KQuIP/UKRR Regional Day
Yorkshire & Humber

6th July 2017 – 11.45-12.45

Focus on AKI Data

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THINK KIDNEYS

KQuIP

Focus on AKI Data -
AKI in Yorkshire and the Humber

Retha Steenkamp

Head of Operations UKRR

Background – The High Cost of AKI

- Estimated that 1 in 5 emergency admissions into hospital associated with AKI (Wang et al, 2012)

- Up to 100,000 deaths in hospitals, a quarter to a third could potentially be prevented (National Confidential Enquiry into Patient Outcome and Death (NCEPOD) Adding Insult to Injury 2009)

- Estimated costs to NHS per annum

  £434-620 million in 2011 (Kerr et al, 2014)

  £500 million in 2012 (NHS Kidneycare 2012, now NHS IQ)

  Rising to £1.02 billion in 2014 (Kerr et al, 2014)

National Algorithm Mandate to Report

- NHS England patient safety alert - Directive issued 09/06/2014
- 5 action points

- **Work with local LIMS supplier to ensure the test result goes** to local Patient management systems and **into a data message sent to a central point for national monitoring purposes**

- To be introduced by 09/03/2015

The UKRR: AKI Direct from Labs

From renal IT systems
CKD4/5, Acute Dialysis, RRT

Renal Units

LABS

Direct from labs
AKI in 1y and 2y care

Patient

UK Renal Registry

HES, ONS etc

Which Data?

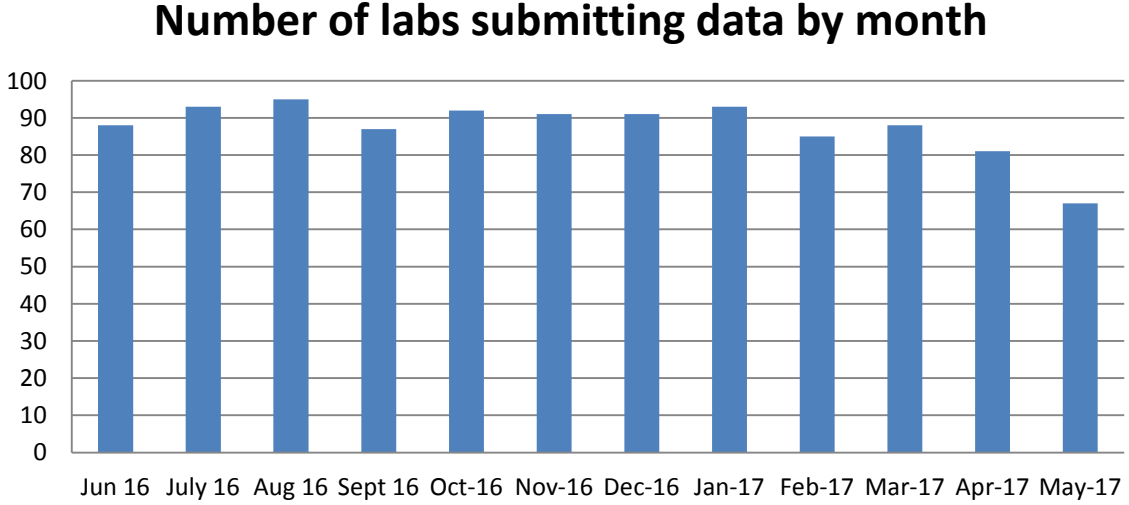
1. **Alert Files - The Warning Grade Test Result**
   - Patient Identifiers
   - The index creatinine and eGFR
2. **Creatinine files - Retrospective and Prospective Lab Data**
   - All creatinine and eGFR data from preceding 15 months
   - All creatinine and eGFR data from next 15 months

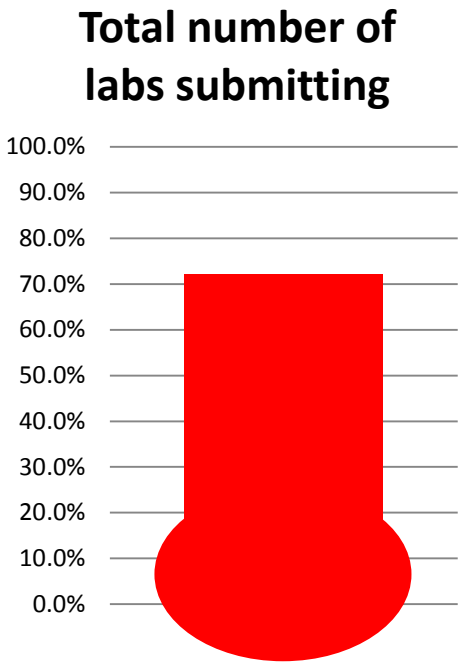
"The Master Patient Index"
Linkage to:
- UKRR
- HES
- ONS
- ICNARC

Alert File Data Items
NHS Number
Local Patient Identifier
Forename
Surname
Sex
DoB
Address 1
Address 2
Address 3 (Town)
Address 4 (County)
Post Code
Lab Code
Specimen Number
Source of Request
Primary/Secondary Care Indicator Field
Date of Sample
AKI Warning stage test result
Serum Creatinine Result (micromol/l)
eGFR Test Result

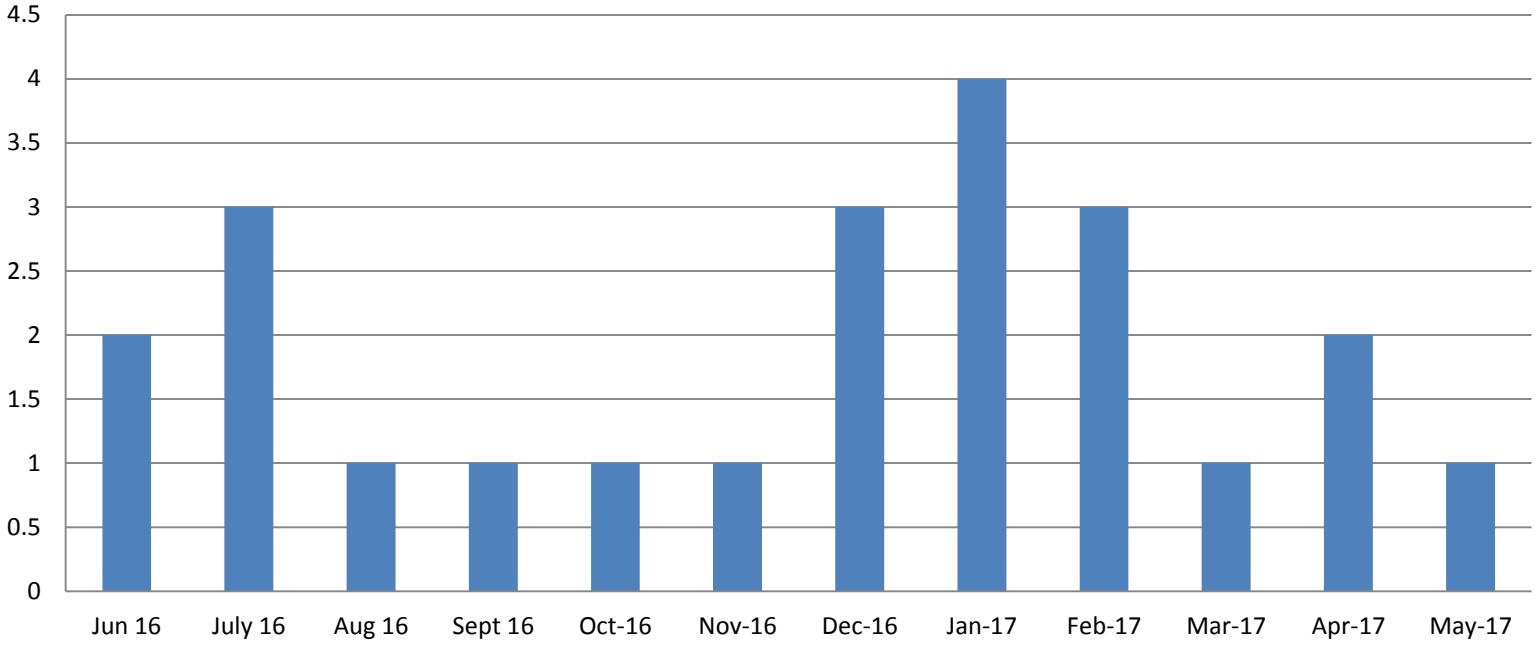
Progress

Currently 111 labs submitted AKI alert files (111/154)





Number of labs submitting data for the first time



Increase in AKI reporting

Laboratories are gradually coming on board to submit AKI data to the UKRR:

- In March 2015, 27 (18%) of an estimated 154 laboratories in England were submitting data, increasing to 71 (46%) by March 2016 and 88 by March 2017
- The UKRR has had AKI alert files from 111 labs (72%)

Incidence of AKI

For the period April 2015 and March 2017:

- 135,423 e-alerts were reported for Yorkshire & the Humber (England 1,546,571)
- 42,561 individual patients were identified as having AKI (England 470,400)

AKI reporting Yorkshire & the Humber

Lab Name	Lab Code	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
AIREDALE	697C0												
BRADFORD ROYAL INFIRMARY	690H0												
SHEFFIELD CHILDREN'S HOSPITAL	698E0												
DONCASTER ROYAL INFIRMARY	69180												
HULL & EAST YORKSHIRE	69460												
LEEDS GENERAL INFIRMARY	695N0												
NORTHERN GENERAL HOSPITAL	693E0												
ST JAMES'S UNIVERSITY HOSPITAL	696B0												

AKI Data Completeness – Yorkshire & Humber

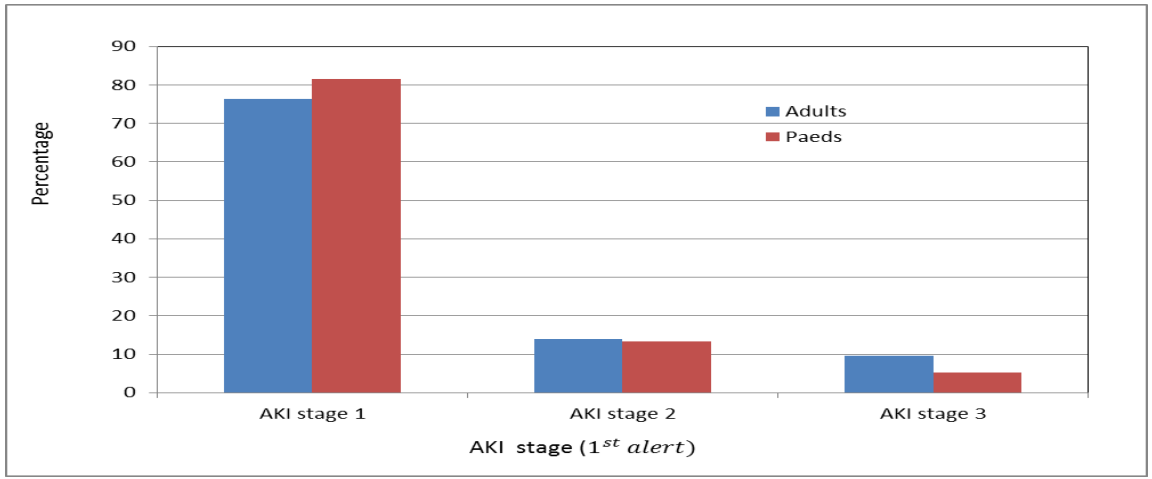
	Y&H	Eng
Total number of labs:	8	91
Total number of alerts:	135,423	1,546,571
Total number of patients with NHS number:	42,561	470,400
Data Item	% Complete	% Complete
NHS no	99.7	99.3
Sex	100.0	100.0
DOB	99.4	99.9
Postcode	97.9	97.2
Care Ind	95.7	96.3
AKI stage	100.0	100.0
eGFR (either CKD EPI or MDRD)	78.7	82.9
Creatinine	100.0	99.2

Up to date to March 2017

Number and Percentage by AKI Stage

AKI stage (first alert)	Number	Percentage	Eng
Stage 1	32,616	76.6	78.0
Stage 2	5,910	13.9	13.2
Stage 3	4,034	9.5	8.8
Missing	1	0.0	0.1
Total	42,561	100.0	100.0

