Rapid response systems

Barriers to activation of the rapid response system

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A R T I C L E   I N F O

Article history:
Received 29 April 2014
Received in revised form 24 June 2014
Accepted 22 July 2014

Keywords:
Rapid response system
Medical emergency team
Activation barriers
Afferent limb failure
Physician and nurse attitudes, Knowledge and behavior

A B S T R A C T

Background: The rapid response system (RRS) has been widely implemented in the US. Despite efforts to encourage activation of the RRS, adherence to activation criteria remains suboptimal. Barriers to adherence to RRS activation criteria remains poorly understood.

Objective: To identify barriers associated to activation of the RRS system by clinical staff.

Methods: Physicians and nurses on the medical and surgical wards of a New York City community hospital were surveyed to identify barriers to six criteria for activation of the RRS. A paper questionnaire was disseminated. We assessed familiarity with, agreement with, and recognition of perceived benefit of the RRS calling criteria using a Likert scale. Self-reported adherence to RRS activation was also measured on a Likert scale. Logistic regression was used to assess the association between the barriers and the six RRS criteria.

Results: Sixty eight physicians and 16 nurses completed the survey; response rates were 59% and 35%, respectively. Self-reported adherence rate was ≤25% for the six criteria. We observed that as the familiarity with, agreement with, and perceived benefit of activating the RRS increases, the self-reported adherence also increases.

Conclusions: Adherence to activation of RRT based on the six criteria measured is low. As familiarity with, agreement with, and perceived benefit of the RRS activating criteria rise, self-reported adherence rates increase, with familiarity having the greatest impact. These results can be used to develop tailored interventions to increase adherence to RRT activation in health care institutions.

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1. Introduction

Serious adverse events among hospitalized patients are associated with an increase in morbidity and mortality, and have become an area of concern to healthcare institutions internationally.1–7 Studies have shown that many fatal adverse events do not occur suddenly and are usually preceded by abnormal vital signs that appear transiently or continuously minutes to hours before and which are insufficiently treated.8–10

In an attempt to reduce the rates of preventable fatal adverse events, the rapid response system (RRS) was developed.11 Its major role is to provide early coordinated intervention to patients with warning signs and prevent the occurrence of serious adverse events by detecting quickly patients who deteriorate and responding swiftly and effectively with a rapid response team (RRT) or medical emergency team (MET).12 Its benefits include reduced hospital mortality, reduced ICU days, and earlier identification of trends of deterioration that give hints to faulty processes. Since its development over two decades ago, it has been widely adopted by healthcare institutes as a marker of quality of care and patient safety, and as a life-saving initiative.13–15

Even though the RRS has been widely advocated and adopted, there is still evidence of ongoing suboptimal activation of this system in hospitals where it has been implemented. Studies have shown no activation of the RRS after a patient met the criteria in 30% to 78% of cases, and a median delay of 16 h in RRS activations from the time patient met the criteria.16–19 Several studies attempting to identify reasons behind sub-optimal activation rates have been carried out, mostly among nurses and in non-US settings.20–25 Barriers to optimal RRT implementation in the United States are still unclear. Our study aimed to assess the types and prevalence of some of these barriers.

1 A Spanish translated version of the summary of this article appears as Appendix in the final online version at http://dx.doi.org/10.1016/j.resuscitation.2014.07.013.
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http://dx.doi.org/10.1016/j.resuscitation.2014.07.013
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Table 1
Criteria for activating the rapid response team.

<table>
<thead>
<tr>
<th>Heart rate (HR)</th>
<th>&lt;45 or &gt;125 Beats per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean arterial pressure (MAP)</td>
<td>&lt;70 or &gt;130 mmHg</td>
</tr>
<tr>
<td>Respiratory rate (RR)</td>
<td>&lt;10 or &gt;30 per minute</td>
</tr>
<tr>
<td>Oxygen saturation (O₂%)</td>
<td>&lt;92%</td>
</tr>
<tr>
<td>Patient ‘not looking right’</td>
<td></td>
</tr>
<tr>
<td>Change in mental status</td>
<td></td>
</tr>
</tbody>
</table>

