THE SUSTAINABILITY OF INNOVATIONS IN HOSPITALS: A LOOK AT RAPID RESPONSE TEAMS

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ABSTRACT

DEONNI PAMELA STOLLDORF: The Sustainability of Innovations in Hospitals: A Look at Rapid Response Teams
(Under the direction of Cheryl Jones)

This study sought to broaden our understanding of the factors, contexts and processes that bring about the sustainability of innovations in hospitals. Rapid response teams (RRTs)—an innovation that brings critical care expertise to patients in crisis with the goal of improving quality of care—was examined. Guided by an adapted version of Shediac-Rizkallah and Bone's (1998) Planning Model of Sustainability, a two phased approach that incorporated both quantitative and qualitative methods, was used. In Phase One, to determine the level of RRT sustainability, an online survey was administered to a convenience sample of 56 North Carolina (NC) hospitals that had participated in the NC Hospital Association's RRT Collaborative. The RRT-Institutionalization Scale, based on Goodman, McLeroy, Steckler, and Hoyle's (1993) Level of Institutionalization Scale, was developed and used to measure sustainability. Thirty-three hospitals (58%) participated in the survey. Descriptive statistics were used to obtain information about organizational and RRT characteristics, and to calculate and then rank hospitals into quartiles based on their sustainability scores. The mean sustainability score for participating hospitals was 3.71 (range, 1.0 to 5.19).

In Phase Two, a multiple case study approach was used to examine four cases (two hospitals in the highest and two in the lowest quartiles of sustainability scores)

and gather in-depth data about the sustainability of RRTs in hospitals. Data were gathered using a brief hospital questionnaire, interviews with key stakeholder groups (leadership, RRT members, and RRT end-users), and documentation review. Cross-case analyses were conducted by comparing (a) the two high-sustainability hospitals, (b) the two low-sustainability hospitals, and (c) the two groups of high- and low-sustainability hospitals. The results indicated that the presence of PMOS and other factors, as well as certain contexts, and processes facilitated sustainability in hospitals. Several differences were found between hospitals that reported high levels of RRT sustainability and those that reported low levels of RRT sustainability. Based on these findings, a model of RRT sustainability was proposed. Further research is needed to test the applicability of this model to hospitals in other states in the U.S., other types of hospitals, and other types of innovations.

To my husband, my son, and my family.

I am thankful to the God of the Universe, who made my feet like the feet of a deer and caused me to stand on the heights. To my husband, thank you for being my help-mate and for your continued encouragement and unwavering faith in me. To my family and my friends, thank you for your support and prayers. To my dissertation chair, tremendous thanks for mentoring and guiding me to become a better researcher and writer. And, to my dissertation committee, thank you for your direction and advice and helping me to be successful.

"May he who made the rainbow and send the raindrops too, come down and bless you richly, and be very near to you." (Helen S. Rice)

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CHAPTER 1

INTRODUCTION

Innovations are the lifeblood of successful organizations. They add value to organizations by bringing potentially cutting edge technologies and services to the market, and attracting and retaining a highly skilled workforce. Innovations are defined as "the intentional introduction and application within a role, group, or organization, of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, the group, or wider society" (West, 1990, p.309). In healthcare, innovations can take many forms such as drug therapies, devices, procedures, communication techniques or management processes (Dixon-Woods, Amalberti, Goodman, Bergham, Glasziou (2011).

Since the Institute of Medicine reports (1999, 2001), which identified widespread systems problems and the failure of health care organizations (HCOs) to improve the quality of care, the adoption of innovations has been touted as a way to improve health care systems and the quality of care delivered to patients. When innovation adoption and implementation result in benefits for hospitals, their patients, and their employees, HCOs have the opportunity to enhance their competitive, strategic edge, attracting clients and healthcare workers (Lansisalmi, Kivimaki, Aalto, & Ruoranen, 2006). Unfortunately, organizational leaders may not always find innovations to be beneficial because of the lack of innovation sustainability. Innovation sustainability is a major organizational challenge because it often requires organizational change or changes in employee behavior, both of which can be difficult to attain (Lansisalmi et al. 2006). Yet, in today's healthcare environment of limited funds, ever changing innovations, and demands for improvements in care delivery, it is prudent for organizational leaders to establish the

necessary environments that foster the sustainability—or continuation—of innovations that they implement. In healthcare, and particularly in hospitals we know very little about what is needed to facilitate sustainability. Yet hospitals represent a large sector of the healthcare industry, and they are continually adopting innovations to improve quality of care. Without understanding the sustainability of these innovations, however, achieving the desired outcomes may be difficult.

Sustainability of Innovations

Anecdotal and research evidence indicate that certain conditions must first be established for organizations to achieve sustainability of innovations. Without efforts to create an ideal organizational environment to sustain innovations, breakdowns may occur in the process, and organizational resources, as well as potential benefits, may be lost (Wilson & Kurz, 2008).

Researchers have found that factors such as organizational infrastructure, leadership, culture, financial support, and goal alignment were factors that facilitated sustainability. Patterson et al. (2013) conducted a national survey of the sustainability of hospital-based nursing research programs. Examining these programs is relevant to innovation sustainability because, due to the requirements for Magnet ® designation, the implementation of hospital-based nursing research programs are increasing in U.S. hospitals. Also, although nursing research is not a new idea per se, hospital-based research programs fostering the involvement of frontline staff in the research process are. Patterson et al. (2013) surveyed a purposive, convenience sample of 798 nursing research representatives from three groups of U.S. hospitals: Magnet designated (n=202), Children's Hospital Association (CHA) (n=195), and The Joint Commission accredited hospitals (TJC) (n=401). Random selection of hospitals in the four U.S. geographic regions ensured geographic representation of hospitals. Overall response rate was 20.05% with 66% of hospitals being Magnet and 33.75% being non-Magnet hospitals. Non-Magnet hospitals included 29 (18.13%) TJC and 25 (15.63%) CHA hospitals. Patterson and colleagues found that nursing

research programs were sustained when hospitals' infrastructure, leadership, and the hospital culture (i.e., nursing and leadership attitudes and values that supported nursing research) provided support for it. An important infrastructure element was onsite centers for research and grants. Chief nursing officers, administrators, director of nursing research, and senior nursing leadership played an important role in being supportive of the innovation by championing research studies and facilitating funding for such studies. A hospital culture, where nurses were empowered to identify research opportunities to improve patient care, also fostered the sustainability of nursing research. The reliability and validity of the findings are, however, limited because of the low response rate and the omission of reliability testing of the survey instrument. Furthermore, a significant difference existed in organizational characteristics (i.e., number of beds and full-time equivalent registered nurses) between Magnet and non-Magnet hospitals ($p < .0001$), and the researchers failed to account for these differences in the overall outcome of hospital-based research program sustainability.

Tibbits, Bumbarger, Kyler, and Perkins (2010) examined the sustainability of evidence-based interventions that were implemented by community agencies and schools to prevent delinquency, substance abuse, and violence in Pennsylvania. The researchers examined post-funding sustainability, the factors associated with the predicted post-funding sustainability, and the factors associated with actual post-funding sustainability. Community readiness, the strength of collaboration with local coalitions, the perceived quality of training, and sustainability planning were hypothesized to be correlates of sustainability. Representatives of all agencies/schools that received funding to participate in the prevention program were invited to complete a survey in 2001 (n=50), 2005 (n=115), and 2007 (n=130). Response rates varied from 64% in 2001, to 73% in 2005, and 76% in 2007. Tibbits et al. (2010) found correlates of predicted post-funding sustainability to include the presence of program staff ($p<.05$), overall school support ($p<.01$), and school administrator support ($p<.01$). Furthermore, correlates between predicted post-funding sustainability and actual post-funding sustainability were

significant ($p<.05$). A significant relationship was also found between sustainability, once funding support for the project ended, and financial sustainability ($= < .05$) and alignment of intervention and agency goals ($p <.01$). The reliability and validity of the study findings were enhanced through the use of several scales with acceptable Cronbach alpha coefficients ($\alpha = .55$ to .79) to measure the correlates of sustainability. A longitudinal study design, collecting data on three occasions over the course of 6 years, was used and good response rates were reported. A limitation of the study is, however, the lack of a valid and reliable scale to measure sustainability. Instead, to measure predicted post-funding sustainability, administrators were asked one question on the likelihood that the program would be continued beyond the funding period. To measure actual post-funding sustainability, administrators were asked the extent to which the program was still operating.

The aforementioned studies indicate that factors facilitating sustainability include organizational infrastructure, leadership, hospital culture, the alignment of innovation goals and organizational goals, and the continuation of funding once external program funding has ended. Other researchers have similarly identified factors important to sustaining innovations in organizations. For example, Commins and Elias (1991) conducted multiple-case studies of four school districts to examine the sustainability of a specific curriculum with a social-cognitive approach to teaching elementary school children. These researchers found important facilitators of the sustainability of the curriculum in the schools to be the presence of innovation champions in the organization, the "fit" between the innovation and aspects of the organization, and the perceived benefits of the innovation.

