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Rapid response systems

Clinical outcomes of patients seen by Rapid Response Teams: A template for benchmarking international teams☆

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ABSTRACT

Aim: The study was developed to characterize short-term outcomes of deteriorating ward patients triggering a Rapid Response Team (RRT), and describe variability between hospitals or groups thereof.
Methods: We performed an international prospective study of Rapid Response Team (RRT) activity over a 7-day period in February 2014. Investigators at 51 acute hospitals across Australia, Denmark, the Netherlands, USA and United Kingdom collected data on all patients triggering RRT review concerning the nature, trigger and immediate outcome of RRT review. Further follow-up at 24 h following RRT review focused on patient orientated outcomes including need for admission to critical care, change in limitations of therapy and all cause mortality.
Results: We studied 1188 RRT activations. Derangement of vital signs as measured by the National Early Warning Score (NEWS) was more common in non-UK hospitals ($p = 0.03$). Twenty four hour mortality after RRT review was 10.1% (120/1188). Urgent transfer to ICU or the operating theatre occurred in 24% (284/1188) and 3% (40/1188) of events, respectively. Patients in the UK were less likely to be admitted to ICU (31% vs. 22%; $p = 0.017$) and their median (IQR) time to ICU admission was longer [4.4 (2.0–11.8) vs. 1.5 (0.8–4.4) h; $p < 0.001$]. RRT involvement lead to new limitations in care in 28% of the patients not transferring to the ICU; in the UK such limitations were instituted in 21% of patients while this occurred in 40% of non-UK patients ($p < 0.001$).
Conclusion: Among patients triggering RRT review, 1 in 10 died within 24 h; 1 in 4 required ICU admission, and 1 in 4 had new limitations in therapy implemented. We provide a template for an international comparison of outcomes at RRT level.

Introduction

Patients admitted to hospital wards have increasingly complex conditions and multiple co-morbidities.[1,2] Rapid Response Teams (RRTs) and similar services have been introduced to identify, review and treat at-risk and deteriorating ward patients in an attempt to reduce serious adverse events, cardiac arrests, and unplanned admissions to the intensive care unit (ICU).[3,4] The characteristics of patients subject to RRT review[5] and typical triggers for RRT calls[6] are known. At the same time in-hospital mortality rate of patients seen by RRTs is in the order of 20%.[7–10]

Most of the literature related to RRTs evaluates the effects of introducing a RRT on outcomes of all hospitalized patients. Less information exists about the immediate outcomes of individual patients after RRT review or how patient outcomes after RRT

Abbreviations: RRT, Rapid Response Team; NEWS, National Early Warning Score; ICU, Intensive care unit; DNAR, Do not attempt resuscitation.

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review may vary between countries. This information is important as results of RRT implementations are being reported from an increasing number of countries with divergent health care systems. Improvements such as those recently reported from a French group of hospitals[11] might be due to changes in hospital culture or due to changes in outcomes of the group of sick patients seen by RRTs.

The purpose of this study was to examine the short-term (24 h) outcome of patients triggering RRT review and the variations in such outcomes between hospitals from different countries.

Methods

Definitions

For the purpose of this manuscript, the term Rapid Response Team (RRT) is used to describe Rapid Response Teams, Medical Emergency Teams or Critical Care Outreach Teams, and RRT denotes individuals or groups of health care professionals responding to deteriorating hospitalized patients in locations other than Intensive Care.

Ethics approval

The human ethics committee at each location approved participation, and data handling conformed to local practices. For the UK, we obtained formal approval from the Human Research and Ethics Committees at the principal investigator's hospital (Ysbyty Gwynedd Hospital, Bangor, UK; REC ref: 12/WA/0372). The need for informed patient consent was waived as the study protocol and data collected were categorized as audit in nature, and no deviations from normal care occurred.

Study design, infrastructure and coordination

In this multi-national prospective observational cohort study centres with existing rapid response systems were invited to submit data concerning a 7 day period of activity with follow-up of all patients at 24 h post RRT activation. All patients triggering RRT review during the study period were eligible for inclusion.

