Supplementary File A

a) Details of inclusion and exclusion criteria for acute hospital trusts

This paper focuses on acute trusts (excluding specialist trusts) in England, some of which are covered by more than one pathology laboratory. During 2017 and 2018 not all laboratories were submitting AKI data to UKRR for every month. This was due to a combination of factors including delays in implementation of the NHS AKI algorithm and technical issues with 'laboratory information management systems (LIMS)' and/or data feeds to the UKRR and/or data feeds to the UKRR. and/or data feeds to the UKRR. As studies have shown evidence that incidence and outcomes of AKI varies with season, trusts were only included if the associated laboratory/laboratories submissions were rated as complete for every month of a calendar year.[1]

We acknowledge that there may be inconsistencies in data flow between the Laboratory Information Management Systems (LIMS) and MPI, even in laboratories that send data to UKRR every month. As an additional quality assurance measure, we compared the number of AKI alerts in the MPI from each hospital trust with the number of ICD-10 coded AKI (N17) in HES records. Most trusts have more AKI alerts than N17 coded AKI, as we expected, because the alerts are a more sensitive measure.[2] We excluded three trusts that had a very low ratio of AKI Alerts:AKI N17 Codes in HES however, at these trusts we have been made aware of a data extraction problem that leads to under-reporting of AKI Alerts to the MPI. As our primary outcome measure is mortality rather than incidence of AKI, trusts with a minor deficit in the Alert:Code ratio are still included.

b) Defining AKI episodes

AKI episodes start on the date of first AKI alert returned to UKRR, with subsequent AKI alerts only considered part of a new episode if >30 days has elapsed since the preceding alert[2].

c) Defining post-hospitalisation AKI and attributing AKI episodes to a hospital spell and provider

HES has a field for date of admission, but not time of admission, therefore post-hospitalisation AKI was defined as an alert that was dated at least two days after the admission date in HES.[3, 4] Because HES has no time field, the minimum possible interval between admission and the AKI alert is 24 hours and one minute. The AKI alert must coincide with a Continuous Inpatient Spell (CIP) and therefore all CIP spells used in the analyses were at least two days long. AKI alerts that did not fit this definition of post-hospitalisation AKI were excluded.
Although an individual can generate multiple AKI alerts, only the first AKI alert that coincided with a HES spell was included. Each patient was allocated to the NHS trust by the provider code recorded on the HES episode that coincided with the date of the AKI alert, using the first

provider code (sorted in the same order as used to define CIP spells) if there were multiple on that date.[5]

Supplementary File B - *Reweighting of Charlson Comorbidity Index for Patients with AKI*

The first AKI alert for each HES-linked patient in the MPI was included in the reweighting. ICD-10 codes were extracted from all secondary diagnoses fields contained in HES episodes in the year prior to the AKI alert, and mapped to the 17 comorbidity groups used in SHMI.[6] Log odds ratios (ORs) for mortality within 30 days of AKI alert were calculated for each comorbidity. Logistic regression models, adjusting for age, sex, month of alert, AKI alert warning level and each comorbidity individually, were run on 200 bootstrapped samples of the MPI cohort. Each comorbidity group was then given a newly weighted score based on the average of the 200 log ORs; a log OR <0.25 scored 0, log OR 0.25 - ≤0.5 scored 1, log OR 0.5 ≤1 scored 2 and log OR >1 scored 3.

Supplementary File C

Extracting Covariates from dataset

Admission method, month of admission, diagnosis group and comorbidity score were all extracted or derived from the first episode in the spell that contained the AKI alert. Diagnosis group and comorbidities were extracted from HES following the methodology used in the SHMI specification.[6]

Supplementary File D

Missing Data

Five patients who did not have a method of admission recorded in HES were excluded from the cohort.

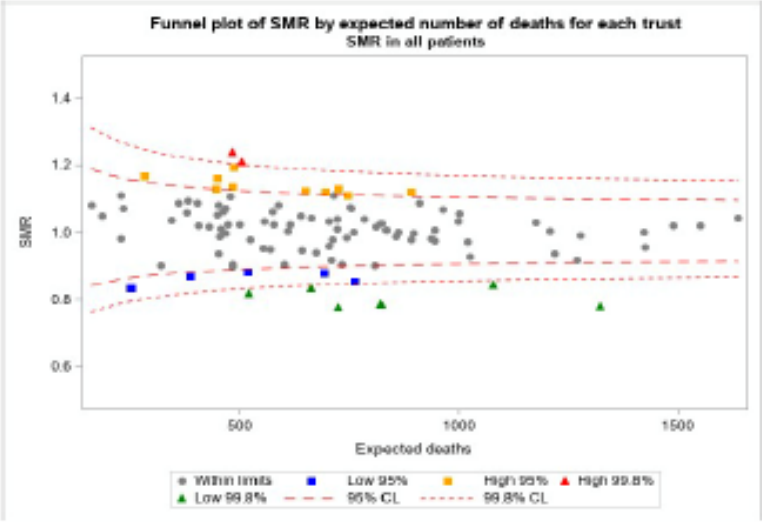
Ethnicity data from the HES episode that coincided with the AKI alert were used. If these were either missing or unknown, then the next most recent HES episode with non-missing and non-unknown ethnicity was used instead. Some patients remained with missing or unknown ethnicity and these groups were included in the analysis.

