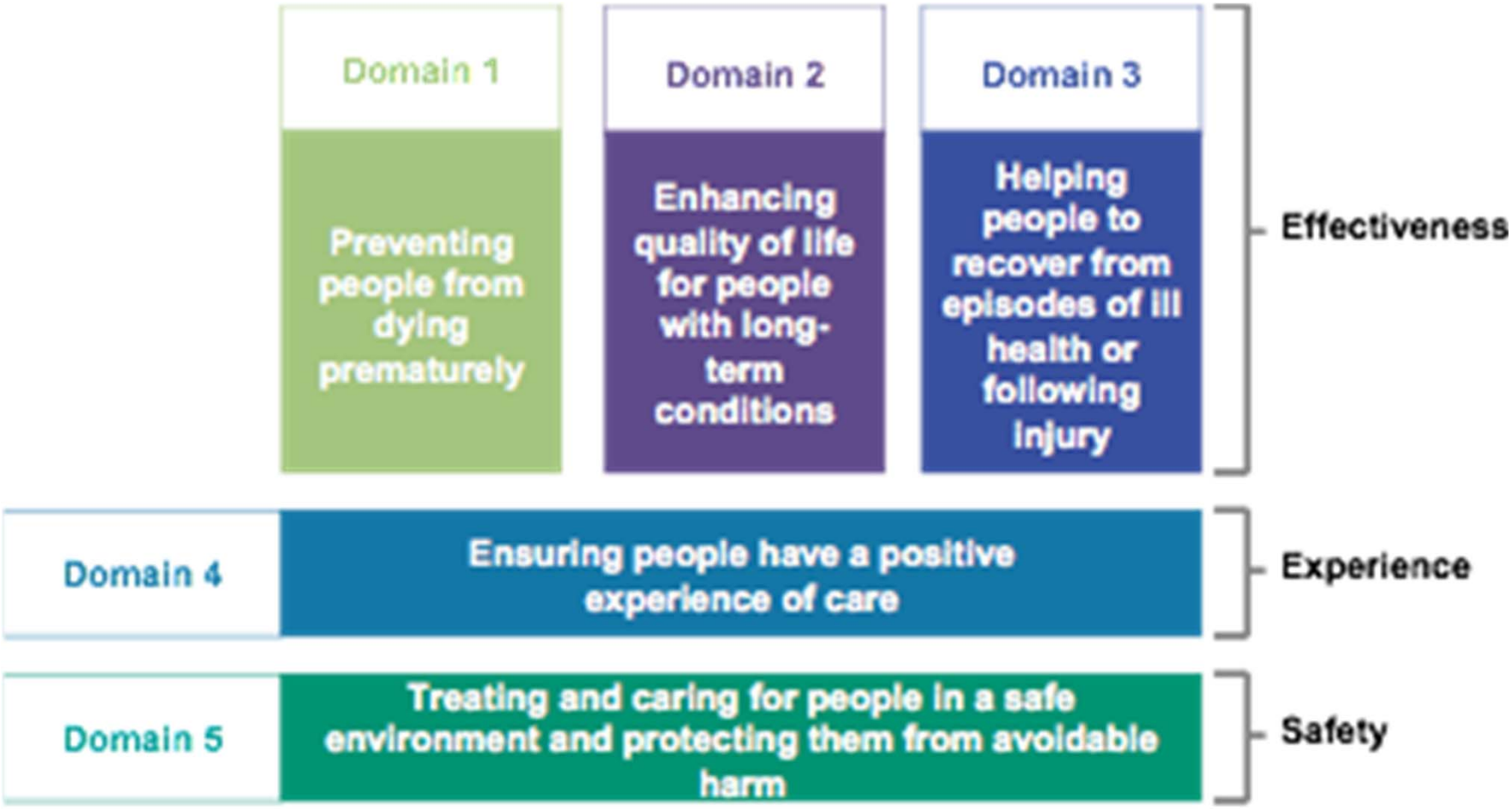
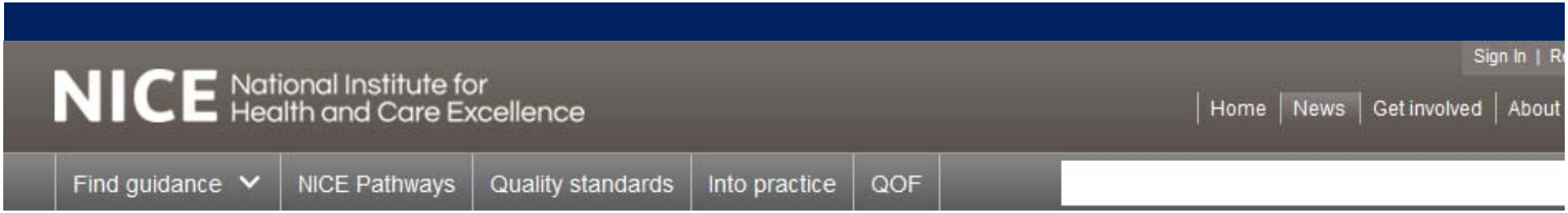
# Acute kidney injury

Common, harmful, treatable

Dr Richard Fluck

# NHS Outcomes Framework Summary






News

## Could preventing acute kidney injury hold the key to cutting the number of avoidable deaths on the NHS?

”**One in five** emergency admissions to hospital will have AKI”

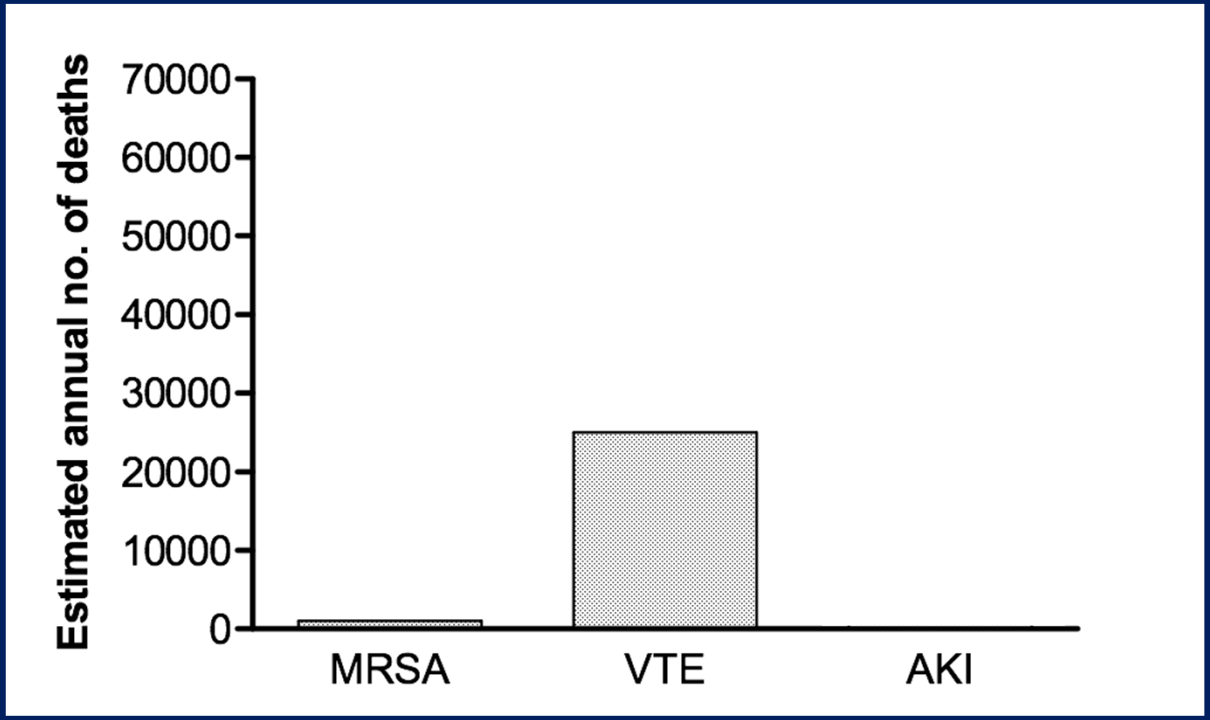
"AKI is 100 times more **deadly** than MRSA infection”

”Around 20 per cent of AKI cases are **preventable**”

”**costs** of AKI to the NHS are £434-620m pa”

# ‘reducing avoidable death, long-term disability and chronic ill health…’

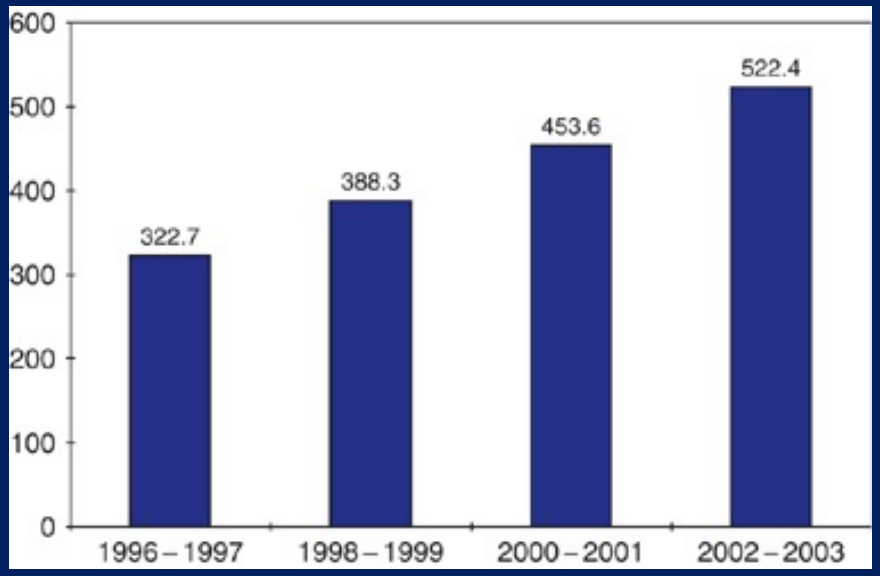
- VTE prevention: estimate 25,000 deaths pa




*Data derived from: Hospital Episode Statistics Annual Report DoH VTE Prevention Programme 2010 and Selby et al 2012*

