iOS9 for iPhone,

iPad, Android. This was supported by an apple ibook with embedded video content.

- We have created the UKs first online resource for AKI patients and relatives (www.londonaki.net/patients). This resource, which went live in 2012, includes advice, links to support charities and agencies and a video presentation of Michael Wise's AKI survivor story. This resource was further expanded in 2015 with 'My AKI: A patient's guide to acute kidney injury' and further video materials. These resources have been developed through an award-winning collaboration with UCL Health Creatives (Vincent Harding).
- In December 2012 we held out first AKI Academy – a 2-day, multidisciplinary course on AKI management for healthcare professionals. We repeated this course in October 2014 with an expanded format including workshops and high-fidelity clinical simulation. We will repeat the academy in 2016. The AKI Academy his is the first regular, recurring AKI course in the UK.
- Network clinical leads and members have used LAKIN, and local, resources to deliver multidisciplinary education at undergraduate and postgraduate level across London.

Advice, advocacy and influence

- London AKI Network has provided advice to Think Kidneys and several other projects including prior NHS Kidneys Care programmes (such as the National AKI Audit) and an HUS preparedness project.
- We represent London AKI patients at National forums.
- We have shared resources freely with local and regional AKI teams outside of London, many of which have been adapted for local use.
- As of Autumn 2015 there were AKI Networks, or AKI programmes embedded in regional Strategic Clinical Network programmes, across England.
- Advocacy for AKI improvement and the AKI network approach has been provided at several regional and National forums including the 2013 UK Renal Association, 2013 Renal CD Forum, The 2014 Future Hospital Commission launch event, the 2014 Joint UK-France Renal Associations 'Entente Cordiale' meeting, the 2014 Irish Society of Nephrology and the Intensive Care Society 2015 State of the Art meeting.
- We have made numerous presentations of specific projects at societal meetings.



Network Governance and membership

LAKIN now sits within the London Renal Strategic Clinical Network and reports to the London Renal Specialist Clinical Leadership Advisory Group and Renal Clinical Director for London (Neil Ashman).

Key stakeholders include London's 3 Academic Health Science Networks and the Think Kidneys AKI National Programme. We also contribute to the 'National AKI Cluster', a grouping of Academic Health Science Network and Strategic Clinical Network regional AKI programmes.

LAKIN has transitioned from voluntary membership to the Strategic Clinical Network cross-London membership. It does not however mandate use of its products or performance manage its members. LAKIN supports local AKI teams to improve AKI management, scale innovation and share best practice.

LAKIN comprises a chair, the LAKIN Board and Trust leads in every hospital in London, as well as some hospitals outside of London who refer to London renal units. The LAKIN board membership (Autumn 2015) is listed below.

Foundational chair, NC London lead	Chris Laing, Consultant Nephrologist, Royal Free London NHS Foundation Trust
Co-founder, board member, SW London co-lead	Bhrihu Sood, consultant nephrologist, Epsom and St Helier University Hospitals
Co-founder, board member, SW London co-lead	Debasish Bannerjee, consultant nephrologist, St George's Hospital
Co-founder, board member, SE London co-lead	Satish Jayawardene, consultant nephrologist, King's College Hospital NHS Foundation Trust
Co-founder, board member, SE London co-lead	Marlies Ostermann, consultant intensivist and nephrologist, Guy's and St Thomas's NHS Foundation Trust
Co-founder, board member, NE London lead	Hamish Dobbie, consultant nephrologist, Bart's Health.
Co-founder, board member, NW London co-lead	Ganesh Sunthalingham, consultant intensivist, London Northwest Healthcare NHS Trust, Clinical Lead North West London Critical Care Network
Co-founder, board member, NW London co-lead	Angela Walsh, Director, North West London Critical Care Network
Board member	Jack Galliford, consultant nephrologist, Imperial College Healthcare NHS Trust
Board member and biochemistry lead	Anne Dawnay, consultant biochemist, University College London NHS Foundation Trust
Board member	Anita Bannerjee, consultant in acute and maternal medicine, King's College Hospital NHS Foundation Trust and Guy's and St Thomas's NHS Foundation Trust
Co-founder, board member and patient member	Michael Wise, AKI survivor and renal transplant patient
Board member	Daniel McGuinness, speciality registrar nephrology, North Thames
Board member	Matt Varrier, speciality registrar nephrology, South Thames
Board member	Kelly Wright, lead nurse for AKI, King's College NHS Foundation Trust
Board member	John Prowle, consultant intensivist and nephrologist Bart's Health
Board member	Chris Kirwan, consultant intensivist and nephrologist Bart's Health
Board member and London Clinical Director for Renal	Neil Ashman, consultant nephrologist Bart's Health
Board member and Improvement Manager, London Strategic Renal Clinical Network	Katy Gordon
Board member and London Strategic Clinical Network Lead	Paul Trevatt
Board member and NHS England Specialist Commissioning lead	Carrie Gardner
Board member	Mirek Skrypak, UCLP Patient Safety Programme Manager
Board member	Shruti Goel, consultant acute physician and nephrologist, Hillingdon Hospitals NHS Foundation Trust
Board member	Oliver Rose, consultant intensivist, University Hospital Lewisham

Key stakeholders and partners

- NHSE Clinical Director for Renal Care (Richard Fluck)
- Think kidneys National AKI Programme
- London Strategic Clinical Networks and Renal Strategic Clinical Leadership Advisory Group
- The 3 London Academic Health Science Networks
- London Hospital Trusts
- Clinical Commissioning Groups
- Commissioning Support Units
- Local Education and Training Boards
- We are likely to extend into other sub-speciality areas, building on successful 2015 projects in AKI-HUS and AKI-pregnancy.
- Formal quality improvement methodology: We have identified a need to support implementation using formal improvement science. Following preparatory developmental work with Martin Marshall and Improvement Science London this is now being take forward by the UCL Partners NHS England-funded Patient Safety Programme. This project is utilizing the Institute of healthcare Improvements 'Breakthrough Series' collaborative model in 9 trusts in North and East London, Essex and Hertfordshire.

