ORIGINAL RESEARCH

Hospital System Barriers to Rapid Response Team Activation: A Cognitive Work Analysis

Numerous factors affected nurses' decision making, including the need to justify the call.

Carla Bowen, 64 years old, was admitted to a surgical unit after undergoing knee replacement surgery. (This case is a composite based on the author's experience.) Over the next 48 hours she became increasingly restless and short of breath and had episodes of tachycardia. The nurse had communicated with the attending physician regarding these changes and had received orders to increase oxygen, obtain a chest X-ray, and administer anxiolytic medications. The X-ray revealed no significant findings. Ms. Bowen's restlessness decreased, and her oxygen saturation levels rose slightly. But on the third morning after her surgery, she was found unresponsive at change of shift. A Code Blue was called, but she could not be revived. This occurred in a hospital with a fully implemented rapid response team system and well-established call criteria that included changes in oxygen saturation levels, dyspnea, and tachycardia.

In a 2009 "Perspectives" piece published by the *Lancet*, Bosk and colleagues wrote, "Nothing threatens safety so much as the complacency induced when an organisation thinks that a problem is solved."[1] They could have been referring to the ways hospitals "think" about rapid response teams (RRTs). Such teams consist of various expert providers who can quickly be called upon to assess a patient for deterioration and either treat or triage that patient for transfer to the appropriate care level. In theory, the immediate availability of such a team should lower mortality and failure-to-rescue events in acute care hospitals and decrease resuscitation events outside critical care areas.[2,3] But the actual success of an RRT system depends on whether it is implemented appropriately.

Although RRT systems have been widely implemented to solve the problem of failure to rescue, the problem has not been solved.[4,5] Events such as those described in the case above still occur every day. There is evidence that RRT systems aren't working as designed, particularly with regard to problems in the activation stage.[6,7] (RRT systems can be broken down into four "arms": an activation stage or afferent arm, a response stage or efferent arm, an administrative arm, and a quality improvement arm.[6]) The literature suggests that RRT interventions may be underutilized in hospitals as a result of contextual or organizational factors not considered with implementation.[5] Some specific individual and team barriers that may discourage nurses from calling an RRT have been identified, including fear of criticism, lack of confidence, limited knowledge, traditional reliance on calling the attending physician, previous negative experiences with RRT members, and lack of staff and administrative support.[8-12] But systemic barriers are less well understood.

Research gap. Experts generally agree that the successful implementation of a patient safety initiative (such as an RRT) in a complex sociotechnical system (such as a hospital) depends on whether implementation takes into account the context of that system. Yet

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ABSTRACT

Background: The goal of rapid response team (RRT) activation in acute care facilities is to decrease mortality from preventable complications, but such efforts have been only moderately successful. Although recent research has shown decreased mortality when RRTs are activated more often, many hospitals have low activation rates. This has been linked to various hospital, team, and nursing factors. Yet there is a dearth of research examining how hospital systems shape nurses' behavior with regard to RRT activation. Making systemic constraints visible and modifying them may be the key to improving RRT activation rates and saving more lives.

Purpose: The purpose of this study was to use cognitive work analysis to describe factors within the hospital system that shape medical–surgical nurses' RRT activation behavior.

Methods: Cognitive work analysis offers a framework for the study of complex sociotechnical systems. This framework was used as the organizing element of the study. Qualitative descriptive design was used to obtain data to fill the framework's five domains: resources, tasks, strategies, social systems, and worker competency. Data were obtained from interviews with 12 medical–surgical nurses and document review. Directed content analysis was used to place the obtained data into the framework's predefined domains.

Results: Many system factors affected participants' decisions to activate or not activate an RRT. Systemic constraints, especially in cases of subtle or gradual clinical changes, included a lack of adequate information, the availability of multiple strategies, the need to justify RRT activation, a scarcity of human resources, and informal hierarchical norms in the hospital culture. The most profound constraint was the need to justify the call. Justification was based on the objective or subjective nature of clinical changes, whether the nurse expected to be able to "handle" these changes, the presence or absence of a physician, and whether there was an expectation of support from the RRT team. The need for justification led to delays in RRT activation.

Conclusions: Although it's generally thought that RRTs are activated without hesitation, this study found the opposite was true. All of the aforementioned constraints increase the cognitive processing load on the nurse. The value of the RRT could be increased by modifying these constraints—in particular, by lifting the need to justify calls, improving protocols, and broadening the range of culturally acceptable triggers—and by involving the RRT earlier in patient cases through discussion, consultation, and collaboration.