# Incidence of AKI is increasing

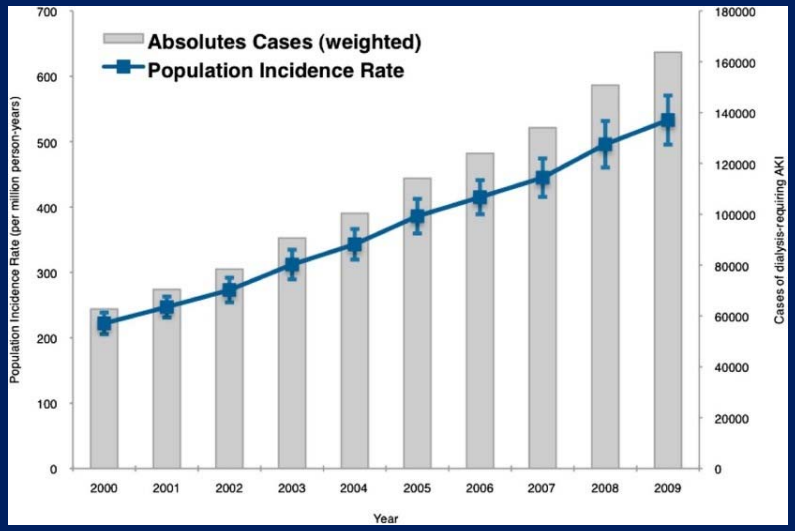
## AKI not requiring dialysis




Hsu CY et al. *Kidney International* (2007) **72,** 208

* Per 100,000 person years

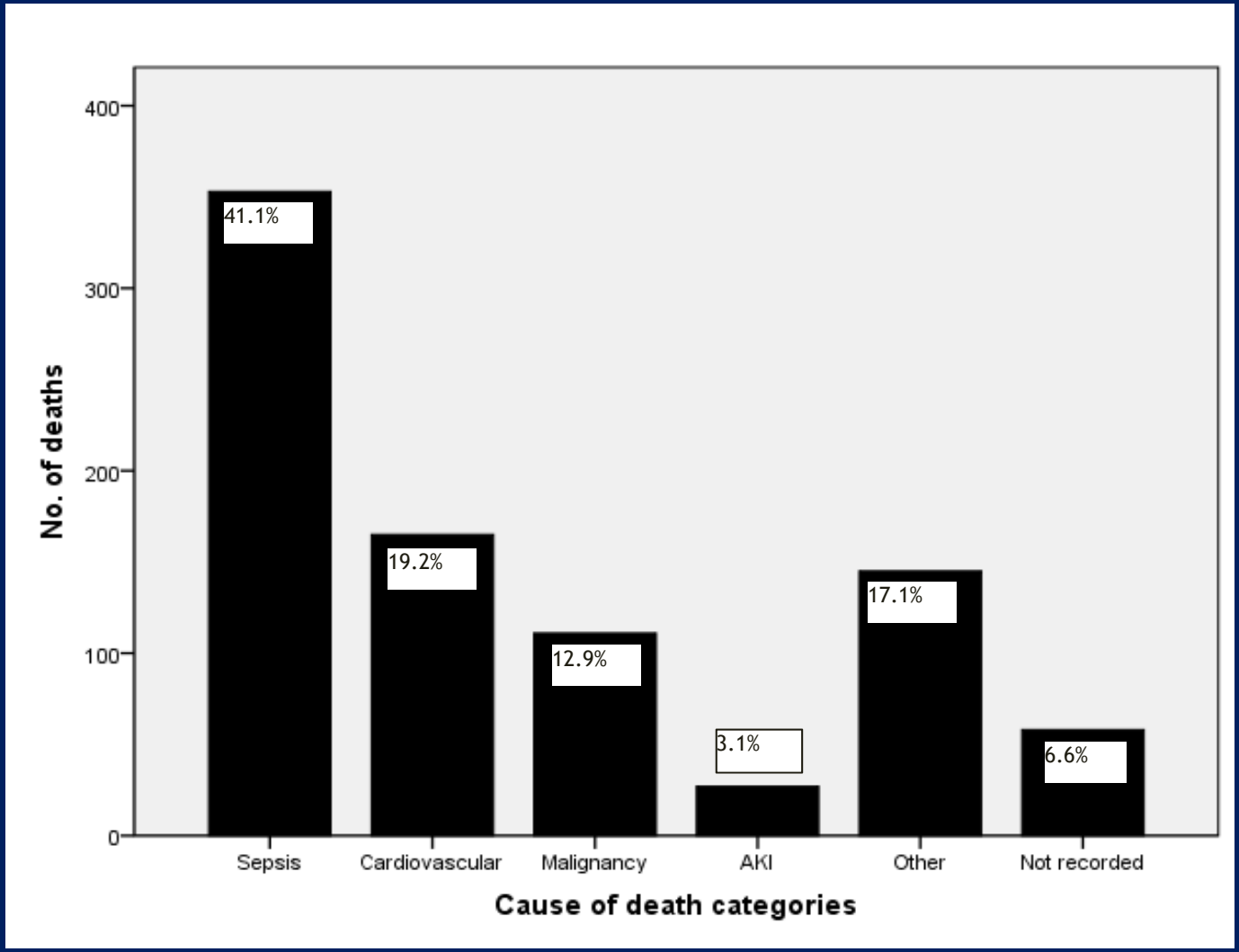
## Dialysis-requiring AKI




Hsu RK et al. JASN 2013;24:37-42

* Per million person years

# Patients with AKI do not die from uraemia




*Selby NM et al. PLoS ONE 2012; 7(11): e48580*

# Bi-directional relationship of AKI and CKD

1million patients with baseline assessments of serum creatinine and proteinuria

**CKD and proteinuria increase risk of AKI**

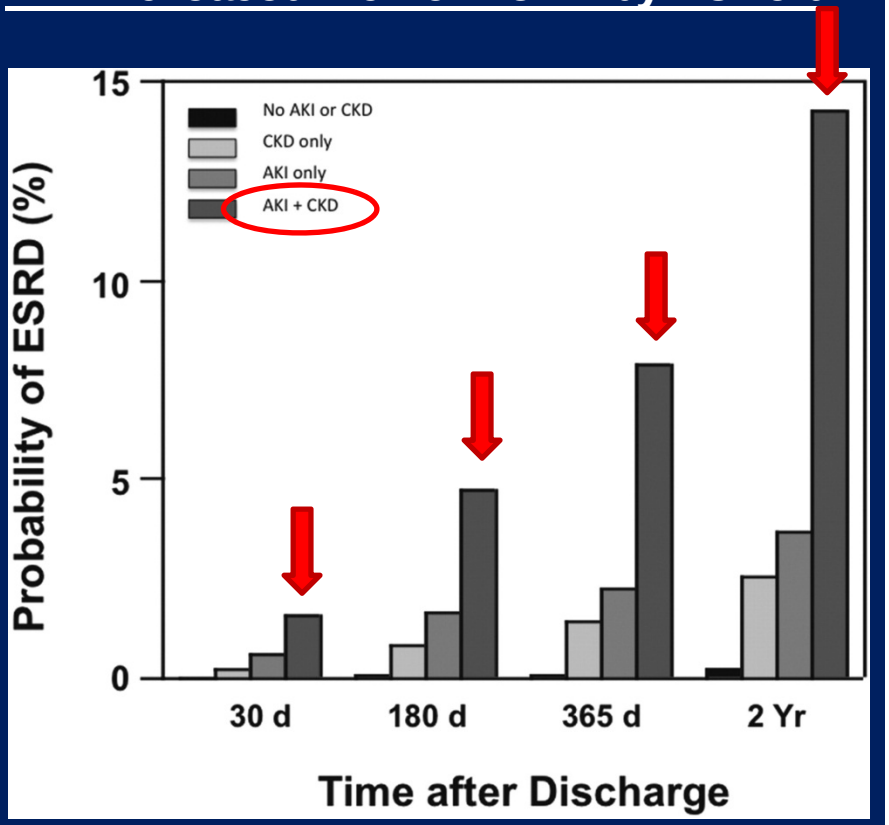
| Baseline renal function | Rate ratio for hospital admission with AKI* |
|---|---|
| eGFR >60 | 1.0 |
| eGFR 45-59.9 | 2.3 |
| eGFR 30-44.9 | 5.6 |
| eGFR 15-29.9 | 13 |

*non-proteinuric group shown; similar pattern seen across all levels of proteinuria

*James MT et al. Lancet 2010; 376: 2096-2103*

233,803 hospitalised patients aged over 67

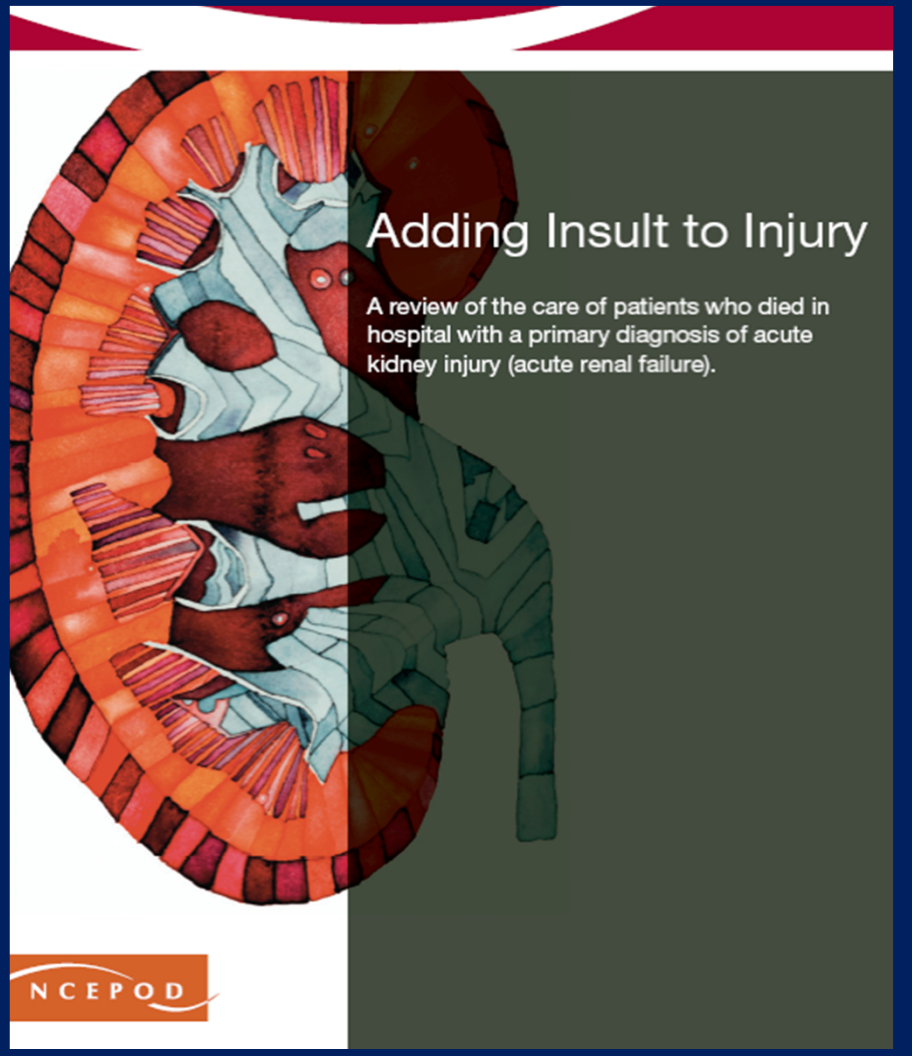
**AKI increased risk of ESKD by 13 fold**




*Ishani A et al. JASN 2009; 20: 223–228*

# NCEPOD report published in 2009

- Poor assessment of risk factors for AKI and acute illness
- **Delays in recognising AKI**
- **Most patients with AKI are not cared for by nephrologists**
- Post admission AKI avoidable in 21%
- **‘Good’ care in <50% cases**