Looking ahead

We have identified 'next steps' for collaborative AKI care in London as follows:

- Collation of data: We have, in collaboration with a UCL research group, collated a large scale, anonymised dataset from hospitals across London. Under National Research Ethics we are investigating trends in AKI incidence and outcomes across London. In tandem we are working with ICNARC (the UK Intensive Care National Audit and Research Collaboration) on a review of AKI incidence and therapy in London critical care units and will work closely with the UK Renal Registry to maximize the potential for London patients of the Registry AKI Master Patient Index.
- Clinical trials: We are developing collaborations to support the execution of clinical trials on novel AKI care pathways supported by technology innovations.
- Operational function: LAKIN does not have a formal operational function or budget to formally 'manage' cross-pathway AKI care. We have however identified some potential in this approach and will, with the renal SCLG, keep this under review.

References:

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Appendix 1

Patient Stories

Patient 1

A 55 year old patient presented with loin pain and haematuria. She was treated at a local acute hospital for urinary tract infection. Her kidney function declined progressively over several days in spite of treatment. This was not recognised by the admitting team and the basic AKI investigation and care bundle was not instituted. After a serious loss of kidney function the patient was referred to an attending nephrologist who diagnosed renal inflammatory disease (vasculitis) requiring kidney biopsy and disease-specific treatment (both 'high-impact interventions'). In spite of referral for urgent transfer transfer was delayed, due to lack of bed availability, for 72 hours. On transfer a biopsy confirmed the diagnosis and emergency treatment with immunosuppression and plasma exchange was commenced. In spite of this the patient lost the remainder of her kidney function and required chronic dialysis then transplantation. The patient subsequently became a London AKI Network patient member.

This case highlights problems with AKI detection, institution of the basic care bundle, adherence to referral guidelines and access/timely transfer to tertiary nephrology services.

Patient 2

A 69 year old male was admitted to a local acute hospital generally unwell. On presentation to hospital he had severe acute kidney injury. There was a 48 hour delay in ultrasound being performed. This demonstrated obstruction to drainage of the kidneys, likely from extensive prostatic cancer. Retrograde kidney stenting from the bladder was attempted but unsuccessful. He was transferred to a different (non-renal) acute trust for percutaneous drainage through nephrostomy. This resulted in severe perinephric haemorrhage and admission to critical care for stabilisation and renal support (dialysis). Finally after a further delay he was transferred to the critical care of a tertiary renal and urological centre for further management. He was subsequently treated and came off dialysis but required a prolonged spell of rehabilitation.

This case demonstrates problems with timely access to diagnostic services and the utilisation of overly complex, uncoordinated care pathways for access to high impact AKI interventions such as relief of renal obstruction. Though this patient survived his acute admission his pathway involved 3 hospitals, 3 radiology departments, 2 critical care units, a serious procedural complication and resulted in a very extended hospital stay. Timely direct access to a combined tertiary renal and urology centre would have avoided this.