In healthcare, studies of innovations have focused primarily on activities surrounding the implementation of innovations rather than factors and conditions necessary for sustainability (Brown, Chervany, & Reinicke, 2007; Helfrich, Weiner, McKinney, & Minasian, 2007). Further, the sustainability studies to date have not examined why certain factors are important or how they contribute to sustainability. Also, the studies have been largely atheoretical, variables often were

operationalized inadequately, and measures of sustainability have lacked thorough reliability and validity testing. The research has also focused primarily on the sustainability of community-based innovations rather than on innovations adopted in organizational settings, particularly acute healthcare organizations. As a result, relatively little is known about the sustainability of innovations in hospitals.

Rapid Response Teams as an Organizational Innovation

One innovation implemented in the past 5 to 10 years in hospitals across the U.S. is rapid response teams (RRTs). These teams consist of specialists who intervene quickly to bring critical care expertise and resources to the bedside of patients in crisis on acute care units. Depending on organizational polices, staff members, patients and families may activate RRTs when a patient is in distress or concerned. However, RRTs are primarily activated by health care providers when predetermined calling criteria are met, and their goal is to prevent avoidable patient progression to cardiopulmonary arrest (Duncan, 2005; Barbetti & Lee, 2008).

The concept of RRTs started in 1990 in Australia where these teams were called medical emergency teams (METs). However, RRTs were introduced to U.S. hospitals in 2004 with the launch of the *100,000 Lives* Campaign by the Institute for Healthcare Improvement (IHI). The IHI, a not-for-profit organization that initiates and supports innovations, views innovations as holding potential for saving lives by improving the quality of care provided to patients in HCOs (Jonas, Goldsteen, & Goldsteen, 2007). The implementation of RRTs was one of six organizational efforts supported by the IHI in its *100,000 Lives Campaign* (December, 2004 – December, 2006).

Several arguments can be made as to why these teams were initially developed and subsequently adopted and implemented in organizations. First, preventable clinical antecedents (such as abnormal heart rate and respiratory rate) to unexpected deaths, in-hospital cardiac arrests and unplanned intensive care unit (ICU) admissions can be observed in patients (Aneman & Parr,

2006). These clinical antecedents were found to have been present within 8 hours preceding death (Hillman et al., 2001). RRTs offer prompt intervention and treatment of patients with these clinical antecedents to possibly prevent arrest and death. Second, Aneman and Parr (2006), who conducted a systematic review of 80 MET studies, also reported deficiencies in the care of patients who were subsequently admitted to ICUs. These deficiencies were related to clinicians' lack of knowledge and supervision, and the failure of clinicians to identify the urgency of patients' situations or to consult others and seek advice. RRTs help to overcome these deficiencies by specifying RRT calling criteria to help nursing staff identify patients who may be deteriorating, and by providing expert clinicians who can care for patients who may be in distress on general units. ICU admissions may also be averted because care is expedited. RRT programs also offer a system for training caregivers to recognize signs and symptoms of deterioration and likely addresses knowledge deficits and failures to identify patients in distress. Third, RRTs serve to compensate for the inability of nursing staff to get hold of physicians in a timely manner to report changes in vital signs or other patient-related concerns (Pickoff, 2006). Failures in communication result in the absence of experts who could assess the patient and develop a treatment plan to correct the problem, thus resulting in delayed patient care. RRTs compensate for this problem by providing nurses with a mechanism to gain immediate access to experts who can assess the patient and intervene appropriately.

As of May 2008, approximately 3,100 hospitals in the United States (US) had joined the IHI 100,000 Lives campaign, and about 60% of them had implemented RRTs. This IHI's program was later expanded to the *5 Million (5M) Lives Campaign* and RRTs continued to be a part of the campaign. Although the 5M Lives Campaign concluded in December 2008, the dissemination of RRTs in hospitals has continued, with the 2009 Joint Commission mandate that hospitals must have a rapid response system in place for early identification and immediate treatment to prevent avoidable patient deterioration.

RRTs, like other recent organizational initiatives, have the potential to improve both patient and organizational outcomes by bringing critical care skills to the bedside of a potentially deteriorating patient, and attending to issues of patient safety and the timeliness of patient care. Members of these teams are critical care experts who are knowledgeable and experienced in the care of unstable, critically ill patients. RRTs thus augment the knowledge and skills of physicians and nurses on acute care units who are unfamiliar with caring for critically sick patients and reduce the likelihood of treatment errors by less experienced staff (Stolldorf, 2009).

RRTs have also been linked to successful detection of preventable adverse events. Braithwaite et al. (2004) examined whether the review of RRT responses could be used to detect medical errors. Charts of all patients for which an RRT was called (n = 364) during an 8-month period at a large (567 licensed beds) medical center in the U.S. were reviewed by the hospital's quality improvement committee. Braithwaite et al. found that 114 (31.4%) of these RRT calls were preceded by one or more medical errors that were associated with either improper or delayed diagnosis, incorrect procedures, drugs, or tests, or failure to provide prophylactic treatment in at-risk patients. Root cause analysis was subsequently used to evaluate these errors and processes were implemented to prevent future occurrences of these errors. The use of protocols to extract data from patients' electronic medical records and to identify and categorize medical errors ensured consistency in the data collected and categorized. Also, the quality improvement committee made all error categorizations by consensus. Although the goal of RRTs is to prevent rather than detect errors by intervening early in the care of patients with avoidable problems on acute care units, Braithwaite et al. demonstrated that RRTs could be used as a mechanism to successfully detect preventable adverse events and facilitate actions to enhance the quality of care.

To understand the impact of RRTs, Benin, Borgstrom, Jenq, Roumanis, and Horwitz (2012) recently conducted 49 interviews with hospital administrators, primary team attending physicians, trainees, RRT attending hospitalists, staff nurses, nurses and respiratory technicians of

a 944-bed, university-affiliated hospital. Standardized open-ended questions and probes were used during interviews to obtain participant's perceptions of the RRT impact in the organization. Subjective improvements were reported in staff morale and teamwork, redistribution of nurses' workload, escalation of the care of the patient in crisis, and organizational learning. Nurse administrators also reported that the RRT improved patient flow in the organization and aided nurse retention. The credibility of the study was enhanced because interviewing various groups (registered nurses, administrators, senior attending physicians, house staff members, and RRT nurses, physicians, and respiratory therapists) allowed for data triangulation. Inter-rater reliability of coding by the research team was also established. However, the use of a purposive sample of participants might have introduced selection bias and the use of interviews increases the risk for response bias. Transferability of the data is limited because of the use of a single institution. Transferability of the data could have been enhanced by providing sufficient descriptive data to determine if the findings were transferable to other settings (Polit & Beck, 2004).

Unfortunately, the evidence remains inconclusive on whether patient outcomes improve following RRT adoption and implementation. Bristow et al. (2000) conducted a quasi-experimental pre-post study of a convenience sample of three hospitals: one with an RRT (intervention group) and two with conventional cardiac arrest teams (control groups). Critical care nurses were trained in and conducted data collection at all sites. Clinical staff in the three hospitals were blinded to the purpose of the study to reduce a Hawthorne effect. The researchers found no statistically significant difference in rates of cardiac arrests or total deaths between the three hospitals. Chan et al. (2008) also conducted a quasi-experimental pre-post study and examined patient records of hospital admissions before and after RRT implementation. The study was conducted over a 3-year period at a large academic medical center and consisted of a large sample size (24,193 admissions before and 24,978 admissions after RRT implementation). After adjusting for demographic variables, the researchers found no significant difference in mortality rate after RRT implementation. Secondary analysis of the data revealed some instances of RRT

under-utilization that may have affected patient outcomes. Stolldorf (2009) suggested that RRTs are under-utilized or inappropriately used. Interviews that were conducted with 12 staff nurses (RRT members and RRT end-users) at one academic medical center indicated that, because many nurses experienced anxiety in deciding to call the RRT, they would exhaust their options before calling an RRT. Specifically, even though the patient met RRT calling criteria, nurses would consult with others, continually page the physician, or double-check themselves before finally calling the RRT.

In a recent qualitative exploration of nurses' decisions to activate RRTs, Astroth, Woith, Stapleton, Degiz, and Jenkins (2013) identified some barriers and facilitators to calling the RRT. A purposive sample of 15 medical/surgical nurses was recruited from a small medical center. Semi-structured, open-ended questions were used during interviews. Facilitators to RRT calling included staff perceptions of team members as experts who effectively managed the seriously ill patient and as validating nurses' concerns about patients' status. RRT calling was also found to be fostered when a unit's culture was supportive and positive of RRT activation. The authors also found that RRT characteristics and unit culture were barriers to RRT calling, especially when RRT members behavior were negative towards staff who activated the RRT, and nurses felt incompetent in front of their colleagues. The trustworthiness of the study was enhanced by the review of transcribed data by two members of the research team and an audit trail was established to track decision-making and the development of codes. Consensus on the final themes in the data by members of the research team was achieved. Bracketing was used to limit the impact of researchers' biases during data analysis. A limitation of this study was, however, the small sample size (n=15) and that the study was conducted in a single institution. Transferability of the study findings is therefore limited. Also, only one data source and one data method were used, preventing triangulation of data sources and methods and thus limiting the credibility of the findings.