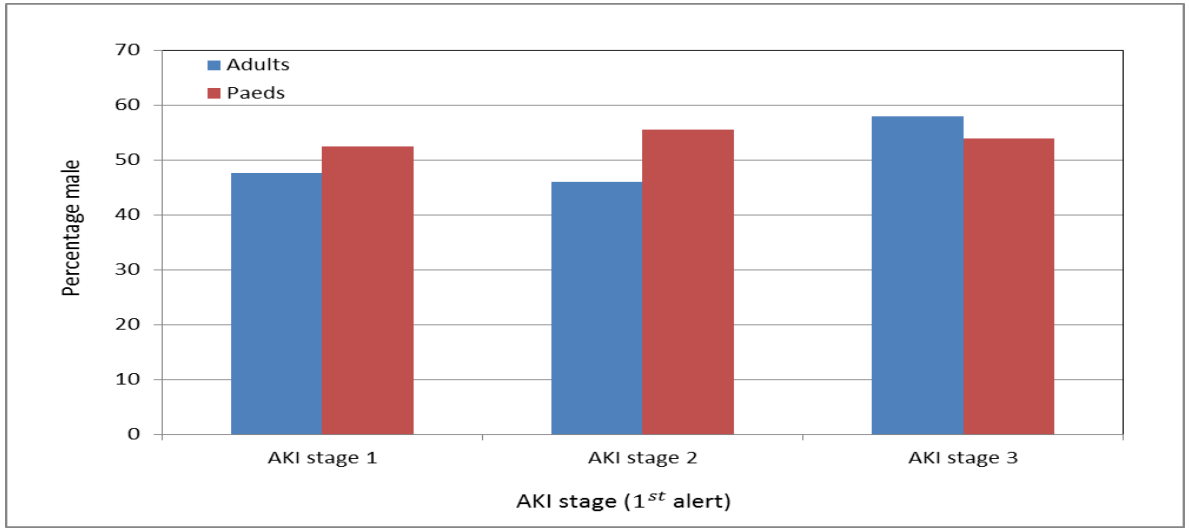
Percentage of Adult and Paediatric patients by AKI stage



Adults			
AKI stage	**N**	**%**	**Eng%**
1	30,984	76.4	78.0
2	5,642	13.9	13.2
3	3,929	9.7	8.8
Missing	1	0.0	0.0

CHILDREN			
AKI stage	**N**	**%**	**Eng%**
1	1,426	81.4	79.0
2	234	13.4	12.7
3	91	5.2	8.2
Missing	0	0.0	0.1

Percentage of adult and paeds patients by AKI stage and gender



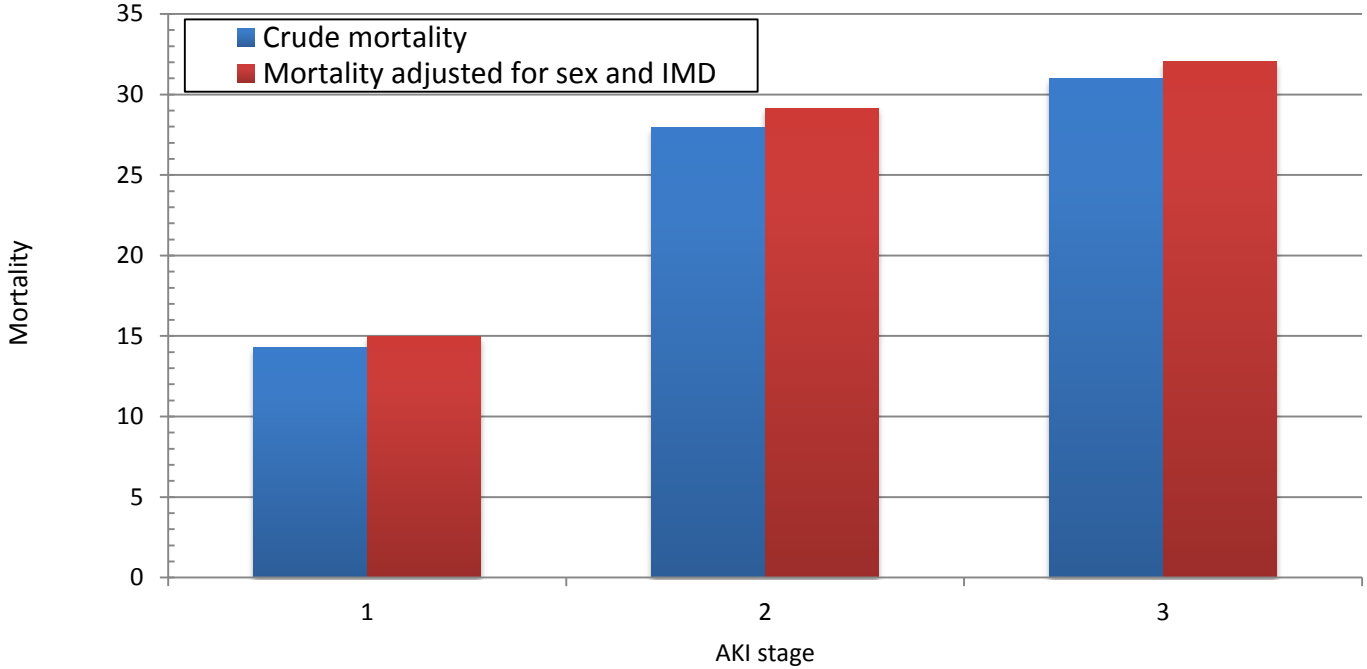
AKI stage (first alert)	% Male	Median age (min, max)
Stage 1	47.7	72 (0, 95+)
Stage 2	46.5	73 (0, 95+)
Stage 3	57.9	71 (0, 95+)

Percentage of patients by AKI stage and age group

Data item	Group	AKI stage 1	AKI stage 2	AKI stage 3
Total (number)		28,065	7,286	6,030
Age (median)		72.3	73.3	71.0
Age group (%)	< 18	4.2	4.2	2.7
	18-39	10.0	6.6	6.9
	40-64	22.3	21.6	26.8
	65-74	19.0	20.9	22.3
	75+	44.6	46.8	41.3

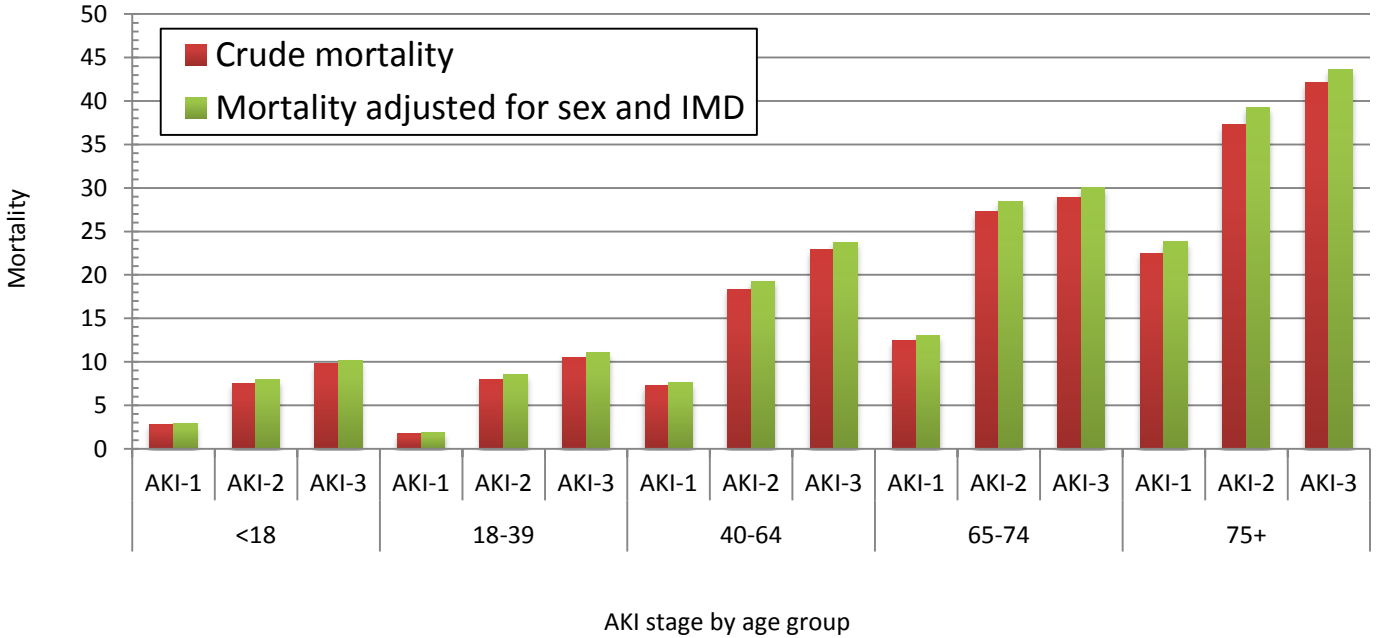
* Peak alert within 30 days

30 Day mortality by AKI stage



* Peak alert within 30 days

30 Day mortality by AKI stage and age group



* Peak alert within 30 days

AKI: 30-Day Mortality– illustrative data

AKI cases for one year: 1 Sept 2016 to 28 February 2017
Analysis restricted to data from labs that sent files for at least 5 of 6 months considered

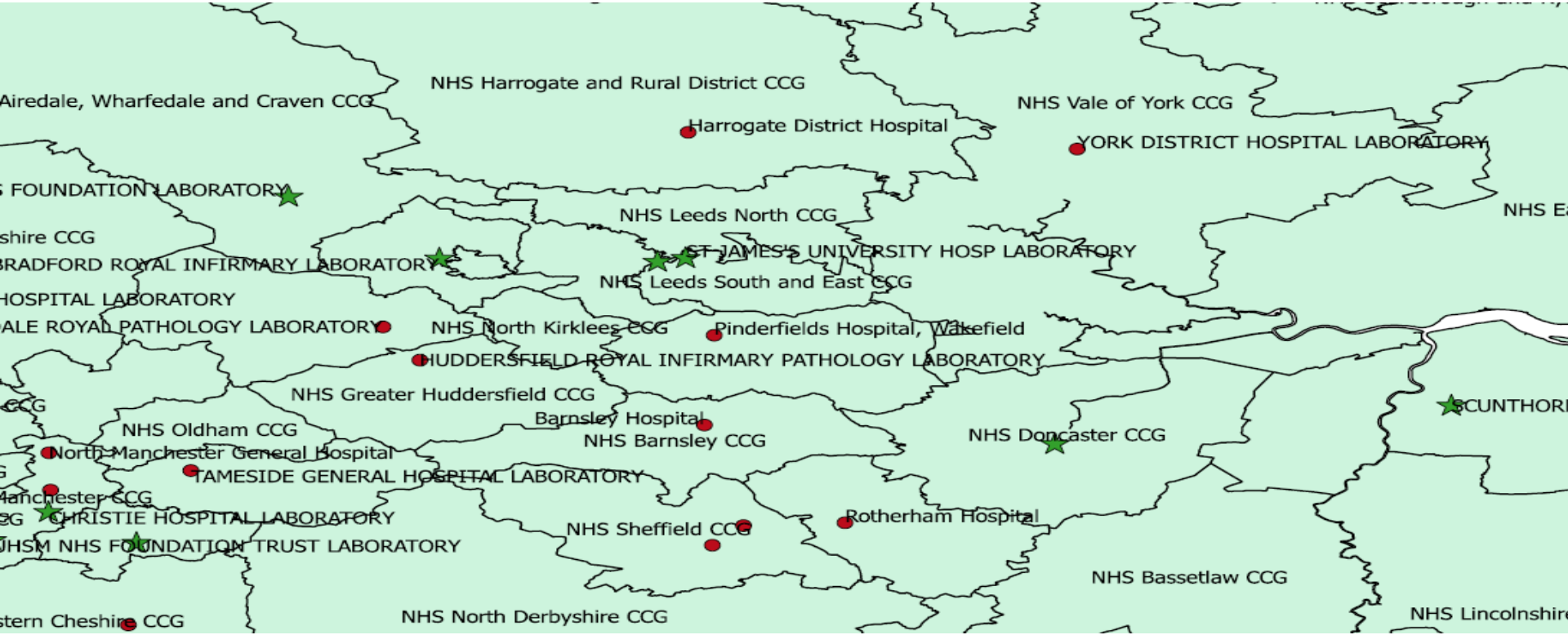
UK Area	Name	Code	CCG Population	Number AKI	Deaths with AKI	% 30-days crude survival for AKI patients	Estimated incidence of AKI
North Yorkshire and Humber	NHS East Riding of Yorkshire	E38000052	314,560	943	223	22.6	5.5
	NHS Hambleton, Richmondshire and Whitby	E38000069	153,638	362	74	19.4	4.2
	NHS Harrogate and Rural District	E38000073	158,249	67			**
	NHS Hull	E38000085	257,589	1,059	230	20.7	7.3
	NHS North East Lincolnshire	E38000119	159,827	675	149	21.1	7.9
	NHS North Lincolnshire	E38000122	168,760	752	140	17.6	8.4
	NHS Scarborough and Ryedale	E38000145	110,136				na
	NHS Vale of York	E38000188	349,066	33			**
South Yorkshire and Bassetlaw	NHS Barnsley	E38000006	235,757	38			**
	NHS Bassetlaw	E38000008	113,654	513	128	24.0	8.5
	NHS Doncaster	E38000044	303,622	1,449	286	18.7	9.0
	NHS Rotherham	E38000141	258,689	73			**
	NHS Sheffield	E38000146	560,085				*
West Yorkshire	NHS Airedale, Wharfedale and Craven	E38000001	158,476	697	152	20.8	8.3
	NHS Bradford City	E38000018	82,739	23			**
	NHS Bradford Districts	E38000019	334,626	193			**
	NHS Calderdale	E38000025	206,355	81			**
	NHS Greater Huddersfield	E38000064	240,399	68			**
	NHS Leeds North	E38000094	199,944	646	144	21.3	6.0
	NHS Leeds South and East	E38000095	241,039	835	162	18.4	6.4
	NHS Leeds West	E38000096	320,498	877	188	20.4	5.0
	NHS North Kirklees	E38000121	187,880	84			**
	NHS Wakefield	E38000190	329,708	164			**

**** = blanked cells for areas where >=20 AKI-patients reported but with a low estimate of incidence (<3.5 per thousand persons per year)

na = no patients with AKI alert in the CCG

* = blanked cells for areas with < 20 patients with AKI-alert reported

CCG coverage – laboratory mapping



Summary

- Submission by labs are increasing

- Analysis of AKI data are progressing and we are beginning to understand the data better

Next steps

- Further data validation - focus on improving data submission for labs that send data but for which there are format and data completeness problems
- Increase coverage - publish compliance with reporting
- Providing feedback on data content to try to drive up quality and completeness – quarterly lab report
- Examine the serum creatinine files (from +/- 15 months)
- Establish the linkages - HES/ONS, UKRR, Intensive Care National Audit and Research Centre
- Novel statistical analysis: health economics relating to AKI - greater understanding of the association of healthcare resource use and acute kidney injury

NHS England

➡ **Use for audit, quality improvement and research**

Acknowledgements

Thank you to all the healthcare professionals and patients who are participating in the Registry's National Programme on AKI.