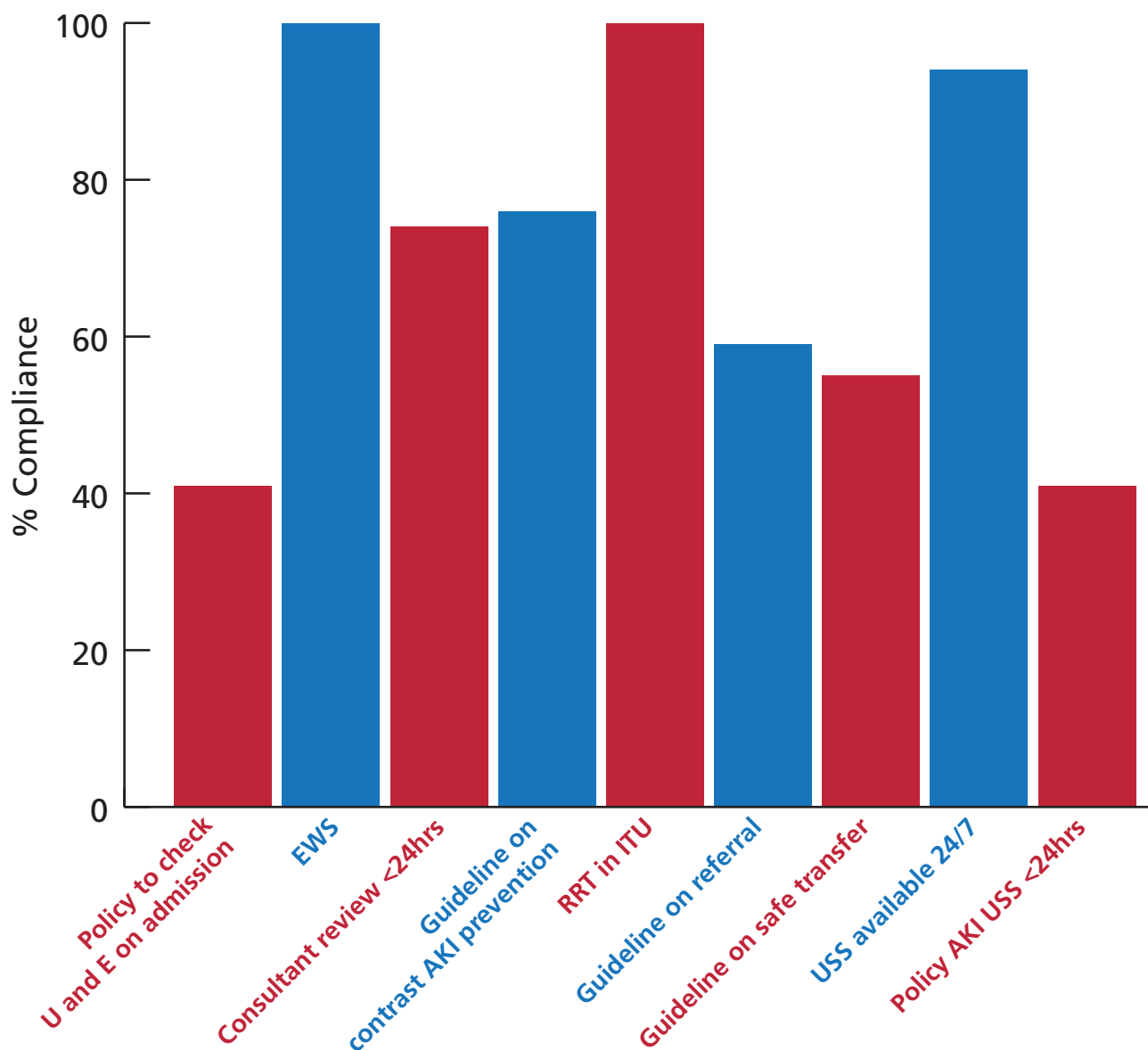
Patient 3

A patient with known liver disease and recent vomiting and diarrhoea was admitted for assessment of general ill health, abdominal pain, vomiting and diarrhoea. A contrast CT was performed without pre-hydration or contrast prophylaxis. The patient was high risk as he had several AKI risk factors including CKD, liver disease and acute dehydration. The patient developed stage 3 (severe AKI), likely worsened by delayed recognition and failure to stop diuretic therapy. Transfer to the renal unit for dialysis was delayed and he required admission to the critical care unit for 3 days for single-organ dialytic support until a renal bed became available.

This case highlights problems with risk-assessment, detection, reliable delivery of the AKI care bundle, escalation and timely access to tertiary nephrology services.

Appendix 2

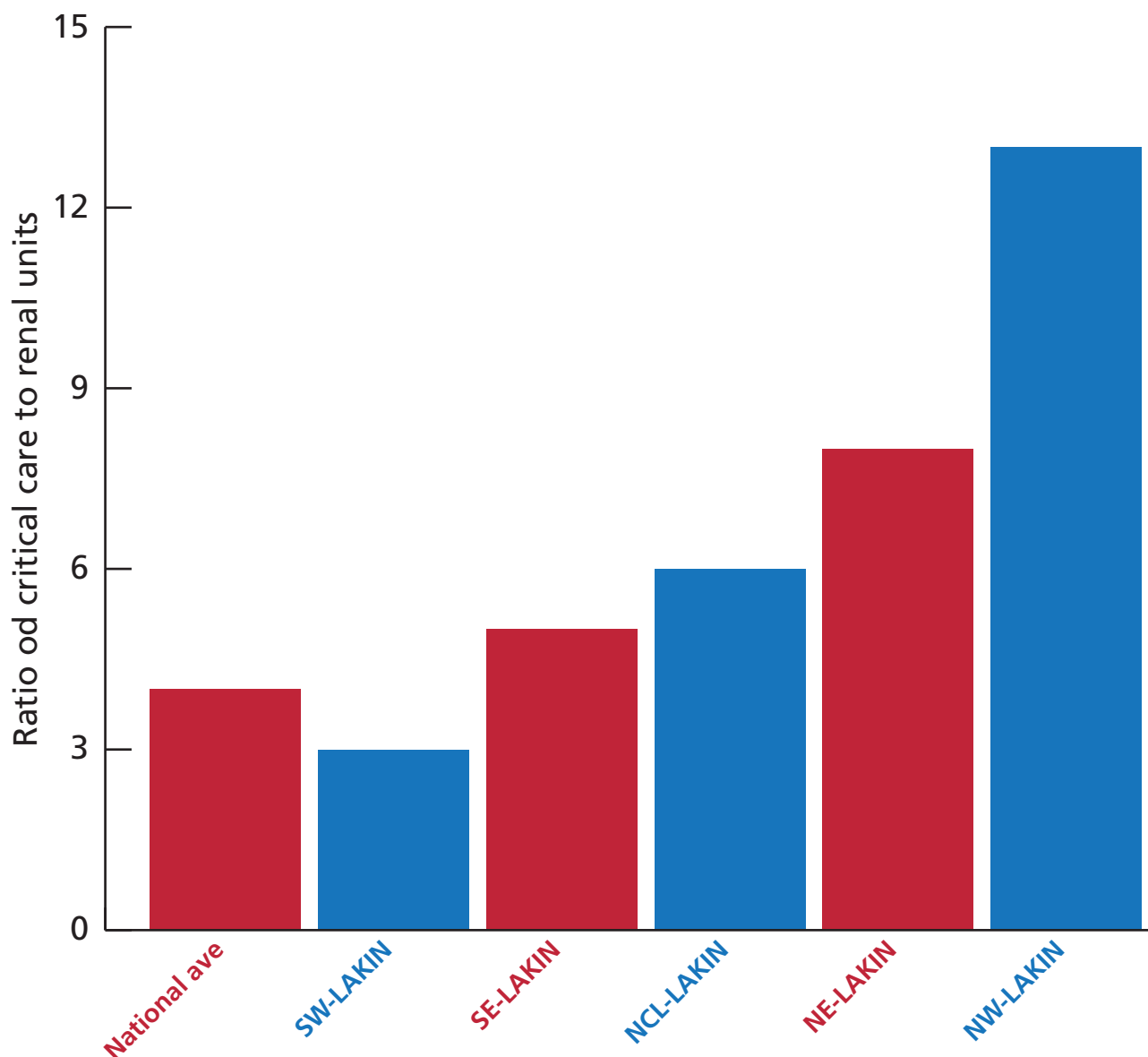
London AKI Network Service Mapping (2013 Data)



This organisational self-assessment exercise was undertaken by London AKI Network against NCEPOD AKI standards. 75% of London Trusts responded. We have identified variation in provider capability against these standards.