Keywords: clinical deterioration, cognitive work analysis, medical emergency team, qualitative research, rapid response system, rapid response team

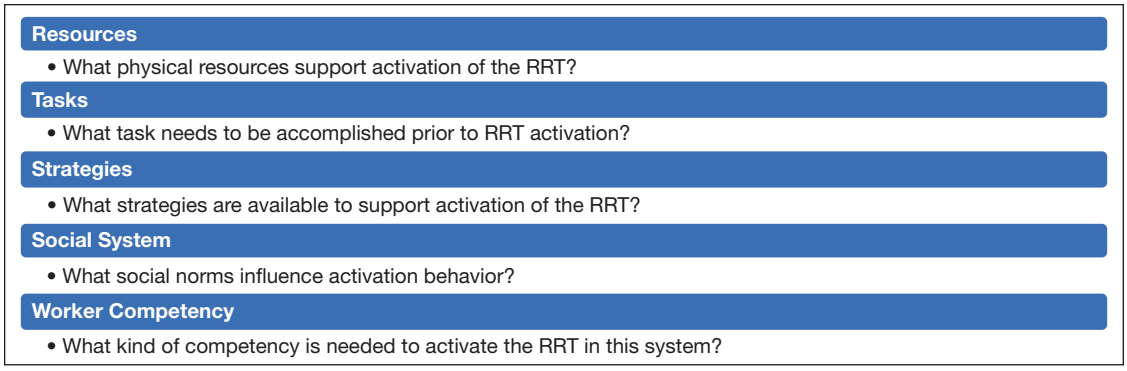
in most institutions, patient safety initiatives are typically implemented outright, with little consideration of the context. If the desired goals aren't achieved, we tend to scrutinize individuals, not the system. Indeed, a literature search found no studies specifically examining the impact of hospital systems or context in shaping RRT activation behaviors of nurses. The purpose of this study was to use cognitive work analysis to describe factors within a hospital system that shaped medical–surgical nurses' RRT activation behavior.

Cognitive work analysis is a methodology that offers a framework for studying multiple dimensions within a complex sociotechnical system (such as a hospital) and for organizing data into five broad, inclusive domains.[13] The specific research questions of this study are given in Figure 1 and are categorized according to these domains.

Cognitive work analysis incorporates aspects of open systems theory, sociotechnical systems theory, and complexity theory. Its framework was developed during the 1960s and 1970s by a team of Danish researchers who were seeking to improve human–machine interactive reliability in the nuclear power plant industry.[14,15] Since then, the use of cognitive work analysis has spread to other high-risk fields such as aviation,[16] industrial engineering,[17] and military operations.[13] Health care researchers have used this process to analyze operating room dynamics,[18] inpatient falls,[19] nurse managers' decision making,[20,21] wrong-site surgeries,[22] and a computerized provider order entry system.[23]

A main assumption of cognitive work analysis is that in a given work system, individuals and emergent events cannot be controlled. But it is possible to identify the boundaries of safe practice, the possibilities, and the barriers to achieving goals that exist in that system.[16,24] Cognitive work analysis uses the term *constraints* to describe factors that guide or shape behavior[25]; the term covers "a wide range of limitations including physical, contextual, and societal" elements.[13] Cognitive work analysis can be used to create a model that describes constraints in a given work system and indicates modifications, so that workers can better achieve their goals.[26]

Figure 1. Five Domains of Cognitive Work Analysis and Corresponding Study Questions



METHODS

Setting. The study was conducted on medical–surgical units in a large, urban, not-for-profit, nonteaching, acute care hospital in Colorado. The hospital is licensed for approximately 500 beds, including 36 critical care beds and 36 cardiovascular beds, and admits about 22,000 patients annually. The hospital has a well-established RRT system with a standardized policy and calling criteria, developed and implemented in 2005. This study received Colorado Multiple Institutional Review Board and hospital institutional review board approvals in June 2012.

Data generation. A qualitative descriptive design was used to obtain data to fill the cognitive work analysis framework's five domains: resources, tasks, strategies, social systems, and worker competency.[14] Data generation focused on sources that might reflect system variables that affect activation of the RRT. Two primary qualitative methods of data generation were used: document review and individual interviews. Observation was not chosen as a study method because of the spontaneous nature of events leading to an RRT and the inherent difficulty in observing them. Retrospective review of the electronic medical records (EMRs) for RRT events was also considered but was rejected because of the lack of documentation reflecting context and cognitive processing.