# Study population

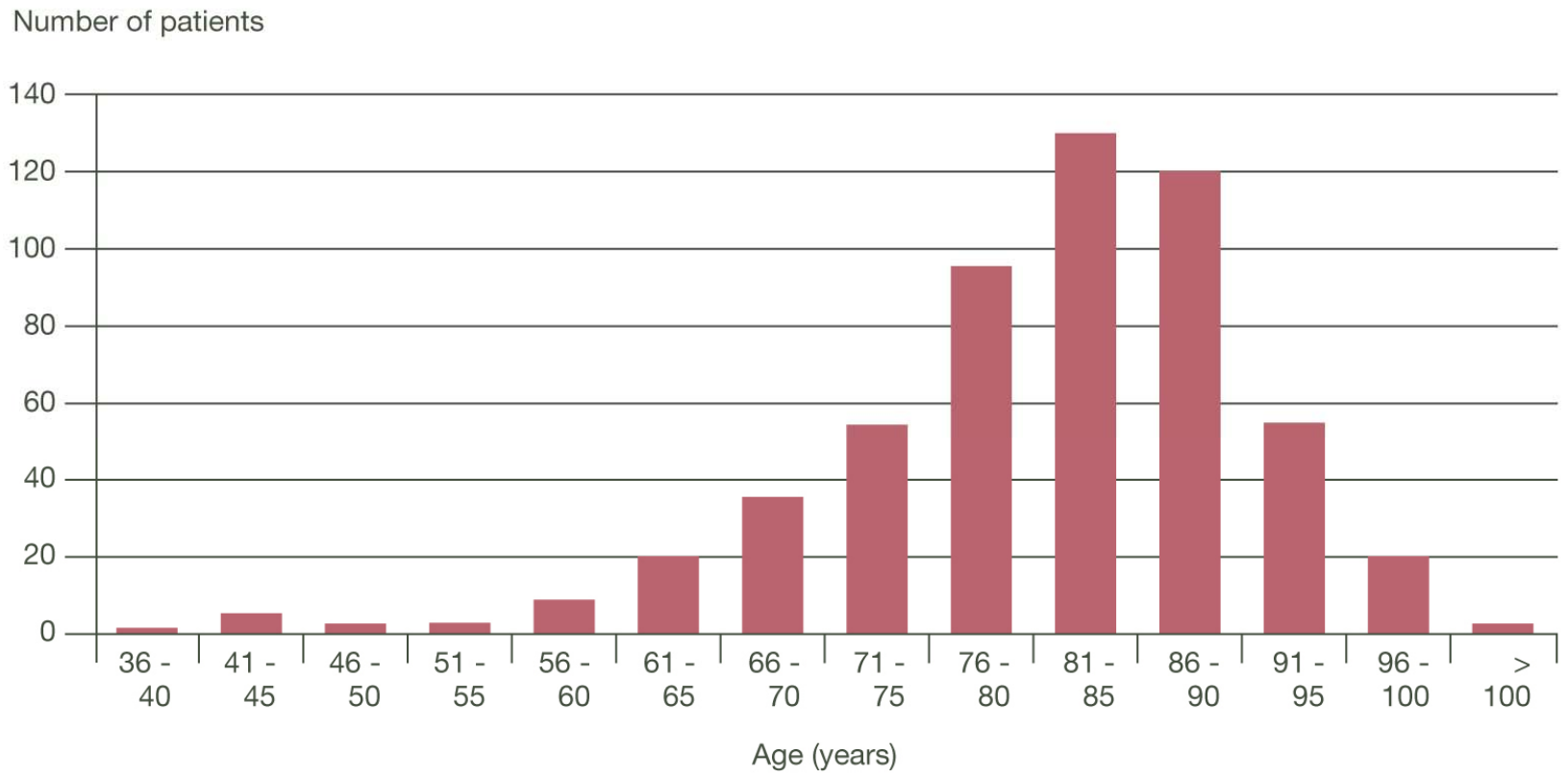



**Figure 3.1 Age distribution of study population**

Elderly population - median age of 83

# Admitting specialty

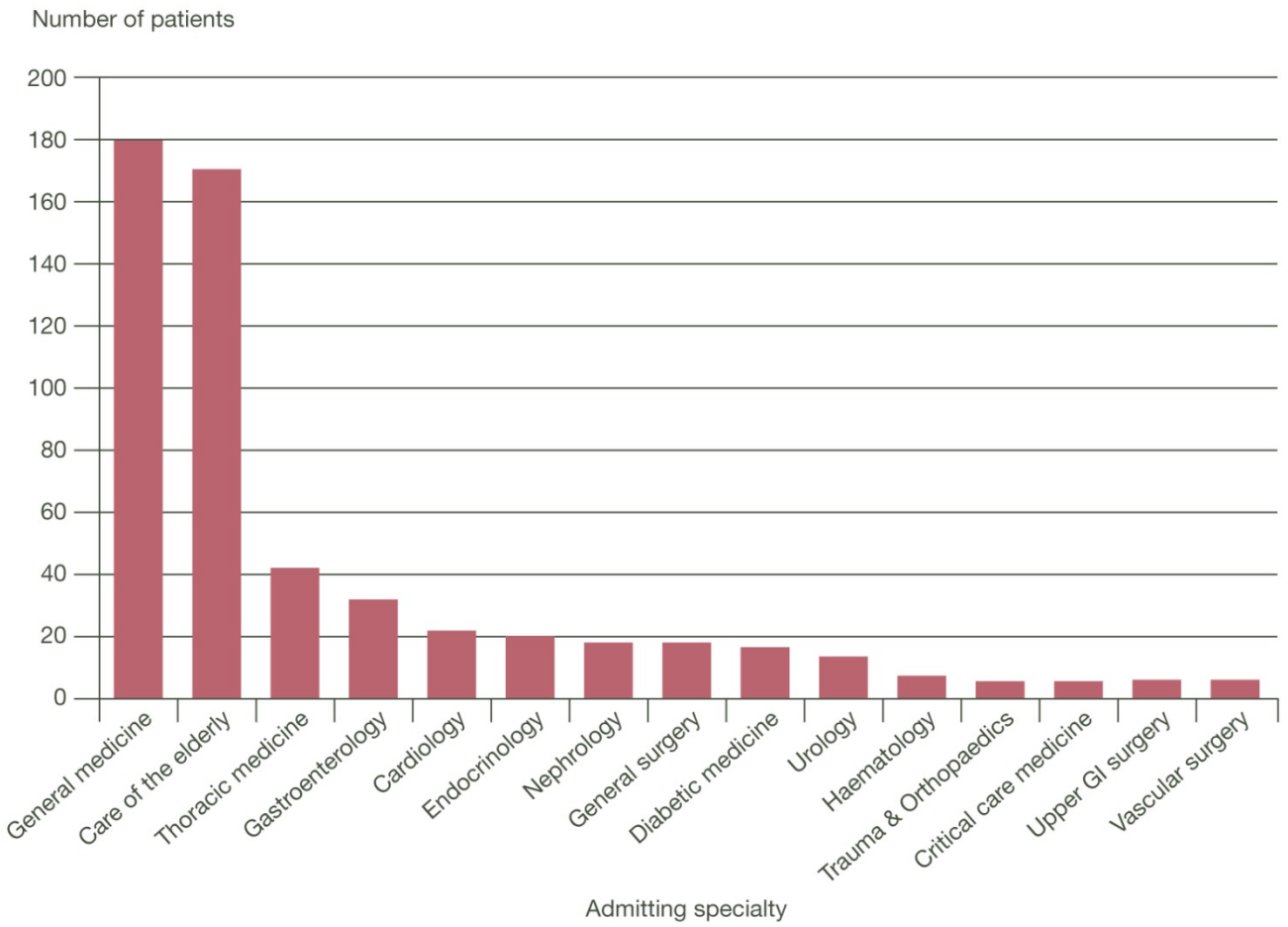
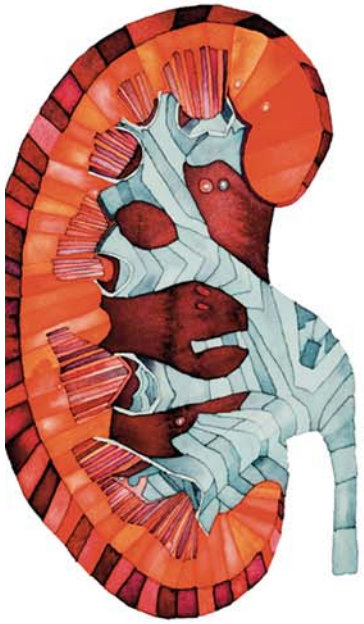



**Figure 3.2 Specialties of admitting consultants**

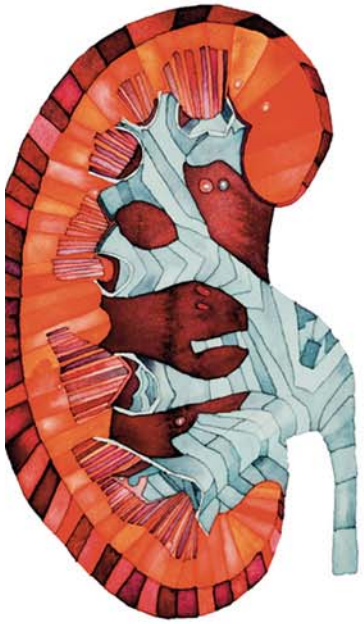
# Key findings



- Only 50% of AKI care considered good
- Poor assessment of risk factors
- Unacceptable delay in recognition of post-admission in AKI in 43%
- 22 patients died with a primary diagnosis of post-admission AKI which was predictable and avoidable
- Complications missed (13%), avoidable (17%) or badly managed (22%)

NCEPOD

# Conclusion



- Systematic failings in AKI
- Failures in:
  - Recognition and management of AKI
  - Recognition and management of complications
  - Referral and support
- Failures in recognition of the acutely ill

NCEPOD


At present systems are being developed *ad hoc*. A national group should be established to develop agreed standards for e-alert systems recognising the need for some system-dependent local flexibility.

Royal College of Physicians of Edinburgh

NHS Kidney Care

NICE National Institute for Health and Care Excellence

# Support for implementing the NICE clinical guideline on acute kidney injury (CG169)

- Identifying acute kidney injury in patients with acute illness
- Identifying acute kidney injury in patients with no obvious acute illness*
- Assessing risk factors in adults having iodinated contrast agents and in adults having surgery
- Ongoing assessment of patients in hospital
- Detecting acute kidney injury
- Identifying the cause(s) of acute kidney injury
    - Urinalysis*
    - Ultrasound
- Managing acute kidney injury
    - Relieving urological obstruction*
    - Pharmacological management*
    - Referring for renal replacement therapy*
    - Referring to nephrology
    - Information and support for patients and carers

**AKI: Key priorities for implementation**

* not a KPI, but considered a key issue by the guideline development group

# Risk factors: adults

- Chronic kidney disease (or history of)
- Diabetes
- Heart failure
- Sepsis
- Hypovolaemia
- Age 65 years or over
- Use of drugs with nephrotoxic potential (for example, NSAIDs, ACE inhibitors)
- Use of iodinated contrast agents within past week
- Oliguria
- Liver disease
- Limited access to fluids, e.g. via neurological impairment
- Deteriorating early warning scores
- Symptoms or history of urological obstruction

# Detecting AKI

- Investigate for AKI when risks factors are present
- Compare serum creatinine with the patient's baseline

| Detect AKI using (p)RIFLE, AKIN, KDIGO criteria: | |
|---|---|
| Serum creatinine | rise ≥ 26 micromol/litre from baseline within 48 hours |
| Serum creatinine | rise by 50% or more in 7 days |
| Urine output | < 0.5ml/kg body weight/hour for 6 consecutive hours in adults |

- **Urine output < 0.5ml/kg/hour for more than 8 hours in children and young people**
- **In children and young people – a 25% or greater fall in eGFR**

# Adults: ongoing hospital assessment

- Use early warning scores (track and trigger systems) (CG50)
- Ensure there is a system in place to recognise and respond to oliguria <0.5ml/kg/hour (if not part of early warning score)
- Continue to monitor serum creatinine regularly in all patients with, or at risk, of acute kidney injury

# Managing AKI

- Pharmacological management
- Relieving urological obstruction
- Referral
- Information and support for patients and carers