Thank you to colleagues at NHS England for their support and advice in delivering this programme.

Thank you also to all the people at the UKRR who work in the background to make all this possible.

A programme in partnership with

School of Medicine

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Tackling Acute Kidney Injury

Dr Nick Selby
Associate Professor of Nephrology

Centre for Kidney Research and Innovation
Division of Health Sciences and Graduate Entry Medicine
University of Nottingham
Royal Derby Hospital

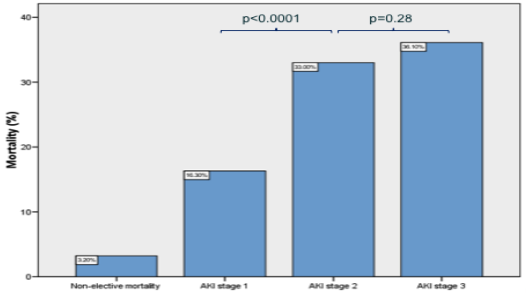
CKRi Centre for Kidney Research and innovation

TACKLING ACUTE KIDNEY INJURY

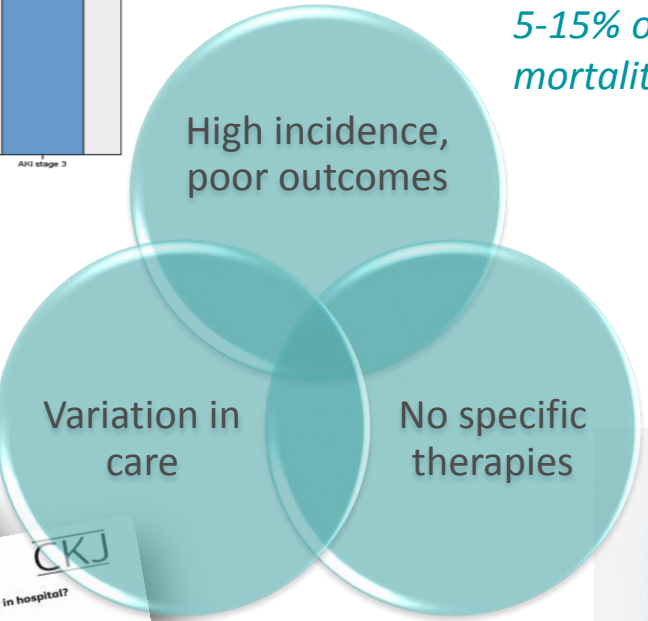
The Health Foundation

Derby Teaching Hospitals NHS Foundation Trust

The clinical need



5-15% of hospital admissions, mortality ~25% and >35% in AKI3



CKRI centre for Kidney Research and innovation

The NHS campaign to improve the care of people at risk of, or with, acute kidney injury

In the UK up to 100,000 deaths each year in hospital are associated with acute kidney injury. Up to 30% could be prevented with the right care and treatment

NCEPOD. Adding insult to injury, 2009

One in five people admitted to hospital in the UK each year as an emergency has acute kidney injury

Wang, et al. 2012

Just one in two people know their kidneys make urine

Ipsos MORI survey, July 2014

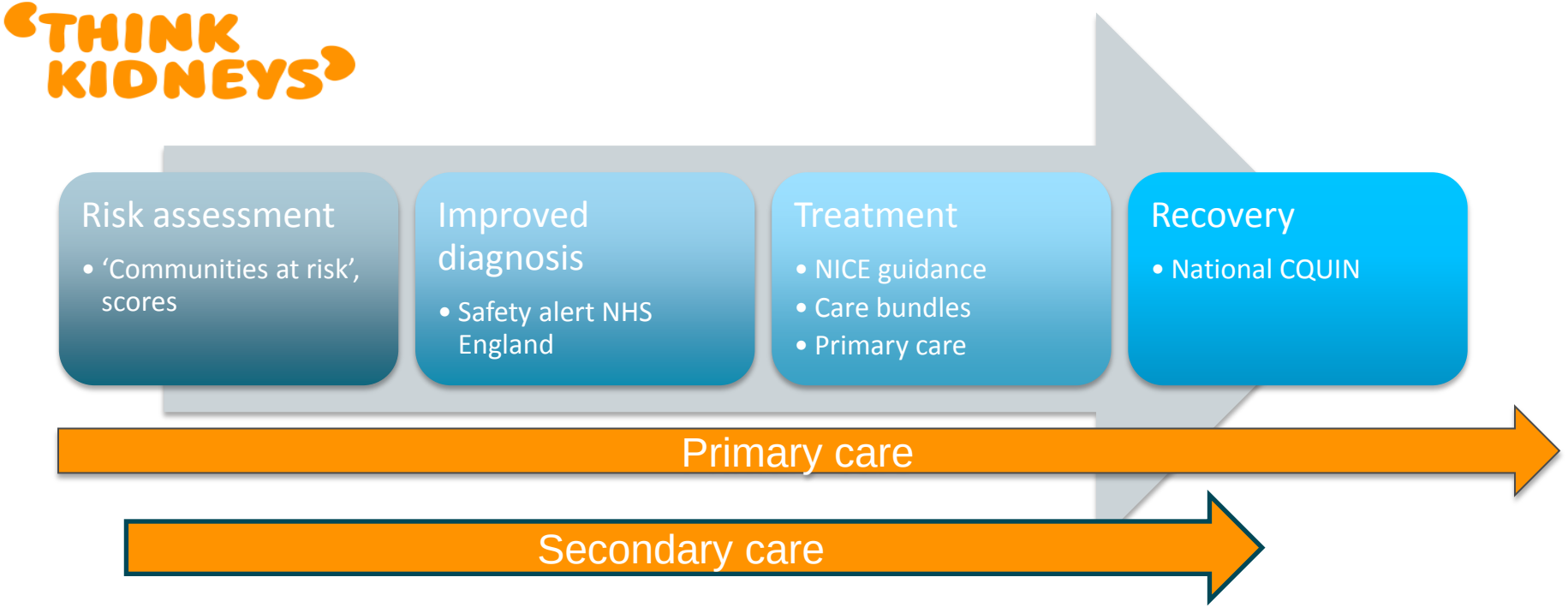
About 65% of acute kidney injury starts in the community

Selby, et al. 2012

CKRi Centre for Kidney Research and innovation

https://www.thinkkidneys.nhs.uk

Think Kidneys: an AKI pathway approach

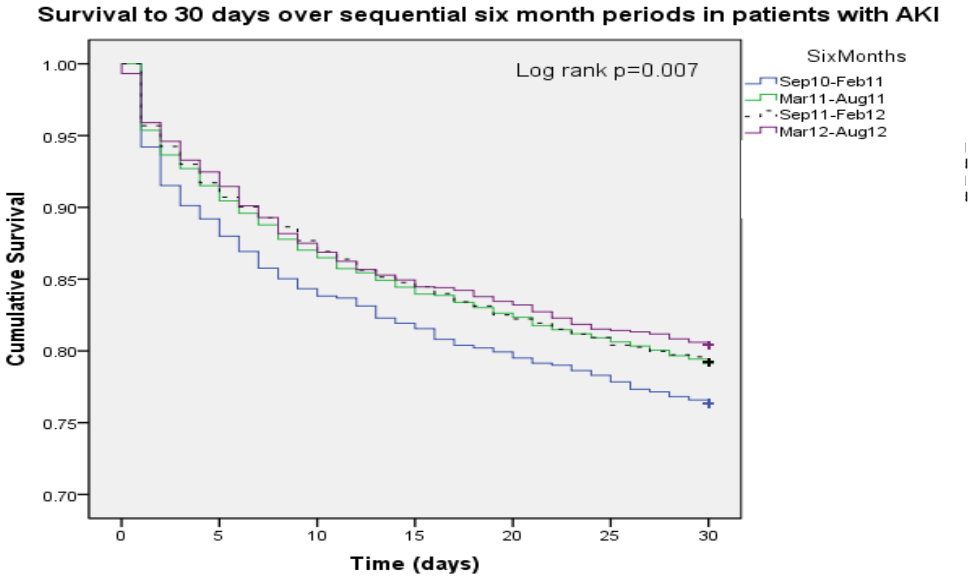


Signal of effectiveness: single centre data

- 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
Mar12-Aug12	0.81	0.71-0.93

Selby NM. Curr Opin Nephrol Hypertens. 2013; 22(6): 637

ORIGINAL ARTICLE

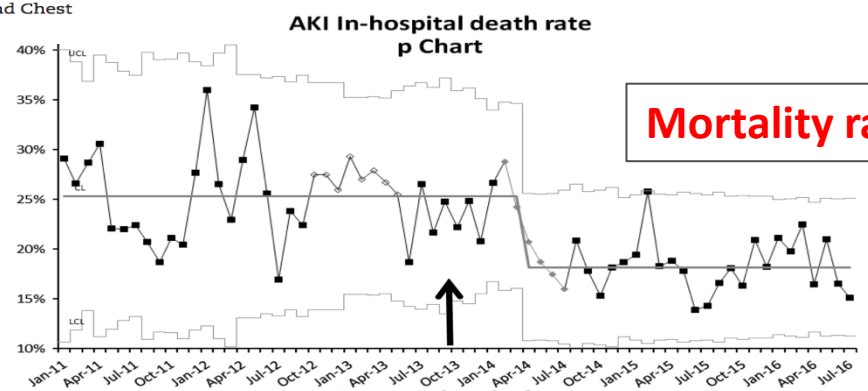
A whole system approach to improving mortality associated with acute kidney injury

T. Chandrasekar[1], A. Sharma[2], L. Tennent[3], C. Wong[1], P. Chamberlain[4] and K.A. Abraham[1]

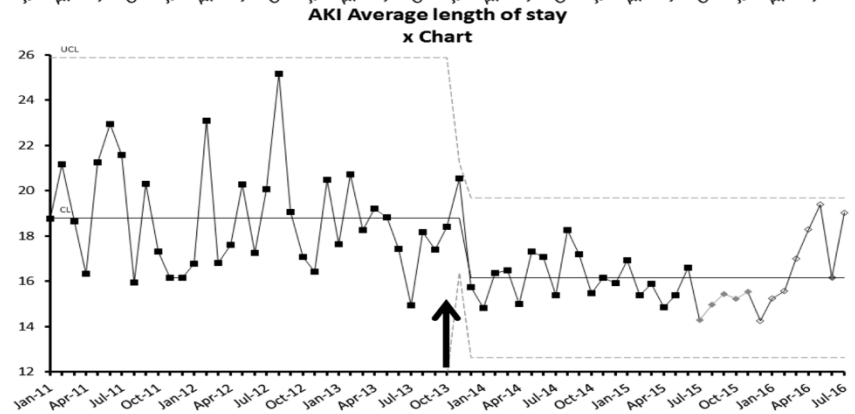
From the [1]Nephrology Directorate, Aintree University Hospital, Liverpool L9 7AL, UK, [2]Nephrology Directorate, Royal Liverpool University Hospital, Liverpool L7 8XP, UK, [3]Administrative Services, Liverpool Heart and Chest Hospital, Liverpool L14 3PE, UK and [4]Innovation and Strategy, South Sefton CCG, Liverpool L20 3DL, UK

Same interventions:

- 29% reduction in AKI mortality (26% versus 18.5%)
- Reduction in AKI patients who progressed to stage 3
- Length of stay declined by 2.4 days (12.4% decline, p<0.001)
- Similar data from Manchester, Royal Liverpool



Mortality rate



Chandraseekar. QJM. Published online May 18, 2017

Debate about effectiveness of AKI detection and alerting

'In conclusion, this randomised, controlled study did not show a meaningful benefit of an electronic alert system for acute kidney injury in patients in hospital'