Appendix 3

National and London Ratios of Critical Care Units to Renal Units

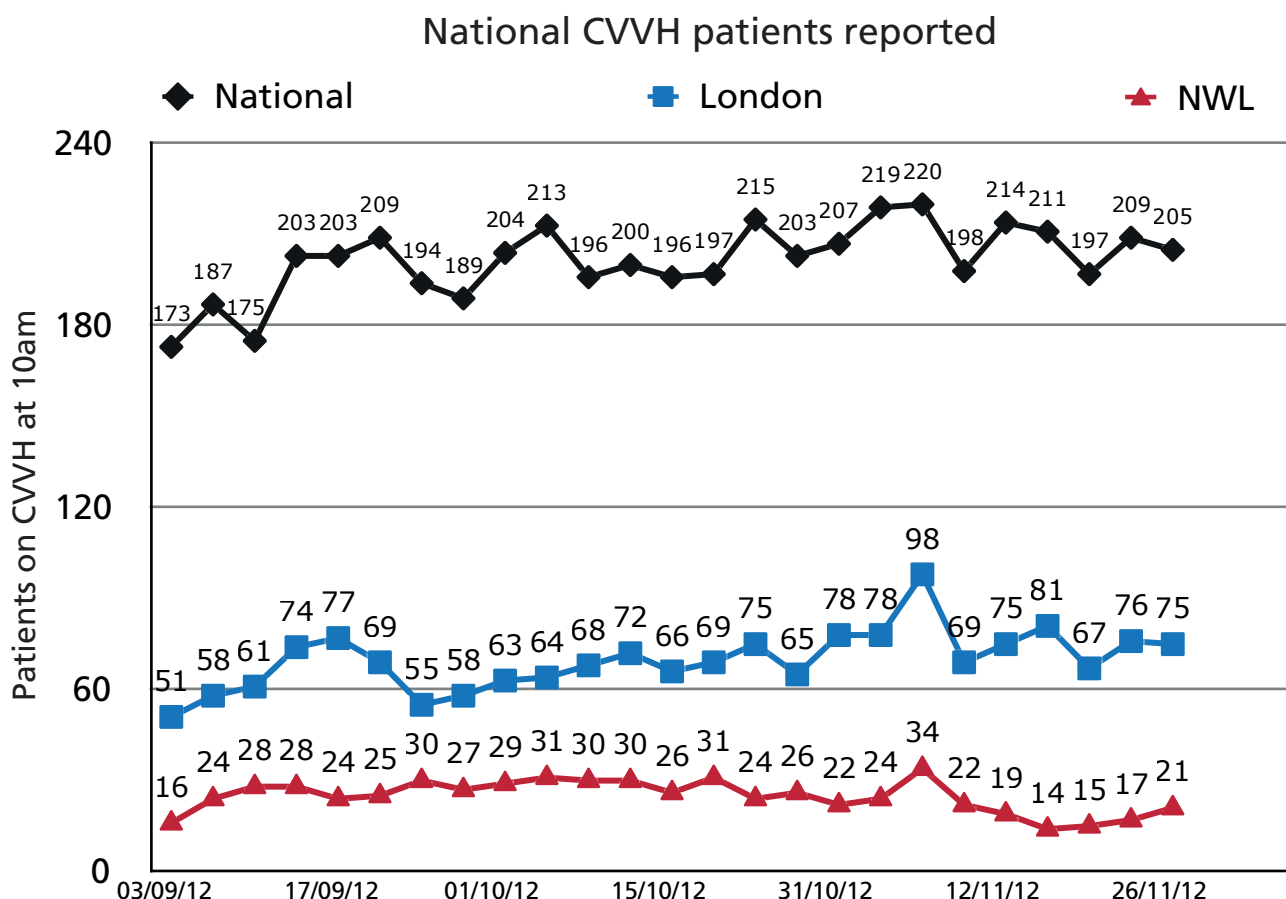


London and National ratios of critical care units (and acute hospitals) to renal units. In London the ratio is high, that is a large number of acute sites are serviced by a small number of renal units.

During the 2012 Baxter haemofiltration supply chain incident the Department of Health mapped ratios of critical care units to regional renal units that can accept AKI patients. This largely reflects the ratios of renal units to referring hospitals. This demonstrated a National average of 4 critical units to each renal unit. Though this ratio exists in SW-LAKIN (the St Georges and St Hellier units each accepting patients from 4 hospitals) the ratios of critical units/acute hospitals to renal units in the remainder of London are considerably higher than the National average. IN NE-LAKIN the ratio is 8:1 and in NW-LAKIN 13:1. This results in system-wide stress on delivery of nephrology liaison and tertiary nephrology transfer pathways.

Appendix 4

2012 National & London Prevalence Audit of Continuous Renal Replacement Therapy in Critical Care Units



National, Trust-validated snapshot data on renal support in critical care during period of data collection (September-December 2012)

During the 2012 Baxter haemofiltration supply-chain incident the Department of Health led a sequence of National snapshot prevalence audits of renal support in critical care units. All data was Trust validated and provided using a standard UNIFY collection tool.

This data was collected to identify the scale of vulnerability in critical care renal support capacity. It also provides a snapshot view of system capability.

The numbers of patients undergoing renal support in critical care units (CRRT) in London is exceptionally high. This may reflect high AKI prevalence or variation in practice (e.g. thresholds for initiation or ceilings of care). It is likely however this data is a marker of difficulties in accessing tertiary renal care for renal support acutely or in step-down.

On 5th November 2012 220 patients were identified undergoing CRRT Nationally and of these 98 were in London and 34 were in North West London. Using mid-2011 population estimates we have calculated (from all the snapshot data) average prevalence of critical care renal support per 100,000 populations. This has shown prevalence of critical care renal unit support to be 3 times the National average in London and 6 times the National average in West London.