Purposive sampling was used to obtain participants for interviews and relevant documents. Recruitment was conducted by e-mail from June 1 through September 30, 2012, using a descriptive flyer that was sent to all medical–surgical nurses on all shifts, as they are often responsible for activating the RRT.[10] Twelve participants volunteered to discuss their experiences with patient deterioration, with or without an RRT call. Of the 12, 11 were female and one was male. Ten worked on the day shift and two worked on the night shift; work experience ranged between five and 25 years. After informed consent was obtained, interviews were conducted between July 1 and December 20, 2012. These ranged from 20 to 60 minutes in length and were digitally recorded. Each interview was transcribed and analyzed immediately after it concluded. The represented nursing units included oncology, medical, surgical, acute care rehabilitation, and ICU step-down.

An interview guide was used to ensure that all aspects of the specific domains of cognitive work analysis were covered. The initial interview question asked participants to describe a patient deterioration experience that they'd had within the last year. The time period for recall of events was chosen, after considering the number of RRTs called within the last year (approximately 100), in order to include the largest number of available participants. Further questions included asking whether the participant had called an RRT and what kind of information was used in making that decision. Saturation of themes began to occur between interviews eight and 10. Other sources of information included review of the RRT policy and protocols to gain background information on the activation criteria for and expectations of the RRT.

Data analysis. The primary researcher (JSB) completed data analysis concurrently with data collection, per the qualitative method described by Marshall and Rossman.[27] Data were transcribed and entered into the AtlasTi.7 qualitative data program for coding. The CWA tool templates were used to display data within the cognitive work analysis framework.[28] Directed content analysis was used as the method for data exploration.[29] This is a flexible method that allows for themes to emerge while using predetermined data categories (such as the cognitive work analysis framework's five domains). Data analysis consisted of two parts: inductive and deductive. The inductive portion consisted of open coding to identify units of meaning within the data. These codes were then reduced to categories of codes with common meaning. The deductive portion involved going back to the data and placing the inductively derived codes into categories based on the five framework domains. All of the derived codes fit into the framework and were included. Rigor was established through validation of emergent

themes with each new interview and through review by patient safety experts of the audit trail from raw data to themes.

RESULTS

An overriding theme was a distinct difference in the likelihood of RRT activation, depending on the type of clinical change noticed by the medical–surgical nurse: subtle or gradual clinical changes with subjective data, or abrupt clinical changes with objective data. RRT activation for an abrupt change was, for the most part, well supported by the work system. But RRT activation for a subtle change required navigation around several system obstacles, causing activation delay.

Five themes emerged as the data were populated into the five domains of the cognitive work analysis framework, as follows:

1. RRT activation is highly dependent on human resources.
2. RRT activation requires the task of justification.
3. The availability of multiple strategies for addressing subtle clinical changes can delay RRT activation.
4. Informal social rules can influence RRT activation.
5. Subtle clinical changes require increased competencies to justify RRT activation; abrupt clinical changes are more likely to lead to immediate RRT activation.

(*Editor's note:* In the quotes below, calling a "Rapid Response" is shorthand for calling the RRT.)

RRT activation is highly dependent on human resources. The first domain of the framework identifies the resources available to workers in their pursuit of a goal. Participants identified both human and nonhuman resources as used in RRT activation. Human resources included staffing within and outside the unit. Nonhuman resources included physical and electronic equipment such as the EMR, and policies such as the RRT and staffing policies. One broad limitation that participants noted was nurses' high dependence on human resources, which were often inadequate, and the limited usefulness of nonhuman resources.

Reliance on human resources. Participants consistently cited human resources as the most helpful resource in situations that might require RRT activation. Several stated that the most important factor in recognizing and interpreting an RRT situation was not a vital sign but rather "laying eyes on the patient" and bringing others over to "have more eyes on the patient." When clinical signs were obvious, such as when there was acute bleeding or an abrupt mental status change, an aide or family member could also notice the change and realize that an RRT was needed. One nurse said that when a change was abrupt and witnessed, there was no need to look for RRT activation criteria or trends in vital signs in the EMR.

> She started choking and couldn't breathe . . . that's because of a huge mucous plug down in the stoma. But at that point, we've already determined to call a Rapid Response before we've taken [the patient's] vital signs.

But this necessary physical monitoring of patients could be constrained by several factors including staffing levels, assignments, and the availability of other providers. As one participant explained,

> Probably the biggest barrier to detecting any deterioration would be staffing, or being able to spend time to lay eyes on those patients.

When clinical changes were gradual or subtle, participants described the importance of physical assessment by a nurse as even more important to the recognition that an RRT was needed. One participant described how she searches for information that will help her detect such changes:

> You're going to listen to somebody's lungs, and you're going to look at their pupils . . . you should be looking at the whole person because it will tell you a story, and . . . because you are doing the assessment; you're not missing something.