Wilson et al. Lancet 2015; 385: 1966–74

	Alert (n=1201)	Usual care (n=1192)	p value
Renal consult within 7 days	120 (10%)	102 (9%)	0·23
Renal consult within 14 days	129 (11%)	112 (9%)	0·28
Renal consult inpatient	139 (12%)	125 (11%)	0·41
Time to consult	1·61 (0·36–4·07)	1·78 (0·74–4·41)	0·33
Chart documentation of AKI	545 (46%)	531 (45%)	0·68
Contrast within 7 days	179 (15%)	174 (15%)	0·84
Contrast within 14 days	219 (18%)	223 (19%)	0·92
Contrast during AKI	177 (15%)	176 (15%)	0·97
Fluid bolus within 7 days	426 (36%)	422 (35%)	0·75
Time to fluid bolus, h	9·5 (3·1–39·7)	11·1 (4·2–35·8)	0·38
Aminoglycoside within 7 days	64 (5%)	83 (7%)	0·09
Aminoglycoside within 14 days	78 (7%)	99 (8%)	0·08
Aminoglycoside during AKI	82 (7%)	91 (8%)	0·42
NSAID within 7 days	78 (7%)	77 (7%)	0·94
NSAID within 14 days	86 (7%)	92 (8%)	0·62
NSAID during AKI	74 (6%)	81 (7%)	0·55
ACE or ARB within 7 days	272 (23%)	240 (20%)	0·13
ACE or ARB within 14 days	287 (24%)	262 (22%)	0·27
ACE or ARB during AKI	238 (20%)	226 (19%)	0·60
Urinalysis within 48 h	280 (23%)	284 (24%)	0·74
Renal ultrasound within 48 h	92 (8%)	82 (7%)	0·47
Creatinine tests within 48 h	2 (2–3)	2 (2–3)	0·05*
Creatinine tests within 7 days	6 (3–9)	6 (3–9)	0·23
Length of stay, days	9·7 (5·6–16·1)	10·0 (6·0–17·8)	0·11
Time from randomisation to discharge, days	5·4 (2·5–11·4)	5·9 (2·5–12·3)	0·32

Data are n (%) or median (IQR). Administration during AKI connotes that the drug was given before the creatinine returned to within 10% of baseline. Chart documentation of AKI based on discharge International Classification of Diseases-9 codes. All times are from randomisation. Although not demonstrable from the distribution reported, creatinine tests were done less often in the alert group than in the usual care group. AKI=acute kidney injury. NSAID=non-steroidal anti-inflammatory drugs. ACE=angiotensin-converting enzyme inhibitor. ARB=angiotensin receptor blocker. *p=0·0501.

Table 3: Secondary process outcomes

Royal Derby **Hospital**

Increasing number of published QI studies

The University of Nottingham
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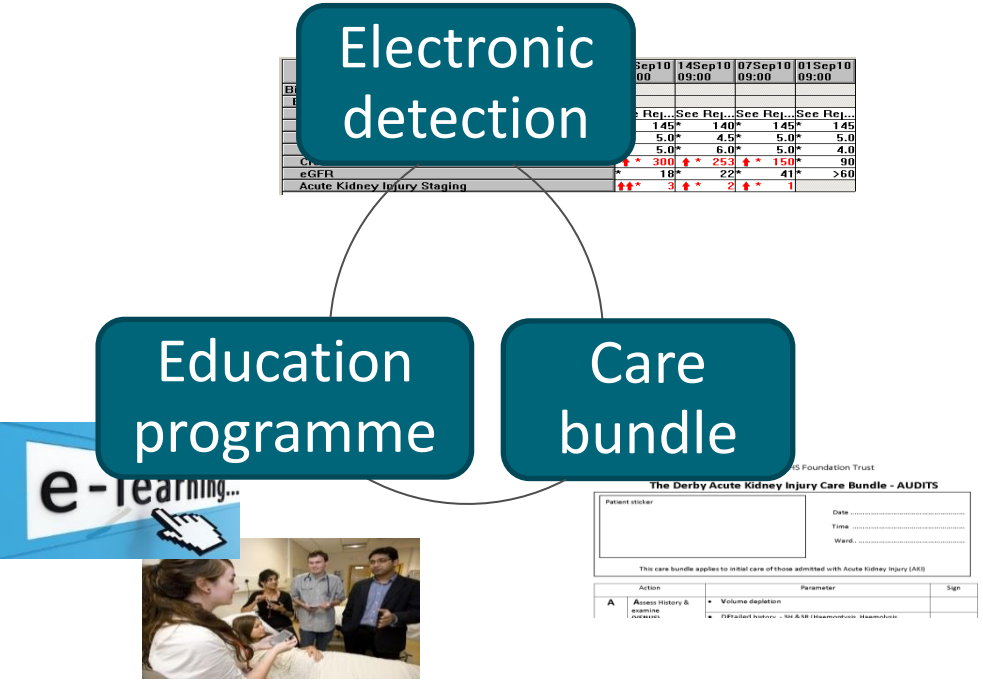
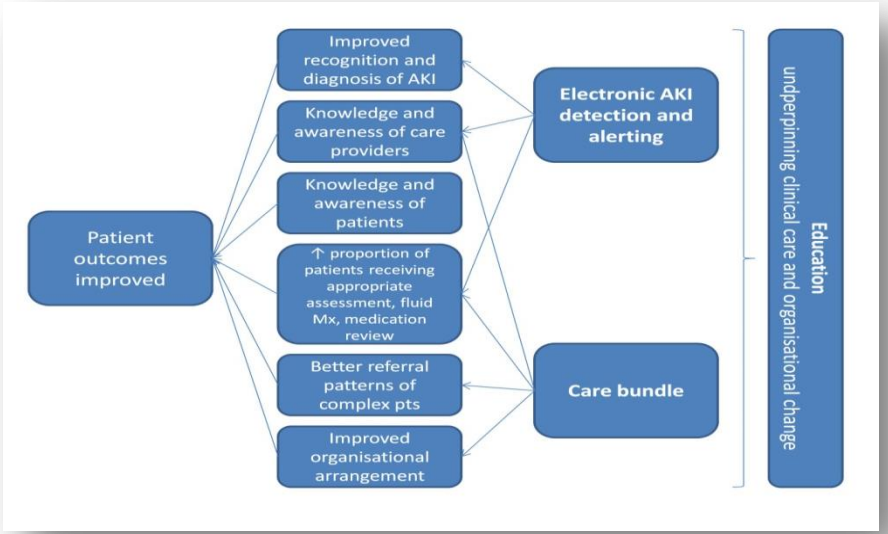
Author	Year	QI intervention	Results
Goldstein	2013	EHR screening and decision support in paediatric pts on nephrotoxins	Reduction in AKI incidence and intensity
Brown	2014	Multicentre QI project with CI-AKI prevention bundle	Reduction in CI-AKI
Balasubramaniam	2011	Early nephrology consult in AKI patient	Less progression to higher AKI stages
Joslin	2015	AKI care bundle	Improved AKI recognition and care delivery
Kolhe	2015	AKI care bundle, interruptive alert and education	Improved care delivery and reduced mortality
Tsui	2014	AKI care bundle and education	Improved care delivery and reduction in ICU admission
Silver	2015	AKI follow-up clinic with automated referral	Improved nephrology follow up rates with additional care provided
Chandrasekar	2017	Complex intervention for AKI	Improved mortality and reduced LoS, hospital outcomes benchmarked

Central hypothesis:

…the introduction of a package of interventions for AKI will improve both basic standards of patient care and patient outcomes…

Package of interventions





Selby NM et al. Clin J Am Soc Nephrol. 2012
Selby NM. Curr Opin Nephrol Hypertension 2013
Xu G et al. BMJ Open 2014

Royal Derby **Hospital**

Our team

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Lead organisation:

Derby Teaching Hospitals NHS
NHS Foundation Trust

Evaluation partners:

Dissemination partner:

Think Kidneys is a national programme led by NHS England in partnership with UK Renal Registry

Funder:

The Health Foundation
Inspiring Improvement

Implementation partners:

Leeds General Infirmary

St James's University Hospital

Bradford Teaching Hospitals NHS

Ashford and St. Peter's Hospitals NHS
NHS Trust

Frimley Health NHS
NHS Foundation Trust

Royal Derby **Hospital**

Stepped wedge design

The University of Nottingham
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Centre 1 (Frimley)	Centre 2 (Bradford)	Centre 3 (ASPH)	Centre 4 (LGI)	Centre 5 (LSJ)
Baseline				
Intervention				
	Intervention			
		Intervention		
			Intervention	
				Intervention
Post intervention				

Randomisation happened on 11th May 2015

← Data collection

← Data collection

← Data collection

← Data collection

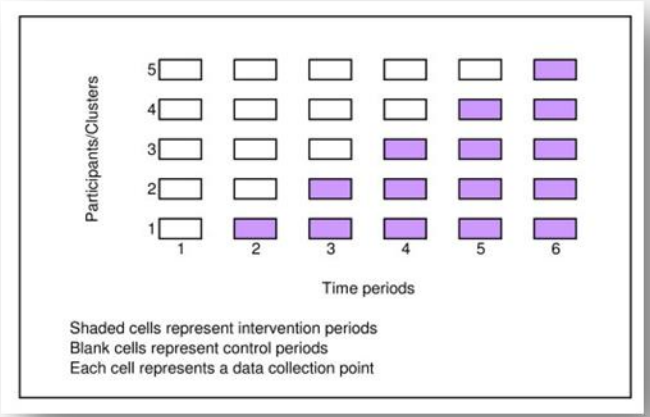
← Data collection

← Data collection

CKR

Stepped wedge cluster randomised study design

- Avoids contamination of groups
- Overcomes ethical problems w.r.t. failure to address variation in care - all centres are exposed to intervention
- Improvement over time-series design; differentiation between treatment effect vs. time-related factors
- Designed within CONSORT 2010 Cluster RT guidance
- Allows quality improvement approach



Data collection

1. Patient outcome data
    - IT based
    - All patients with one or more results from laboratory detection of AKI
    - Detection runs in control periods but results not visible to end-users
    - Data specification developed

2. Audit of process of care
    - Recurrent audit throughout project (7 cycles in total)
    - 30 cases per centre audited per cycle
    - Audit standards and data collection variables constant between centres
    - Requires manpower to deliver

3. Qualitative
    - Why do elements of the intervention work/not work?
    - Can we develop a ‘how to’ guide for scaling/implementing an AKI package?

Outcomes

Primary endpoint: 30 day mortality rate in patients with AKI

Secondary endpoints

a) Patient outcome measures:

1. Incidence of hospital acquired AKI (h-AKI)
2. Incidence of AKI progression (AKI that increases by ≥1 stage from that at first detection)
3. Incidence of individual AKI stages
4. Length of hospital stay of patients with AKI
5. Number of critical care bed days used by patients with AKI
6. Proportion of patients with AKI who achieve complete renal recovery by hospital discharge

b) Measures of basic care:

- Clinical audit of metrics of basic care

c) Qualitative data

Sample size calculation

- Assumptions used were very conservative
- The annual number of admissions in the 5 institutions is ~434,000 *Data from HSCIC*
- <u>Assumptions:</u>
  - AKI incidence of 2.5% of admissions
  - 30-day mortality of 16%
  - Power was set at 80%, alpha at 0.05 and a range of values for inter class correlation (ICC) between 0.01-0.2 was considered.
  - Cases from transition block (initial 3mnth implementation) not included
- With a trial duration of two years and one centre per randomisation step, we would be able to detect a decrease in mortality from 16% to 12.8%.
- This corresponds to a reduction of about 20% in 30-days mortality, or around 300 fewer deaths each year across the 5 units

Quality improvement framework

- **Locally led**
  - Key AKI team members engaged from outset
  - Education/care bundles can be locally tailored
  - Centres can explore AKI ‘alerting’ above the minimum requirement
- **Wider local project team in each hospital**
- **Change methodology**
  - Peer assist and review events: ‘pass on learning’
  - Measurement for improvement
  - Logic model to demonstrate theory of change
- **Ensure executive support**
- **Project manager support**
- **Shared materials/experiences**
  - Repository, monthly updates, periodic learning events
- **Move from implementation to sustainability within life of project**

Qualitative evaluation

Where? (context)

- In all types of hospitals?

What? (description of intervention)

- What type of AKI package?
- Who designed and delivered it?

When? (barriers and facilitators/context)

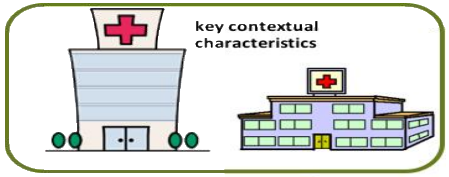
- At all times of year?
- When capability/opportunity/motivation is high/low?

For who? (barriers and facilitators)

- When the package targets nurses/doctors/HCAs?

How? (theory of change)

- What processes/attitudes/knowledge does the package change?



???