Appendix 4 - continued

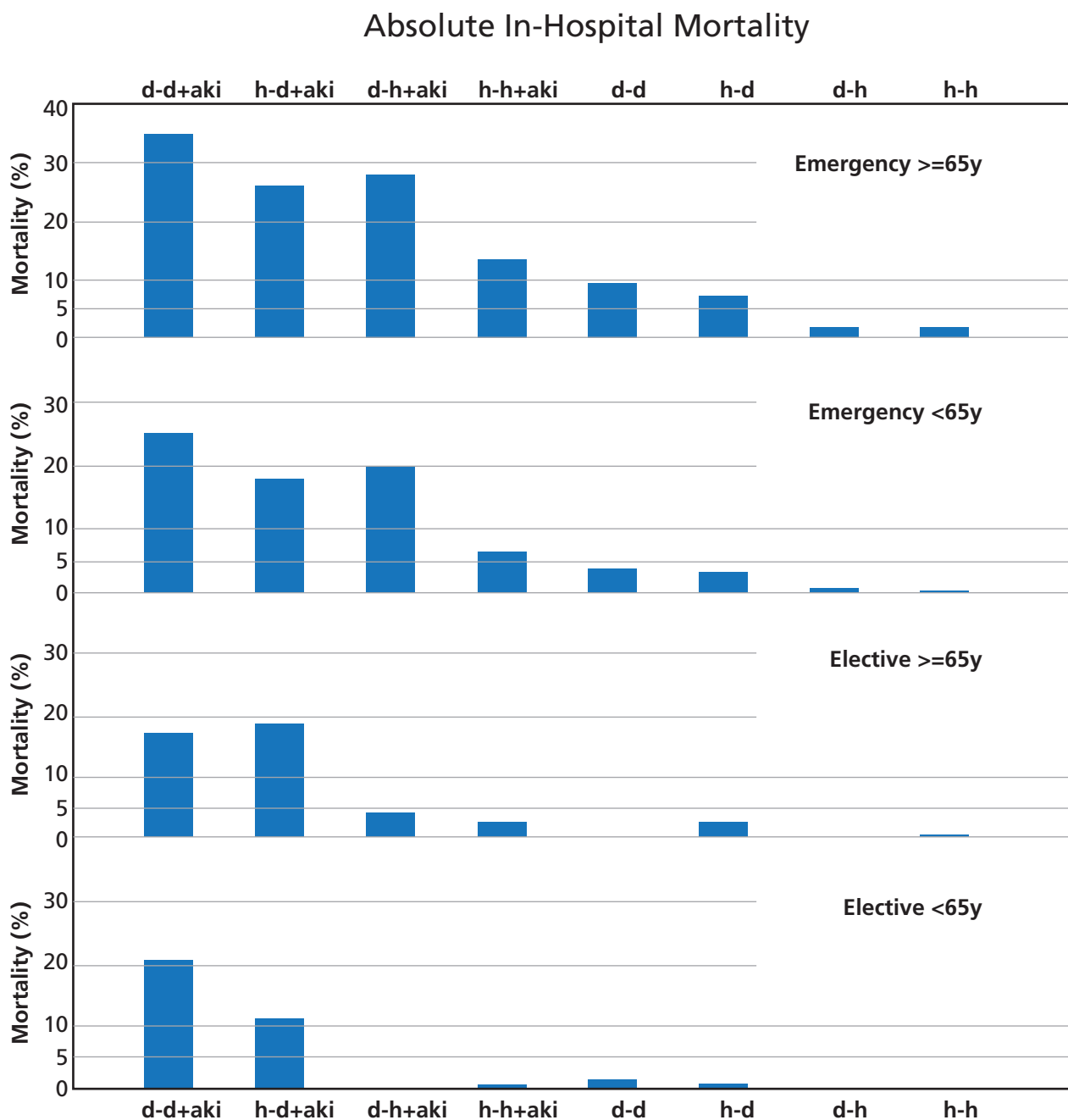
2012 National & London Prevalence Audit of Continuous Renal Replacement Therapy in Critical Care Units

Mid-2011 Population Estimates: Selected age groups for health areas in England and Wales; estimated resident showing 16+ population based on 2011 census results			Average snapshot number of patients requiring CRRT used to derive average prevalence per 100,000 population (2012)
16+residents	number	100,000	Average per 100,000
North East	2,134.3		
North West	5,732.1		
Yorkshire and the Humber	4,290.5		
North	12,156.9	121.569	0.350966666
East Midlands	3,698.8		
West Midlands	4,514.2		
East of England	4,753.0		
Mid-East	12,966.0	129.66	0.392051005
London	6,574.5	65.745	0.975993105
South East Coast	3,638.9		
South Central	3,370.0		
South West	4,370.9		
South	11,379.8	113.798	0.329531275

Population adjusted prevalence of renal support (dialysis) in critical care units (per 100,000 population). The prevalence in London is 3 times the National Average. This suggests difficulties in accessing renal units for acute or step-down AKI care from acute sites.