Gradual changes often required consultation and discussion with others who had more experience or prior knowledge of the patient, such as the charge RN, peers, and the patient's family. These sources of additional information and collaborative support weren't usually found in the EMR or hand-off reports. As one participant stated,

> Some nurses are not that confident in their skill assessing the patient, so they want the charge nurse to take a look before they call a Rapid Response . . . also I would normally just grab the charge nurse and say, "Hey, what do you think?" Then I would call Rapid Response.

Another nurse noted how a patient's family helped her clarify a subtle change as syncope:

> Her pressures were in the low 80s, couldn't really get her to respond that much . . . her son was actually here and said that she had done this multiple times before and had actually been seeing a cardiologist for it.

Limitations of nonhuman resources. Nonhuman resources such as equipment and protocols were of limited usefulness for activation of the RRT. Although participants had access to large

Table 1. Changes in Patients in Deterioration Situations, as Reported by Participants

Subtle or gradual (ambiguous, subjective) changes: need for RRT was not clearly justified	Abrupt (easily observable, objective) changes: need for RRT was clearly justified
Swallowing change	Acute bleeding
Change in mentation	Increase in size of hematoma
Gradual increase in oxygen requirements	Respiratory distress
Lethargy	Chest pain
Borderline vital signs	Fainting
Increasing pain and agitation	Stroke symptoms

repositories of clinical data, the information they needed in order to place a clinical change into context was often scarce, and obtaining it often took precious time in urgent situations. For example, although the EMR was seen as a great benefit to patient care, its value can be limited by the timeliness and nature of the information entered. Delayed entry of vital signs may delay detection of clinical changes. Furthermore, participants stated that the EMR contains very little data that can help in placing subtle changes (such as certain neurological or behavioral changes) into context. Even in cases of abrupt clinical changes, a decision to call an RRT is seldom based only on the documented vital signs available in the EMR.

Participants felt the RRT policy itself was not very helpful in making a decision to activate the RRT. Although the RRT policy includes activation criteria, these were seen as nonspecific, and participants believed that simply meeting these criteria didn't justify a call. For example, participants said:

> We're used to dealing with certain stuff, we're not going to call for [the RRT] to come up and do the exact same things we would do for the patient. . . . So I believe there are guidelines and criteria in the protocol, but it doesn't mean you have to follow them word for word.

Another participant mentioned criteria in another protocol, the hospital stroke protocol, that were seen as more specific and helpful. The stroke protocol includes a step that states specifically when to call the RRT.

> Maybe if we had a clearer-cut criteria on when we do call an RRT and when we wait. You know? . . . People aren't sure. Do we wait until they get this bad . . . or their O^2 requirements are at this level? At what point do we need to call them? . . . The stroke protocol [is] pretty clear-cut.

RRT activation requires the task of justification. The second domain of the framework identifies the tasks that need to be completed in order to achieve a goal. Decision ladders are employed to portray how information is used and how decisions are made in task completion.[13, 30] In this study, each experience of patient deterioration described by a participant was sequentially plotted onto a separate decision ladder, in order to paint a picture of the task or tasks that had to be completed as information emerged and was processed from the clinical change to the decision to call or delay activation of the RRT.

Participants described a task of having to justify the need for the RRT before making the call. In general, when clinical changes were acute or abrupt and when no physician was available, the need for the RRT was quickly justified and the call was made promptly. But when clinical changes were either subtle or gradual, and especially when a physician was involved, participants reported needing more information and time in order to justify the RRT call. (See Table 1 for a list of abrupt versus subtle clinical changes identified by the participants.)

Digging deeper. Participants described how their response to a subtle change (such as a change in one vital sign) included digging deeper in order to determine what was happening to the patient. This often involved gathering further objective data through increased monitoring, finding an objective description of the patient's baseline condition for comparison with the noted change, or both. Decisions to act on information received by calling the RRT were based on whether the nurse felt the situation justified doing so. Justification was influenced by several factors, including the available information, presence or absence of a physician, availability of colleagues for consult, perceived ability to handle the situation on the unit, and the presence or lack of protocols. One participant described the rationale for justifying an RRT call as a need to avoid false alarms:

> If we called Rapid Response every time, we'd be calling them every day . . . we need to do more critical thinking on the floors before we jump straight to that. I've seen nurses

> that call a Rapid Response and by the time they get up here, the patient's sitting up, eating in bed, talking with his family, and it's like, "Should you really have called?"