Delivery…

The Health Foundation
Inspiring Improvement

last updated – 04/07/2016

Work stream Start Date: 01/01/2015

Project Title

ject Plan

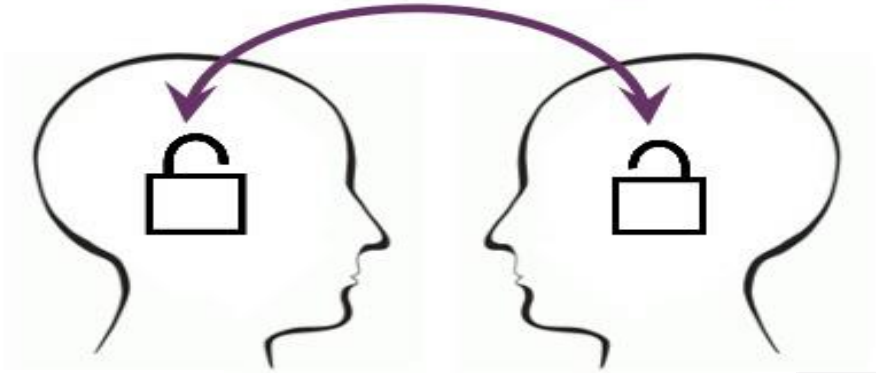
k start (Monday), **Mid blue line** = Today. The timeline below starts on the 1st

	Activity	Responsible	Status	Planned Start Date	Deadline
	Stage 3 – Implementation. NB site specific project plans will provide additional detail				
29	Implementation period Frimley	YS	Completed	01/06/15	31/08/15
30	Peer assist event	YS	Completed	01/06/15	30/06/15
31	Peer review event	YS	Completed	01/08/15	31/08/15
32	Implementation period Bradford	JS	Completed	01/09/15	30/11/15
33	Peer assist event	MJ/NJ/JS	Completed	01/09/15	30/09/15
34	Peer review event	MJ/NJ/JS	Completed	01/11/15	30/11/15
35	Implementation period ASPH	IW/SW/EH	Completed	01/12/15	28/02/16
36	Peer assist event	IW/SW/EH	Completed	01/12/15	31/12/15
37	Peer review event	IW/SW/EH	Completed	01/04/16	07/04/16
38	Implementation period LGI	AL/MJ/NJ	Completed	01/03/16	31/05/16
39	Peer assist event	AL/MJ/NJ	Completed	25/02/16	27/02/16
40	Peer review event	AL/MJ/NJ	Completed	18/07/16	20/07/16
41	Implementation period LSJ	AL/MJ/NJ	Completed	01/06/16	31/08/16
	Peer assist amalgamated with peer reivew as same site				
42	Peer review event	AL/MJ/NJ	Completed	09/10/16	11/10/16
43	Post implementation period (sustainability)	All	Completed	01/09/16	01/03/17
44	Qualitative assessment (as per separate proposal)	MM/EM	Completed	01/08/15	01/03/17
	Data analysis and report writing				

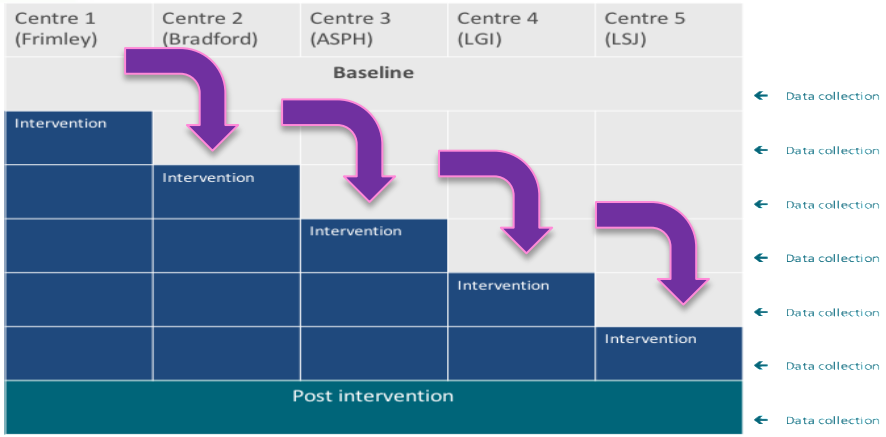
Project Plan | Data submissions | Data submission notes | Outstanding task notes

Peer assist meetings

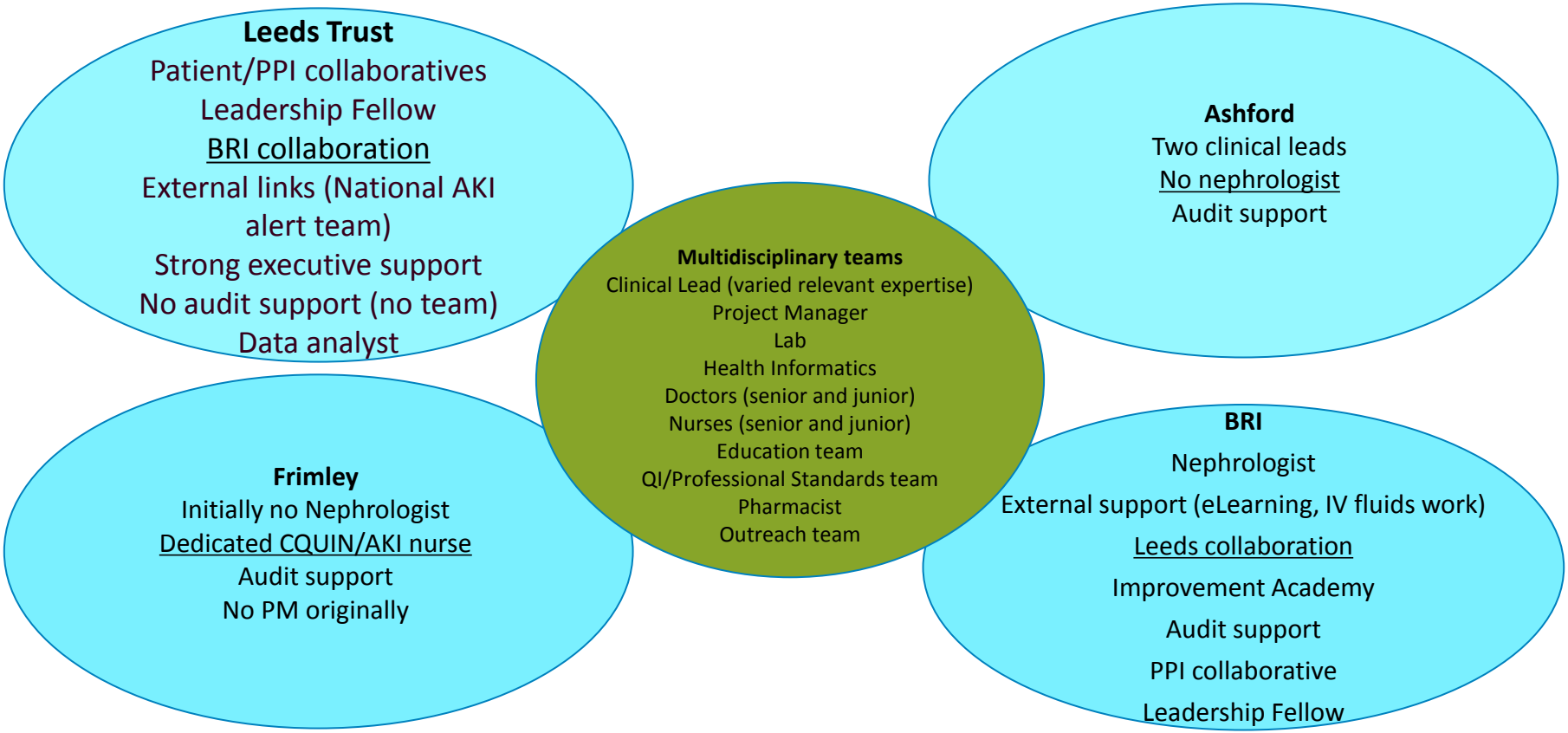
'proven critical knowledge capture….'



advice, tactics, and lessons learned

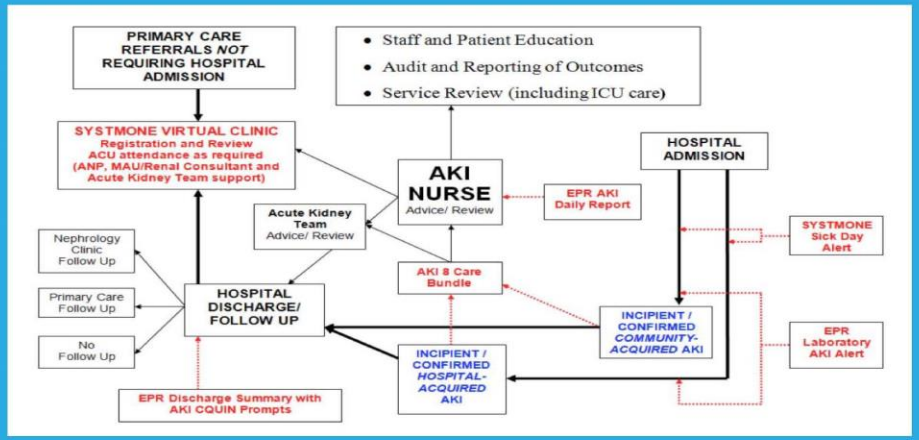


Project teams



'THINK KIDNEYS'

Support for AKI management from the Critical Care Outreach (CCOR) team



The (CCOR) Nurse will receive AKI stage 2 and 3 patient reports each day and either visit the patient or call the relevant ward. We also encourage staff looking after patients with AKI to complete the 'AKI 8' care bundle' and contact the CCOR AKI nurse on #6775 or the Renal Registrar on #6581.

RECOGNISE, EVALUATE, INVESTIGATE, ACT, LIAISE

Royal Derby **Hospital**

VitalPAC Alerting

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

CLINICAL, WARD, NURSE and DOCTOR.

Ward & bed	Patient name	EWS	Pain	Cons	Nurse	Alerts & info	Actions	Next task
AMU Blue: **9**	PATIENTNAME, Abigail	4	1	FRG	JKD			2h
AMU Pink: **8**	PATIENTNAME, Adrian	7 ↑	3 ↑	APM	DFR	C	Obs V	+ 20m
AMU Yellow: **2**	PATIENTNAME, Bethany	1	0	NH	JJ	fm	fm	+15m
AMU Orange: **7**	PATIENTNAME, Bharti	1	0	HD	RJG	V fm		2h
AMU Green: **1**	PATIENTNAME, Darshna	3 ↓	1	FRG	DFR	C	Obs	
AMU Red: **2**	PATIENTNAME, Francis			APM	TGSN		*Awaiting 1st obs*	
AMU Pink: **3**	PATIENTNAME, Genoi	0	0	APM	KJB	O_2		
AMU Blue: **4**	PATIENTNAME, Govinda	9	2	HD	RJG			
AMU Purple: **6**	PATIENTNAME, Harriet	0	3 ↑	JWT	DFR			45m
AMU Red: **7**	PATIENTNAME, Ishmael	1		FRG	JJ		*Awaiting 1st obs*	
AMU Green: **3**	PATIENTNAME, Jerry	8 ↓	3	HD	DFR	C A	P Obs V D	+15m
AMU Red: **4**	PATIENTNAME, Leonard	0	0	JWT	JJ			
AMU Red: **5**	PATIENTNAME, Nelly	3	1	FRG	KJB			45m
AMU Lilac: **8**	PATIENTNAME, Nishal	3+ ↓	1	APM	DFR			2h
AMU Yellow: **2**	PATIENTNAME, Oswald	2	1	NH	JKD			+30m

CKRi Centre for Kidney Research and innovation

Care Bundle Development

Bradford Teaching Hospitals NHS
NHS Foundation Trust

AKI 8 – Care Bundle for suspected/ confirmed Acute Kidney Injury

Please complete the care bundle and affix/file within the patient's clinical notes

- ☐ Assess for volume status/ sepsis, consider iv **fluids/ antibiotics**
- ☐ **STOP** nephrotoxic medications (eg 'prils, 'sartans, NSAIDs, diuretics)
- ☐ Perform a urine dip for **Blood/Protein/Leucocytes/Nitrites** Absent in most pre-renal AKI, present in infection (**BPLN – request urine culture**), nephritis (**BP – send for urine PCR**) and some cases of obstruction (**B**)
- ☐ Manage hyperkalaemia as per intranet guidelines
- ☐ Check acid-base balance (venous bicarbonate +/- ABGs)
- ☐ Consider additional tests eg serum calcium/CK/CRP/ autoimmune and myeloma screen, and renal USS (**avoid** radiocontrast if possible)
- ☐ Monitor fluid balance/ specify frequency of NEWS assessments and repeat blood tests
- ☐ Contact renal registrar (#6581) or consultant if AKI Stage 3 +/- hyperkalaemia, fluid overload and metabolic acidosis, plan repeat tests/ review escalation of care/ inform patient or family as appropriate

In the patient **DISCHARGE SUMMARY**, to comply with AKI CQUIN please state:
1. HIGHEST stage of AKI during the admission
2. Medication changes made – state **YES** or **NO**/ if **YES**, explain *ALL* changes, stating whether *DUE TO AKI* and whether or not medication is to be *RESTARTED* and *WHEN*
3/4. Blood tests required post-discharge – state both *TYPE* and *FREQUENCY*

Date and time of completion:

Signature and bleep:

DRAFT

Simplified wording

AKI 8 – Care Bundle for suspected/ confirmed Acute Kidney Injury

Care bundle commenced: Date: .... Time: ....