2. Methods

2.1. Setting

The study was conducted in the medical and surgical wards at Harlem Hospital Center, a 286 bed Level 1 Trauma Center located in Manhattan, New York. The hospital has 14 adult ICU and 6 CCU beds, and has a functional RRS system that can be activated by any hospital personnel 24/7. Responders for the RRS call follow the MET model: a physician (senior medical resident), an ICU nurse and a respiratory therapist. Hospital policy requires every new employee to get a primer on the RRS during orientation, and there are yearly grand round on RRS activation offered in the institution. In addition, there are posters listing the RRS activation criteria and how to activate the RRS on the medical and surgical wards. Preliminary data from 2013 show that about 30% of RRS events had delays in their activation, 54% of RRS events led to ICU/CCU transfers, and the cardiac arrest rate was under 2 per 1000 admissions. The target population that was eligible for our study consisted of attending physicians, physicians in training, and nurses employed on the medical and surgical wards. Participation was voluntary, anonymous, and confidential.

2.2. Study instrument

A self-administered questionnaire was used. It is a modified version of two previously developed and validated questionnaires for assessing barriers22,26 (Appendix A). Physicians and nurses were asked to report their adherence to six RRS triggering criteria (Table 1). Physicians and nurses reported whether they were adherent to each guideline component on a 5-point Likert scale: 0% to 25%, 26% to 50%, 51% to 75%, 76% to 99%, or 100% of the time. A self-reported adherence of >75% was classified as adherent to that recommendation.

Barriers to RRS activation were assessed using the theoretical model of knowledge, attitude, and behavior.27,28 The principle of this model is that for recommendations to be incorporated, health care personal must overcome a series of internal barriers (directly related to the provider) and external barriers (outside the provider’s control). Internal barriers are considered to affect adherence through the components of knowledge and attitudes. To assess knowledge, we asked the physicians and nurses to rate their familiarity with each of the RRS triggering criteria using a 4-point Likert scale ranging from not familiar to very familiar. To assess attitudes we asked them to rate their level of agreement with the criteria and their perceived benefit of the criteria, using a 4-point Likert scale (strongly disagree to strongly agree and no benefit to large benefit, respectively). External barriers were not assessed in the survey.

2.3. Statistical analysis

Univariate analysis was performed using logistic regression analysis to test whether the barriers identified by the conceptual model (lack of familiarity, disagreement with the criteria and low perceived benefit) were individually associated with self-reported adherence to each guideline component. All p-values were considered statistically significant if the value was less than 0.05 (double sided α). Analysis was conducted using SPSS v 16.

3. Results

Eighty-four staff members (81% physicians and 19% nurses) completed the survey. 115 (85%) of the eligible physicians and 46 (77%) of the eligible nurses were handed a survey. 68 (59%) of the physicians and 16 (35%) of the nurses responded. Demographics of respondents are shown in Table 2. Self-reported adherence rates for triggering the rapid response system were relatively low across all six criteria measured. The adherence rates for the six activation criteria were: HR = 17.8%, MAP = 14.2%, RR = 21.4%, O₂% = 22.6%, mental status = 25%, “Not looking right” = 23.9%.

The prevalence of the potential barriers to RRS activation differed among the six RRS triggering criteria (Table 3). Survey respondents were most familiar with the mental status change criteria. On the other hand, they “agreed” most with the RR criteria and believed the RR criteria had the most benefit. “Unfamiliarity with the criteria” was the barrier with the highest aggregated weight (24–35% of responders were unfamiliar with the various criteria). Triggering the RRS for a change in mental status had the least

Table 2
Characteristics of survey respondents.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department</td>
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<tr>
<td>Medicine</td>
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<tr>
<td>Surgery</td>
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<td>20</td>
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<tr>
<td>Level</td>
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<td></td>
</tr>
<tr>
<td>PGY 1–2 physician</td>
<td>53</td>
<td>63</td>
</tr>
<tr>
<td>PGY 3–6 Attending physician</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>RN</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Years since completing professional school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 yrs</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>5–10 yrs</td>
<td>46</td>
<td>55</td>
</tr>
<tr>
<td>&gt;10 yrs</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Have initiated a RRT call</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have responded to a RRT call</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived adequacy of RRS training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate</td>
<td>55</td>
<td>65</td>
</tr>
<tr>
<td>Adequate</td>
<td>29</td>
<td>35</td>
</tr>
</tbody>
</table>

* Dichotomized at the midpoint.