The management and writing committee consisting of all authors of the paper oversaw the study. The committee directed study design, review and promulgation of the study protocol, collation of results, generation of data queries, resolution of data queries with study sites, data analysis, and writing and revision of the manuscript.

Expressions of interest for participation were initially obtained for sites with investigators known to the committee. Information about the study was subsequently promoted on the Rapid Response Systems website (http://www.rapidresponsesystems.org) and the National Outreach Forum (UK) website (http://www.norf.org.uk). At each hospital, the investigators obtained local ethics approval, and collected data on RRT calls using paper case report forms, which were then manually entered into an electronic database.

Nature of data collected

Hospital and team characteristics were obtained during online registration.

Participating sites collected data on RRT calls for a continuous week of their choosing during the month of February 2014. We collected data for patients who were new referrals to RRTs. Demographics consisted of age, gender, source of admission, parent unit, and date of hospital admission. We recorded the date and time of the RRT call, as well as the primary reason for the call. We then recorded the resuscitation status of the patient before the RRT call (that is, for full active care, for limited critical care, not for critical care, do not attempt resuscitation).

Follow-up visits and repeated referrals were excluded.

Data was collected at 24 h about transfers to an ICU or Operating Room, new or increased limitations of medical therapy, repeated calls, death and whether cardio-pulmonary resuscitation was performed.

Statistical analysis

Site data was compiled in a single record with the addition of a country and site code and anonymised patient identifier. Continuous data was analysed by Analysis Of Variance (ANOVA) or with non-parametric tests for non-normally distributed data. Categorical data was organized into contingency tables and analysed by Fisher's exact test. Correlation analysis was performed with Spearman's test.

Vital signs at the time of arrival of the RRT were part of each patient's data record. The UK National Early Warning Score (NEWS) was derived from each set of vital signs, and used as an additional parameter for analysis.[12] The time between the call to the RRT and subsequent transfer to ICU was calculated and compared in those patients that were admitted.[13] In all inferential analysis, a p value <0.05 was taken to indicate statistical significance. Data from patients admitted to UK units was contrasted with data from non-UK units in order to assess the potential of health care systems to influence outcomes.

Linear regression was carried out to assess the impact of collected data elements on 24-h mortality. Variables that showed significant association with bivariate analysis at $p < 0.01$ were combined and eliminated in a stepwise manner according to regression coefficients. Calculations were performed using STATA version14.0 (Stata Corp.).

Results

Baseline characteristics of study centres demographics

Fifty-one sites from Australia (3), Denmark (4) the Netherlands (1), the United Kingdom (40) and the United States (3) took part in the study. Participating hospitals had a median of 500 beds (IQR 400–762); the median number of new patients seen by teams during the study week was 25 (IQR 15–35). A comparison of the 40 UK and 11 non-UK sites based on the characteristics of their RRT in terms of model and leadership is shown in Table 1. The majority

Table 1
Characteristics of participating sites and their rapid response systems.***.

Characteristic	UK ($n = 33$)	Non-UK ($n = 10$)
Hospital type		
Tertiary/University Hospital	11 (33%)	7 (70%)
Inner City Teaching Hospital	11 (33%)	2 (20%)
District General Hospital	11 (33%)	0 (0%)
Rural/Community Hospital	0 (0%)	1 (10%)
Median number of inpatient beds	500	470
Response model used by RRT		
Largely reactive	8 (24%)	10 (100%)
Largely proactive	2 (6%)	0 (0%)
Reactive & proactive	23 (70%)	0 (0%)
Trigger model used by RRT		
Single parameter triggers	1 (3%)	3 (30%)
Physiological surveillance/warning score	20 (61%)	4 (40%)
Both of the above	12 (36%)	3 (30%)
Leadership of RRT		
Senior ICU physician	7 (23%)[a]	6 (60%)
Junior ICU physician	0 (0%)[a]	3 (30%)
ICU nurse	24 (77%)[a]	1 (10%)

RRT = Rapid Response Team; [a]Leadership data available for 31 UK sites.

Table 2
Baseline characteristics of study patients.