Findings of the abovementioned studies suggest that RRTs have not yet become a standard organizational practice and that certain factors (such as staff morale, teamwork, team member behavior, and unit culture) may determine the sustainability of RRTs. Understanding the specific factors that foster or inhibit the sustainability of RRTs is important because of the potential improvements to patient and organizational outcomes that these teams may bring. Therefore, the purpose of this study was to broaden our understanding of the sustainability of RRTs in acute care hospitals, and the context and processes that facilitate or inhibit RRT sustainability. Specific aims of the study were to:

1. Determine the level of rapid response team sustainability achieved in a sample of North Carolina hospitals;
2. Examine factors that do and do not support RRT sustainability;
3. Explore organizational contexts and processes that facilitate or inhibit RRT sustainability; and
4. Develop a model of RRT sustainability in hospitals.

Research Approach

This research used both quantitative and qualitative methods to examine RRT sustainability in hospitals. The study was conducted in two phases. In Phase One, an on-line survey was administered to a sample of 56 hospitals to derive sustainability scores for hospitals that completed the survey. In Phase Two, a multiple-case study approach was used to study in depth hospitals that had and had not achieved RRT sustainability. The hospitals in Phase Two completed a brief hospital questionnaire to provide descriptive information on the organizations and their RRTs, and semi-structured interviews with key organizational stakeholders (organizational leaders, RRT members, and RRT end-users) were conducted to gather detailed information on factors that have been reported to be associated with organizational sustainability. When appropriate, organizational documents were reviewed to augment information provided

during interviews. This approach allowed the researcher to compare the contexts of organizations and the processes they employed to adopt, implement, and sustain RRTs in their organization. The intent was to provide information to guide hospitals to achieve RRT sustainability. The findings were used to develop a model of sustainability that may be examined in future research for relevance in achieving the to the sustainability of other organizational innovations.

Summary and Implications

Sustainability of effective innovations is important in healthcare; failure to sustain leads to waste of organizational resources and, potentially, to increased costs for consumers. However, because of a lack of research on the sustainability of innovations in hospitals, organizational leaders are not well informed about what is needed to facilitate the sustainability of innovations. This lack of knowledge prevents leaders from putting the necessary conditions in place to achieve sustainability of innovations in their organizations. This study used RRTs as the vehicle to study factors and conditions associated with the sustainability of innovations in healthcare organizations.

CHAPTER 2

LITERATURE REVIEW

The adoption of innovations often gives organizations a strategic advantage over their competitors, and enables them to better serve the needs of their customers and improve organizational performance (Crossan & Apaydin, 2010; Nystrom, Ramamurthy, &Wilson, 2002). The desire to achieve quality in healthcare organizations serves as a particular impetus for innovation adoption (Bates, 2002; Jones & Kessler, 2010). However, the outcomes achieved following the adoption of innovations often depend on the degree to which the innovations are sustained. Very little research has been conducted on the sustainability of innovations in HCOs, yet innovations are routinely adopted and implemented. If these innovations are not sustained, organizational resources may be lost.

This chapter presents a review of the literature in three key areas that pertain to this study: innovations in healthcare, rapid response teams (the specific healthcare innovation studied), and the sustainability of innovations. Both theoretical work and empirical evidence are presented, and the conceptual framework of the study is described. The chapter concludes with a summary of the literature.

Innovations in Healthcare

Several Institute of Medicine (IOM) reports (1999, 2001) have highlighted the need for improvements in the quality of healthcare in the U.S. Quality care is defined as care that is both consistent with current research evidence and results in the health outcomes desired. Quality is

thought to be achieved when care delivery is safe, patient-centered, timely, equitable, effective, and efficient (IOM, 2001).

One mechanism available to HCOs to improve the quality of care is to implement innovations, or ideas, practices, objects, or processes that are new to an organization and are designed to significantly benefit the organization (Barnett, Vasileiou, Djemil, Brooks, & Young, 2011; Rogers, 1995). An innovation can take many forms, including the introduction of a new technology such as electronic health records (EHR), or a new practice such as the introduction of an RRT. The IOM has recommended the use of innovations to reduce system problems and improve the quality of care (1999). Others have also encouraged the use of innovations as ways to enhance patient safety and improve efficiencies (Bates, 2002; Bolton, Gassert, & Cipriano, 2008; Ovretveit, Scott, Rundall, Shortell, & Brommels, 2007), especially by reducing waste and improving workflow (Bates, 2002; Bolton et al., 2008).

Evidence suggests, however, that the implementation of innovations in healthcare, and in hospitals in particular, does not necessarily result in improved outcomes. For example, two large studies recently conducted on EHRs and patient quality of care and hospital efficiency indicated that the benefits of EHRs have not quite materialized in hospitals in the U.S. Himmelstein, Wright, and Woodhandler (2010) conducted a retrospective analysis of 4,000 hospitals to examine the relationships between computerization of hospitals, hospital costs, and quality of care. To quantify computerization, a score (range, 0 to 1.00) was calculated by summing the number of computer applications reported as fully implemented by hospitals and dividing it by the number of applications for which data were available in the Healthcare Information and Management Systems Society (HIMSS) Analytics annual survey of hospitals' computerization. Three subscores were calculated similarly to indicate the degree of computerization in 3 domains: clinical, patient-related administration, and other administration. The researchers also examined the impact of two individual applications (names not mentioned) that were thought to be key to improving quality and the efficiency of patient care. Hospital administrative cost was calculated

for each year between 2003 and 2007 by using Medicare Cost Reports available from Centers for Medicare and Medicaid Services. Quality of care and quality composite scores were based on the 2008 Dartmouth Atlas reports which reports a quality composite score and four quality scores based on Medicare patients cared for from 2001 to 2005 with pneumonia, congestive heart failure, or acute myocardial infarction.

Himmelstein et al. (2010) found that overall hospital computerization scores were associated with higher total Medical spending ($p=.001$), spending for imaging ($p<.0001$), outpatient care ($p<.0001$), and diagnostic testing ($p<.0001$). Thus, computerization had not lowered the cost of care. Instead, a steady increase in administrative cost was observed from 2003 to 2007 ($p<.0001$). Higher administrative cost was associated with for-profit ownership, hospitals smaller in size (i.e., fewer beds), non-teaching status, and urban location. Bivariate analysis revealed a significant correlation between higher overall computerization scores and better quality scores for acute myocardial infarction ($p=.003$), but not for congestive heart failure or pneumonia or the composite quality scores. Multivariate analysis showed a trend towards computerization predicting higher quality, but the finding was not significant ($p=.013$) (only p-values of less than .01 were considered statistically significant in the study due to the large sample size). Hospitals included in the HIMSS and Dartmouth Atlas were more likely to be urban, teaching, and nonprofit. Therefore, the results of the study may be skewed because of an underrepresentation of for-profit and non-teaching hospitals. Teaching hospitals are generally larger than non-teaching hospitals and are more likely to have high quality cardiac intervention centers than non-teaching hospitals. Compared to non-teaching hospitals, teaching hospitals may therefore have a high number of AMI patients. This may account for an over representation of AMI patients (versus pneumonia and CHF patients) and the only statistically significant finding of better quality scores for AMI patients. Computerization scores for hospitals were calculated using self-reported data from hospital administrators' reports of applications as fully implemented. There might, however, have been under or over-reporting of the applications that

were fully implemented and administrators might have defined "fully implemented" differently. Therefore, bias may have been introduced in these scores, potentially reducing the validity of the calculated scores and thus the study findings.

DesRoches et al. (2012) conducted a national survey to examine the relationships between the adoption of EHRs and measures of health care quality and efficiency. They examined the association between EHRs and better performance on standard process-of-care measures, lower mortality and readmission rates, shorter lengths-of-stay, and lower inpatient cost. Four primary sources of data were used: the 2008 American Hospital Association (AHA) hospital information technology (IT) survey of U.S. acute care hospitals; the 2008 AHA annual survey; the 2009 release of the Hospital Quality Alliance (HQA) database; and the 2006 Medicare Provider Analysis and Review File. Quality was measured by using data from the HQA to create condition-specific summary scores for three conditions—acute myocardial infarction (AMI), congestive heart failure (CHF), and pneumonia—and prevention of surgical complications and the thirty-day risk-standardized mortality rate for AMI, CHF, and pneumonia (as reported by HQA). Information of hospital characteristics was also obtained (size, census region, profit status, membership in the Council of Teaching Hospitals, location, membership in a multihospital system, and the presence of a cardiac intensive care unit). Several measures were used to determine hospital efficiency: risk-adjusted length of stay, risk-adjusted thirty-day readmission rates, and risk-adjusted inpatient costs. Cost (actual and observed) was calculated using Medicare data and accounted for the hospital's patient population, mission, and community factors outside its control (such as location in high wage areas like New York City). Existing IT surveys were adapted to create a new instrument which was administered by the AHA. Chief operating officers of all acute care general medical and surgical member hospitals (n=4840) were invited to participate and 3049 surveys were returned (63% response rate). Hospitals that did not return a survey were excluded from the analysis.