Table 3
Prevalence of the main potential barriers assessed.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Familiarity with criteria %</th>
<th>Agreement with criteria %</th>
<th>Perceived benefit of criteria %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>Familiar</td>
<td>Disagree</td>
</tr>
<tr>
<td>HR</td>
<td>26.8</td>
<td>71.4</td>
<td>22.7</td>
</tr>
<tr>
<td>MAP</td>
<td>30.9</td>
<td>69.1</td>
<td>25</td>
</tr>
<tr>
<td>RR</td>
<td>30.9</td>
<td>69.1</td>
<td>14.3</td>
</tr>
<tr>
<td>O₂%</td>
<td>31</td>
<td>69</td>
<td>34.9</td>
</tr>
<tr>
<td>Mental status change</td>
<td>23.8</td>
<td>76.2</td>
<td>14.7</td>
</tr>
<tr>
<td>‘Not looking right’</td>
<td>34.5</td>
<td>65.5</td>
<td>21.5</td>
</tr>
</tbody>
</table>

* Barriers were dichotomized at the midpoint.
aggregated percentage of barriers and activating the RRS for O2% had the highest aggregated percentage of barriers.

When we looked at the association between potential barriers and RRS activation, it was observed that as the familiarity with, agreement with, and perceived benefit of activating the RRS increases, the self-reported adherence rate also increases (Fig. 1). This trend was statistically significant for the following: familiarity to HR (p = 0.01), MAP (p = 0.046), RR (p = 0.017) and change in mental status (p = 0.001); agreement to HR (p = 0.035) and change in mental status (p = 0.007); perceived benefit to HR (p = 0.038) and change in mental status (p = 0.011).

4. Discussion

To our knowledge, this is the first study assessing barriers and attitudes to RRT activation amongst nurses and physicians in a teaching hospital in the United States, although reports from outside the US exist.\(^2\)\(^-\)\(^5\) In addition we sought to study the impact of attitude on self-reported behavior. Our data support the finding that as familiarity with, agreement with, and belief in the benefit of the criteria increased, the adherence rate increased. This relationship was most significant for familiarity with criteria: 4 of 6 criteria had this relationship. On the other hand, agreement with criteria, and perceived benefit of the criteria each were significant for just 2 of 6 criteria. It could therefore be inferred that, for adherence to criteria, familiarity with criteria is more important than agreeing with or believing in the benefit of the criteria. An interesting finding is that low oxygen saturation and “patient not looking right” (similar to the often reported “nurse worried” criterion) were not associated with self-reported RRS activation. Our data show that attitudes toward the RRS impacted self-reported behaviors. This is an important addition to the reported literature, as previously this association could only be inferred.

The RRS had been in existence at the hospital for over five years, there are posters about the triggering criteria prominently displayed around the hospital, and there is in-service training for physicians and nurses regarding the system. Nevertheless, a lack of familiarity with the criteria was one of the barriers identified. All of the six criteria studied had over 20% (range 24–35%) of respondents indicating a lack of familiarity with the criteria. This is in keeping with 65% of respondents who felt they had not been trained to an adequate level on the RRS (Table 2). That these traditional educational methods were not effective was an unexpected finding. There is therefore a need to dedicate resources or reevaluate methods of training to increasing the awareness and self-perceived adequacy of clinical staff education on the RRT activation criteria. Another relevant barrier was a disagreement with the criteria. Four of the six criteria had over 20% of the respondents indicating a disagreement with the criteria in question. This might be because the clinical staff, based on their various personal experiences feel a criterion is too stringent in its parameters, believe they have enough experience to manage such a situation without the RRT or prefer to use their clinical judgment. Preferring to use their own clinical judgment was also observed to be a barrier in the studies by Jones et al., Azzopardi et al. and Shearer et al.\(^2\)\(^-\)\(^5\) Although the actual mortality risk for patients having various levels of deviation from normal vital signs has been extensively studied, the optimal thresholds for RRS activation criteria is still being studied and debated. There is a financial and clinical staffing cost to triggering a response, and the actual benefit to individual patients is not well characterized as a result, quantifying a return on the investment is impossible, and some clinicians and administrators may want to prevent unneeded response to patients with abnormal vital signs.
that are unlikely to lead to adverse events. The lack of a consensus at our hospital in spite of clear guidelines on activation criteria leaves room for personal opinions to play a larger role in decision making.