Please complete the care bundle and affix/file within the patient's clinical notes

	Initial action when completed
1. Assess for volume status/ sepsis, consider iv **fluids/ antibiotics**	Yes N/A
2. Review medication and consider stopping nephrotoxic medications (eg 'prils, 'sartans, NSAIDs, diuretics)	Yes
3. Perform and review urine dip for **Blood/Protein/Leucocytes/Nitrites**. Absent in most pre-renal AKI, present in infection (**BPLN – request urine culture**), nephritis (**BP – send for urine PCR**) and some cases of obstruction (**B**)	Yes
4. Manage hyperkalaemia	Yes N/A
5. Check acid-base balance (venous bicarbonate +/- ABGs)	Yes N/A
6. Consider additional tests eg serum calcium/CK/CRP/ autoimmune and myeloma screen, and renal USS (avoid radiocontrast if possible)	Yes N/A
7. Monitor fluid balance/ specify frequency of NEWS assessments and repeat blood tests	Yes
8. Contact renal registrar (#6581) or consultant if **AKI Stage 3** hyperkalaemia, fluid overload and metabolic acidosis; plan repeat tests/ review escalation of care/ inform patient or family	Yes N/A

Signatures register - Initial and add name when completing each bundle element

Name	Initial	Name	Initial

In the patient DISCHARGE SUMMARY, to comply with AKI CQUIN please state:
1. HIGHEST stage of AKI during the admission
2. Medication changes made – state YES or NO/ if YES, explain ALL changes, stating whether DUE TO AKI and whether or not medication is to be RESTARTED and WHEN
3/4. Blood tests required post-discharge – state both TYPE and FREQUENCY

Some interventions are not always appropriate - we added an N/A to allow for full completion

Bradford Teaching Hospitals NHS

Affix Patient Information Label

AKI 8 Care Bundle for suspected/confirmed Acute Kidney Injury

Care bundle commenced: Date: ______ Time: ______

Please complete the care bundle and affix/file within the patient's clinical notes	Initial action when completed
1. Assess for volume status/sepsis, consider iv fluids/ antibiotics	Yes N/A
2. Review medication and consider stopping nephrotoxic medications (eg 'prils, 'sartans, NSAIDs, diuretics)	Yes
3. Perform and review urine dip for Blood/Protein/Leucocytes/Nitrites. Absent in most pre-renal AKI, present in infection (BPLN – request urine culture), nephritis (BP – send for urine PCR) and some cases of obstruction (B)	Yes
4. Manage hyperkalaemia	Yes N/A
5. Check acid-base balance (venous bicarbonate +/- ABGs)	Yes
6. Consider additional tests eg serum calcium/CK/CRP/ autoimmune and myeloma screen, and renal USS (avoid radiocontrast if possible)	Yes N/A
7. Monitor fluid balance/ specify frequency of NEWS assessments and repeat blood tests	Yes
8. Contact renal registrar (#6581) or consultant if AKI Stage 3 +/- hyperkalaemia, fluid overload and metabolic acidosis; plan repeat tests/ review escalation of care/ inform patient or family.	Yes N/A

Signatures Register - Initial and add name when completing each bundle element

Name	Initial	Name	Initial

In the patient DISCHARGE SUMMARY, to comply with AKI CQUIN please state:
1. HIGHEST stage of AKI during the admission
2. Medication changes made – state YES or NO: if YES, explain ALL changes, stating whether DUE TO AKI and whether or not medication is to be RESTARTED and WHEN
3/4. Blood tests required post-discharge – state both TYPE and FREQUENCY

'THINK KIDNEYS'

The full MDT can contribute to completing the bundle – we added a box to allow for each item to be signed off individually

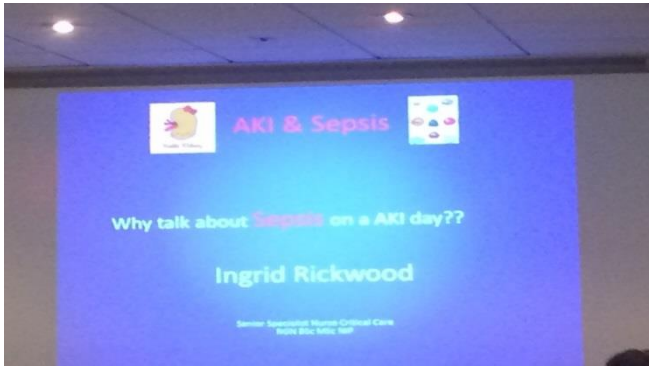
Staff wanted the bundle to look simpler – we put non bundle interventions outside the border

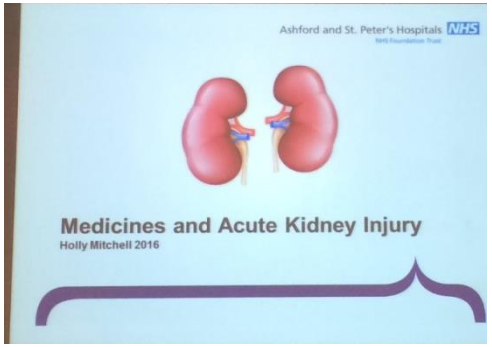
Staff wanted the bundle to stand out in the notes

Royal Derby
Hospital

AKI study day

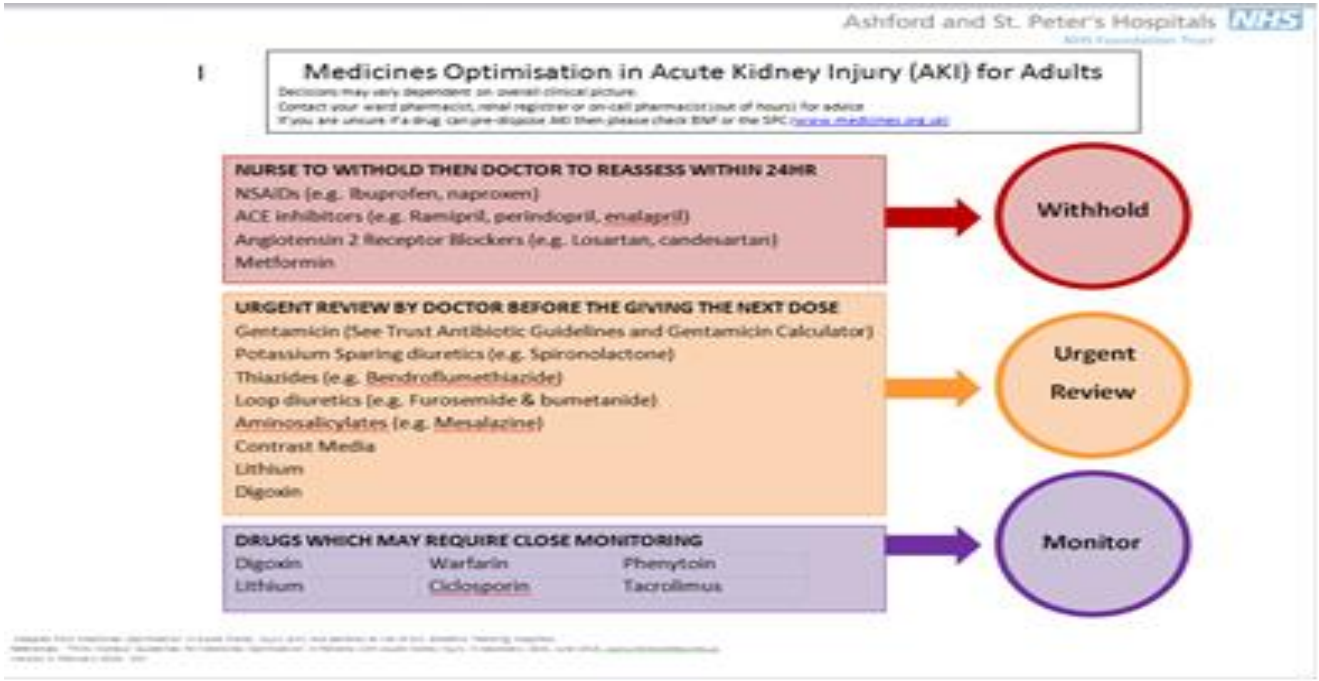
The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA





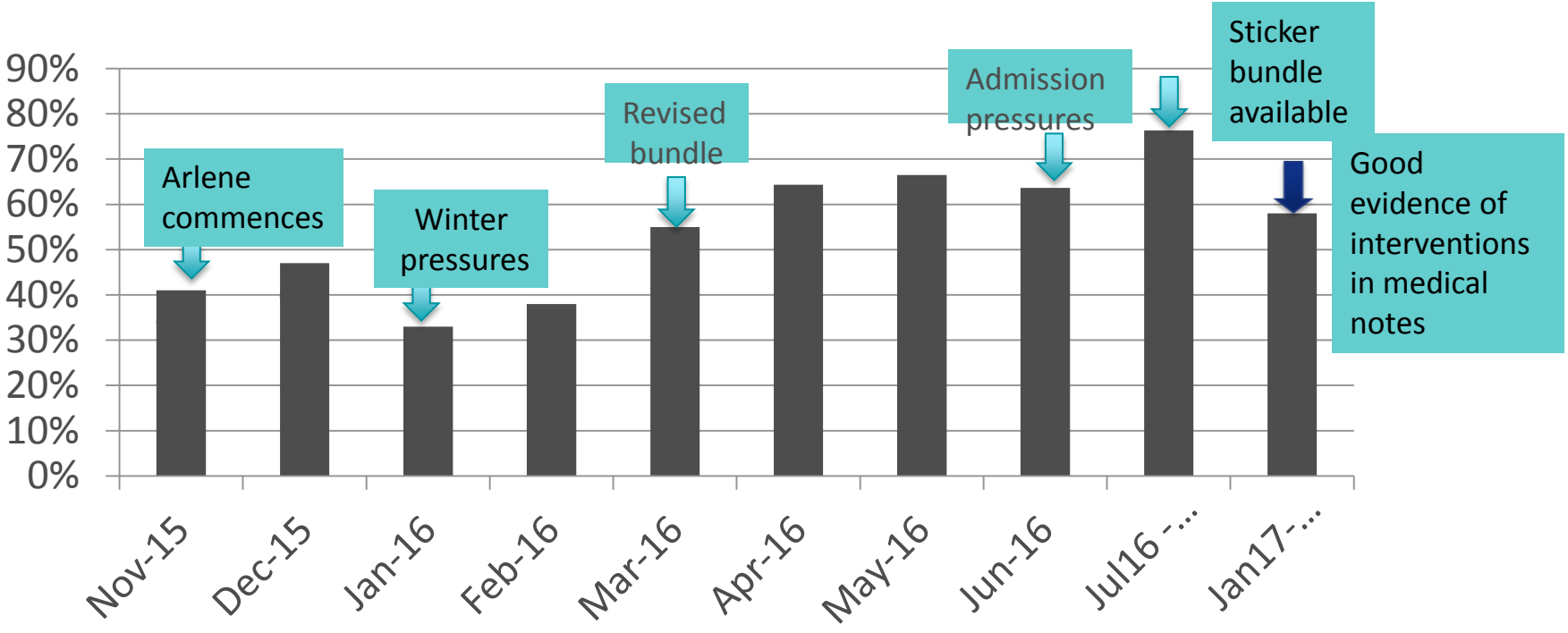
CKRi Centre for Kidney Research and Innovation

Medication Guide for Nurses

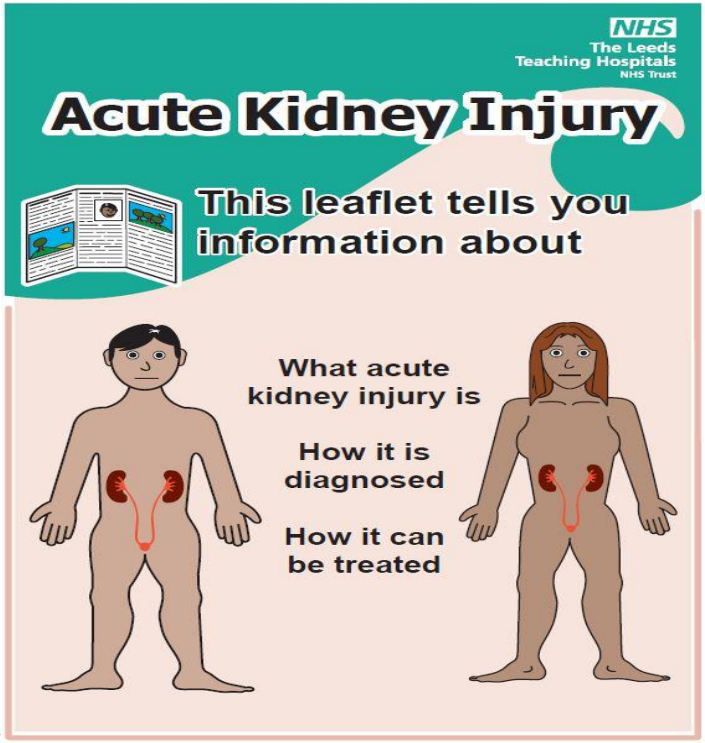


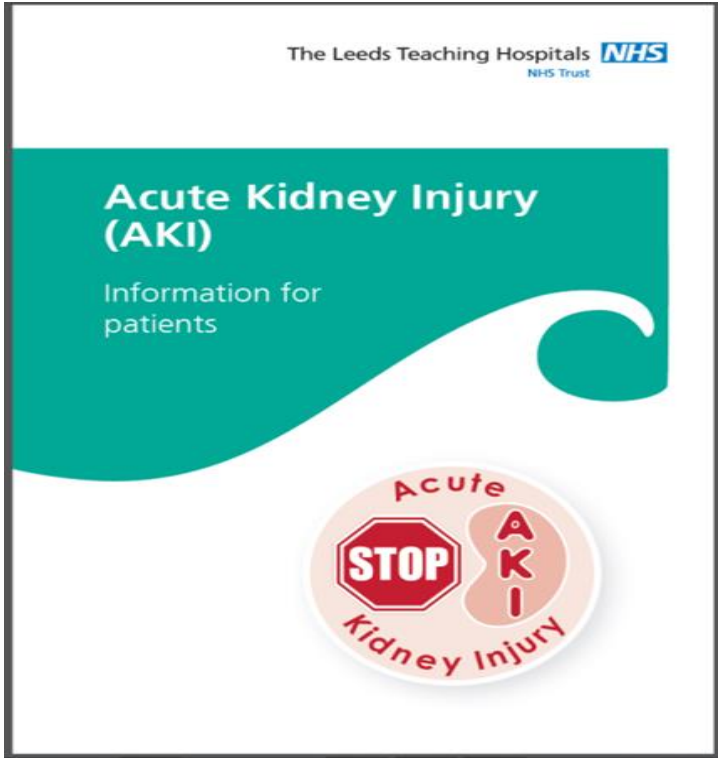
Measurement for improvement

AKI Bundle Compliance at one centre:



Patient Education & Information





Summary 4: According to frontline staff

- Education: not enough…
  - Education for all bar nurses problematic?
- Physical environment does not facilitate attendance
  - Perception is that sometimes educations doesn't allow upskilling
- Staff may have a justifiable reason for not attending OR habitually not attend anyway
- Different across centres
- Alerts and Care Bundles: not rated as a barriers by those who use them

What would we have done differently?