Appendix 5

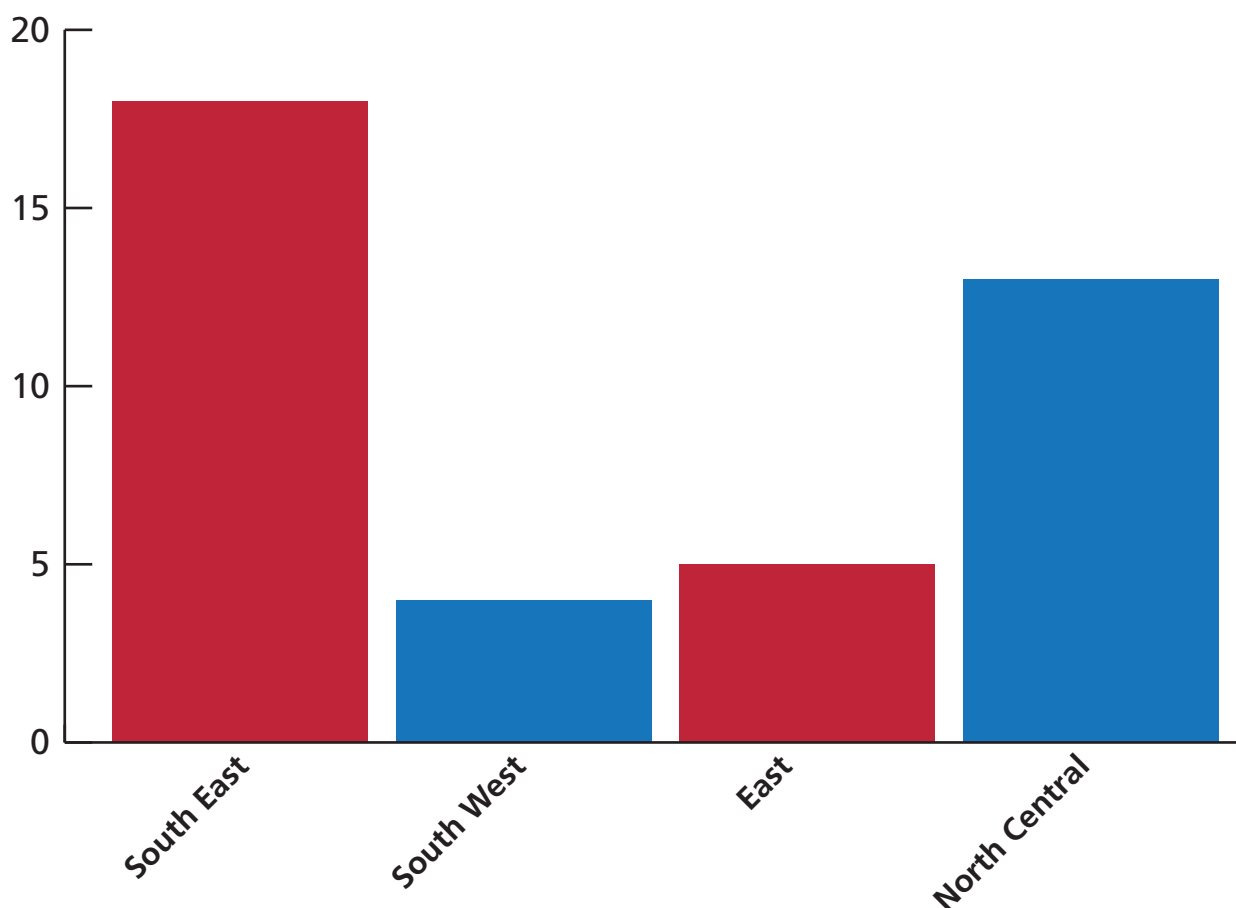
Mortality Associated with AKI and Dehydration in Three London Hospitals



This is a retrospective analysis (through collaboration between UCL Patient Rescue research group and London AKI Network) of 80,000 admissions to 3 large London hospitals. The data is divided into emergency and elective admission groups and by age (over or under 65). There is a strong association between AKI, hydration status (from urea:cr ratio) and mortality. The mortality risk for >65 patients during emergency admissions who develop AKI, are dehydrated and stay dehydrated (d-d+AKI) is 35% (Nangalia et al, under peer review).

Appendix 6

London AKI Network Audit of Delayed Transfers from Critical Care Units to Renal Units



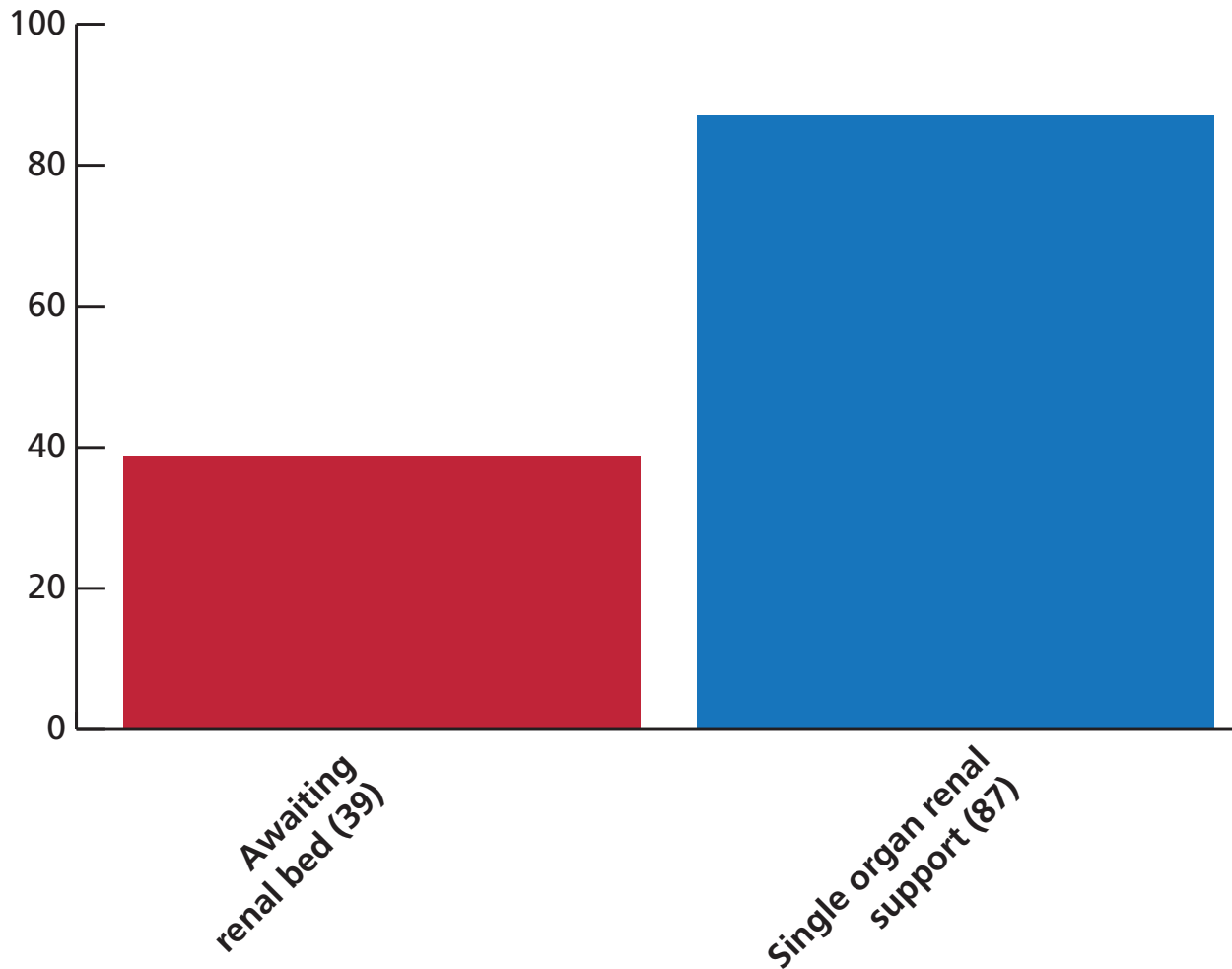
In January and February 2013 London AKI Network consulted a cross-London audit of patients in critical care units awaiting transfer to renal units for ongoing care including dialysis. This cohort includes both patients who accessed critical care because they were unable to access renal unit care sufficiently quickly as well as patients who had necessarily been admitted to critical care but were now awaiting step-down to the renal unit for ongoing (usually dialysis) support.

