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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.