Our data also showed that triggering the RRS for a change in mental status had the least aggregated percentage of barriers and activating the RRS for O₂% had the highest aggregated percentage of barriers. It can be inferred that of the six criteria investigated, survey respondents believe a change in mental status is most worrisome, and a reduction in O₂% to less than 92%, the least. We did not investigate why these attitudes exist, but this is an area worth studying. We speculate that health care workers place various weights on the different criteria and react based on how “significant” or “important” they think a criterion is, as was observed in the studies by Jones et al.22 Azzopardi et al.24 and Shearer et al.25 Another reason for the low adherence rates might be because the response team physician members in our institution are not senior to the primary managing team. Thus the incremental knowledge gained by triggering the response is questionable. The impact of this clinical feature was not assessed in this study, but may be worthy of investigation.

A key finding from the logistic regression analysis was that for each of the main barriers investigated (familiarity, agreement, and perceived benefit), as the perceived barrier reduced on the Likert scale, the self-reported adherence rate increased. About half of the associations showed a statistical significance for this relationship, and the remaining associations had a trend toward significance although the study was underpowered to assess these associations. A larger study will be required to further clarify the strength of the association between perception and reported behavior. Our results demonstrate that improvements on familiarity with, agreement with, and perceived benefit of the RRT calling criteria will improve adherence to the utilizing the RRS.

We feel that an important message from this data is staff education needs to be improved and current methods using lectures, orientation sessions, and posters are not sufficiently effective. Toward this end, after the study was completed, we initiated an in situ simulation training program to familiarize staff with recognizing critical patient deterioration, when and how to trigger the RRS, and how to hand off to the responder team. Benefit of this intervention will be evaluated. A second intervention is being planned: a continuous noninvasive respiratory and pulse rate monitoring system will enable measurement of frequency and impact of vital sign abnormalities among hospitalized patients.

There are several limitations to this study. Physicians and nurses were enrolled from one New York City hospital and, hence, they may not be representative of other settings. Additionally, there is a sampling bias. There were few nurses participating and virtually no faculty physicians participating in the study. We speculate that culture might play a role in the lower response from nursing staff but this is an area that is open to further investigation with appropriately tailored studies. Because a large percentage of the physicians were trainees, the generalizability of the results is limited. However, in most teaching hospitals direct patient care is performed by physicians in training and consequently they are key components for the triggering of the RRS. In addition, the attitude of physicians toward the RRS may impact the attitudes of their nursing colleagues. This association has not been studied to date. Another limitation of this study is that adherence was based on self-report, and may represent an overestimate as a result of social desirability bias. Participants were instructed that their responses would be kept confidential. We believe that because self-reported rates of adherence were low across the board, it makes the presence of this bias less likely. Finally, a different cut off for adherence could have resulted in a different estimate of self-reported adherence to the various criteria.

5. Conclusion
This study demonstrated self-reported low adherence rates to RRS activation criteria. It also demonstrates that as familiarity with, agreement with, and perceived benefit of the criteria increases, the self-reported adherence to RRS activation was higher. These findings may help to develop tailored interventions to increase RRS activation compliance.

Conflict of interest statement
There are no conflicts of interest to declare.

Acknowledgments
The clinical staff of Harem Hospital Center for taking time out to participate in this survey. There are no sources of funding to declare.

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.2014.07.013.

References