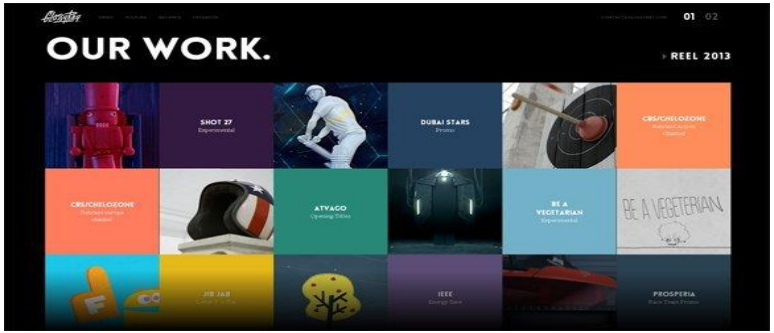
DEFINITE

- Project managers earlier
- Better understanding of THF requirements
    - University of Bradford earlier
- Measurement for improvement resources or alternatives
- Engagement with division of medicine in each hospital

POSSIBLE

- Ward walks from the beginning
- Nurse/MDT engagement from the beginning
- Geography of the programme

- Legacy
  - In hospitals, sustainability
  - Make resources available
- Reports and publications
- Dissemination
  - After results



Summary

- Tackling AKI is a multi-centre quality improvement study
- Rigorous data collection and statistical plan
- Stepped wedge design particularly suited to QI study design
- Change methodology provides a framework to successfully introduce and sustain interventions

nicholas.selby@nottingham.ac.uk
www.nottingham.ac.uk/research/groups/renal

Investigating the extent to which the National Early Warning Score can predict hospital acquired Acute Kidney Injury following emergency medical admissions.

CARS Collaborative

AKI Guidance

NICE guideline CG50 and NICE guideline CG169

- Monitoring of serum creatinine level and urine output
- **Physiological 'track and trigger' systems (early warning scores) should be used to monitor all adult patients in acute hospital settings.**
- The serum creatinine level and urine output should be recorded at admission or in the initial assessment and then as part of routine monitoring.
  - https://www.nice.org.uk/guidance/qs76/chapter/quality-statement-3-monitoring-in-hospital-for-people-at-risk
  - https://www.rcplondon.ac.uk/projects/outputs/national-early-warning-score-news

National Early Warning Score (NEWS)*

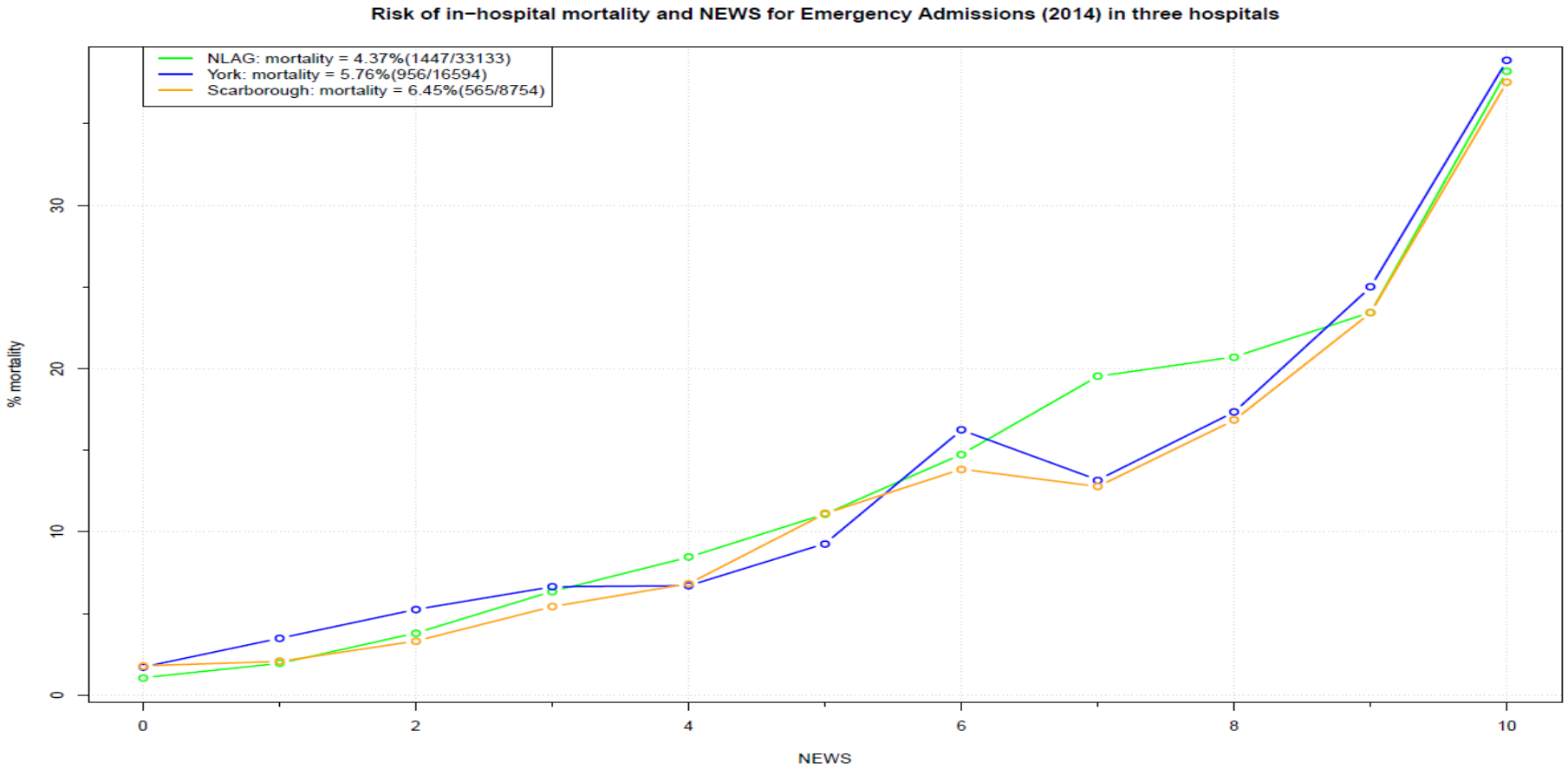
PHYSIOLOGICAL PARAMETERS	3	2	1	0	1	2	3
Respiration Rate	≤8		9 - 11	12 - 20		21 - 24	≥25
Oxygen Saturations	≤91	92 - 93	94 - 95	≥96			
Any Supplemental Oxygen		Yes		No			
Temperature	≤35.0		35.1 - 36.0	36.1 - 38.0	38.1 - 39.0	≥39.1	
Systolic BP	≤90	91 - 100	101 - 110	111 - 219			≥220
Heart Rate	≤40		41 - 50	51 - 90	91 - 110	111 - 130	≥131
Level of Consciousness				A			V, P, or U

*The NEWS initiative flowed from the Royal College of Physicians' NEWS Development and Implementation Group (NEWSDIG) report, and was jointly developed and funded in collaboration with the Royal College of Physicians, Royal College of Nursing, National Outreach Forum and NHS Training for Innovation.

Please see next page for explanatory text about this chart.

Royal College of Physicians

NHS Training for Innovation


Risk of in−hospital mortality and NEWS for Emergency Admissions (2014) in three hospitals
NLAG: mortality = 4.37%(1447/33133)
York: mortality = 5.76%(956/16594)
Scarborough: mortality = 6.45%(565/8754)
% mortality
0
10
20
30
NEWS
0
2
4
6
8
10

Aim

- To determine if the index NEWS can discriminate between AKI (hospitals acquired) and ‘no AKI’ patients.

- Ethical approval for this study was granted by NHS Research Ethics Committee (Ref 16/HRA/2598).

Methods

- Statistical analyses of emergency adult medical admissions in York hospital with routinely collected electronic NEWS.
- We considered the
  - **first or index NEWS,**
  - **the maximum NEWS (before AKI) and**
  - **the penultimate NEWS (before AKI)**
- We developed three models –
  - NEWS only, – based on index values (A1, A2, A3)
  - NEWS and its subcomponents, on maximum values (B1, B2, B3)
  - NEWS, its subcomponents with statistically significant two-way interactions and penultimate values (C1, C2, C3).
- We use area under the receiver-operating curve (AUC) as performance measure for these models.

Results

Table 1: Profile of York hospital patients and their exclusions

Characteristic		N(%)	
Total emergency medical admissions		36776	
Total Number excluded		3168 (8.6%)	
Community acquired AKI (excluded)		2255 (6.1%)	
No NEWS (excluded)		913 (2.5%)	
Number included in this study		33608 (91%)	
Male		15807(47.0%)	
Hospital acquired AKI		1361 (4.1%)	
In-hospital mortality		1619 (4.8%)	
Mean Age [years] (SD)		67.5 (19.7)	
NEWS	Index values	Maximum values	Penultimate values
Mean NEWS (SD)	2.5 (2.5)	4.3 (3.0)	1.5 (1.9)
Mean Respiratory rate [per minute] (SD)	18.5 (4.7)	19.3 (5.3)	16.7 (2.9)
Mean Temperature [°C] (SD)	36.3 (0.8)	36.2 (0.9)	36.2 (0.5)
Mean Systolic pressure [mmHg] (SD)	136.5 (26.8)	127.7 (31.3)	129.9 (23.1)
Mean Diastolic pressure [mmHg] (SD)	75.7 (15.3)	71.6 (16.7)	72.0 (13.2)
Mean Pulse rate [beats per minute] (SD)	85.3 (21.0)	86.1 (23.0)	78.2 (15.5)
Mean Oxygen saturation [%] (SD)	96.4 (2.8)	95.4 (3.5)	96.4 (2.5)
Oxygen sup	3571(10.6%)	6785 (20.2%)	1732 (5.2%)
Alert	32700 (97.3%)	31502 (93.7%)	33152 (98.6%)

Figure 1A: Boxplot without outliers for continuous covariates based on index NEWS