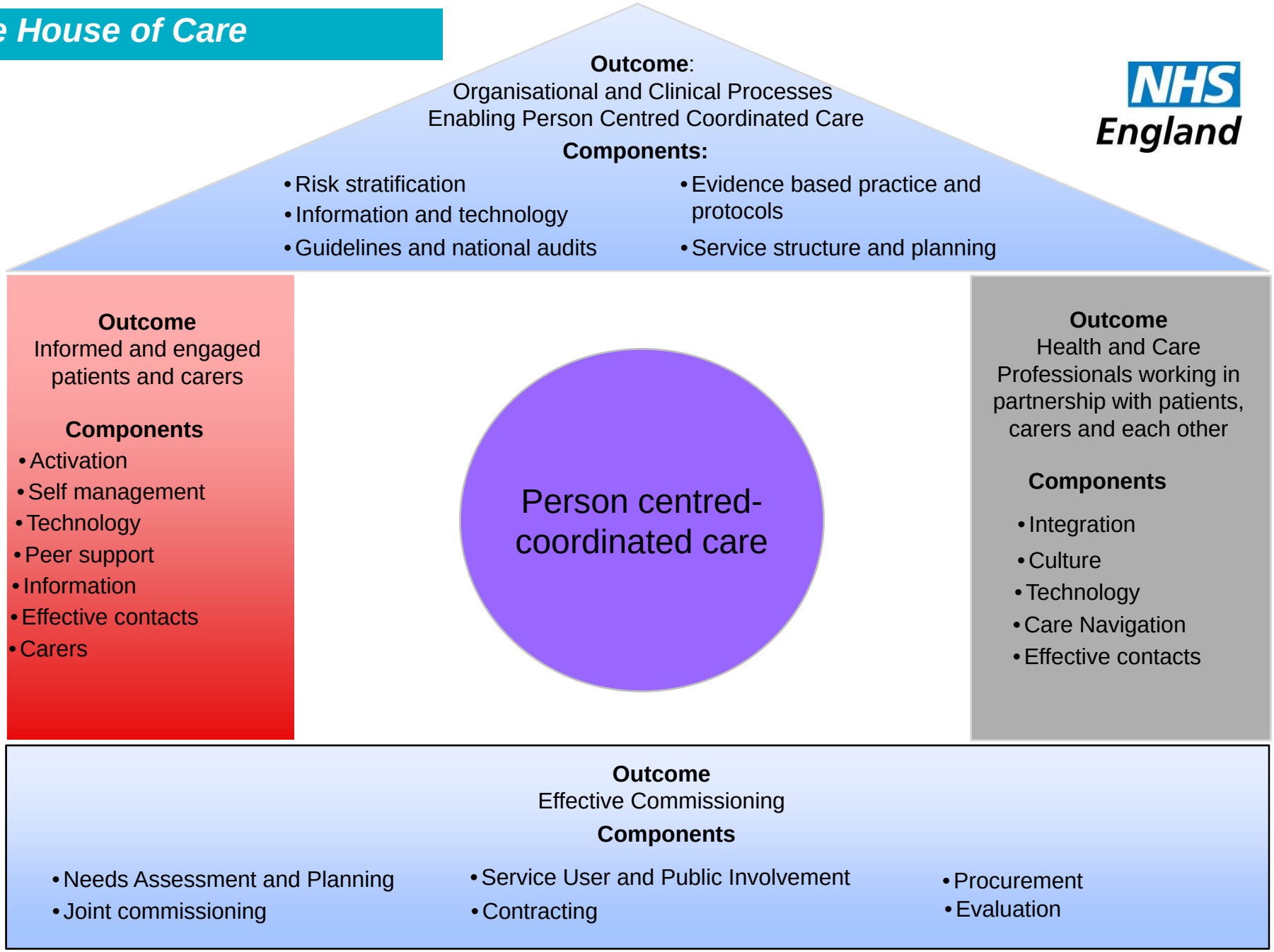
# Referral

| **Nephrology:**<br>**Discuss AKI management with a nephrologist/paediatric nephrologist as soon as possible (and within 24 hours) if one of the following is present:** | | |
|---|---|---|
| Potential diagnosis requiring specialist treatment (for example, vasculitis or glomerulonephritis) | AKI with no clear cause | Inadequate treatment response |
| Complications associated with AKI | Stage 3 AKI | eGFR is less than < 30 ml/min/1.73 $m^2$ after AKI episode |
| Patients with renal transplant and AKI | CKD stage 4 or 5 | |

| **Renal replacement therapy:**<br>**Refer adults, children and young people <u>immediately</u> for RRT if any of the following are not responding to medical management:** | | | |
|---|---|---|---|
| Hyperkalaemia | Metabolic acidosis | Symptoms or complications of uraemia such as pericarditis or encephalopathy | Fluid overload +/- pulmonary oedema |

# Acute Kidney Injury Programme Board NHS England

# *The House of Care*



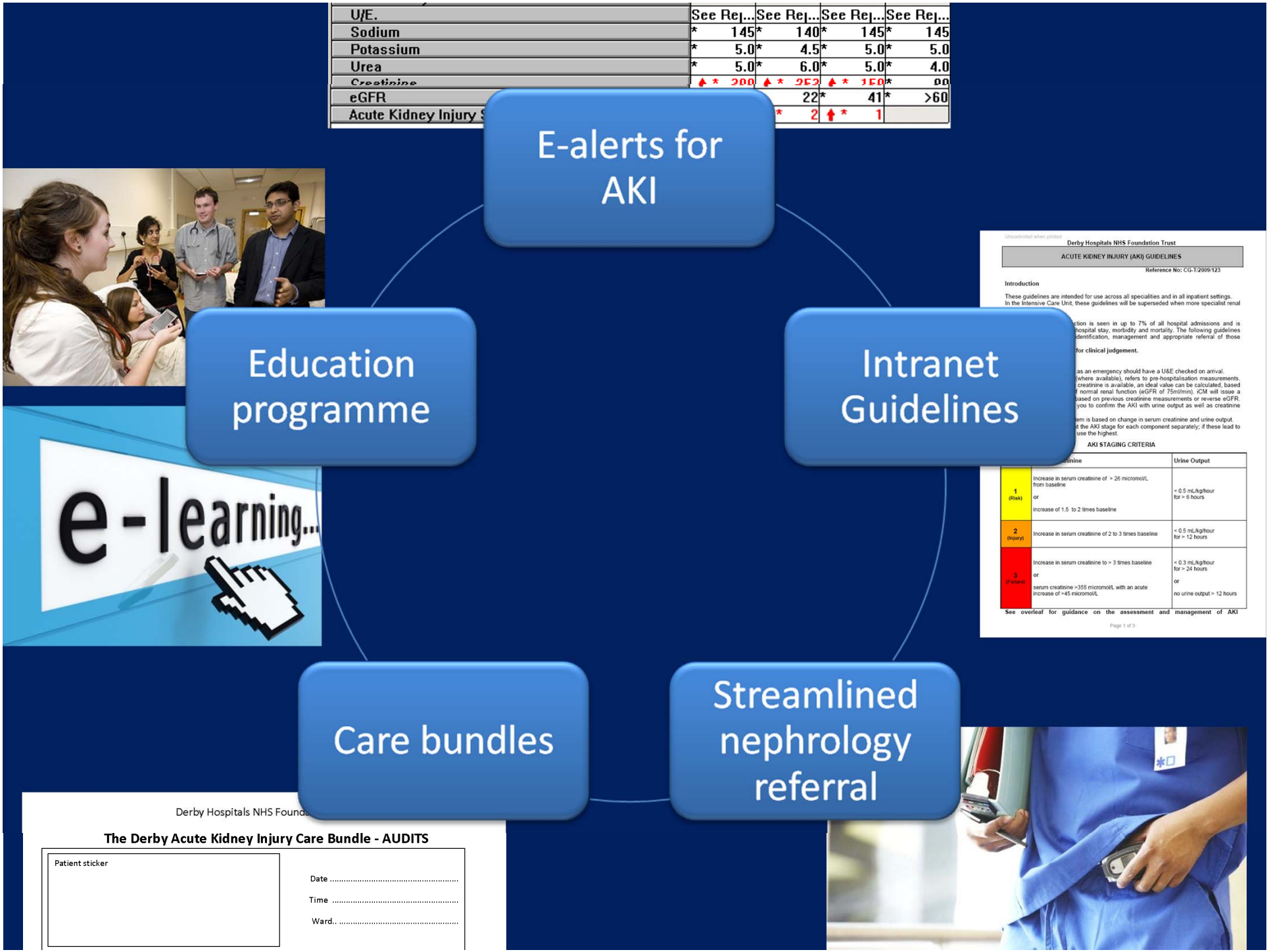
# The steering group

- Provide governance and strategy to the project
- Responsible for communication to stake holders
- Be accountable for the deliverables
- Supported by the programme manager
- Review of the project budget
- Provide leadership to the work streams

# Work streams

- Chair and deputy
- Co-opted membership agreed by the management team
- Develop project plan with support of programme manager

  - Delineate scope
  - Provide timelines and objectives
  - Identify evidence and best practice
  - Develop tools
  - Provide research and development focus
  - Ensure equity and transparency in approach - e.g. paediatric dimension


U/E.
See Rej...
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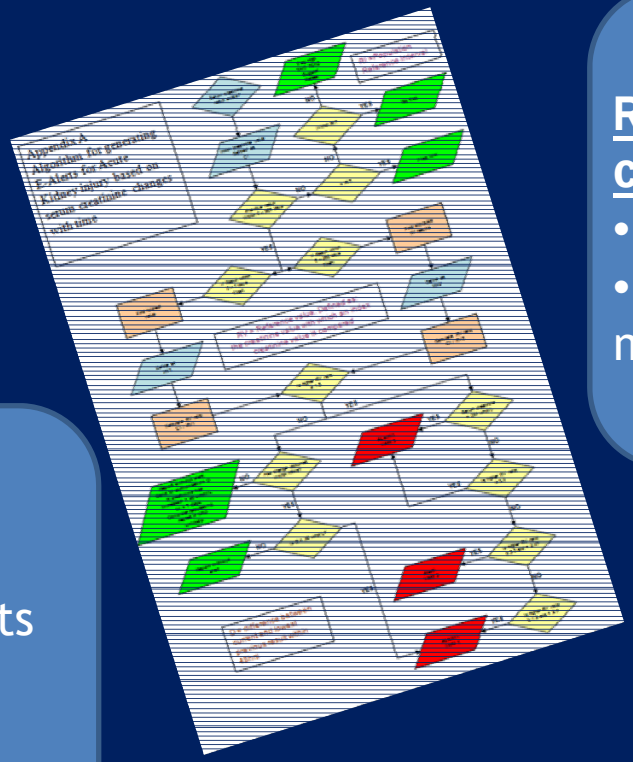
Sodium
145
140
145
145
Potassium
5.0
4.5
5.0
5.0
Urea
5.0
6.0
5.0
4.0
eGFR
22
41
>60
Acute Kidney Injury
2
1
E-alerts for AKI
Intranet Guidelines
Streamlined nephrology referral
Care bundles
Education programme
e-learning...
Derby Hospitals NHS Foundation Trust
ACUTE KIDNEY INJURY (AKI) GUIDELINES
Reference No: CG-T/2009/123
Introduction
AKI STAGING CRITERIA
Urine Output
See overleaf for guidance on the assessment and management of AKI
The Derby Acute Kidney Injury Care Bundle - AUDITS
Patient sticker
Date .....
Time .....
Ward.. .....