Characteristic	Total	UK	Non-UK			p-Value[a]
Number of patients	1188	973				
			215	Australia	109	
				Denmark	53	
				United States	43	
				Netherlands	10	
Patient characteristics						
Age: mean (SD) years	68 (18)	68 (18)	68 (18)			n.s.
Male gender: *N* (%)	644 (54%)	534 (55%)	110 (51%)			n.s.
Admitted from patients own home	995 (84%)	829 (85%)	166 (77%)			$p = 0.005$
Severity of illness as measured by NEWS mean (SD)	6.5 (2.8)	6.4 (2.7)	6.8 (3.0)			$p = 0.03$
Unit characteristic						
Medicine	756 (64%)	614 (63%)	142 (66%)			n.s.
Surgery	332 (28%)	269 (28%)	63 (29%)			
Call-out characteristic						
Call during daytime hours *N* (%)	495 (42%)	417 (43%)	78 (36%)			$p = 0.046$
Pre-existing limitations of care	217 (18%)	176 (18%)	41 (19%)			
Call out criteria						
Worried/Other	210 (17.7%)	177 (18.2%)	33 (15.6%)			
Hypoxia	201 (16.9%)	167 (17.2%)	32 (15.1%)			
Hypotension	156 (13.1%)	128 (13.2%)	28 (13.2%)			
Raised Early Warning Score	153 (12.9%)	137 (14.1%)	16 (7.5%)			$p = 0.007$
Increased Respiratory Rate	114 (9.6%)	84 (8.6%)	30 (14.2%)			$p = 0.021$
Altered Level of Consciousness	111 (9.3%)	79 (8.1%)	32 (15.1%)			$p = 0.004$
Tachycardia	107 (9.0%)	82 (8.4%)	25 (11.8%)			
Cardio-respiratory Arrest	44 (3.7%)	41 (4.2%)	2 (0.9%)			$p = 0.046$
Frequent Seizures	27 (2.3%)	19 (2.0%)	8 (3.8%)			
Threatened Airway	23 (1.9%)	23 (2.4%)	0 (0%)			
Bradycardia	21 (1.8%)	16 (1.6%)	5 (2.4%)			
Difficult or noisy breathing	16 (1.3%)	15 (1.5%)	1 (0.5%)			
Low Respiratory Rate	5 (0.4%)	5 (0.5%)	0 (0%)			

[a] Comparisons between UK and non-UK centers. Mean (standard deviation) are given for continuous variables and number (percentage) are given for categorical variables; n.s. indicates comparisons lacking statistical significance. In the lower panel, *p* values are presented only for statistically different groups.

of UK RRTs were nurse led, compared to non-UK RRTs which were generally led by an ICU physician.

Patient characteristics

Data were obtained for 1188 RRT events. The mean patient age was 68 ± 8.2 years and 54% were male. Most patients were at home prior to hospitalization (84%), and were located on either medical (64%) or surgical (28%) units at the time of the RRT call. The degree of physiologic derangement at the time of call was assessed retrospectively by calculation of the UK National Early Warning Scores (NEWS, scale 0–20) from patient encounter data. The distribution of NEWS scores for the patients studied is shown in Fig. 1. The mean (SD) NEWS on RRT arrival was 6.5 (2.8). Mean NEWS scores were higher for non-UK sites compared to the UK sites (6.8 ± 3.0 vs. 6.4 ± 2.8 respectively; $p = 0.03$).

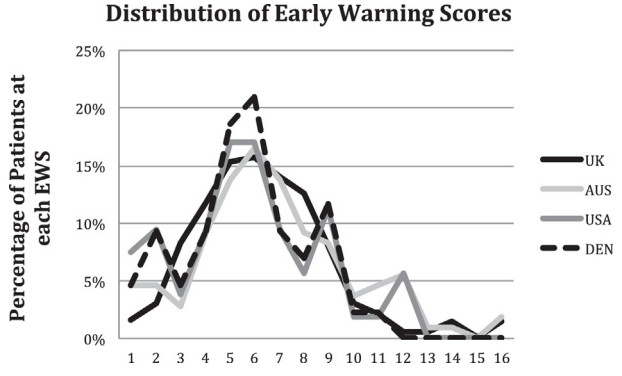

Fig. 1. Distribution of calculated early warning scores in RRT patients. National early warning scores (NEWS) were calculated for each patient with the distribution indicated. NEWS values are shown on the horizontal axis, while percentage of patients is displayed vertically.