Finding a trigger. Justification often depended on identifying an objective finding that served as a "trigger" for RRT activation. In several instances, participants described searching for a trigger by increasing patient monitoring, using an available treatment, and consulting with other unit staff. For example, one patient had a groin hematoma that had reportedly increased in size, as well as several brief episodes of tachycardia. Considerable time was spent searching for objective data to verify that these were actual changes that required action. The nurse also talked to a physician about the situation, and more time was spent waiting for the physician to see the patient. The justification came when the nurse's shift was about to end, the physician still hadn't seen the patient, and the patient's condition seemed to be worsening. The nurse described how the decision to call the RRT was made:

> Is that new? It was there today but they said it was small. The trigger was that the physician wasn't doing anything. . . . I don't know what's going on but I'm not comfortable. Finally called an RRT.

Another nurse described the steps she took as she processed a subtle change in a patient's neurological status.

> I had come on shift, and this person I was taking care of had had issues throughout the day, and the physician was well aware, and had dealt with things, but I was very concerned . . . I was monitoring her very closely. Her vital signs and her neuro status were normal . . . I noticed that her swallowing had changed and [she] had blood in her mouth, so I said, "Oh, she's bitten her tongue, or her cheek or something." And then I was concerned she'd had a seizure. So I called the nurse supervisor and asked him to come help me assess her, and we both agreed that a Rapid Response needed to be called.

Making faster decisions. Conversely, certain factors led to less cognitive processing and an immediate decision to call the RRT. For example, a nurse on a neurological unit described noticing a subtle change during a patient's blood transfusion that led her to make the leap from assessment to RRT call, in part because she knew the patient well:

> All of a sudden she sort of slumped a little bit, and both me and her daughter were with her, and we both saw that there was something different all of a sudden. So at that point we stopped the transfusion and called a Rapid Response as well as hit our staff emergency light. . . . When I thought about it later, it wasn't really a change that probably would have been different on any other person . . . but I think it was because it was somebody that I knew very well just because we'd taken care of her for days upon days upon days.

Another quick decision to activate the RRT occurred with a patient who had passed out postoperatively and was hypotensive. The surgeon was in surgery, and the nurse felt that RRT activation was justified because the surgeon was unavailable and the clinical change was abrupt. She stated that the surgeons are supportive of RRT calls when they are off site:

> No, just call a Rapid Response. Up here they don't get mad if you call a Response without consulting them.

The nurse's decision was based on her experience (she knew these postoperative clinical changes weren't normal) and the recognition that the surgeon wasn't available and would be supportive of the call.

RRT activation for a subtle clinical change required navigation around several system obstacles.

Recognition of a symptom that is addressed in a protocol was seen as justification for an immediate RRT call. For example, in the aforementioned stroke protocol, the recognition of certain stroke symptoms directly prompts RRT activation. The protocol also outlines the RRT's next steps: immediately taking the patient for a brain scan and then transferring the patient to the ICU if warranted.

The availability of multiple strategies for addressing subtle clinical changes can delay RRT activation. The third domain of the framework identifies the strategies available for workers to use in order to achieve a goal. Participants stated that when clinical changes are acute and the nurse recognizes that treatment options are limited (by the medical–surgical environment or lack of expertise), the strategy is either to immediately call out of the unit to obtain a transfer or to call the RRT. In such situations, the call for the RRT is seen as justified because the objective data are clear and there are very few other options.

But when clinical changes were subtle or gradual and the call required more justification, the strategies varied more. These included waiting for a bigger change to occur that would justify an RRT call ("wait for it to get worse"), waiting for a higher-level consult ("physician coming after ICU rounds"), seeking more information ("usually get the charge in to have a second opinion"), or trying available interventions such as existing protocols ("try a PRN medication and see if that works"). Participants felt that the availability of numerous strategies in such cases tended to delay RRT activation.

Informal social rules can influence RRT activation. The fourth domain identifies social norms and rules that exist as barriers or facilitators to achieving a goal. In this study, participants noted that an RRT call for an abrupt clinical change was socially acceptable. But with subtle or gradual clinical changes, participants described three main constraints to RRT activation that are informal and well-ingrained in the hospital's culture. The first constraint was the norm of consulting a peer before calling for outside help: "Don't want to bring people over for nothing . . . don't want to look dumb." The second constraint was an informal rule that one didn't "go over the physician's head" unless one had to: "We called and called . . . nothing was improving . . . had to call RRT . . . physician was mad." The third constraint was an expectation that the nurse should first try to "handle" the situation; one participant noted that she asked herself, "Is this something I can handle on my own?"

Participants described an established hierarchical hospital culture that placed physicians at the top and nurses—particularly medical–surgical nurses—at the bottom. Medical–surgical nurse participants recounted incidents in which they'd received criticism and condescension from those seen as higher up in the hierarchy. One participant said,

> Med–surg nurses are the unsung heroes. They have a huge load. . . . They get all the new grads.