DesRoches et al. (2010) found no significant relationship between EHR adoption and quality process measures for AMI, CHF, and pneumonia. A significant relationship was, however, found between EHR and prevention of surgical complications (p=.01). In terms of efficiency of care, no significant relationship was found between EHR and thirty-day risk-adjusted length-of-stay (p-value not reported). Length-of-stay, however, improved for patients with pneumonia (0.5 days shorter length-of-stay) when compared with hospitals without EHRs (p=0.003). Risk-adjusted readmission rates for hospitals with EHR were similar to hospitals without EHRs and risk-adjusted costs for hospitals with EHRs were comparable to hospitals without EHRs. The researchers also found that the availability of computerized physician order entry (CPOE) for medications and other clinical decision-support tools (such as clinical reminders and guidelines) were associated with better performance of the HQA quality scores for patients with CHF, pneumonia, and surgical care improvements (p values all less than .001). No relationships were found between the adoption of individual IT functions and risk-adjusted mortality rates or hospital efficiency measures (i.e., lengths-of-stay, readmission rates, and cost ratios) (p-value not reported). The differences in these two findings were likely because applications such as CPOE and clinical-decision support tools had built-in systems that could mitigate care provider errors or noncompliance whereas individual IT applications did not have these functionalities. A relatively high response rate (63%) was reported, but non-response bias was still possible. These researchers analyzed and found differences between the hospitals that did not respond to the IT survey and those who did. To overcome this problem, the researchers weighted the analysis to account for these differences (in-depth details of the process were not provided).

Reliability and validity of the two aforementioned studies' findings were enhanced in several ways. First, the researchers controlled for variables that may have influenced the study findings (such as hospital ownership and type, bed size, teaching status, urban/rural location, and location by state). Second, the use of longitudinal data allowed the researchers to examine the

impact of EHRs over time. Third, variables were well-defined, conceptually and operationally. Fourth, reliability was likely enhanced because, although not reported, power was likely achieved in these studies because of the large sample size (> 3000 hospitals). The two abovementioned studies were, however, limited in terms of generalizability of the findings because of their sample selections. Cost data came from hospital claims submitted to Medicare and may, therefore, not accurately demonstrate the cost of care for patients under the age 65. Also, quality measures of patients with only three diseases were examined. Therefore, any potential benefits of EHRs for other patient populations could not be demonstrated.

Himmelstein et al. (2010) suggested several reasons why IT failed to decrease administrative or total cost including: savings are offset by the cost of IT implementation; cost and efficiency gains may only be observed at a more advance implementation stage than what was achieved in hospitals; and, the lack of optimal IT systems. DesRoches et al. (2012) argued that the benefits from EHR implementation may not be observed until the majority of healthcare providers use them and until the necessary infrastructures to support data exchange between physicians and hospitals have been sustained.

Other authors have also suggested some reasons for why studies of new innovations such as EHRs failed to report improvements in outcomes. Making a case for IT in healthcare, Bates (2002) offered that improvements in outcomes are not observed because studies of comparisons of outcomes by conditions from claims data often aggregate disparate groups of patients, involved long lag times and lacked clinical detail. Dixon-Woods, Amalberti, Goodman, Bergman, and Glasziou (2011) hypothesized that innovations in healthcare improvement failed to produce outcomes because of the lack of collaboration and involvement of those to be mostly affected by change and with the relevant information to support decision-making about innovation and implementation. In effect, the organizational contexts failed to support the implementation of the innovation. Jones and Kessler (2010) argued that ineffective implementation and inconsistent utilization of innovations may also not result in improved outcomes following innovation

implementation. Drawing from management research, Nembhard, Alexander, Hoff, and Ramanujam (2009) similarly argued that the failure of innovations to result in desired outcomes was due to the inconsistent and infrequent use of the innovations by organizational members. The implementation of innovations requires changes in organizational routines and the behavior of employees and both can be difficult to achieve.

Researchers have offered suggestions to overcome these problems. In their model of sustainability, Johnson et al. (2004) proposed that organizational leaders must establish a context or organizational milieu that is receptive to innovation and encourage the use of processes that support integration of the innovation into existing structures and processes. The importance of an organizational context in innovation implementation and sustainability was also demonstrated by Burnett et al. (2010). These researchers conducted four case studies of four organizations that participated in the Safer Patients' Initiative (SPI) (4-year program to reduce adverse health outcomes like mortality, ventilator-associated pneumonia, and central-line bloodstream infections) to explore the organizational preconditions in organization-wide patient safety improvement programs. A survey was administered and semi-structured interviews were conducted with senior executive leaders, principal program coordinators and the operational leaders at each of the four sites. The survey included items relating to organizational readiness and items were scored on a 6-point Likert scale (low readiness to high readiness). Psychometric properties were not reported. Forty-one surveys were completed (response rate of 90%) and 34 of these participants agreed to participate in individual interviews. The researchers found that some organizational preconditions were necessary for the successful implementation and sustainability of safety improvement programs. These included the selection of the right people to be involved, setting up program structures to manage the program, engaging clinicians, and communicating the program to the wider organizations. Organizational readiness was significantly positively correlated with the sustainability of the benefits of the SPI program ($p < .01$) and the successful spread of the program in the organizations ($p < .05$). Strengths of the study included the use of

well-defined concepts, a high response rate, interviewing those who were most familiar with the SPI program (leaders and clinical staff), inter-rater agreement of the coding of interviews by two researchers, and methodological triangulation. Also, the study was conducted three years after the initial pilot phase was completed, allowing time for the PSI program to become fully integrated in each organization. Limitations included the lack of a conceptual framework, the use of cross-sectional retrospective design, and generalizability of findings. Furthermore, the four organizations that participated were selected from a group of organizations that volunteered to participate in the study, thus introducing bias.

Without effective implementation, innovation sustainability is highly unlikely. Organizational leaders must take steps to actively move innovations from adoption and implementation to sustainability. Johnson et al.'s argument is supported by the findings of Helfrich, Weiner, McKinney, and Minasian (2007) who examined the implementation of clinical cooperative groups that were funded by the National Cancer Institute. Case study data, obtained through interviews, questionnaires, and archival documents, of four of the seven cooperative groups were analyzed. Helfrich et al. (2007) reported that the consistent and quality of innovation use (called implementation effectiveness) was dependent on management support, mediated by organization specific implementation policies and practices, and innovation-values fit. Threats to the validity and reliability of the study findings were mitigated by triangulation of data sources and methods and establishing inter-coder reliability by having a second investigator review all coding.

Failure to achieve innovation sustainability, due to the lack of management strategies and policies and procedures that facilitate sustainability, may be costly. Experts attribute about half to two-thirds of annual health care spending increases due to medical technology advances that drive increases in healthcare costs and insurance premiums (Beecken & Kimberly, 2007; Goyen & Debatin, 2009). When organizational leaders fail to put conditions in place that sustain innovations, they may lose their investment and the returns that might have been gained by

implementing the innovation and incur additional costs if they have to correct adoption and implementation processes or implement a new innovation when the previous one failed (Manfredi, Crittenden, Cho, Engler, & Warnecke, 2001; Young, 2006).

Achieving the sustainability of an innovation can, however, be difficult. Parrish, O'Malley, R Adams, S Adams, and Coleman (2009) examined the sustainability of the Care Transitions Intervention (TCI) in five hospital and five community sites. The TCI consisted of a 4-week self-management program that was designed to provide patients who were discharged from acute care settings with the necessary skills, tools, and the support of a transition coach to meet their health and self-management needs. Staff members received training before the 4-week intervention was implemented and site visits and phone calls were conducted during the 12-month study period. At the end of the study period, three organizations indicated that they would achieve full sustainability of the intervention; three sites indicated that they would achieve partial sustainability of the intervention; and four sites reported that they had no formal plans regarding sustainability. These differences were attributed to leadership scores, with those organizations that reported full sustainability achieving high leadership scores whereas those who reported partial or no sustainability scored lower on the leadership scores. Bradley, Webster, Baker, Schlesinger, and Inouye (2005) similarly demonstrated the difficulty of sustaining the Hospital Elder Life Program (HELP) innovation. By the end of the three-year longitudinal, qualitative study, of the 13 hospitals in the sample that had implemented the innovation, ten achieved sustainability of HELP whereas three terminated the program. Although both studies failed to measure sustainability per se and instead relied on participant reports of the continuation of the innovation, both studies were longitudinal, increasing the reliability of their findings.

Upon further investigation of the organizations included in these studies, the researchers found certain factors to be present in only the high sustainability hospitals. For example, Parrish et al. (2009) determined a strong presence of leadership in only the high-sustainability hospitals. Bradley et al. (2005) similarly found the presence of clinical leadership, the adaptability of the

innovation, and having adequate resources and funding to support the innovation in the hospitals that had achieved sustainability. These findings suggest that achieving the sustainability of innovations is dependent on the presence of certain sustainability factors in organizations. Other studies have also identified that contextual factors, processes, innovation characteristics, and the capacity of the organization are important for program sustainability (Commins & Elias, 1991; Casey et al., 2009; Evashwick & Ory, 2003; Goodman & Steckler, 1989; Stetler et al., 2009; Stirman, Kimberly, Cook, Calloway, Castro, & Charns, 2012).