# On going professional groups




**Renal Association guidelines committee**

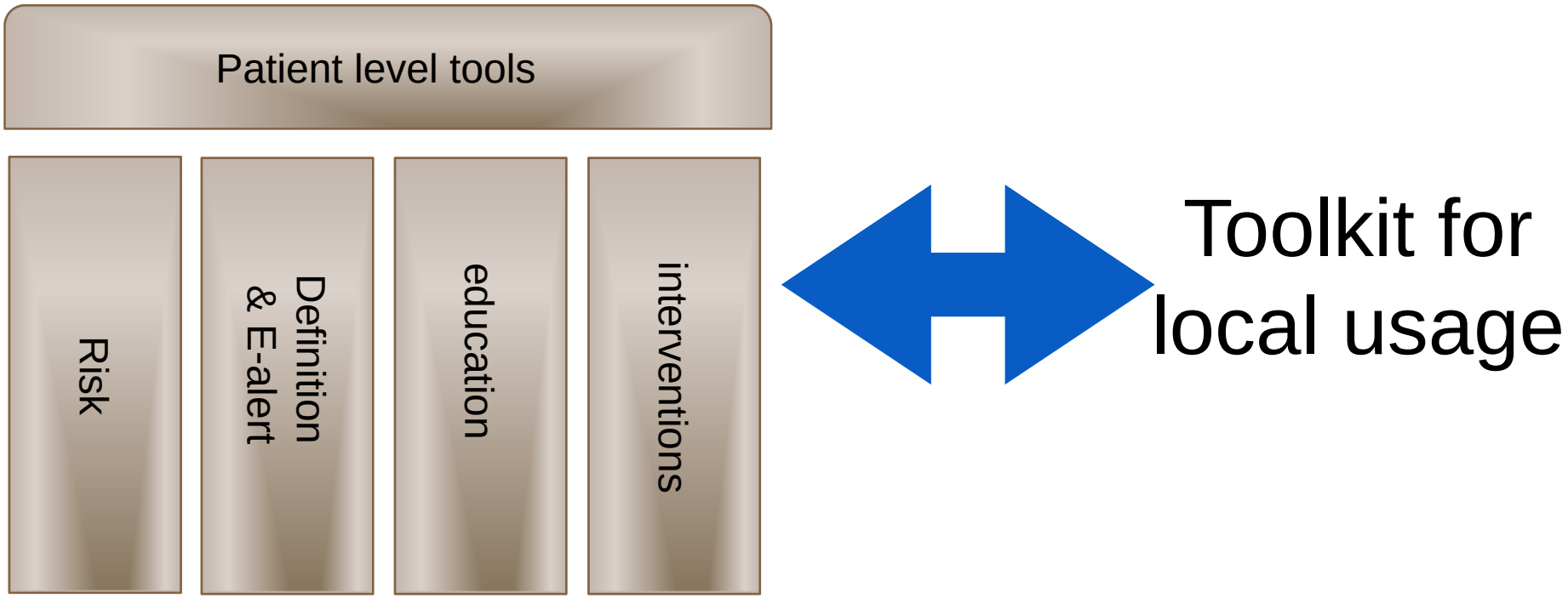
- Due to meet October 2013
- Nephrologists, ICU, general medicine

**ACB scientific committee**

- Met July 2013
- Biochemists, nephrologists and software providers
- Initial algorithm and minutes available online

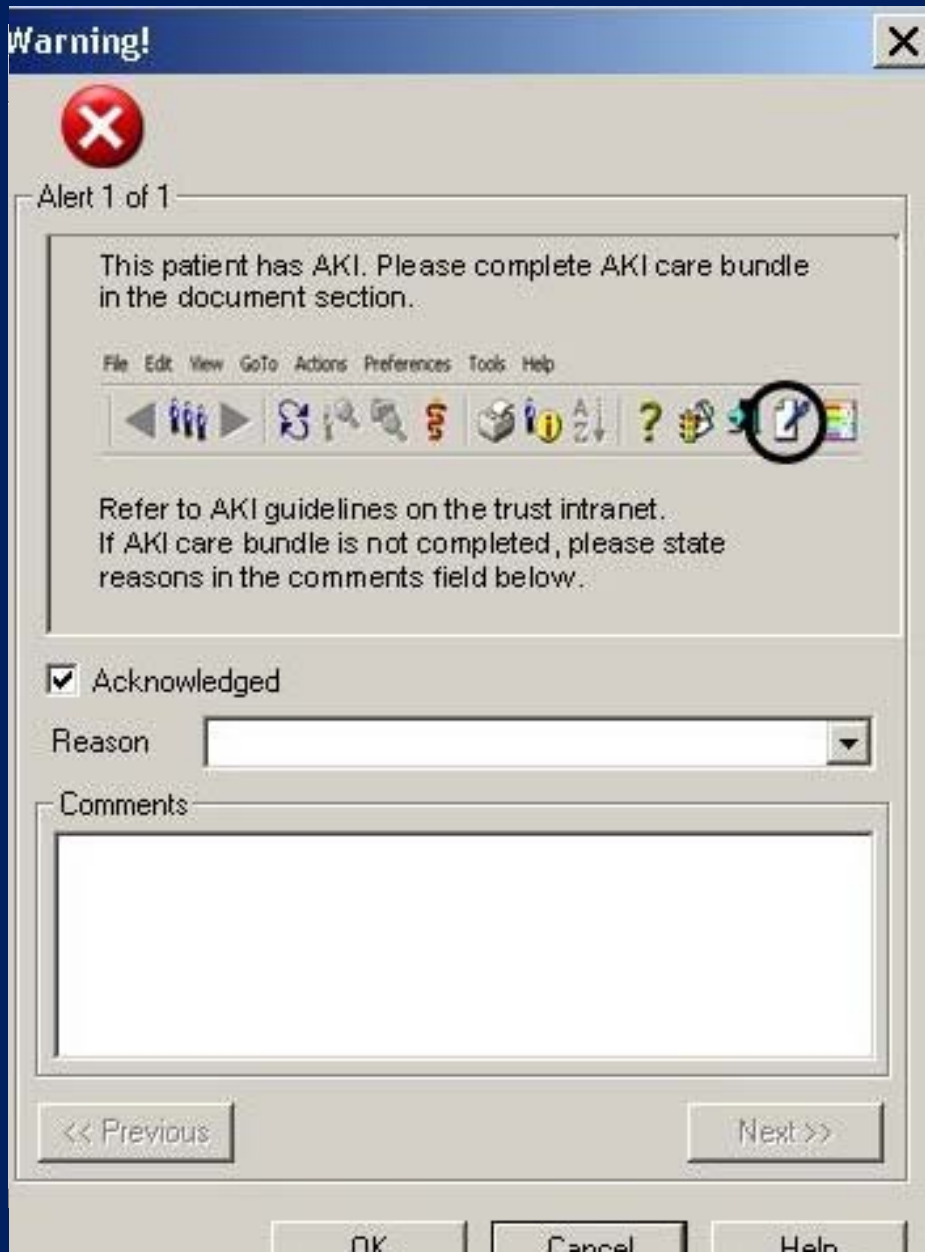
http://www.acb.org.uk/docs/default-source/guidelines/e-alerts-for-aki-meeting-statement.pdf

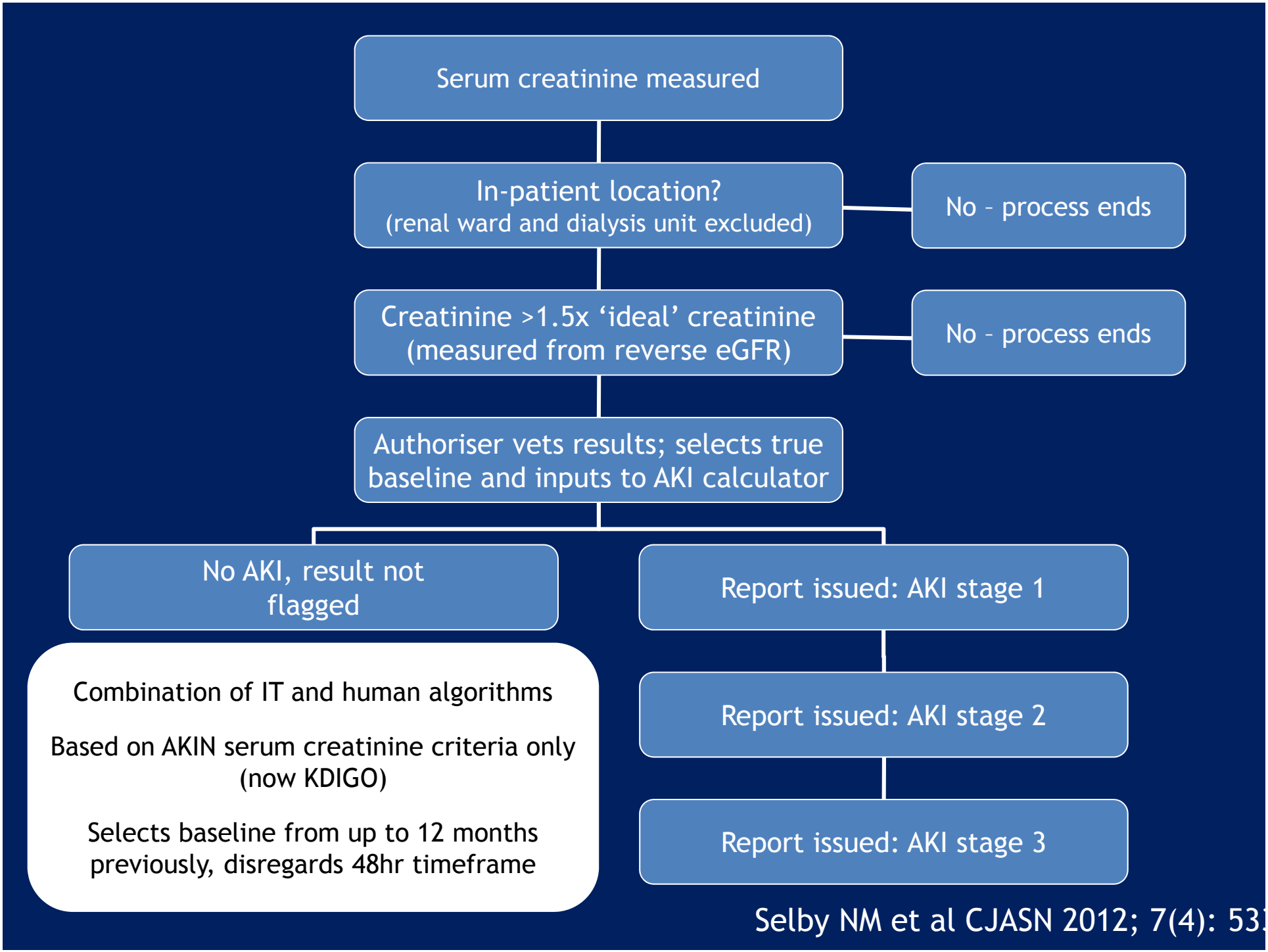
# AKI work streams - Programme board plan



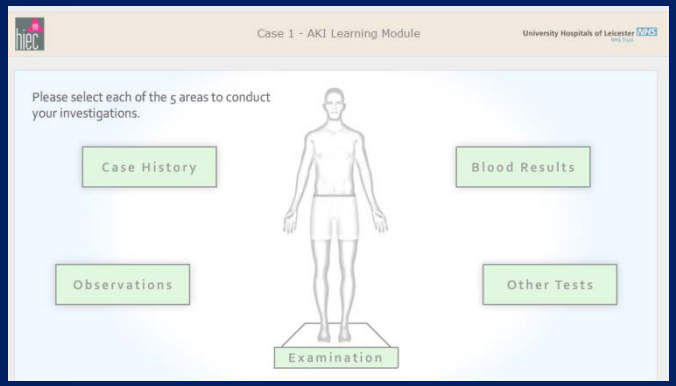
# AKI care bundle

- Introduced to assessment units in 2011
- Targets systematic improvements in basic elements of care
- Consistent with intranet guidelines

