Acute Kidney Injury: identifying those who might benefit from electronic alerts and care bundles

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Introduction

Acute Kidney Injury (AKI) affects up to 20% of hospital patients and is associated with increased morbidity and mortality.[1] Despite a lack of reliable evidence, a national patient safety campaign has established electronic alerts for AKI with care bundles in many acute NHS trusts.[2,3] The care bundles target sepsis and cardiovascular compromise, which may account for ~60% of deaths in patients with AKI.[4]

AKI occurs in a wide variety of clinical scenarios, and is often self-limiting without specific intervention. In order to improve the quality of AKI care, one needs robust measures of process and outcomes, and to target interventions at those most likely to benefit.

Objectives

- Examine data from one acute NHS hospital trust prior to introduction of AKI alerts or care bundles
- Identify patients who are likely to benefit from AKI alerts and care bundles

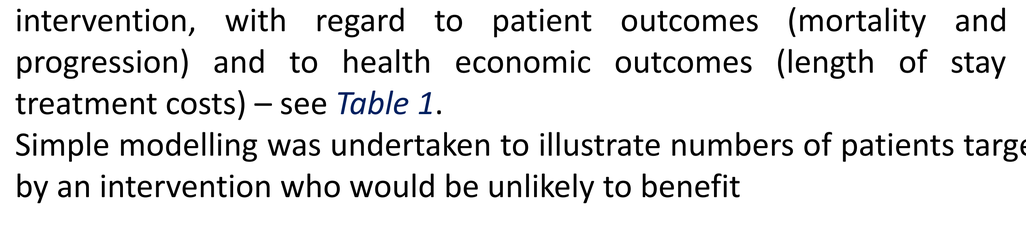
Methods

- Demographic and coding data from a single NHS acute trust were linked with routine biochemical data identifying all inpatients with AKI
- AKI defined using national algorithm as stages 1-3; patients flagged with raised creatinine but no recent result were excluded
- Data from a 13 month period (Feb 2015 to Mar 2016) prior to launch of AKI electronic alerts linked to an electronic care bundle in secondary care (planned intervention)
- Patients were classified as being likely or unlikely to benefit from intervention, with regard to patient outcomes (mortality and AKI progression) and to health economic outcomes (length of stay and treatment costs) – see *Table 1*.
- Simple modelling was undertaken to illustrate numbers of patients targeted by an intervention who would be unlikely to benefit

Table 1: definitions of likelihood of benefit

CATEGORY	DEFINITIONS
Very unlikely to benefit	• Died within 48 hours of 1st alert (too sick) • Single AKI 1 alert and discharged alive (acute reversible illness)
Some potential to benefit health economic outcomes	• Single AKI 2 or 3 alert and discharged alive • Multiple AKI 1 alerts but no progression from initial stage and discharged alive
More potential to benefit health economic outcomes (length of stay [LOS] / treatment costs)	• Multiple AKI 2 or 3 alerts but no progression from initial stage and discharged alive
Potential to benefit patient outcomes (mortality / AKI progression)	• Died at least 48 hours after 1st alert • Progressed to higher AKI stage and discharged alive

Patient AKI trajectories demonstrating variation in potential for benefit



(1) Potential to benefit for patient outcomes (mortality / AKI progression)
(2) Potential to benefit for health economic outcomes (LOS / costs)
(3) Very unlikely to benefit for either patient or health economic outcomes

Results

- 20220 AKI alerts occurred in 7230 admissions involving 7150 patients
- 70% began in first 48 hours of admission indicating community acquired AKI
- 74%, 15% and 11% had AKI stages 1,2 and 3 respectively as initial AKI stage
- Mean length of stay was 16 days
- 18% died in hospital (16% stage 1, 19% stage 2, 23% stage 3)
- Only 9% had progressive AKI

Classification of patients by likelihood of benefit (Figures & Table 2)

Over half would be very unlikely to benefit:

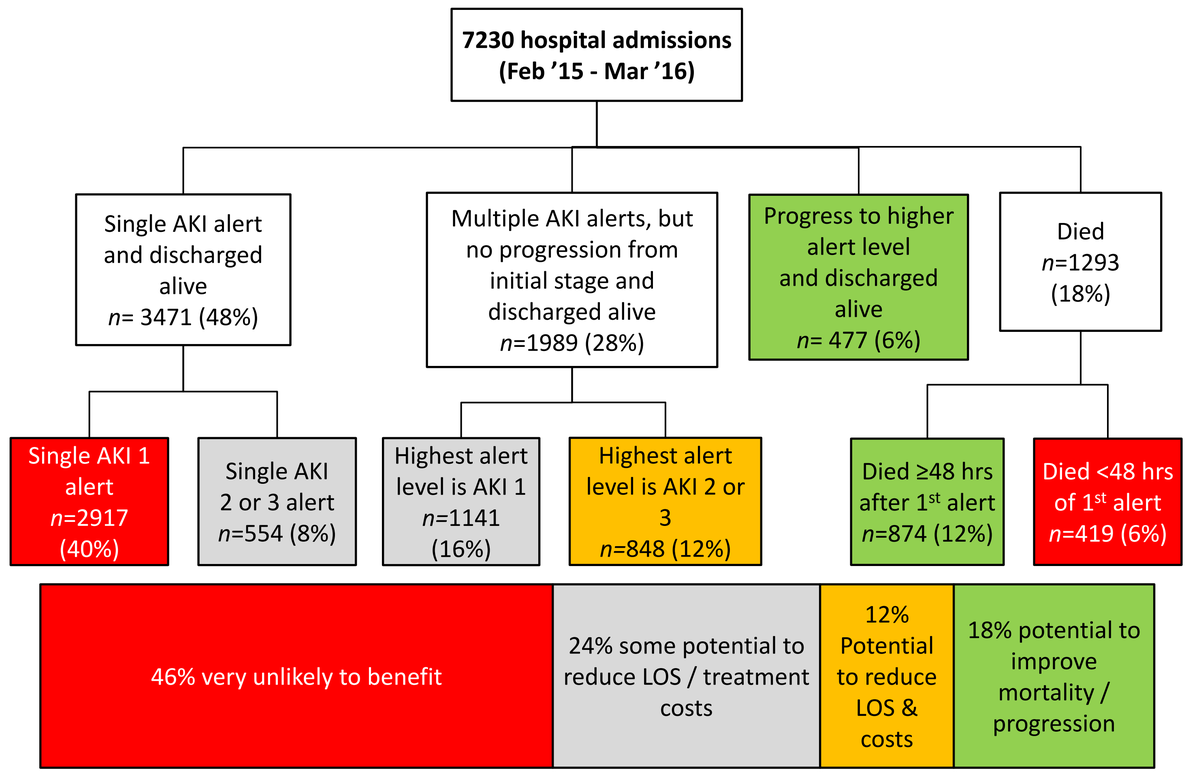


Table 2: patient characteristics by category

	PATIENT DIED <48 HRS OF 1ST ALERT	SINGLE AKI 1 ALERT + DISCHARGED ALIVE	MULTIPLE AKI 1 ALERTS + DISCHARGED ALIVE	SINGLE AKI 2 OR 3 ALERT + DISCHARGED ALIVE	MULTIPLE ALERTS, HIGHEST ALERT IS AKI 2 OR 3 BUT NO PROGRESSION + DISCHARGED ALIVE	PATIENT DIED >48 HOURS AFTER 1ST ALERT	PATIENT PROGRESSES TO A HIGHER ALERT LEVEL + DISCHARGED ALIVE
n (%)	419 (6%)	2917 (40%)	1141 (16%)	554 (8%)	848 (12%)	874 (12%)	477 (6%)
Male (%)	228 (54%)	1296 (44%)	581 (51%)	269 (49%)	447 (53%)	467 (53%)	269 (56%)
Age *Est. mean*	77	65	67	66	68	77	66
LOS *Median (IQR)*	2 (5)	6 (12)	13 (19)	4 (10)	10 (15)	15 (19)	21 (26)
First alert *AKI 1* *AKI 2* *AKI 3*	248 (59%) 100 (24%) 71 (17%)	2917 (100%)	1141 (100%)	0 379 (68%) 175 (32%)	0 435 (51%) 413 (49%)	609 (70%) 151 (17%) 114 (13%)	403 (84%) 74 (16%) 0

Discussion

Ability of intervention to reduce mortality or AKI progression

- Of those who died, ⅓ died within 48 hours, so only 12% of AKI patients might benefit with regard to an intervention targeting mortality
- Care bundles target sepsis and cardiovascular compromise (~60% of AKI deaths[4]), so deaths amenable to intervention are 12% x 60% = 7%
- Similarly only 6% progressed to a higher AKI stage and survived
- Thus the vast majority of patients targeted by this intervention are very unlikely to benefit with regards mortality and AKI progression

Ability of intervention to influence length of stay (LOS)

- 46% died within 48 hours or were discharged alive after a single alert, so would be very unlikely to benefit from an electronic alert and care bundle

Conclusions

- This data, from a period prior to the local implementation of electronic alerts or care bundles, suggest that AKI progression was uncommon and many deaths were likely unamenable to intervention with a care bundle
- Requiring the completion of a care bundle in all patients with AKI would target many more patients than could possibly benefit from an intervention with regard to mortality or AKI progression
- The proportion of those with AKI in whom a care bundle might be expected to be reduce length of stay or costs is substantially higher
- Further work will characterise based on primary diagnosis those most likely to benefit so that interventions can be targeted at a subset of AKI patients

References

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2. https://www.thinkkidneys.nhs.uk/aki/
3. Haase M, Kribben A, Zidek W, *et al.* Dtsh Arztebl Int (2017) 114: 1-8
4. Selby NM, Kolhe NV, McIntyre CW, *et al.* PLoS One (2012) 7: e48580

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