The audit was undertaken through personal contact with each critical department for a full 7 day period in each of 4 LAKIN regions (NCL, NEL, SEL, SWL) sequentially. Data was collated using a standardised format. West London did not contribute. Data was collected on patients accepted and awaiting renal unit transfer and patients undergoing single-organ renal support. The latter group had not been referred for transfer but it is possible that there may be under-referral of these cases due to critical care units already having patients 'waiting ahead' for access.

The collated snapshot data (excluding West London) demonstrated 39 critical care bed days per week in London utilised for patients accepted for and awaiting renal unit transfer. This suggests over 2,000 critical care bed days per annum are unnecessarily used in London for this purpose. If one includes West London it is likely that this figure is more than 3,000. This alone costs the NHS in London £3.6M per annum in unnecessary critical care usage. A further 87 critical care bed days per week were used for patients on single organ support in these 4 sectors alone (4,500 bed days per annum). Delayed step-down in is likely to result in delayed rehabilitation, discharge and may be limiting critical care access for other patients. Variation in performance was noted between the sectors.

Appendix 6 - continued

London AKI Network Audit of Delayed Transfers from Critical Care Units to Renal Units



Cumulated snapshot data for critical care bed days per week unnecessarily utilised for patients accepted for renal unit transfer and those requiring only single organ support.

Appendix 7

London AKI Network Audit of Delays in Transfers to Renal Units from all Ward Areas

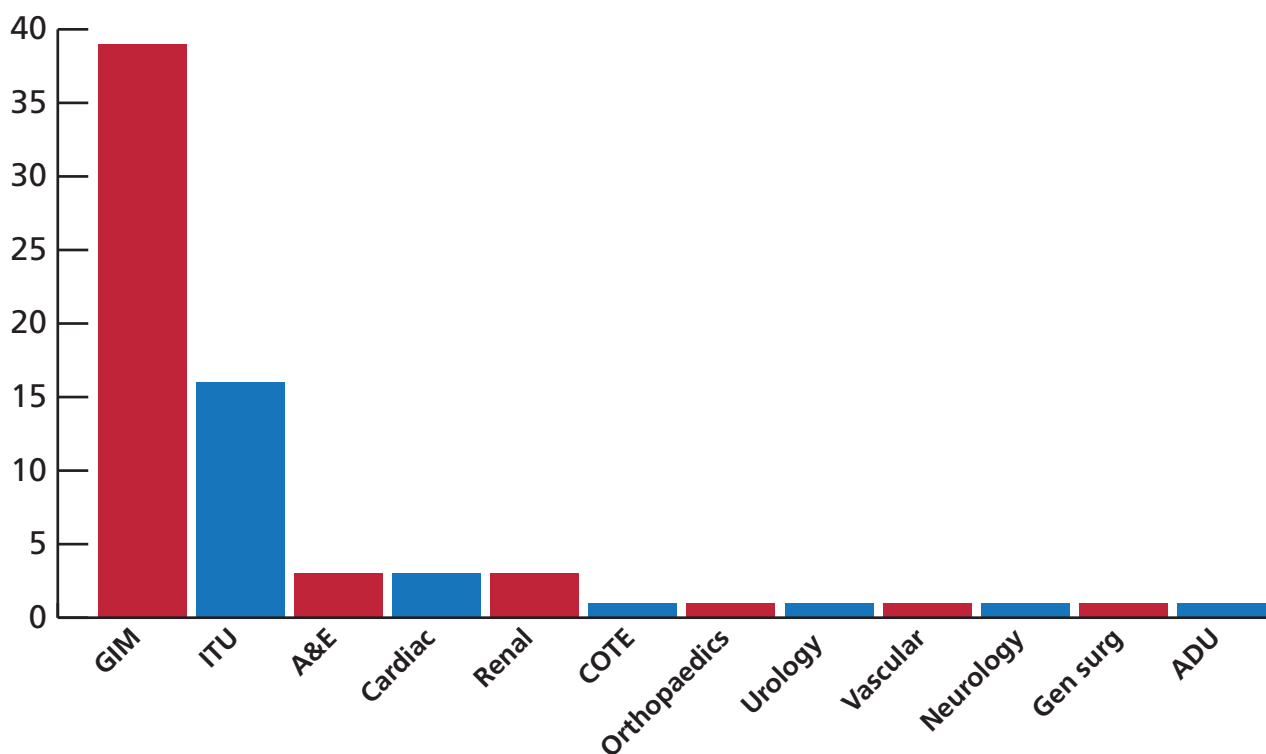
We have had considerable network feedback from non-nephrology network members regarding timely transfers from secondary care areas (critical care and general wards) to renal units. This was at times delayed and deleterious to care. This has also been identified as a prime concern of patient members. Transfer delays relate almost entirely to bed capacity. Renal units are all located in acute hospitals and tertiary transfers may not always be prioritised during periods of Trust bed pressure. A quality standard of transfer within 24 hours exists within the NHSE AKI dialysis commissioning standards, though it should be born in mind that not all renal transfers are for dialytic care.