This hierarchy was also reflected in medical–surgical nurses' experiences with the RRT team. One participant recalled an interaction between herself and an RRT responder:

> They don't want to listen to our side of the story or what we have to say. They are just more like, "I'm in charge and this is what you have to do," so they're more like barking out orders rather than kind of flowing with whatever we've already been doing and working as a team.

Participants acting within this hierarchy wanted to avoid calling the RRT for false alarms, preferring first to assess the situation within the unit. This hierarchy also kept them from calling the RRT when a physician was involved in the case. If a physician was immediately available, planning and prescribing treatment with the bedside nurse, the nurse was not likely to call the RRT; that was seen as going over the physician's head and unnecessary. If a physician wasn't available, an RRT call was more likely. Participants reported that physicians rarely asked that an RRT be called. One participant posited that perhaps physicians feel they've failed if an RRT has to be called:

> I think some of the doctors take it defensively, you know, "Well! They had to call a Rapid Response, so what did I miss?" You know, in their head they're saying that.

One of the most important constraints mentioned was the expectation that medical–surgical nurses handle their assignments, including gradually deteriorating patients. In the hospital culture, nurses are expected to use their competencies and critical thinking before resorting to a call for help. Participants reported that when the RRT arrives, they expect to be questioned about what they have done. For example, as one participant recounted,

> [The RRT team leader] asks . . . "Did you do this, this and this before you called? Did you call the doctor? No? Why not?"

Participants described employing every nursing tool available to them before calling in someone else. Participants further described feeling that an RRT should be called only when someone else is needed to "take over" the situation or when the nurse has exhausted all other options, including her or his own competencies.

> Yeah. And I think as nurses, you need to use your better judgment. Is this something I can handle on my own?

Subtle clinical changes require increased competencies to justify RRT activation; abrupt clinical changes are more likely to lead to immediate RRT activation. The fifth domain identifies the competencies needed to perform the required tasks within the constraints that exist in the environment. The analysis looks at how data and environmental cues are interpreted by workers in order to understand their cognitive processing load. Rasmussen introduced a taxonomy to distinguish differences in human behavior in a given environment.[31] Accordingly, skill-based behavior is automated and takes place without conscious control; rule-based behavior involves using a protocol or rule on which to base

Table 2. Environmental Constraints That Either Facilitate or Delay an RRT Call in Situations of Clinical Deterioration

Factors that shape behavior toward making an RRT call	Factors that shape behavior away from making an RRT call
Clear objective data, easily recognized	Subjective data, ambiguous
Nurse present to detect subtle changes	Nurse not present to detect subtle changes because of other priorities or time constraints
Symptom is covered by a protocol	Symptom isn't covered by a protocol
Physician off site or not responding	Physician on site and responding
Unfamiliar condition, or condition not responding to treatment as predicted	Recognition of a familiar condition, treatable on the unit
Knowing "We can't fix it"	Thinking "I can handle it"
Perceived collaboration with RRT	Discomfort and perceived noncollaboration with RRT
Attending physician supportive of nurse activation of RRT	Attending physician critical of nurse activation of RRT

actions; and knowledge-based behavior involves specific goals and takes in a broader context that considers relationships among environmental events and human behaviors and their effects. Knowledge-based behavior is the most cognitively "expensive" and requires the most time and expertise.

With regard to this study, in situations involving abrupt or acute clinical changes, nurses could use skill- or rule-based behaviors in order to activate the RRT. For example, abrupt bleeding, syncope, certain stroke symptoms, and loss of consciousness are objectively observable and likely to be recognized by nurses with less experience, family members, and nonnurses.

> They're crashing [and] you can see it happening—I don't ask anybody, I just call a Rapid . . .
>
> We have a little diagram that says . . . "If they're having stroke symptoms, 'Call an RRT.'"

But in situations involving subtle or gradual clinical changes, nurses had to use knowledge-based behavior. Increased observation, reliance on one's experience or consultation with a more experienced clinician, and cognitive processing are required in order to place such changes into context. Specifically, the nurse must be able to predict whether further observations will be needed, have the time to observe the patient, know which diagnoses might match the symptoms, and be able to articulate the reasons for the call to the responding RRT. One nurse described how she acted on a patient's unexplained lethargy:

> We looked at her vital signs, we looked at the medication she had been given. We found nothing [that would] make her so lethargic. I was thinking sepsis because she had an open wound at the same time. Septicemia crossed my mind, but something wasn't right. I was monitoring every hour, then I went to 30 minutes, then I went to 15 minutes, and then I thought . . . I needed help to figure it out.