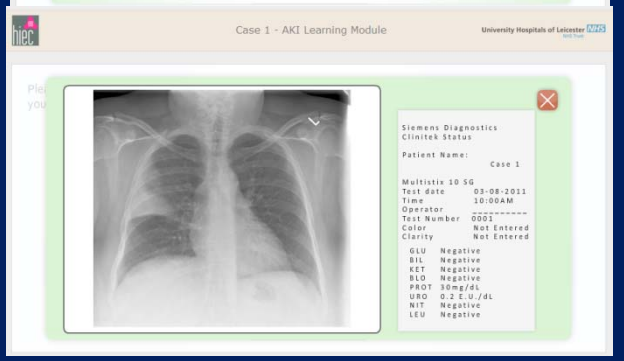


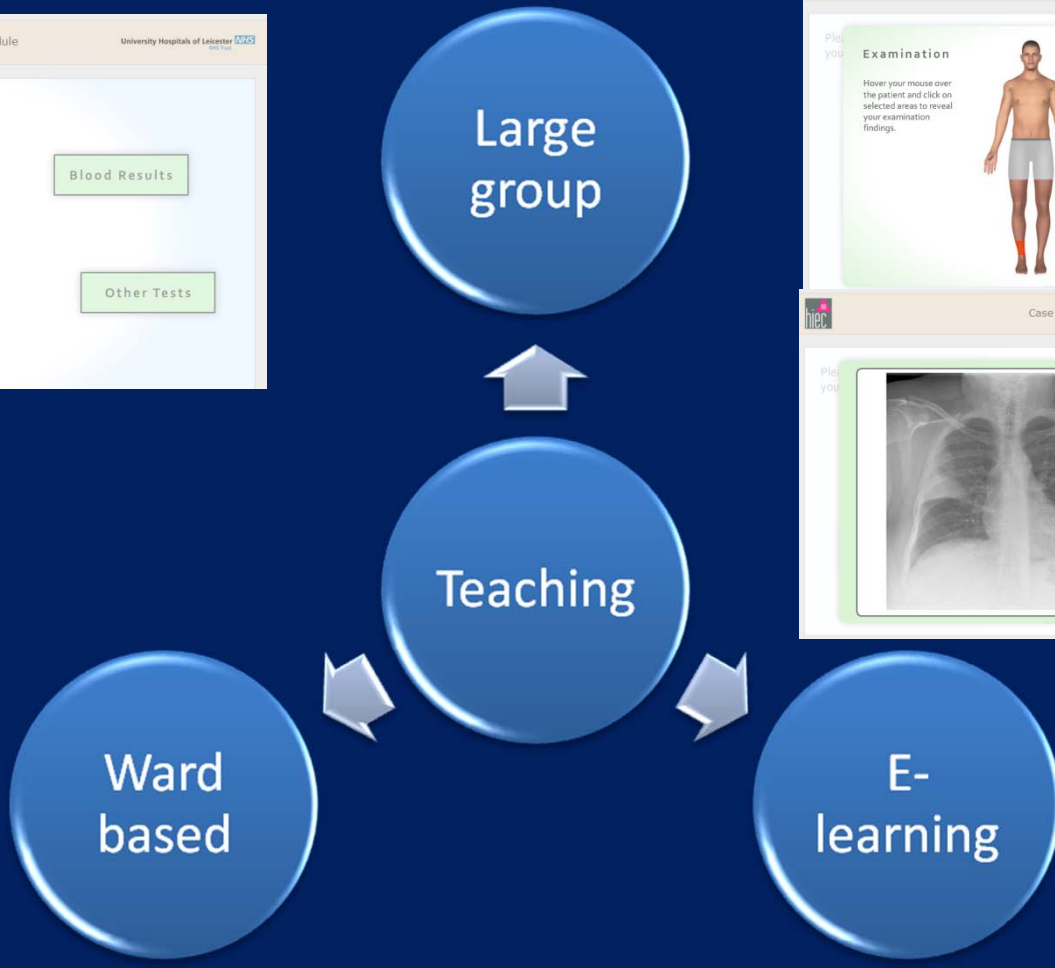

Serum creatinine measured
In-patient location?
(renal ward and dialysis unit excluded)
No – process ends
Creatinine >1.5x 'ideal' creatinine
(measured from reverse eGFR)
No – process ends
Authoriser vets results; selects true baseline and inputs to AKI calculator
No AKI, result not flagged
Report issued: AKI stage 1
Report issued: AKI stage 2
Report issued: AKI stage 3
Combination of IT and human algorithms
Based on AKIN serum creatinine criteria only (now KDIGO)
Selects baseline from up to 12 months previously, disregards 48hr timeframe
Selby NM et al CJASN 2012; 7(4): 53

# Components of the Educational Toolkit







# Educational outcomes

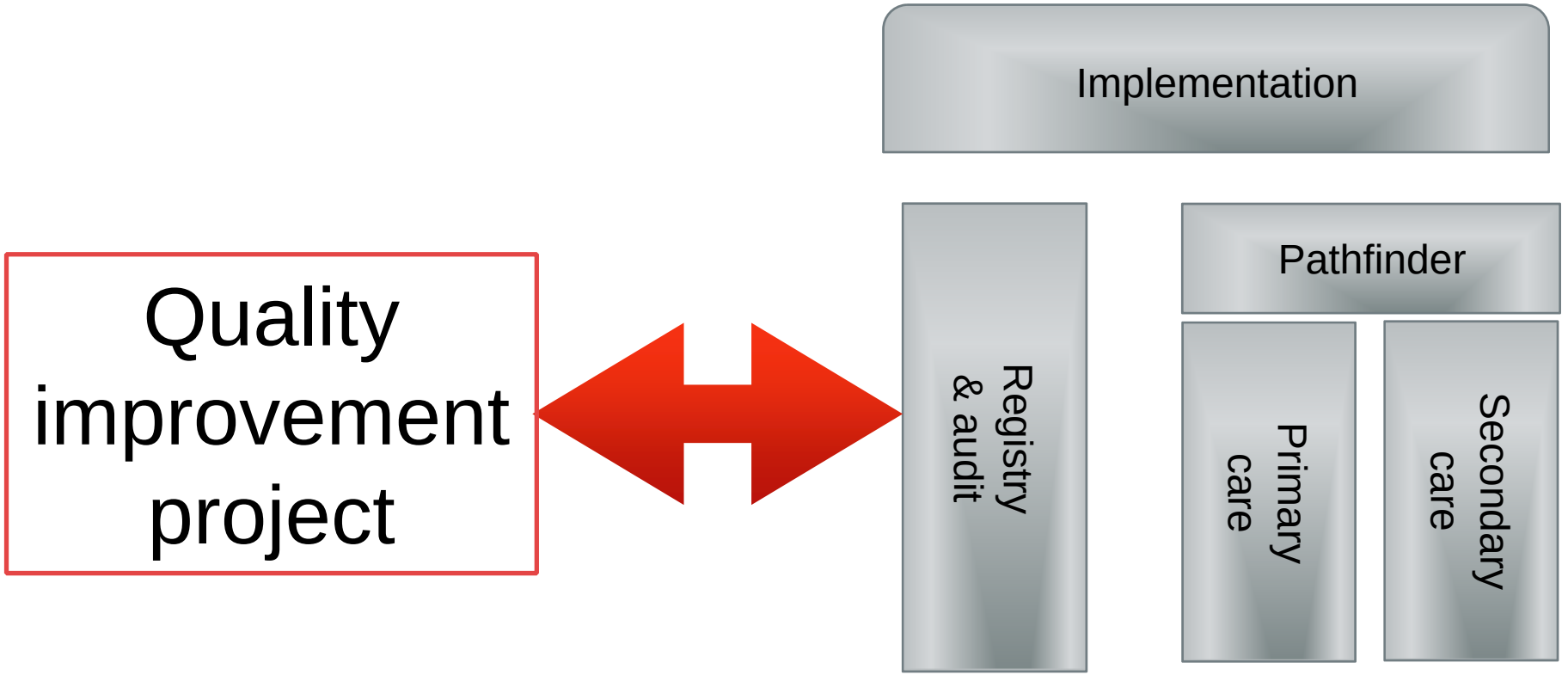
- 457 clinicians surveyed (319 at baseline, 138 post intervention)
- Improvements seen in self-reported indicators:

  *(Combined data from RDH and UHL)*

  - **Confidence levels**
    50% vs. 68%, p<0.001
  - **Independent initiation of investigation and treatment**
    48% vs. 64%, p=0.002
  - **Awareness of local AKI guidelines**
    25% vs. 64%, p<0.001
- Improvements in **knowledge scores** in junior doctors (F1/F2)

Xu G, Westacott R, Baines R, Selby NM, Carr S. Submitted QJM

# AKI work streams



# Objectives

- Lead implementation across England - need for coordination and globalisation
- Reduce burden of illness related to AKI
- Provide patient level tools for improved management
- Establish a national Registry
- Initiate and lead QI

- April 2014 Workstream meeting
- October 2014 National Launch meeting

# The safety thermometer - a place for AKI?

**Table 2: NHS Safety Thermometer summary results**

The following table summarises the national percentage of patient assessments which showed each of the four harms and which sl
none of the harms – 'harm free' - for the period from October 2012 to October 2013 based on the number of records shown in Tabl

| | Oct12 | Nov12 | Dec12 | Jan13 | Feb13 | Mar13 | Apr13 | May13 | Jun13 | Jul13 | Aug13 | Sep13 | Oct13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Harm Free | 92.0% | 92.3% | 92.4% | 92.3% | 92.1% | 92.4% | 92.2% | 92.4% | 92.7% | 92.8% | 93.0% | 93.2% | 93.4% |
| Pressure Ulcers - All | 5.4% | 5.3% | 5.2% | 5.5% | 5.6% | 5.4% | 5.6% | 5.5% | 5.2% | 5.1% | 5.0% | 4.8% | 4.7% |
| Pressure Ulcers - New | 1.2% | 1.2% | 1.2% | 1.3% | 1.3% | 1.3% | 1.3% | 1.2% | 1.2% | 1.2% | 1.1% | 1.1% | 1.1% |
| Falls with Harm | 1.0% | 1.0% | 1.0% | 0.9% | 1.0% | 0.9% | 1.1% | 0.9% | 0.9% | 1.0% | 0.9% | 0.9% | 0.8% |
| Catheters & UTIs | 1.2% | 1.1% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 0.9% | 1.0% | 1.0% | 1.0% | 0.9% |
| Catheters & New UTIs | 0.6% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.4% | 0.5% | 0.4% |
| New VTEs | 0.8% | 0.7% | 0.7% | 0.7% | 0.7% | 0.6% | 0.6% | 0.6% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| All Harms | 8.1% | 7.7% | 7.6% | 7.7% | 7.9% | 7.6% | 7.8% | 7.6% | 7.3% | 7.2% | 7.0% | 6.8% | 6.6% |
| New Harms | 3.5% | 3.4% | 3.3% | 3.3% | 3.4% | 3.2% | 3.3% | 3.1% | 3.0% | 3.0% | 2.8% | 2.8% | 2.7% |
| Patient Assessments | 175,199 | 178,853 | 177,561 | 185,338 | 188,901 | 192,085 | 208,444 | 206,849 | 204,397 | 202,214 | 201,030 | 201,167 | 194,284 |
| Organisations | 559 | 587 | 605 | 618 | 648 | 655 | 715 | 738 | 749 | 780 | 788 | 784 | 725 |

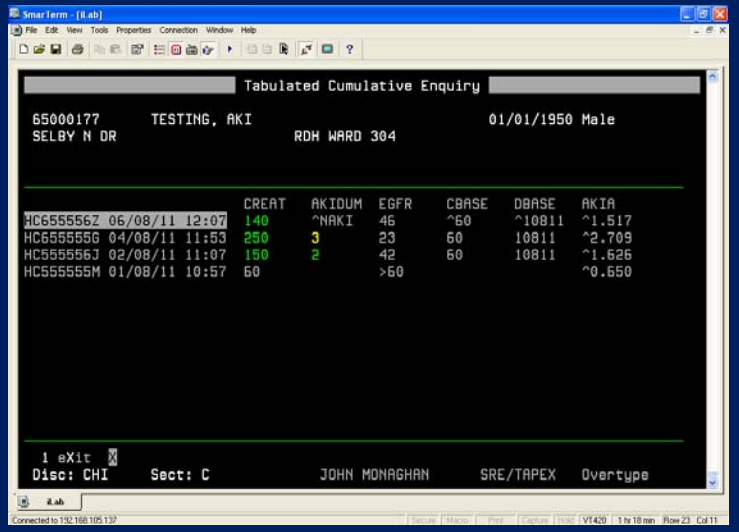
Note: a patient may have all, some, one, or none of the harms, so the percentages may not add up to 100%.