Characteristics of RRT activation

Table 2 shows trigger use and related outcome data for both UK and non-UK hospitals participating in the study. UK reported a high use of elevated NEWS (14% vs. 7%) and cardiopulmonary arrests (4% vs. 1%) than centers not in the UK. Non-UK centers reported a greater frequency of MET calls triggered by altered level of consciousness (15% vs. 8%) and increased respiratory rate (14% vs. 9%). All of these differences were significant with $p < 0.05$. None of the MET syndromes had a significantly higher mortality in the UK vs. outside.

The majority of calls across all sites were between 07:00 and 17:00, with a peak at 08:00. Reviews were infrequent between midnight and 06:00, however calls during this interval were two fold higher in non-UK centres (20% vs. 10%; $p < 0.0001$).

Changes in limitations of medical therapy following RRT review

Overall, 307 (26%) of RRT calls resulted in increased limitations of care orders and/or changes of resuscitation status (Table 3). Institution of new limitations in care was more common in the non-UK hospitals (32% vs. 24%; $p = 0.029$) and patients were on average nearly 10 years older (74 ± 14 years vs. 65 ± 19; $p < 0.0001$). There was a positive correlation between NEWS scores and the proportion of patients where new limitations in care were made as a result of the RRT call (Fig. 2; Pearson correlation $r^2 = 0.69$, $p < 0.01$). This correlation was significant only for UK hospitals ($r^2 = 0.81$, $p < 0.0001$).

Resolution of RRT calling criteria within 24 h

In 709/1188 (59%) of cases, the criteria prompting RRT activation resolved within 24 h of the call. A repeat call within 24 h occurred in 175/1188 (15%) of patients, and 75% of repeat RRT calls were for the same criteria that prompted the original call. For patients

Table 3
Patient outcomes.

Outcomes	Total	UK	Non-UK	*p*-Value
Number Studied	1188	973	215	
Transfer to ICU	284 (24%)	217 (22%)	67 (31%)	$p = 0.008$
To ICU in <4 h[a]	146 (51%)	97 (45%)	49 (73%)	$p = 0.0001$
NEWS score of ICU patients	7.1 (1.4)	6.9 (2.6)	7.5 (3.2)	n.s.
Died ICU within 24 h of transfer	23 (8.1%)	17 (7.8%)	6 (8.9%)	n.s.
Transfer to OR	40 (3.4%)	27 (2.8%)	13 (6.0%)	$P = 0.044$
To OR in <4 h	15	9	6	n.s.
Died within 24 h	120 (10.1%)	103 (8.4%)	17 (8.4%)	n.s.
Died on ward within 24 h[a]	97 (10.7%)	86 (11.3%)	11 (7.4%)	$p = 0.0001$
Died with CPR	7	5	2	n.s.
Ward deaths with full care status[a]	37 (38.1%)	36 (41.9%)	1 (9.1%)	$p = 0.03$
NEWS, patients remaining on ward	6.2 (2.8)	6.2 (2.8)	6.5 (2.9)	n.s
New limitation of care	307 (26%)	238 (24%)	69 (32%)	$p = 0.029$
Trigger resolution	709 (59%)	575 (59%)	134 (62%)	n.s.
Repeat MET call	175 (14.7%)	138 (14.1%)	37 (17.2%)	n.s.

[a]Percentages on these lines use the number of patients remaining on the ward for a given group as the denominator (UK = 756; outside = 148). ICU = intensive care unit; OR = operating room; n.s.= not statistically significant.

remaining on the ward, failure to resolve the initial trigger was associated with a 6.6-fold increased risk of death ($p < 0.0001$).