DISCUSSION

RRTs were never intended to be reserved solely for extreme situations or used as a bailout when every other resource has failed. These teams are there to provide early treatment, *before* a situation becomes extreme. But the findings of this study indicate that nurses consider it justifiable to call an RRT only in extreme situations, not beforehand. They also suggest that although nurses' information and collaboration needs are greatly increased in the time before the situation becomes extreme, the available resources are often physically or culturally inadequate (or both) to justify making the call. (See Table 2 for a list of constraints.)

To my knowledge, the results of this study have not yet been duplicated. That said, the findings do relate to and extend the information presented in other relevant studies published recently.

The challenge of decision making when data are lacking. The results of this study reflect the difficulty nurses have in making decisions when crucial information is insufficient or lacking. Participants didn't activate the RRT based on data from the EMR or by examining data trends. The data they needed to

justify an RRT call were either objectively apparent through assessment or subjective and not documented in the EMR. To date, there has been little research exploring how nurses use information in the EMR in order to prevent or detect patient deterioration. Easier access to data trends might facilitate earlier RRT calls. Many hospitals have implemented "track-and-trigger" or other early warning systems in order to ensure such early detection.[32] These systems either allow the nurse to package data together to make a stronger case for early intervention,[33] or they automate RRT activation through the use of EMR data trending and notification.[34] This study's results show that, for EMR data to be more useful in identifying early clinical deterioration, we'll need a greater understanding of the objective and subjective information that support the cognitive processing needs of medical–surgical nurses.

Participants described a task of having to justify the need for the RRT before making the call.

The need for justification. I found little in the literature explicitly about the need to justify RRT activation, but some studies lent implicit support. Andrews and Waterman found that packaging data together allowed nurses to make a patient's deterioration more "credible" through the use of "convincing referral language" and thus get a physician's attention.[33] And in a study by Astroth and colleagues, nurses described feeling criticized by RRT members when the call was seen as unnecessary.[35] The researchers also found that the perceived busyness of ICU nurses "discouraged participants from RRT activation"[35]; it's likely that calling would then require more justification.

The importance of nursing presence to the detection and processing of subtle clinical changes was a key finding. Nursing presence is similar in concept to nursing surveillance, which has been defined as a process to "identify threats to patient health and safety through purposeful and ongoing acquisition, interpretation and synthesis of patient data for clinical decision-making."[36] As Henneman and colleagues have pointed out, surveillance and monitoring aren't synonymous.[37] Monitoring largely involves collecting and recording certain physiological data (such as vital signs and laboratory values), whereas surveillance involves collecting a wider range of information and then analyzing, synthesizing, and acting on it.[36, 37] Inadequate nursing surveillance has been associated with failure to rescue.[36] Factors that affect surveillance include staffing levels as well as the experience and expertise of the individual nurse.[36, 38] Barriers to effective surveillance include inadequate staffing, inadequate resources, poor collaboration by health care team members, failure to include patients and families in decision making, and underuse of technology.[37] This study's findings offer support. Participants cited nurse staffing levels, nursing experience, and the input of patients' families as factors that affected their recognition and interpretation of a clinical change. They also identified several barriers, including delays in access to a colleague's expertise, poor intra- and interdisciplinary communication, and the hierarchical hospital culture.

The inadequacy of activation criteria. Another finding was that the RRT policy's activation criteria were not useful when the data were subjective or when a patient's deterioration was subtle or gradual. Many participants described waiting until the patient met certain objective criteria before they called for help. Simply meeting the RRT activation criteria did not seem to be regarded as strong enough reason. In a relevant study, Minick and Harvey investigated early problem recognition among medical–surgical nurses.[39] They found that nurses who perceived subtle clinical changes had to be able to convey the problem clearly, especially in the absence of objective data, in order to get a physician's attention. And in the aforementioned study by Andrews and Waterman, the authors described how nurses packaged objective and subjective data together and used "clear and unambiguous language" to ensure such attention.[33] Taken together, these findings suggest that an RRT policy's activation criteria alone are not adequate to prompt action on a change. A British study by Shearer and colleagues that explored failures to activate the RRT offers further support. The researchers found that clinical staff didn't seem to consider the RRT call criteria sensitive enough to indicate a true problem, so they would wait for more information.[11]