# Local IT

- Pathology IT: iLab
- Results reporting: iCM

- Functionality limited:
  - Delta check
  - Compare current value with a calculated field

- No options to change programming
- No response from company to work collaboratively




# Educational programme

- Collaboration between Royal Derby Hospital and University Hospitals Leicester
- Joint funding from East Midlands HIEC
- Initiated April 2011

**Project team**

Prof Sue Carr (project lead)
Dr Nick Selby (project lead)

Dr Rachel Westacott
Dr Richard Baines
Dr Nitin Kolhe
Dr Gang Xu
Dr Salman Riaz
Joanne Kirtley
James Trew

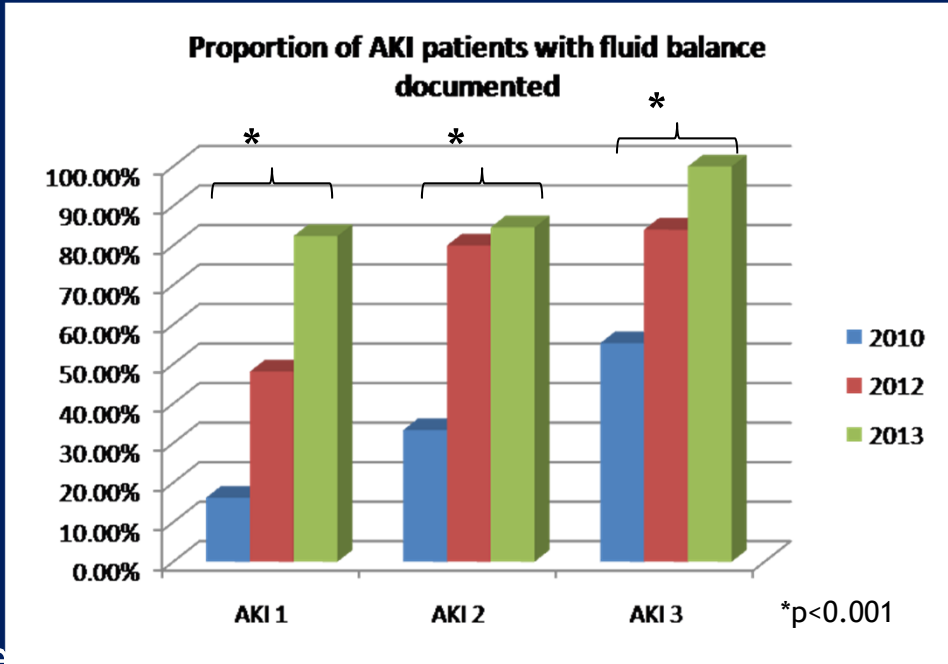
University Hospitals of Leicester NHS
NHS Trust

Derby Hospitals NHS
NHS Foundation Trust

*Winner of BMJ 'Excellence in Education' Award 2013*

# Impact on standards of basic care

- Cases note audit of 306 pts.
  - 132 cases baseline
  - 156 cases post intervention
    - 77 in 2012 audit, 79 in 2013 audit
  - Equal numbers in each AKI stage




| | Baseline | 2012 | 2013 | p value |
|---|---|---|---|---|
| Fluid balance assessed | 36.4% | 66.2% | 79.7% | p<0.001 |
| Medication review | 71.1% | - | 88.4% | p<0.001 |
| Renal imaging (AKI 2 & 3) | 45.3% | 54.2% | 71.0% | p<0.001 |
| Nephrology referral (AKI 3) | 37.8% | 56.5% | 78.9% | p<0.001 |

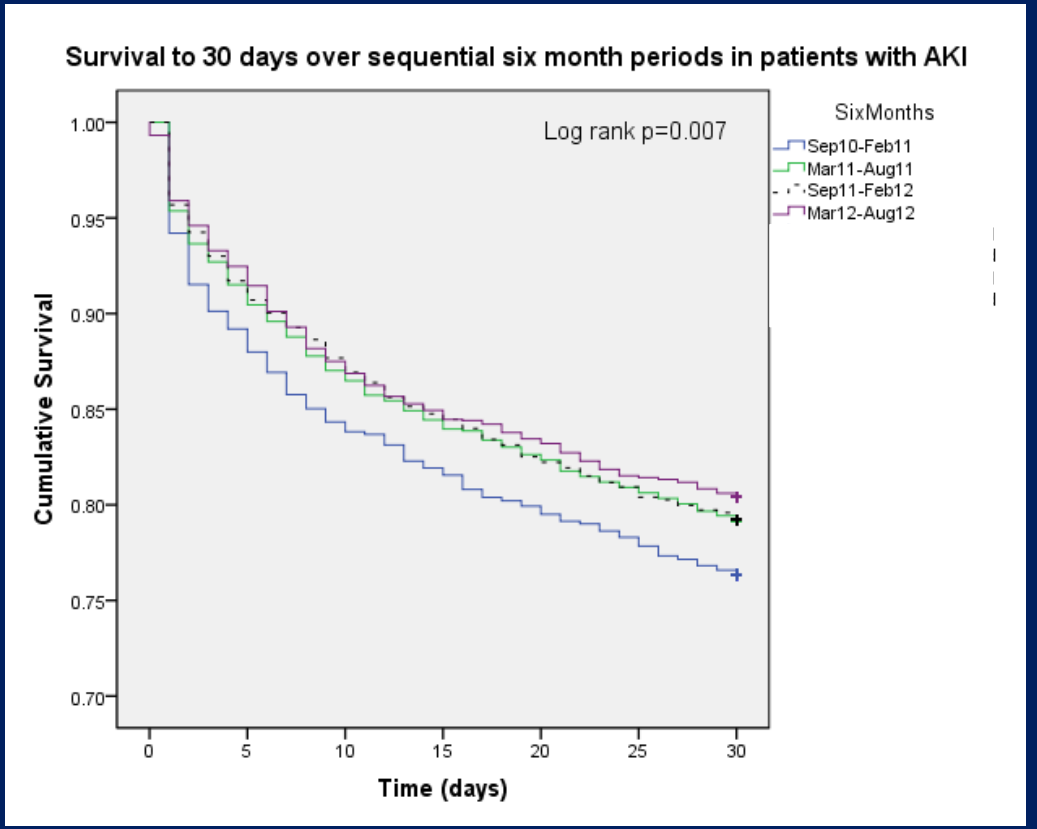
# Impact on patient outcomes

- n=8411
- Unadjusted 30-day mortality:

| | |
|---|---|
| Sep10-Feb11: | 23.7% |
| Mar11-Aug11: | 20.8% |
| Sep11-Feb12: | 20.8% |
| Mar12-Aug12: | 19.5% |

Chi square for trend p=0.006

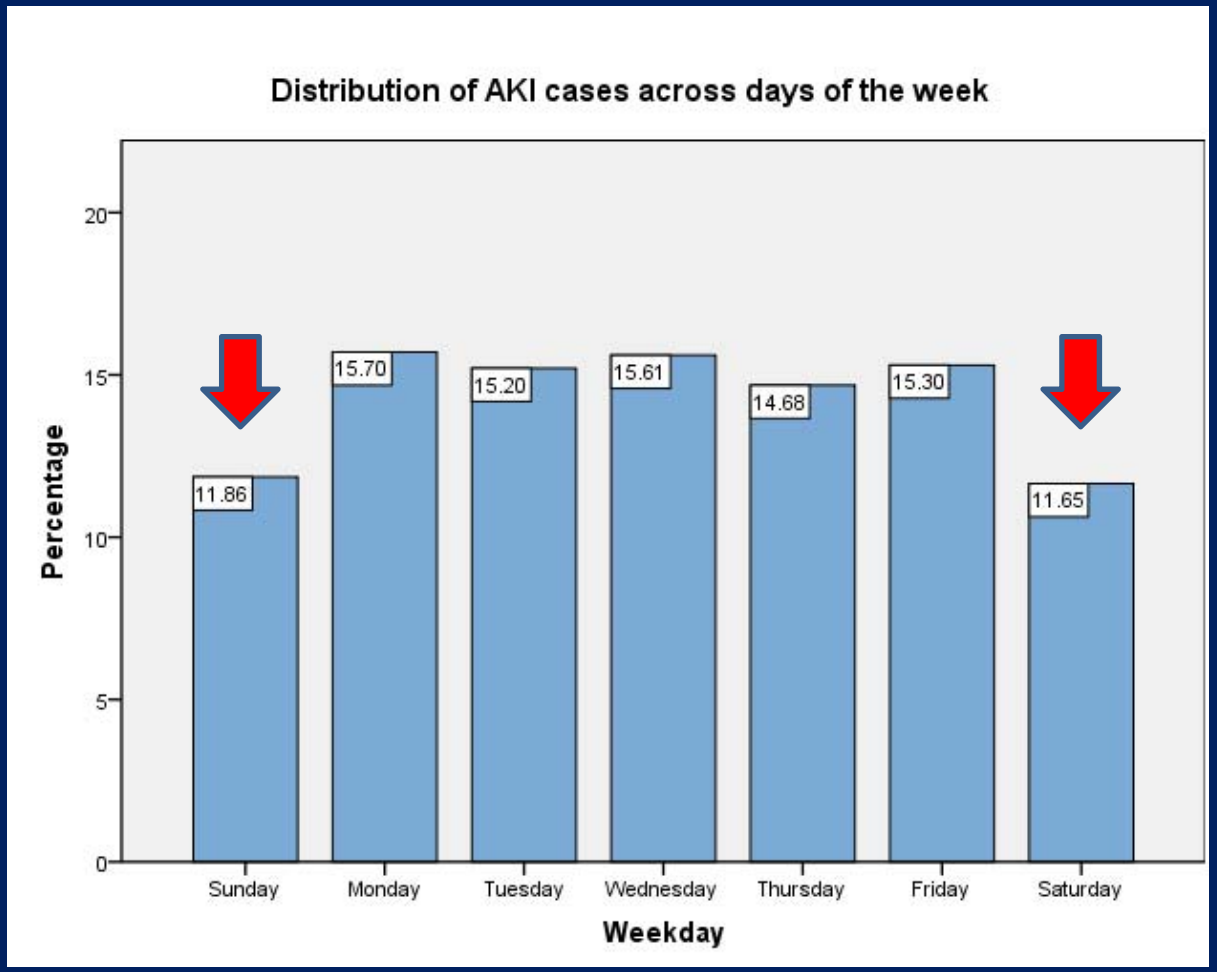
- No differences in LoS or rate of renal recovery




| Cox regression | Hazard ratio | 95% CI |
|---|---|---|
| Sep10-Feb11 | Reference | |
| Mar11-Aug11 | 0.9 | 0.79-1.0 |
| Sep11-Feb12 | 0.87 | 0.77-0.99 |