In January 2013 we undertook a simultaneous prospective audit of times from acceptance of transfer to the renal unit of all AKI patients requiring transfer in 6 London renal units in a 2 week period. Only 21% of accepted transfers were from the same site while a further 17% were accepted from the same Trust (different location). For the 6 participating units, 79% of AKI patients accessing nephrology inpatient beds from secondary care in London (in this period) therefore required an inter-hospital transfer.

55% of transfers were accepted from acute medical teams while 23% were accepted from critical care teams.

In 52% of patients AKI was due to sepsis and hypoperfusion, the remainder being due to toxicity, obstruction and parenchymal renal disease.

Only 53% of patients achieved transfer the same or next day following acceptance. The largest single delay for transfer in this cohort was 9 days. The most commonly cited reason for transfer delay was renal bed availability.



Prospective renal unit transfer time audit: This shows services from which patients were accepted for transfer. Only 21% of accepted transfers were from the same hospital site. Only 53% of patients achieved transfer within 48 hours. 2,500 patients per annum use this pathway in London.

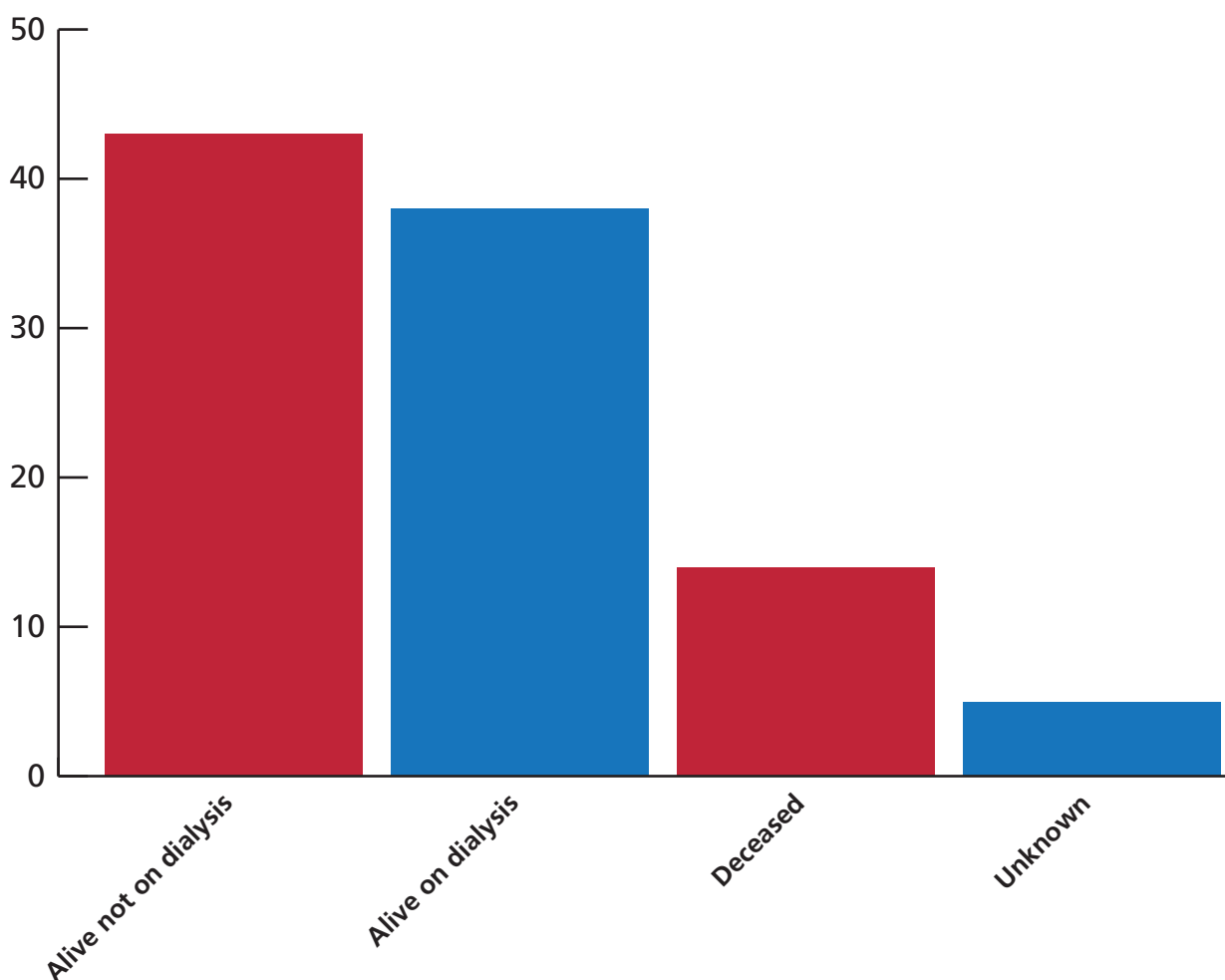
Appendix 8

London AKI Network Audit of Outcomes of Patients Receiving Aki Dialysis in London Renal Units

We collated data on patients undergoing dialysis for AKI in London renal units from 1st to 30th April 2012 and performed a follow up outcome review at 3 months. Patients with stage 4 or 5 CKD within 3 months of the AKI episode were excluded and a diagnosis of AKI was verified by the auditing senior clinician.

At 3 months 38% of surviving patients had remained on dialysis and 14% were deceased. 43% were alive and dialysis independent. Sepsis and hypoperfusion was the cause of AKI in 57% of this cohort. Substantial amounts of primary renal disease (such as myeloma kidney or vasculitis) were evident in this cohort of patients, in one unit constituting nearly 60% of AKI dialysis demand.

Median length of stay was 14 days but ranged between 2 days and 6 months. The majority of patients were discharged home but in around 29% of cases discharge required repatriation to the referring hospital.



90 day outcomes from April 2012 cohort of patients receiving acute dialysis in 5 London renal units. A large proportion of survivors require long-term dialysis (around 480 patient per annum entering the chronic haemodialysis programme in this fashion).



London Acute Kidney Injury Network

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