The importance of teamwork. Experts agree on the importance of intra- and interdisciplinary communication and collaboration among health care professionals to ensuring patient safety,[40] and this study's findings provide ample reinforcement. Participants described several instances characterized by poor communication and lack of collaboration, both with physicians and with their nursing peers. Furthermore, in cases of subtle or gradual clinical changes, participants seemed to rely on a hierarchy of consult, first consulting local nursing colleagues and only later consulting other professionals (such as physicians) and going outside the unit. The recent literature offers some additional support. Astroth and colleagues found that reliance on physician direction and communication problems with the RRT team were among the barriers to activation.[35] But while Shearer and colleagues found the hierarchy of consult a reason to delay calling the RRT, only a minority of staff were found to delay owing to expected communication difficulties.[11]

The expectation that nurses will 'handle' the situation. Several participants stated that not all changes that meet the RRT call criteria actually warrant a call. They stated that they use their judgment: if a situation seems to be under control, they feel no call is needed. Similarly, in the study by Shearer and colleagues, 41% of nurses who didn't activate the RRT when the patient met the call criteria stated that they did not call because they felt they could handle it.[11] It's interesting that in that study, the nurses *did* handle it: the majority of such patients did not have an adverse outcome. The researchers surmised that staff felt the RRT criteria often weren't sensitive enough to justify activation, so they delayed or activated based on other reasons.

In a large, long-term study of 855 RRT activations, Beitler and colleagues found that emphasizing activation based on clinical judgment, rather than on specific criteria such as vital signs, fostered higher RRT use: fully 47% of the activations were based on clinical judgment.[41] The high activation rate was in turn associated with a significant decrease (11%) in hospital-wide mortality. The researchers concluded that these positive results were likely due to "this flexibility, to activate an RRT for any reasonable clinical judgment without threat of repudiation or reprisal."

Implications. The results of this study highlight several systemic barriers to RRT activation, especially in cases of subtle or gradual clinical changes. There are important implications for organizational leadership as well as frontline staff. In this study, support for early RRT activation was clearly lacking when nurses were faced with subtle clinical changes and a physician was involved. One reason for this was that calling the RRT was seen as a bailout instead of as a form of collaboration. Organizational leadership could support interventions that support collaboration and offer assistance with nurses' increased cognitive processing needs. These might include proactive rounding on high-risk patients by either the RRT or an advanced practice nurse,[42] EMR data trending with automated triggers that prompt a visit from an experienced provider,[34] decision support in cases of subtle clinical changes,[43] and collaborative RRT activation protocols.[44]

Frontline medical–surgical staff would benefit from collaboration with the RRT team in nonemergent situations. This might include using simulation exercises, debriefing after RRTs, and looking at case studies in which RRT activation was delayed. Involving medical–surgical nurses in the collaborative creation of protocols that include clear, accepted RRT activation criteria could help to minimize activation delays.

Limitations and suggestions for further study. This study was limited by the small sample size and single-hospital setting, the inclusion of only medical–surgical nurses and no other disciplines, the predominance of day-shift nurses, and the lack of input from less-experienced nurses. Participants speculated about the thoughts of physicians and discussed their perceptions of the experiences of less-experienced nurses, but there were no physician participants and none with fewer than five years' experience. Because nurses volunteered their participation, bias could have been introduced in drawing nurses who either had experienced more extreme cases of patient deterioration or had more vivid recollections.

This study's findings warrant further investigation and expansion. The results and suggested modifications could be specifically used in developing and testing an intervention aimed at increasing RRT activation rates. Several factors that affect RRT activation warrant closer examination, including the need to justify RRT calls, the presence or absence of a physician, the quality of the nurse–physician collaboration, the nurse's access to advanced practice nurses and other human resources such as family members, and the use of EMR data trending to detect subtle clinical changes. Lastly, further study is needed on the outcome effects of increasing RRT activation versus improving multidisciplinary evaluation and collaboration so that at-risk patients are transferred sooner to a higher level of care.

Many participants described waiting until the patient met certain objective criteria before they called for help.

CONCLUSIONS

These findings highlight the challenge that medical–surgical nurses face when a patient concern arises that may not be apparent to others. Although RRT activation criteria are typically broad and believed to cover any condition that might cause a nurse to worry, in reality, making the decision to call the RRT is not easy. Systemic constraints, especially in cases of subtle or gradual clinical changes, include a lack of adequate information on which to base decisions, the availability of multiple strategies to address such changes, the need to justify RRT activation, a scarcity of human resources to draw upon for assistance, and informal hierarchical norms in the hospital culture. All of these constraints increase the cognitive processing load on the nurse facing a case of patient deterioration. The value of the RRT could be increased by modifying these constraints—in particular, by lifting the need to justify calls, improving protocols, and broadening the range of culturally acceptable triggers—and by involving the RRT in patient cases before they become emergent, through early discussion, consultation, and collaboration. ▼

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