Despite the importance of sustainability to healthcare organizations, few studies have examined the sustainability of innovations in hospitals. There is a lack of research not only on the extent to which healthcare innovations have achieved sustainability, but also on the ways in which sustainability of innovations can be achieved. Theories of sustainability and models of sustainability of innovations in healthcare organizations, specifically hospitals, are limited, and this further reduces the ability of hospitals to facilitate sustainability and increases the risk for misuse of organizational resources, higher healthcare costs, and employee disillusionment.

The focus of this study is on the sustainability of one innovation that has been widely adopted and implemented in the U.S. The innovation has a goal of improving patient outcomes and enhancing the quality of care in these organizations. RRTs are important because they have the potential to improve patient safety and the timeliness of care. However, their adoption and implementation require the use of organizational resources and the coordinated efforts of various groups of individuals (such as critical care nurses and respiratory therapists), and a change in nurses' clinical practice for managing patients on acute care units who are experiencing an acute medical problem. Achieving RRT sustainability in hospitals across the U.S. could facilitate improved patient and organizational outcomes, ensure the judicious use of organizational resources, and increase ongoing staff member support for the RRT program in the organization. However, given that achieving sustainability is dependent on the presence of various organizational factors, the sustainability of RRTs is also contingent on the presence of these

factors that are known to be important to achieving sustainability. To date, no such research has been conducted to examine RRT sustainability and the related organizational factors, or the contexts and processes that facilitate or inhibit achieving sustainability of this innovation.

Rapid Response Teams

RRTs are teams that have been implemented as a way for organizations to quickly respond to patients on acute care units who show signs or symptoms of acute clinical deterioration or when a pre-determined objective (such as a heart rate less than 40/minute) or subjective (such as nurse is worried) RRT calling criteria are met. An RRT can be initiated by staff members, patients or family members, depending on organizational policy. RRTs are one type of rapid response system (RRS) in hospitals. A RRS is a coordinated and organizational-wide approach to care for patients in crisis by getting the right resources and services to the patient as quickly as possible to prevent adverse patient outcomes. The RRS provides a means for detecting a patient event (by using predetermined objective and subjective criteria), which then trigger an organizational response. The response to the trigger involves calling the RRT or other specialized resources (e.g., a cardiac arrest or stroke team) to resolve the crisis (DeVita et al., 2006). Other types of RRS include medical emergency teams and critical care outreach teams (http://psnet.ahrq.gov).

When RRTs were first introduced, they were touted as having the potential to improve patient outcomes, specifically decreasing cardiac arrest rates outside of Intensive Care Units (ICUs), unanticipated ICU admissions, and hospital mortality rates (Cretikos et al., 2006; Garretson et al., 2006). Some researchers have reported improvements in patient outcomes following RRT calls (Bellomo, Goldsmith, Uchino, et al., 2004; Butner, 2011; Randhawa, Turner, Woronick, & duVal, 2010). Bellomo et al. (2004) conducted a prospective controlled study using a pre-post design to examine the effect of medical emergency teams on postoperative morbidity and mortality rates. Outcome measures included the percentage of patients affected by adverse

events, the incidence of in-hospital deaths and individual adverse events, and the mean duration of hospital stay. In the 4-month "before" period, outcome measures were studied under the normal operating conditions of the hospital. After a period during which initial education of the RRT was provided to nursing and medical staff , the RRT was implemented. A "run-in" period was observed to identify and manage logistical problems, followed by a 4-month intervention period during which an RRT operated in the hospital. Patients who were admitted to the hospital and who underwent major surgery (i.e., any operation associated with a hospital stay longer than 48 hours) were included in the study. Bellomo et al. (2004) found a significant reduction in adverse events (acute myocardial infarction, pulmonary embolism, acute pulmonary edema, respiratory failure, severe sepsis, stroke, and acute renal failure) for patients who underwent major surgery ($p < .0001$). A significant reduction in hospital stay ($p = .0092$) was also observed. Because the study was conducted in one institution (i.e., a 400-bed teaching hospital in Australia), the generalizability of findings is limited. The improvements in adverse outcomes observed could also have been a function of other quality improvements initiatives that were conducted during the time of the study. It could also have been a function of RRT program-related training enhancing nurses' existing knowledge and skills to identify patients with problems that potentially resulted in interventions to treat problems, thus reducing the need for RRT calling. Because the study was limited to surgical patients, the potential impact of RRTs on other patient populations could not be demonstrated.

In an integrative review of 12 studies on RRTs, Butner (2011) found that 30% of studies reported a reduction in mortality or overall inpatient deaths, 40% of studies reported reduction in non-ICU arrests, and 60% reduction in overall cardiac arrests. There are, however, some limitations to the study. Butner included studies that examined patient outcomes as well as studies that examined the effectiveness and/or receptiveness of RRTs. These studies were also conducted mostly in single institutions which limits the generalizability of their findings. The use of a pre-post study design in the majority of these studies also increases threats to internal validity

because the changes that were observed after the intervention may have been due to changes in the participants rather than due to the intervention (i.e., maturation) (Brink & Wood, 1998).

The impact of RRTs stretches, however, beyond patient outcomes. Many have reported that RRTs improve the quality and safety of care (Berwick, Calkins, McCannon, & Hackbarth, 2006; Sarani et al., 2009; Williams, Newman, Jones, & Woodard, 2011) through the early detection of medical errors, the prevention of avoidable adverse events, and providing treatment for errors that might occur (Braithwaite et al., 2004; Chen et al., 2009; Iyengar et al., 2009; Stolldorf, 2009). Williams et al. (2011) conducted focus group interviews with staff nurses, nurse clinicians, and supervisors/educators from medical and cardiac care units in a 156-bed community hospital. Fourteen nurses participated in the study. Content analysis was used to identify themes in the data until data saturation was achieved. Three broad categories (the individual nurse, the team, and the system) were identified. The researchers reported that the use of RRTs as a learning tool enhanced nurses' skills and knowledge about patient care and provided support for new graduate nurses to learn their new roles. The teamwork that occurred during RRT calls also enhanced the collaboration between RRT members and nurses. The trustworthiness of the study findings is limited because it was conducted in a single institution and no triangulation of data of methods or sources, peer debriefing, and member-checking were reported. Steps were taken to enhance the rigor of data collection and interpretation and included: to reduce investigator bias, an external research team member conducted the focus group interviews; and to reduce self-selection, a broad range of nurses (different units and different work shifts) were included in the interviews.

Nurse satisfaction has also been reported to improve following RRT implementation. Metcalf, Scott, Ridgway, and Gibson (2008) conducted a survey of nurses on an orthopaedic unit of a large community hospital in North Carolina to determine the impact of RRTs on nurses' satisfaction. An 11-question 5-point scale was scored using face symbols to indicate strongly disagree to strongly agree. The survey was piloted for readability before administering it to 55

staff members on the unit. A total of forty-two nurses (who did or did not previously call an RRT) responded to the survey (response rate of 69%). However, to determine nurses' attitude toward the RRT, only the surveys of nurses who had called the RRT at least once were included in the analysis. A total score for each item in the survey was calculated by multiplying the maximum score for each question (i.e., five) with the number of surveys returned. The total point option for each item was 200. From the results a favorable rate of 80% was calculated (score equal to or greater than 168) and a very favorable rate was set at 90% (score equal to or greater than 189). Nurse satisfaction (84.5%), learning new skills and assessments from RRT interventions with patients (88.5), and RRTs enhancing nurses' comfort of practice as a nurse (96%) scored favorably. Piloting the survey before administering it to the rest of the staff on the unit enhanced the readability of the survey. The validity and reliability of the survey instrument were not established and rigorous statistical analysis is absent. The generalizability of the findings is also limited because the study was conducted in one type of unit (orthopaedic) in one type of hospital (community). Nurses on this unit might have been less skilled or less experienced than nurses on other units. The rigor of the study could have been enhanced by surveying staff from other units where RRTs responded to calls. Also, surveying staff from units where RRTs did not respond to calls and staff members who had not previously activated the RRT would have allowed for a comparison of results across units and groups of staff members who have and have not previously activated RRTs to ensure that the results of the study was related to RRTs and not other causes.

Other unintended benefits from RRT implementation include the breaking down of system barriers in the delivery of care and the enhancement of nurses' knowledge and skills. For example, Williams et al. (2011) found that nurses used the RRT to circumvent unit or system barriers in an effort to provide safe, timely care to patients. Nurses also perceived that RRTs improved their knowledge and skills, helped them to overcome deficits in knowledge and experience, and empowered them to call for help when it was needed. Thus, the potential for

unintended benefits and improvements in organizational outcomes such as patient safety and timeliness of care may make the implementation and sustainability of RRTs a worthwhile endeavor for hospitals.