Overview of disposition and short term mortality after RRT review

Transfers to an ICU occurred after 24% (284/1188) of RRT calls. Transfers to the Operating Room occurred in 3% (40/1188) of patients. The 24-h mortality of patients in this study was 10.1% (120/1188). Twenty four hour follow-up data for mortality were available for nearly all patients (1183/1188). Ward and ICU mortality at 24 h were 11% (97/904) and 8% (23/284), respectively. The 24 h mortality according to country is presented together with other outcomes in Table 3. NEWS values were positively correlated with the risk of death within 24-h ($r^2 = 0.41$; $p = <0.01$) and the likelihood of resolution of the RRT trigger at 24 h amongst survivors.

Details of ICU and ward patients

The proportion of patients admitted to Intensive Care was lower in the UK than in other countries (UK: 22% vs. non-UK: 31%, $p = 0.008$; see Table 3). However, mean NEWS for patients admitted to ICU was similar (UK: 6.9 ± 2.6 vs. non-UK: 7.5 ± 3.3; $p = 0.7$).

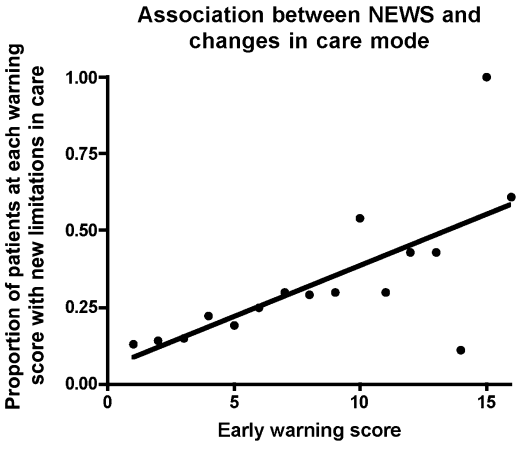

Fig. 2. Correlation between National Early Warning Scores and proportion of patients with new limitations in care. NEWS scores were calculated from patient encounter data as described, and compared to the proportion of patients at each NEWS interval where new limitations in care were made following the RRT call. (Pearson correlation $r^2 = 0.48$, $p < 0.01$); this effect was significant only for UK data ($r^2 = 0.56$, $p < 0.0001$)

Of the 284 patients admitted to ICU, 54 (18%) had limitations of care in place. For patients admitted to ICU, the mean NEWS was 6.8 ± 2.5 for patients without limitations of care and 7.9 ± 3.6 for patients with limitations of care ($p < 0.001$). Patients receiving full care in the ICU were also significantly younger (mean age 63 ± 17 for full ICU care vs. 73 ± 16 for limited ICU care; $p < 0.001$). The pattern of higher NEWS scores and age for full care patients was similar for both UK and non-UK centres but did not reach statistical significance except for age effect in UK hospitals (64 ± 17 for full care vs. 70 ± 17 for limited care; $p = 0.05$).

Ward mortality was 11% overall, and 11% for UK vs. 7% for non-UK locations ($p = 0.0001$ for difference). On the wards, 42% of deaths of UK patients had a full care status (i.e. not DNR) compared to 9% for non-UK hospitals ($p < 0.05$). Mortality of patients transferred to the ICU was 8% and 10% respectively, and was not significantly different. There were no significant differences between UK and outside centers for full care vs. DNR status of patients that died in the ICU.

Of the 904 patients who remained on general wards, 252 (28%) received new limitations of care orders (changes in either resuscitation or ICU transfer status) after the RRT review. Changes in care status were instituted in 21% of UK patients, and in 40% of patients in non-UK centres ($p < 0.001$ for difference). For patients who remained on the ward, the mean NEWS was 5.9 ± 2.7 for patients without limitation of care and 7.09 ± 2.8 for patients with limitations of care ($p < 0.001$). The differences in NEWS scores between full and limited care patients was similar in difference and magnitude for the UK sites, but not so for the non-UK sites (UK: 7.2 ± 2.8 for limited care vs. 5.9 ± 2.6 for full care, $p < 0.0001$; non-UK 6.6 ± 2.6 vs. 6.4 ± 3.1, $p = 0.6$). In UK centres, the mean age was significantly higher in patients with new limitations of care orders vs. full care (77 ± 13 vs. 66 ± 19; $p < 0.0001$).