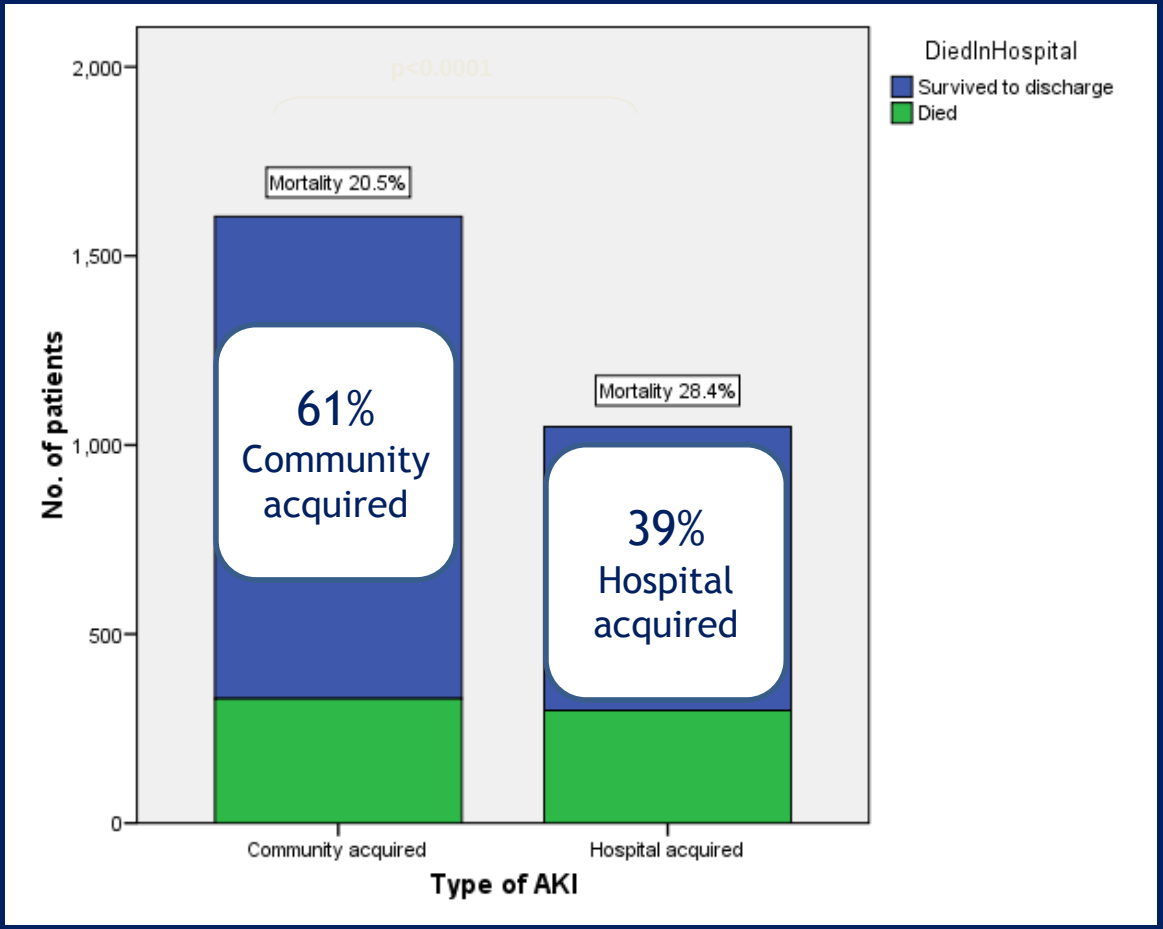
Selby NM. Curr Opin Nephrol Hypertens. 2013 *in press*

# Weekend versus weekday AKI



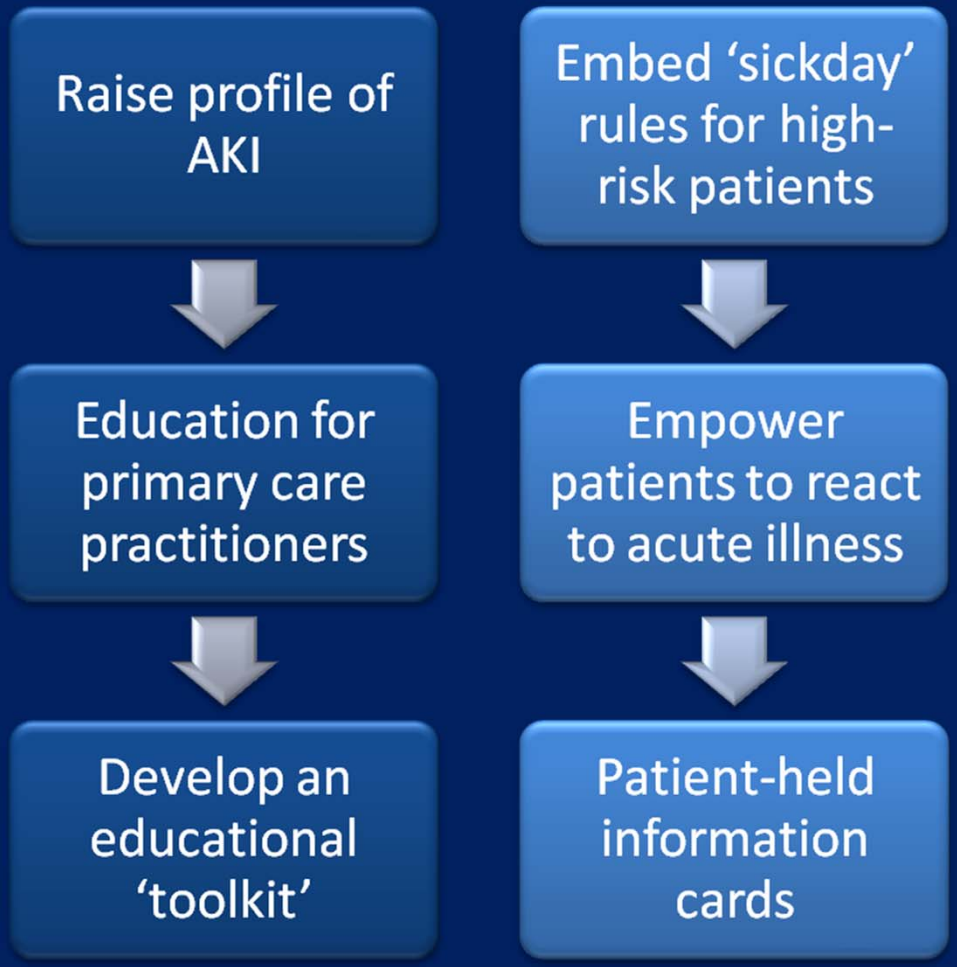

Crude mortality:
weekday 20.4%
weekend 24.9%,
p<0.001

# Working with primary care: 'Community acquired' AKI accounts for two-thirds of cases



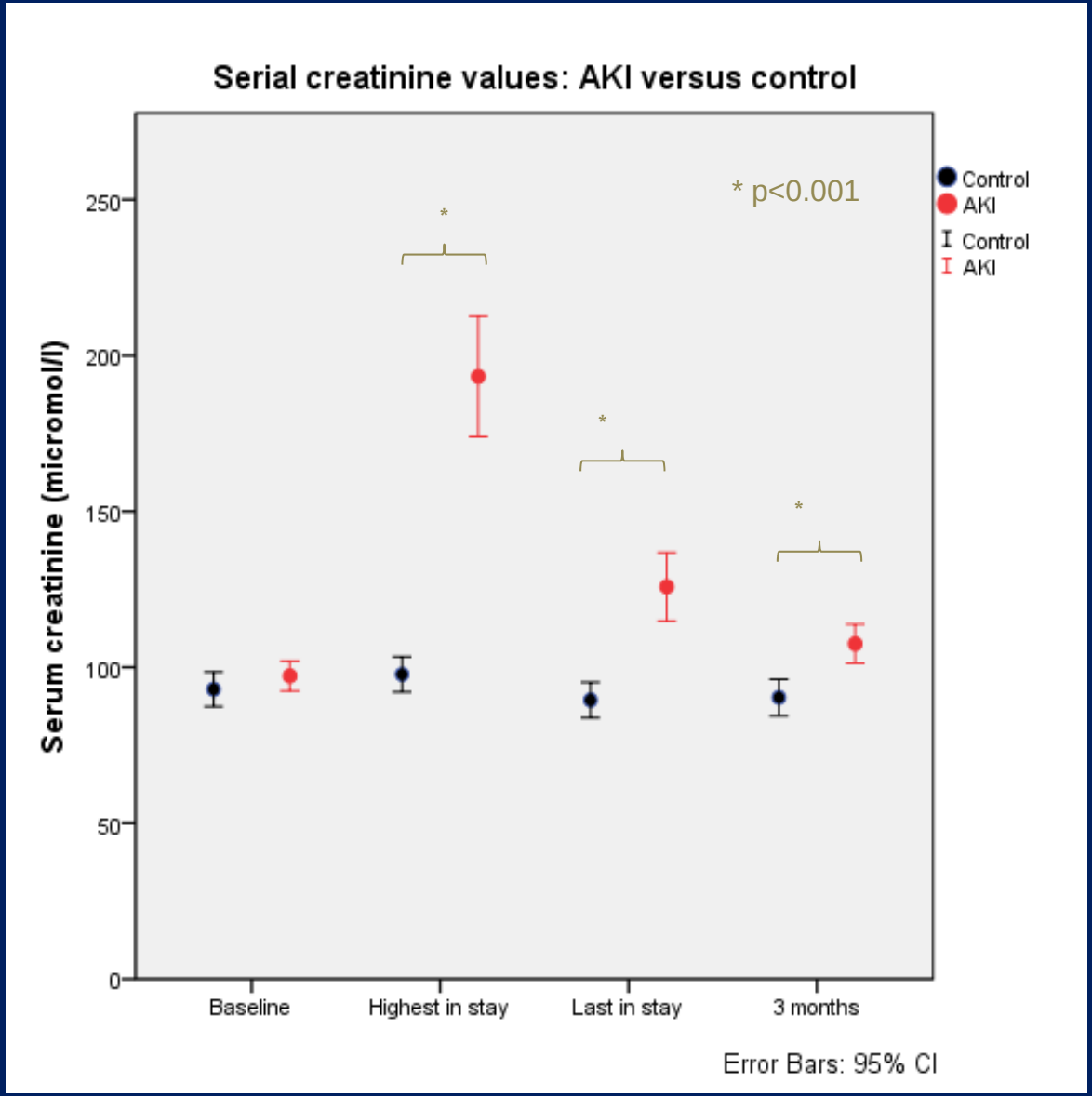

Selby NM et al CJASN 2012; 7(4): 53

# AKI prevention project




- Project team:
  - Nephrologists
  - GPs
  - Pharmacists
- Measure outcomes:
  - Educational outcomes
  - Patient acceptability
  - Admission rates and outcomes for patients with community acquired AKI

# CKD and AKI ARID- serial creatinine results




n=298

# Conclusion

- AKI represents a significant patient safety
- It is harmful
- It is common
- Management could be better - lives saved, reduced disease burden and reduced resource utilised