However, the evidence of improvement in patient outcomes following RRT implementation remains inconclusive (Bristow et al., 2000; Buist et al., 2002; Chan, et al., 2010; DeVita et al. 2004; Hillman et al., 2005; Kellett, 2009; Kenward, Castle, Hodgetts, & Shaikh, 2004). Two studies underscore the lack of evidence of improved patient outcomes. First, in the only experimental design study (the gold standard in research designs), Hillman et al. (2005) randomized twenty-three hospitals, eleven to continue functioning as usual and twelve to implement a rapid response system. Despite standardized implementation strategies and training, the researchers found no significant changes in the incidence of cardiac arrest rates, unplanned ICU admissions, or unexpected deaths following RRT implementation. A possible explanation for the insignificant study findings may be the difficulty in standardizing RRT implementation across the study hospitals. However, compared to baseline data, there was a significant reduction in unexpected cardiac arrest ($p = .003$) and death ($p = .01$) in both control and study hospitals, suggesting that Code Blue teams may have operated as informal RRTs in the control hospitals. That is, the Code Blue teams in the control hospitals functioned similarly to the RRTs in the other hospitals in the study by responding to both patients experiencing a cardiac and/or respiratory arrest and patients with signs and symptoms of acute deterioration. Differences in team composition and calling criteria, the scope of RRT member functions, and the personalities of those serving on the team may have also influenced the use of the RRTs in the different experimental hospitals which may have impacted patient outcomes.

Second, in a systematic review and meta-analysis of RRT literature (N=18), Chan, Jain, Nallmothu, Berg, and Sasson (2010) reported that RRT implementation resulted in a 33.8% reduction in cardiac arrest rates outside the ICUs, but not a reduction in hospital mortality rates. These findings suggest that, despite reductions in cardiac arrest rates of patients outside of the

ICUs, overall patient mortality rates in hospitals have not improved. Therefore, the effectiveness of RRTs to improve patient mortality rates remains unsupported. The majority of hospitals in the sample were academic medical centers, physicians served on the RRT in 81.3% of the hospitals, and activation criteria were similar across studies. Thus, variances in hospital type, team composition, and activation criteria across studies were reduced, limiting their impact on the findings.

Differences in findings between the aforementioned studies likely related to differences in the design of studies and the dependent variable (patient outcomes) that were examined. The rigor of the research method (e.g., a meta-analysis versus an integrative review) may also account for differences in the outcomes reported. Inconsistencies in patient outcomes between studies may also be related to variations in RRT composition, activation criteria used to call the RRT, strategies and comprehensiveness of RRT-related education and training, and the underuse of RRTs in hospitals (Winters et al., 2007). How these variations impact patient outcomes has not been examined. Therefore, it is unclear what potential role variations in RRT composition activation criteria, RRT-related education and training, and the underuse of RRTs variables may play on subsequent patient outcomes. Furthermore, the personal interaction (positive or negative) that occurs during RRT calls between team members and end-users of the team (i.e. staff members on patient care units) may impact future calling (Astroth, Woith, Stapleton, Degitz, & Jenkins, 2013; Donaldson et al., 2009) and the degree to which RRTs effect patient outcomes.

The inability of RRTs to conclusively improve patient outcomes may also bring about the underuse and delayed use of RRTs (Schmid-Mazzoccoli, Hoffman, Wolf, Happ, & DeVita, 2008). Downey et al. (2008) conducted a two-year retrospective analysis of two cohorts of 100 patients—those with acute changes in conscious state or arrhythmias—for whom the RRT was activated. The purpose of the study was to determine the characteristics and outcomes of patients who experienced an RRT call during their hospital stay. The two groups of patients were similar in the following characteristics: demographics (age, gender); the presence of comorbidities like

ischemic heart disease and congestive heart failure; and acute underlying causes of RRT calls like sepsis and hypovolemia. No significant differences were found in delayed calls—defined as calls with documentation that patients met RRT calling criteria at least 30 minutes prior to the activation of the RRT call—between the two groups in terms of delayed calls. However, when the two cohorts were pooled, 29% of calls were delayed. Patients with delayed calls had a significant reduced 30-day survival rate compared with patients without delayed calls ($p = .02$). Unfortunately, the study was conducted in a single academic institution and was limited to two medical conditions as the reason for the RRT, which limits the generalizability of their findings. However, the study does demonstrate the impact of delayed calls on patient outcomes.

Other studies have also reported delays in RRT calls. Schmid-Mazzoccoli, Hoffman, Wolf, Happ, and Devita (2008), reviewed a convenience sample of 108 RRT calls that were made over a 2-year period in five medical and five surgical units of a university hospital. Nurse characteristics (such as education and experience), patient characteristics (age, gender, days in hospital prior to RRT event, and reason for RRT call), and organizational characteristics (admission site, type of unit, and number of patients the nurse was assigned) were examined. These researchers found that 44% of RRT calls were delayed and a significant relationship between delayed calls and work shift (i.e., more delayed calls on night shift) ($p = 0.02$) existed.

Wynn, Engelke, and Swanson (2009) examined the relationship between nurse educational preparation, years of experience, degree of engagement with patients (i.e., knowing the patient well enough to be able to identify subtle changes in their clinical status), and the RRT call status. Several tools were developed to measure nurse educational preparation, years of experience, and RRT call status. One pre-existing tool (Manifestations of Early Recognition Scale [MER]) was adapted and used to measure nurse engagement. (Reported reliability of the MER was a Cronbach alpha of .87) These researchers reported that 73% of RRT calls were delayed by 2-8 hours. Although the purpose of the study was clear, it lacked clear conceptual and operational definitions and the internal consistency of the instruments used to measure nurse

educational preparation, years of experience, and RRT call status was not reported. In both aforementioned studies research questions were well defined. However, these studies were limited to academic medical centers and specific patient populations, thus the generalizability of their findings to other hospitals and patient populations are limited. Reasons for delayed calls were not reported. It is possible that some of these calls were delayed simply because the patient's healthcare team was intervening (such as giving medications and inserting intravenous catheters for fluid administration) and decided to call the RRT only when initial interventions failed to correct the problem. Thus, the researchers could have included delayed calls without any intervention as well as delayed calls that included interventions by the healthcare team.

Reasons for delayed calls and lack of RRT utilization are gleaned from the literature that informed this study. Only a few studies have examined factors that contribute to the successful implementation and use of RRTs. Jones, Bellomo, & DeVita (2009) found that nurses were more likely to use the RRT if they had been educated on the principles, theory, and purpose of RRTs, and if medical and nursing staff (including RRT members) encouraged them to call the RRT. Donaldson, Foley, Shapiro, Spetz, and Scott (2009) conducted a large evaluation mixed-methods study to understand the impact of RRTs in hospitals. Nine multihospital organizations (hereafter called grantees) that had received Robert Wood Johnson Foundation (RWJF) grants to advance the implementation of RRTs were included in the study. The nine grantees were asked to "nominate" hospitals that participated in RRT implementation projects and, using their own criteria, to indicate whether hospitals represented "early and robust" or "delayed" adopters of RRTs. One "robust adopter" and one "reluctant adopter" hospital were randomly selected from each of the nine grantee hospitals (n=18). The researchers collected quantitative data on organizational characteristics and patient outcomes from the 9 grantees hospitals (details on how the data was collected are not reported) and nurses (n=56, from 18 hospitals in 13 states) who had activated at least one RRT call were invited by nurse leaders to participate in the study to gain their perspective on RRTs. The researchers reported that nurses' confidence in the RRT,

leadership support, initial and ongoing training, feedback to staff about the use of RRTs, and clear, consistent communication were important for RRT implementation. Although the generalizability of the study is limited, transcript validation, inter-coder reliability, member checking, and peer review were employed to enhance the reliability and validity. These findings suggest that some organizational contexts and processes are important for RRT implementation and sustainability. Organizational leaders must therefore pay attention to contextual and process elements during implementation and sustainability activities.

Although research on RRTs suggests that certain organizational conditions are necessary for the implementation of RRTs, studies on the sustainability of RRTs following their initial implementation are lacking. Therefore, little is known about whether RRT sustainability is achieved in U.S. hospitals or how hospitals can facilitate RRT sustainability. As a result, hospital leaders lack studies that inform the implementation of RRTs to achieve sustainability, the desired outcomes may not be achieved.

Sustainability

Several different terms have been used in the literature to refer to the sustainability of innovations in organizations or communities. They include *continuation (*Bradley et al., 2005; Scheirer, 1990), *durability* (Glaser, 1981), *institutionalization* (Commins & Elias, 1991; Goodsen, Smith, Evans, Meyer, & Gottlieb, 2001; Goodman & Steckler, 1989; Kalafat & Ryerson, 1999), *routinization* (Yin, 1979), and *sustainability* (Altman, 1995; Bossert, 1990; Bowman, Sobo, Asch, & Gifford, 2008; Casey, Payne, Eime, & Brown, 2009; Johnson et al., 2004; Mancini & Marek, 2004; O'Loughlin et al., 1998; Shediac-Rizkallah & Bone, 1998). In a recent review of 125 studies of sustainability, Stirman et al. (2012) found the terms *institutionalization* (n=6) and *sustainability* (n=77) to be used most frequently. Their findings mirror those of Johnson et al. (2004), who also found these terms to be most frequently used and

suggested that the two terms encompass all the elements of the other terms used. These terms have also been used synonymously to refer to the continuation of innovations in organizations (O'Loughlin et al., 1998; Pluye, Potvin, & Denis, 2004).