Time to ICU transfer

The interval between the RRT call and transfer to ICU was available in 95% of patients transferred. Transfer times differed by site and by country, and are illustrated in Fig. 3. The median times to ICU transfer for UK and non-UK sites were 4.4 h (IQR: 2.0–11.8 h), and 1.5 h (IQR: 0.8–4.4 h), respectively ($p < 0.001$). Reasons for delay included unavailability of an ICU bed, delivery of critical care interventions on general wards, and time taken for diagnostic procedures prior to ICU admission. There was insufficient data on the reasons for transfer delay to make any meaningful comparison between sites.

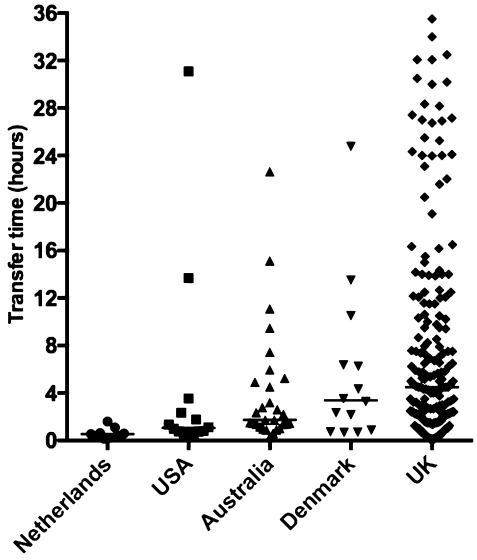

Fig. 3. Interval between RRT call and transfer to higher level of care. Plots indicate individual data points and median times (horizontal lines) for the time interval between MET call and admission to a higher levels of care in applicable patients. UK average transfer times were different from USA and Netherlands. Netherlands was different from Denmark ($p < 0.05$ for all by Kruskall–Wallis test and Dunn's post test for multiple comparisons). Medians and inter quartile ranges are as follows: AUS, 1.6, (1.4–5.1); DK, 3.4, (0.8–8.4); NED, 0.6, (0.3–0.9); UK, 4.5, (2.0–11.8); USA, 1.1, (0.7–3.9)

Predictors of 24 h mortality following RRT review

Multi-variable logistic regression of the whole sample found age, NEWS score and care limitations to be significant predictors of mortality ($p < 0.01$). These three variables accounted for 14% of the variation in 24-h mortality. Analysis of data for patients remaining on the wards found that lack of trigger resolution, age, and NEWS score were highly significant predictors of 24-h mortality ($p < 0.01$); a repeated call was significant at $p = 0.041$, but sensitive to addition of care status and UK to the model.

Discussion

We studied the features, management, and immediate outcomes of 1188 general ward patients receiving Rapid Response Team review in 51 centres across five countries, and compared short-term patient outcomes in UK vs. non-UK hospitals. Overall, we found that approximately 1 patient in 10 died within 24 h; one quarter of calls resulted in ICU transfer, and one quarter resulted in changes to treatment limitations. Focusing on UK data we found, a higher frequency of ward deaths with "full care" status. The processes surrounding ICU transfer took almost four times longer in UK hospitals.

Mortality data compares to an overall mortality rate of 14.9% for patients admitted to UK ICUs[10] and hospital mortality for patients receiving RRT review in Australia between 23 and 34%.[14] Our ICU admission rate was higher than the 10–20% quoted in other studies.[9,14,15] There is evidence from other studies that once a decision to admit patients to ICU has been made, delay in the patient actually arriving on the ICU may result in higher mortality.[16] National UK guidelines now mandate patients be admitted to ICU within 4 h of the clinical decision to admit.[17] Only half of ICU admissions in our cohort occurred within 4 h, but this varied significantly according to centre nationality. In keeping with the findings of Oglesby et al.[13] patients admitted to a UK ICU suffered greater delay compared to non-UK centres. This could be related to the preponderance of nurse led RRTs in UK centres, as opposed to medically led teams in the non-UK centres where the decision on whether to admit a patient to ICU may have been expedited by the earlier attendance of an ICU physician at the bedside. Published reports of ICU bed availability in different countries also indicate a relative scarcity in the UK with perhaps half the ICU beds than in the aggregate of the countries used for comparison in this study.[1,3,4]