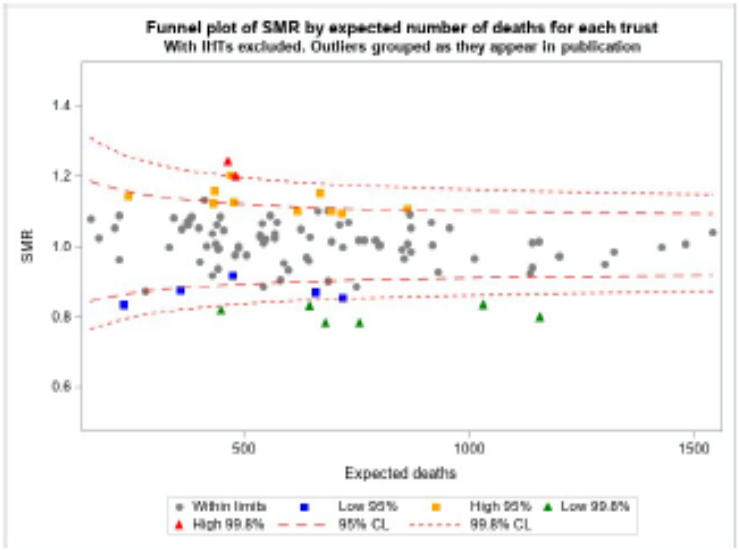
Missing HES deprivation data were enriched with deprivation data from the MPI. Patients who had no deprivation data in HES or the MPI were included in the analysis as a missing deprivation group.

Supplementary File E - *Comparing model parameters when including and excluding interhospital transfers (IHT)*

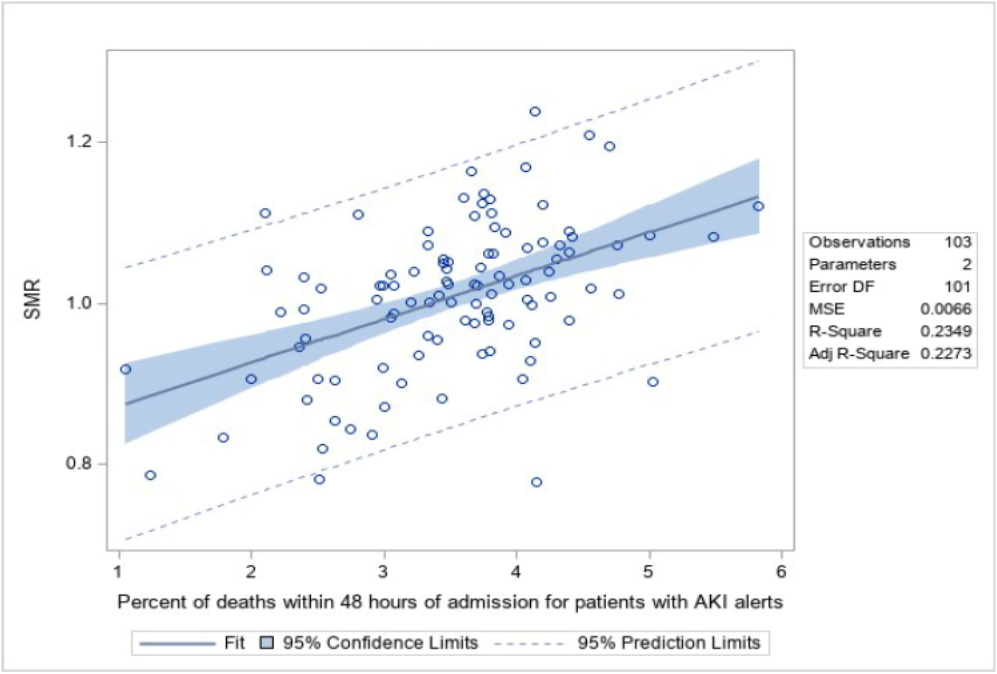
		Including IHTs			Excluding IHTs			Difference between
Variable	Level of covariateble	Parameter Estimate	Standard Error	P value	Parameter Estimate	Standard Error	P value	parameter estimates (%) *
Age	Agespline1	0.03	0.007	<.0001	0.03	0.007	<.0001	2.3
	Agespline 2	0.00	0.001	0.013	0.00	0.001	0.007	-6.5
Sex	Female	-0.24	0.010	<.0001	-0.25	0.011	<.0001	-2.4
Admission Type	Elective	-1.25	0.025	<.0001	-1.34	0.027	<.0001	-3.5
AKI	Alert warning level 1	-0.84	0.212	<.0001	-0.79	0.227	0.001	3.0
	Alert warning level 2	-0.01	0.241	0.975	0.04	0.258	0.884	
Comorbidity Score	1 unit increase	0.48	0.067	<.0001	0.49	0.071	<.0001	-0.1
Month	January	0.09	0.022	<.0001	0.10	0.023	<.0001	-5.1
	February	0.02	0.023	0.378	0.03	0.024	0.159	
	March	-0.05	0.023	0.022	-0.05	0.024	0.050	5.7
	April	-0.07	0.024	0.003	-0.07	0.025	0.003	-0.9
	May	-0.14	0.024	<.0001	-0.14	0.025	<.0001	1.0
	June	-0.16	0.024	<.0001	-0.17	0.026	<.0001	-1.9
	July	-0.16	0.024	<.0001	-0.15	0.026	<.0001	3.0
	August	-0.12	0.024	<.0001	-0.11	0.026	<.0001	3.0
	September	-0.13	0.024	<.0001	-0.14	0.025	<.0001	-2.4
	October	-0.12	0.024	<.0001	-0.12	0.025	<.0001	2.3
	November	-0.08	0.024	0.001	-0.08	0.025	0.001	-3.9

* Only presented if one of the parameter estimates found to be statistically significant at 5% level





Supplementary File F – *Relationship between SMR and 48hr mortality %*



A linear regression model with 48-hour mortality as the independent variable and SMR as the dependent variable found strong evidence of a relationship between the two variables.
The model estimated that for each additional percentage of deaths within 48 hours, a trust's SMR would be expected to rise by 0.05 (P<0.0001).

References:

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