A key dissimilarity between *institutionalization* and *sustainability* is a difference in *what* needs to be continued—program activities or program activities and benefits. In several studies *institutionalization* has been conceptualized as the long-term continuation and integration of a program in an organization (Commins & Elias, 1991; Goodson et al., 2001; Goodman & Steckler, 1989; Kalafat & Ryerson, 1999; Pina, 2008; Stetler, 2009), whether or not intended benefits were achieved. In contrast, *sustainability* has been conceptualized more broadly as the continuation of both program activities and the benefits produced by program activities (Bossert, 1009; Bowman et al., 2008; Casey et al., 2009; Johnson et al., 2004; Mancini & Marek, 2004). Thus, the goal of sustainability is not only the continued use of the core elements of a program, it is also continuation of performance improvements (i.e., actual benefits) that result from the program (Bowman et al., 2008). A defining characteristic of *sustainability*, then, is that the intended benefits of innovations are actually realized.

Shediac-Rizkallah and Bone (1998) envisioned sustainability as a "multi-dimensional concept" (p.92) that encompasses the continuation of programs in various settings, including communities and organizations. Institutionalization, on the other hand, has been examined primarily in studies of innovations in organizations per se (Commins & Elias, 1991; Goodson et al., 2001; Pina, 2008; Stetler, 2009). Sustainability is thus considered broader than institutionalization and as actually incorporating the elements of institutionalization (Johnson et al., 2004). The term sustainability as defined by Shediac-Rizkallah and Bone (1998) is used here to refer to the continuation of both RRT program activities and the benefits achieved from these program activities. However, because sustainability is viewed as encompassing institutionalization, studies on institutionalization as well as studies on sustainability are included in the review of sustainability factors.

Research on organizational sustainability has emphasized the continued use of innovations that have the potential to improve organizational outcomes (O'Loughlin et al., 1998; Scheirer, 2005). The research recognizes that the effects of sustained innovations can be maintained over long periods of time (Manfredi, Crittenden, Cho, Engler, & Warnecke, 2001) and bring value to organizations in terms of profitability, customer satisfaction and employee retention. However, research suggests that organizations must create certain conditions for innovations to become sustainable because, without them, achieving sustainability may be difficult or impossible (Bowman et al., 2008; Bradley et al., 2005; Casey et al., 2009; Commins & Elias, 1991; Johnson et al., 2004).

Studies have been conducted to understand the conditions necessary to facilitate sustainability. These studies have used both quantitative (Mancini & Marek, 2004; O'Loughlin et al., 1998; Tibbits, Bumbarger, Kyler, & Perkins, 2010) and qualitative designs. However, the case study methodology has been the most common approach for studying these aspects of sustainability (Altman, 1995; Bossert, 1990; Casey et al., 2009; Commins & Elias, 1991; Goodson et al., 2001; Goodman & Steckler, 1989; Pluye et al., 2005; Stetler et al., 2009). Data collection strategies used in these case studies have included self-report surveys, interviews, documentation review, and observations.

Sustainability studies have examined health promotion programs implemented in both community settings (Altman, 1995; Bossert, 1990; Bowman et al., 2008; Evashwick & Ory, 2003; Goodman & Steckler, 1989; Kalafat & Ryerson, 1999; Mancini & Marek, 2004; Pluye et al., 2005; Scheirer, 1990) and organizational settings (Casey et al., 2009; Commins & Elias, 1991; Goodson et al., 2001; O'Loughlin et al., 1998; Pina, 2008; Stetler, 2009). The programs examined have included health promotion programs such as heart health and mental health programs (Altman, 1995; Commins & Elias, 1991), recreation-based health promotion programs (Casey et al., 2009), HIV care programs (Bowman et al., 2008), and prevention programs

(Goodson et al., 2001), suicide prevention programs (Kalafat & Ryerson, 1999), and distance education programs in higher education centers (Pina, 2008).

Despite differences in the characteristics of programs and organizations in studies, several factors important to the sustainability of innovations were common to these studies. In the next section, these studies and the factors they identified as facilitating or hindering sustainability are discussed.

Sustainability Factors

Goodman and Steckler (1989) conducted a multiple-case study of the continuation of health promotion programs in schools, community agencies, and health departments. Ten sites were selected based on five predetermined conditions such as type of organization, program content and the degree of institutionalization. The researchers measured, based on the work of Yin (1979), institutionalization as the number of passages (i.e., a formal transition from one organizational state to another [p.66]) and cycles (i.e., an organizational event that occurs repeatedly during the lifetime of an organization [p.66]) that the health promotion program progressed through. The programs in the study ranged from those that were well institutionalized to those that were being disbanded. Differences were found between sites that achieved a high level of continuation of the program and those where continuation was at a very low level or non-existent. Specifically, six factors that facilitated program institutionalization were reported to be present in the organizations with high institutionalization scores: the use of standard operating procedures; precursor conditions such as receptivity to the program in the organization, adaptation of stakeholder aspirations; the presence of a program champion; adaptation of the program to organizational norms; and the fit between the program and the organization's mission. Although a relatively small sample was used and a valid, reliable scale to measure institutionalization was not used, the validity of the study findings were enhanced by the use of well-defined operational definitions of all constructs; the conduct of interviews with a variety of

informants in each organization ; and the triangulation of several sources of data (observation, interviews, and documentation review).

In two recent reviews of the literature on sustainability, several factors were identified as facilitators of sustainability. Scheirer (2005) reviewed 19 studies and identified five factors that were important for the sustainability of innovations in all of the organizations studied: modifiability (i.e., the innovation is or can be modified over time); innovation champions (i.e., those who advocate and defend innovations are present in the organization); 3) "fit" (or agreement) between the innovation and aspects of the organization; benefits perceived by those who work in the organization that the innovation brings advantages to themselves, those they serve, and/or the organization; and stakeholder support for the innovation by key individuals and entities in the community or organizations.

More recently, Stirman et al. (2012) reviewed 125 articles on sustainability and identified a variety of factors that facilitated sustainability. Studies included in the review ranged from medical interventions or healthcare programs, health promotion programs, behavioral health programs, and educational interventions. Strategies used to identify studies included searching databases such as MEDLINE and Academic Search Premier using specific search terms (such as institutionalization, durability, and implementation) and using snowball sampling by searching the reference sections of reviews and theoretical papers on sustainability. An inter-rater agreement of 95% was reached between members of the research team on articles that were excluded from the review. The research team developed an initial coding scheme based on previous conceptualizations of sustainability and implementation and deductively when a construct or process was not previously identified in the literature. These codes were then grouped by the team into four general categories of factors: relative to the innovation, organizational context, processes, and the capacity (internal and external to the organization) that supported achieving sustainability. For example, the factors fit and adaptability were categorized as related to the innovation, organizational culture and structures were categorized as context,

evaluation and goal alignment were categorized as processes, and funding and resources were categorized as the capacity to sustain the program. Two members of the research team coded thirty percent of the articles that were included in the review and they reported inter-rater agreement of the coding of these articles. Of the categories identified, only four of the five factors, identified by Scheirer (2005) were present across studies—modifiability, innovation champions, "fit", and stakeholder support. The presence of perceived benefits was not reported in the study. The trustworthiness of the study findings was enhanced because an initial coding scheme was well-grounded in previous conceptualizations of implementation and sustainability. Inter-rater agreement (of the articles to be excluded and the coding of articles) and team consensus on the four categories that were identified were also reported.

It is unclear whether factors associated with the sustainability of innovations in community settings are applicable to the sustainability of innovations in hospitals or healthcare organizations. Two studies conducted in hospital settings (Bradley et al., 2005; Stetler et al., 2009) identified similar, though slightly different, sustainability factors. In the first of these studies, Bradley and colleagues' (2005) examined the Hospital Elder Life Program (HELP) in 13 hospitals over a 3-year period. Clinical leadership (innovation champions), adaptability of innovations to fit with aspects of the organization, and adequate resources and funding were identified as important sustainability factors. The fact that the study was longitudinal increased the reliability of its findings because sustainability and the factors important to achieve sustainability were examined over time (Shadish, Cook, & Campbell, 2002). In addition, data were gathered from several different sources (nurses, physicians, administrators, coordinators, and volunteers) so that data could be triangulated, which increased the credibility of the findings (Polit & Beck, 2004). However, the study lacked a conceptual framework and an operational definition of sustainability, and it relied only on qualitative interviews with those who were involved with the implementation of the innovation. No quantitative or descriptive data about the innovation were provided to determine its impact on outcomes.