Patients with higher NEWS scores had a higher chance of a resolution of their physiological abnormality within the observation period. We believe that this is due in part to regression to the mean. It is likely to explain the hesitancy to admit to ICU in a healthcare environment with limited ICU capacity, as many patients with significant physiological abnormalities will at least temporarily respond to ward based treatment. Data on long-term outcomes in this patient group is needed.

We found that 26% RRT calls resulted in changes in limitations of therapy orders, considerably higher than the previously reported range of 7–14%.[7,18,19] Our study presents the most recent prospectively collected data on this important aspect, and might suggest that the growing influence of RRTs in acute hospitals could be associated with a transition of responsibility for end-of-life issues away from the parent team and towards the RRT. It is unclear what might drive such a development but changes in training of medical staff and potentially unrealistic expectations about the effectiveness of Intensive Care might be contributors.

We found elevated NEWS scores to be significantly correlated to short-term mortality. This finding is similar to findings in per-hospital patients,[20] patients in emergency departments[21] and other clinical areas[22] Our data supports the value of NEWS in identifying patients at higher risk of death and requiring urgent consideration for interventions such as ICU admission or new limitations of care.

To our knowledge, this is the largest prospective study reporting on the short-term outcomes of patients following RRT review. It was conducted prospectively, using standardized data collection tools, utilizing a pre-defined protocol and data analysis plan. It is arguable that peaks and troughs of activity in individual hospitals might affect our snapshot of data sampled during a single week in a single month. At the same time the pooled data of all units – and especially for those of the UK where the numbers of hospitals and patients analysed is large – is likely to reflect current practice.

Despite these strengths, our study has a number of important limitations. The follow-up time period was limited to 24 h. The number of participating investigators from non-UK hospitals was small, introducing the possibility of selection bias, and limiting the generalizability of findings to all hospitals outside of the UK. Fluctuations is death, changes in care mode, calculated NEWS and other variables may have been artificially magnified or minimised due to small numbers of participants. The analysis of this group was therefore largely limited as a contrast to UK units. However, the 40 hospitals from England and Wales are more likely to be representative of the 141 acute hospitals in England, and 16 in Wales. Additionally the study was undertaken during the winter period in the Northern hemisphere with potential implications for case-mix.

We have acknowledged the variation in composition and leadership of RRTs at contributing sites, but anticipate they would be no more variable than the patients they review nor the healthcare systems they operate within. This concept of RRT dose has been suggested as a potential index of maturity and performance of a RRT,[23] and may have provided a useful parameter for comparing contributing centres, however, it is likely that activity during a single week reflects the overall behaviour of a hospital's RRS.

Future research should focus on factors contributing to ICU admission delays and the effects these delays may have on medium and long-term patient outcomes.

Conclusion

The present paper offers clinicians a standardized benchmarking dataset for short-term outcomes of RRT interventions. Within 24 h of an RRT event, 1 patient in 10 will be dead, 1 in 4 will be transferred to ICU, and 1 in 4 will have limitation of care orders. These results might differ between hospitals and countries. The factors contributing to these outcomes and differences in process of care require further exploration as does investigation of longer-term outcomes.

Conflict of Interest Statement

All contributing authors listed have no competing interests to declare.

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Collaborators consented to the statement that 'Health Research Ethics Committee (HREC) approval has been obtained or need for HREC approval been waived locally.' All ethics committees approached gave their approval.

The METHOD site investigators: [alphabetically by institution, all in the United Kingdom unless otherwise specified to Australia (AUS), Denmark (DNK), The Netherlands (NLD) & United States of America (USA)].

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.resuscitation.2016.07.001.

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