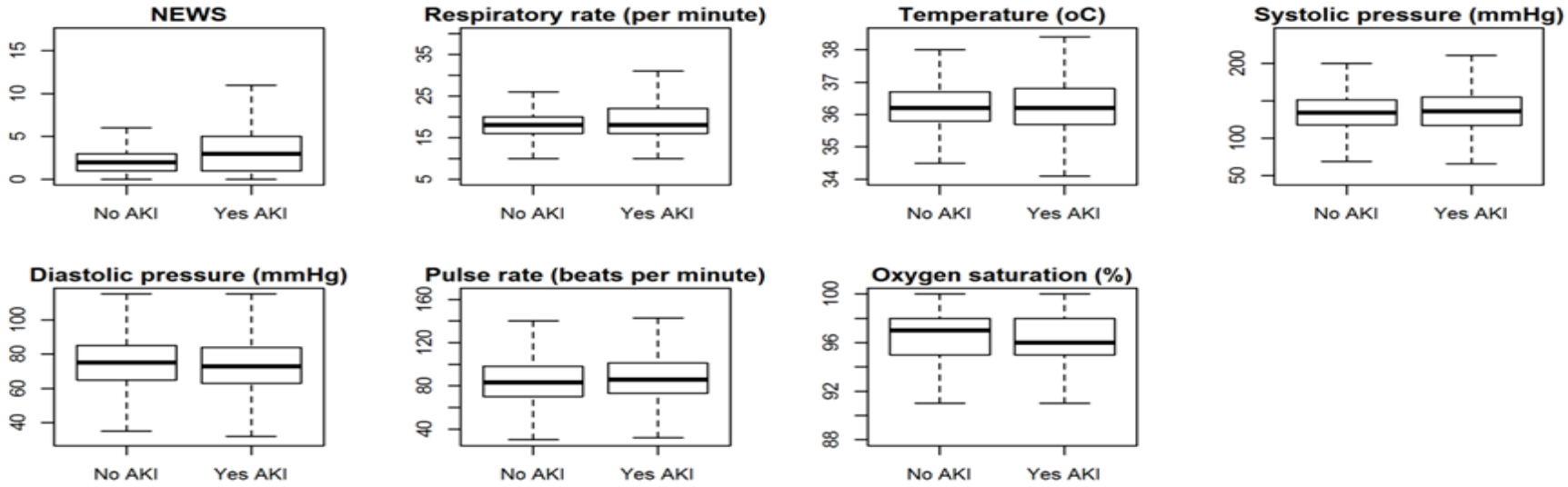
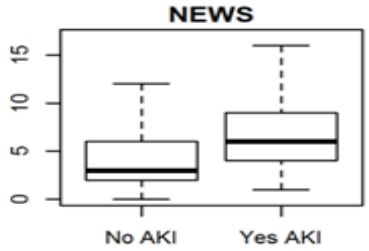
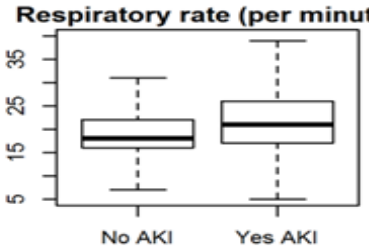
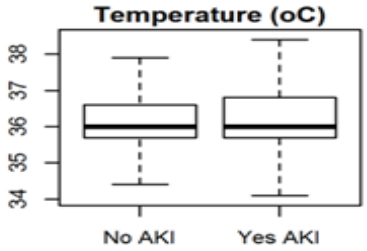
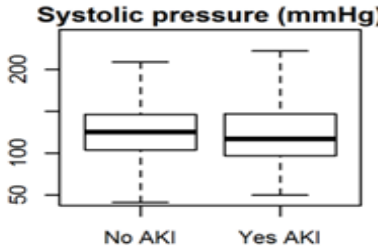


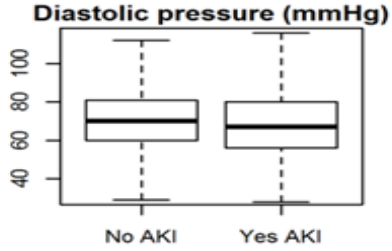
Figure 1B: Boxplot without outliers for continuous covariates based on maximum NEWS

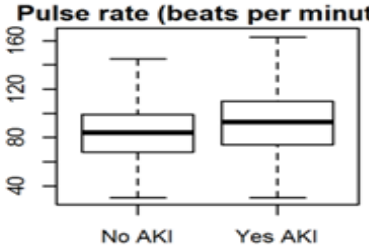












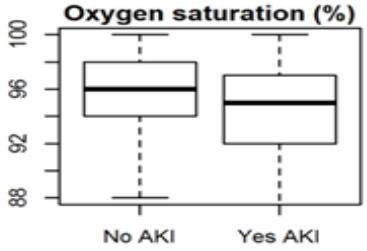


Figure 1C: Boxplot without outliers for continuous covariates based on penultimate NEWS

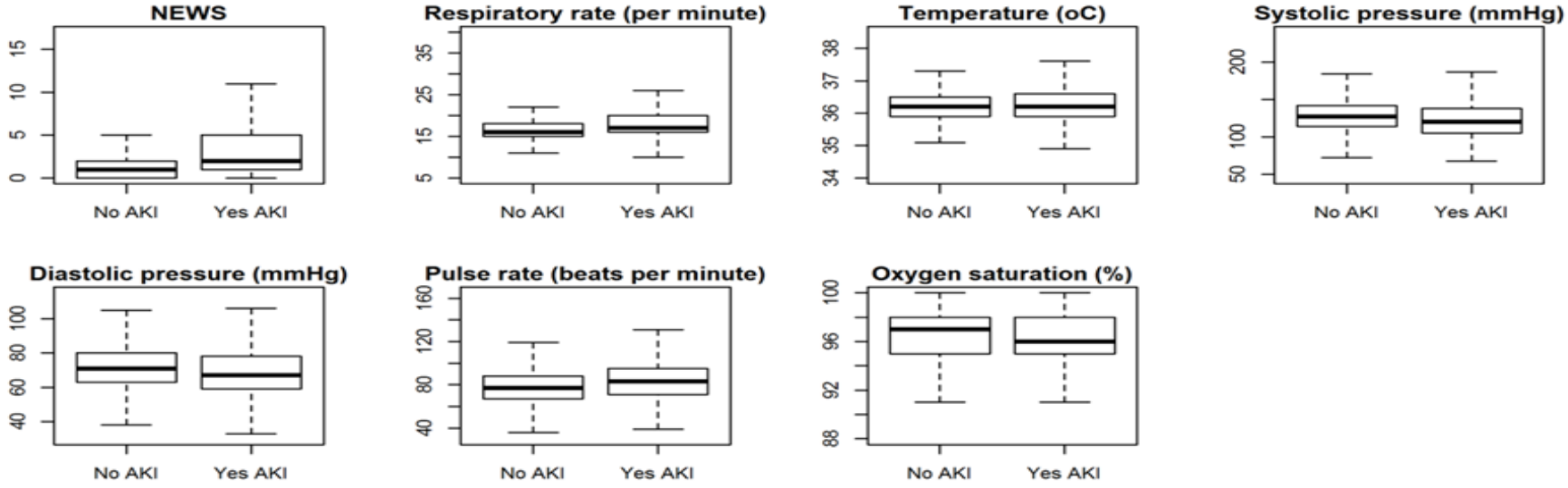


Figure 4: The area under the ROC while estimating the risk of AKI in hospital
(A) Models based on index values **(B)** Models based on maximum values
(C) Models based on penultimate values

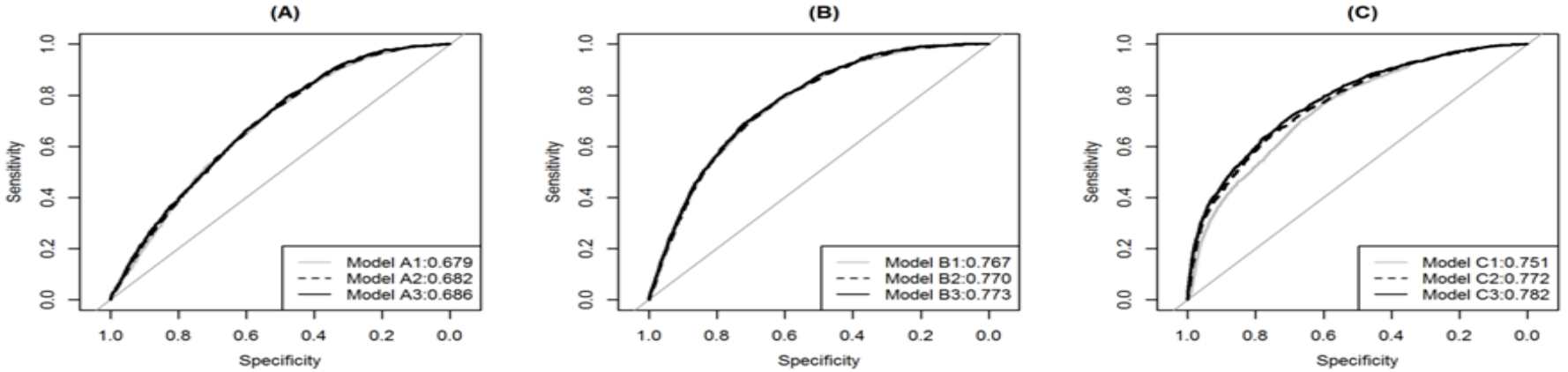


Table 2: Performance of all models with 95% Confidence Interval

Model	AUC [95% CI]
A1	0.6786 [0.6657 – 0.6915]
A2	0.6818 [0.6690 – 0.6947]
A3	0.6857 [0.6729 – 0.6984]
B1	0.7667 [0.7552 – 0.7781]
B2	0.7680 [0.7566 – 0.7793]
B3	0.7731 [0.7620 – 0.7843]
C1	0.7512 [0.7385 – 0.7638]
C2	0.7716 [0.7588 – 0.7843]
C3	0.7815 [0.7689 – 0.7941]

Table 3: Sensitivity analysis of NEWS only and FULL models at different predicted probability thresholds and NEWS values (1 to 6).

Model/ Prevalence%	Predicted probability	NEWS only				FULL Model		
		NEWS	Sens.	Spec.	PPV	Sens.	Spec.	PPV
AKI=1,2,3	0.0314	1	85.08	30.21	4.89	77.74	61.78	7.91
4.05%	0.0397	2	65.61	65.71	7.47	69.14	72.25	9.52
	0.0501	3	34.02	91.80	14.89	58.05	81.19	11.52
	0.0630	4	25.50	95.33	18.74	49.45	87.32	14.13
	0.0789	5	18.66	96.66	19.10	41.88	91.23	16.77
	0.0984	6	12.42	97.59	17.85	37.33	93.77	20.18
AKI=2,3	0.0057	1	69.40	64.72	1.56	80.97	63.20	1.74
0.80%	0.0074	2	57.09	82.82	2.60	72.01	73.24	2.12
	0.0095	3	43.28	91.02	3.73	62.69	81.23	2.61
	0.0122	4	32.84	94.71	4.75	54.48	86.99	3.26
	0.0156	5	25.00	96.21	5.04	47.39	90.58	3.89
	0.0201	6	17.54	97.30	4.96	42.54	92.99	4.65

Table 4:
Workload of NEWS only and FULL models at different NEWS values (3 to 5)

NEWS	AKI = 1,2,3	
	NEWS only (n)	FULL model (n)
3	3109	6843
4	1852	4757
5	1330	3398

Number included in this study		33608 (91%)	
Male		15807(47.0%)	
Hospital acquired AKI		1361 (4.1%)	
In-hospital mortality		1619 (4.8%)	

Results

- Predictive ability of maximum values and penultimate values models are more than index values models (A1, A2, A3), whom AUC ranged 0.679 to 0.686.
- Models with interactions (A3, B3, C3) are well calibrated.
- Model C3 performs better than all other models with AUC 0.782 [95% CI 0.769 – 0.794].
- Further sensitivity analysis shows that Model C3 increased workload by two-fold compare to NEWS only model at NEWS = 4.

Conclusions

- The index NEWS is not a good predictor of hospital acquired AKI.
- The maximum NEWS and the penultimate NEWS are better predictors of hospital acquired AKI.

The Think Kidney Risk Workstream has conducted a systematic review published in their document in 2015 of risk scores focussed on predicting AKI.

- 12 risk tools.
- Common factors included age, CKD, cardiac and liver disease, nephrotoxic drugs, sepsis, and abnormal vital signs.
- These scores used admission characteristics either at the point of hospitalisation or during hospitalisation, the later showed moderate predictive ability.
- The main limitation of these tools that they are not externally validated.

Summary

- The index NEWS is not a good predictor of hospital acquired AKI.
- The maximum NEWS and the penultimate NEWS are better predictors of hospital acquired AKI but will require interventions in a large number of patients if used as a sole guide
- Additional research to include age, diagnosis, chronic co-morbidities and medications may provide the opportunity for development of yet better AKI risk tools.

Thanks to

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Definitions

- If these results are from a population-based study, prevalence can be calculated as follows:
- **Prevalence of Disease= $T_{disease}$/ Total × 100**
- The population used for the study influences the prevalence calculation.
  - (All admitted patients without community acquired AKI)
- **Sensitivity** is the probability that a test will indicate 'disease' among those with the disease:
  - **Sensitivity: A/(A+C) × 100**
- **Specificity** is the fraction of those without disease who will have a negative test result:
  - **Specificity: D/(D+B) × 100**
- *Sensitivity and specificity* are *characteristics of the test*. The population does not affect the results.

- A clinician and a patient have a different question: what is the chance that a person with a positive test truly has the disease? If the subject is in the first row in the table above, what is the probability of being in cell A as compared to cell B? A clinician calculates across the row as follows:
- **Positive Predictive Value: A/(A+B) × 100**
- **Negative Predictive Value: D/(D+C) × 100**
- *Positive and negative predictive values are influenced by the prevalence* of disease in the population that is being tested. If we test in a high prevalence setting, it is more likely that persons who test positive truly have disease than if the test is performed in a population with low prevalence.

	Disease	No Disease	Total number	
Positive test result	A True positive	B False positive	A+B	PPV (A/A+B) x100
Negative Test Result	C False negative	D True negative	C+D	NPV (D/D+C) x100
	Total Disease A+C	Total No Disease B+D	Total number	
	Sensitivity (A/A+C)x100	Specificity (D/D+B)x100		

KQuIP/UKRR Regional Day
Yorkshire & Humber

6th July 2017 – 12.45-13.30

Lunch and Exhibition Viewing

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