In the second of these studies, Stetler et al. (2009) examined the institutionalization of evidence-based practice (EBP) projects in two hospitals—one that reported a high level of institutionalization of EBP projects, and one that reported a low level of institutionalization of EBP projects. The study identified both key contextual elements and strategic processes in organizations that continually used EBP in the delivery of patient care, including leadership, a supportive culture, and coherence in organizational policy and vision. The study used Pettigrew and Whipp's Content, Context, and Process Model of Strategic Change as a framework (Pettigrew & Wipp, 1992) and collected both quantitative and qualitative data (observation, document review, and interviews), allowing for data triangulation. However, cases for inclusion in the study were selected either by a nomination process or by self-report, which may have introduced bias into the study's design. Also, the study did not use a standardized tool to measure institutionalization but, rather, used a tool developed specifically for the study. The study was also limited to only two hospitals, and they were at extreme ends of institutionalization scores. Inclusion of additional hospitals with high and low institutionalization scores would have allowed more comparisons of cases, and possible replication of findings within each group. The evidence from such a comparison would have been more compelling and more robust (Yin, 2009).

In summary, sustainability studies conducted in hospital and community settings have identified several factors as important to sustainability. However, these studies have largely failed to explain why these factors are important or how they facilitate sustainability.

Operationalizing and Measuring Sustainability

Shediac-Rizkallah and Bone (1998) used sustainability as a global term that refers to the continuation of programs in various settings. They suggested that the sustainability of an innovation can be viewed from three perspectives. First, sustainability can be viewed as the maintenance of an innovation's benefits for *individuals*. Second, sustainability can be viewed from an *organizational* perspective as institutionalization, or the integration and continuation of

an innovation within an organization, so that the innovation becomes an integral part of the on-going services offered by the organization. Finally, sustainability can be viewed from a *community* perspective, which recognizes that capacity is built in communities through benefits derived by a community's access to knowledge, skills, and resources attained from the implementation of an innovation. Based on these perspectives, three measures of sustainability are possible: the maintenance of individual benefits, institutionalization, and capacity-building. Shediac-Rizkallah and Bone's (1998) operational definition of sustainability has been widely used in research (Scheirer, 2005; Stirman et al., 2012).

Scheirer (2008) provided support for the use of the three operational definitions of sustainability proposed by Shediac-Rizkallah and Bone (1998). Scheirer (2008) conducted an on-line survey of individuals involved in 74 projects that received funding from the New Jersey Health Initiative. The purpose of the study was to examine the extent and types of sustainability that occurred over 15 years of a foundation-funded health program in New Jersey. Scheirer determined that four major outcomes were possible as measures of sustainability: continuation of the activities surrounding a program or innovation in an organization (institutionalization); maintenance of the benefits for individuals whom the innovation is intended to serve (clients, staff members, or patients); maintenance of the capacity of collaborative networks in communities such as coalitions; and maintenance of the issues addressed through adoption of the innovation, such as continuing advocacy processes. With the exception of the last outcome, this work reflected the three perspectives proposed by Shediac-Rizkallah and Bone (1998).

Scheirer's study (2008) brings some clarity to the operational definition of sustainability because it is grounded theoretically in the earlier work and sustainability model proposed by Shediac-Rizkallah and Bone (1998). Two limitations of the study are observed, however. First, the authors did not measure the benefits of the program directly and were therefore unable to link the sustainability of the program with the actual achievement of the benefits intended. Second, because of the nature of fixed-response questions, in-depth information about the processes that

facilitate sustainability is lacking. Yet, other studies have reported that organizations must create the necessary conditions for innovations to become sustainable (Johnson et al., 2004; Jones & Kessler, 2010; Wilson & Kurz, 2008).

In this current study, two measures of sustainability proposed by Shediac-Rizkallah and Bone (1998) were used: continuation of the innovation in organizations and maintenance of the benefits for the individuals whom the innovation was intended to serve. Continuation of programs without realizing benefits from their implementation does, however, not ensure the effective use of organizational resources and funding, a high priority for hospitals in today's economic and health care climate. Therefore, examining only institutionalization without thought to effectiveness is short sighted. The goal of RRTs is to improve patient outcomes in hospitals; therefore, continuation of patient benefits in hospitals a valid measure of RRT sustainability. It is possible that, over time, as staff members in hospitals gain knowledge and skills from RRT implementation and as organizations acquire resources (such as funding and qualified RRT members) to support RRT continuation, the capacity of the community may expand. Examining the capacity building of communities (the third measure of sustainability proposed by Shediac-Rizkallah and Bone [1998]) was, however, beyond the scope of this study and it was therefore excluded as a measure of sustainability. RRT sustainability was operationalized as reported maintenance of actual and perceived benefits for patients from RRT implementation and institutionalization of RRTs in hospitals.

Studies on sustainability or institutionalization have either failed to indicate the instruments they used to measure sustainability or measured sustainability as simply the continuation of an innovation or program in organizations. Well-developed, reliable, and valid instruments to measure sustainability or institutionalization appear largely absent from the literature. For example, in a study by Kalafat and Ryerson (1999) of the institutionalization of a youth suicide prevention program, a survey to assess the degree of institutionalization in organizations was used, but details on the items and response options and the psychometric

properties of the survey were not described. Other studies have offered definitions of sustainability or institutionalization, but not used a specific scale to measure these constructs. For example, in Stetler et al.'s (2009) study of the institutionalization of evidence-based practice, a specific scale to select organizations to participate in their study was not used. Instead, the researchers relied on nurse executives to subjectively identify a "role model" and a "beginner" site of evidence-based nursing practice. Other studies have measured sustainability simply as the continuation of a program or an innovation once funding for a program has ended without the use of specific instruments. For example, in their study of a health promotion program within sport and recreation organizations, Casey et al. (2009) measured sustainability as the continuation of the health promotion program once the four-year funding period ended. Similarly, Bradley et al. (2005) measured the sustainability of a hospital-based intervention program as the continuation of the program at the end of the three-year dissemination project.

Tibbits, Bumbarger, Kyler,and Perkins (2010) and O'Loughlin et al. (1998) measured sustainability using a single question with four response options. As a measure of predicted post-funding sustainability, Tibbits et al. (2010) asked participants in 2001 "How likely do you think it is that your program will continue beyond the [program's] funding period?"(p.256). Responses were scored on a Likert scale of 1-4 (highly unlikely to highly likely). In 2005, the researchers asked participants to report if actual sustainability was achieved. They found a significant correlation between actual post-funding sustainability and predicted post-funding sustainability, suggesting that this approach was sufficient to measuring sustainability. O'Loughlin et al. (1998) asked participants "At this point in time, how permanent do you think the (intervention) is at (provider)?" (p.704), which they answered based on the response options very permanent, moderately permanent, not at all permanent, and no longer available at or delivered by the organization. These researchers found that the key informant's perception of how permanent the intervention was in the organization correlated significantly with the transition of the intervention from trial to permanent status and the continuation of the intervention in the organization. In

their study of a community-based program for at risk youth and families, Mancini and Marek (2004) asked participants "To what extent does this project's current programming meet the needs of at-risk children, youth, and families?" (p.341). Response choices were not at all, somewhat, moderately, and fully. They also asked "How confident are you that your project will still be active in five years?"(p.341). Response choices were not at all, somewhat, and very confident. These questions were asked to determine the construct validity of the Program Sustainability Index (PSI) developed to measure sustainability. The researchers found correlations between the six factors in the PSI and the two aforementioned questions. Thus, these questions may potentially be used to measure sustainability.

Commins and Elias (1991) based their measurement of institutionalization on the work of Yin (1979) who conceptualized institutionalization as "the achievement of certain passages and cycles" (p.210). Commins and Elias defined passages as "transitions from one organizational state to another" and cycles as "periodic organizational states" (p.210). Passages and cycles (also known as routines) were measured on a continuum of achievement of a passage or cycle, evidence of active movement toward the achievement of a passage or cycle, or no achievement. The specific scale for scoring these elements was, however, not reported.

The current study expands on the work of the aforementioned researchers by incorporating two measures of sustainability. In Phase One, an existing instrument, the Level of Institutionalization Scale (Goodman & Steckler, 1989), was adapted and used to measure institutionalization. In Phase Two, two questions developed by Mancini and Marek(2004) to determine institutionalization and two questions (developed for the study) to determine the maintenance of health benefits were included.

Conceptual Framework

The conceptual framework used in this study was developed from the Planning Model of Sustainability (PMOS) developed by Shediac-Rizkallah and Bone (1998) (see Figure 1) to study

the presence of sustainability factors, and the contexts and processes that facilitated sustainability. Next, an in-depth discussion of the PMOS is offered followed by a presentation of the study's conceptual framework.

The Planning Model of Sustainability

Shediac-Rizkallah and Bone (1998) posit that organizations must take into account certain factors if they are to sustain innovations they adopt and implement. They identify sustainability factors in three categories: the broader community, the project design and implementation, and the organizational setting. The PMOS, shown in Figure 1, incorporates factors in these three broad categories that have been shown to be important for the sustainability of innovations, and that have been supported through prior research (Casey et al., 2009; Evashwick & Ory, 2003; Sarriot et al., 2004). Shediac-Rizkallah and Bone (1998) posit that factors in the broader community environment, project design and implementation factors, and organizational factors facilitate program sustainability. Each of these constructs is discussed next.

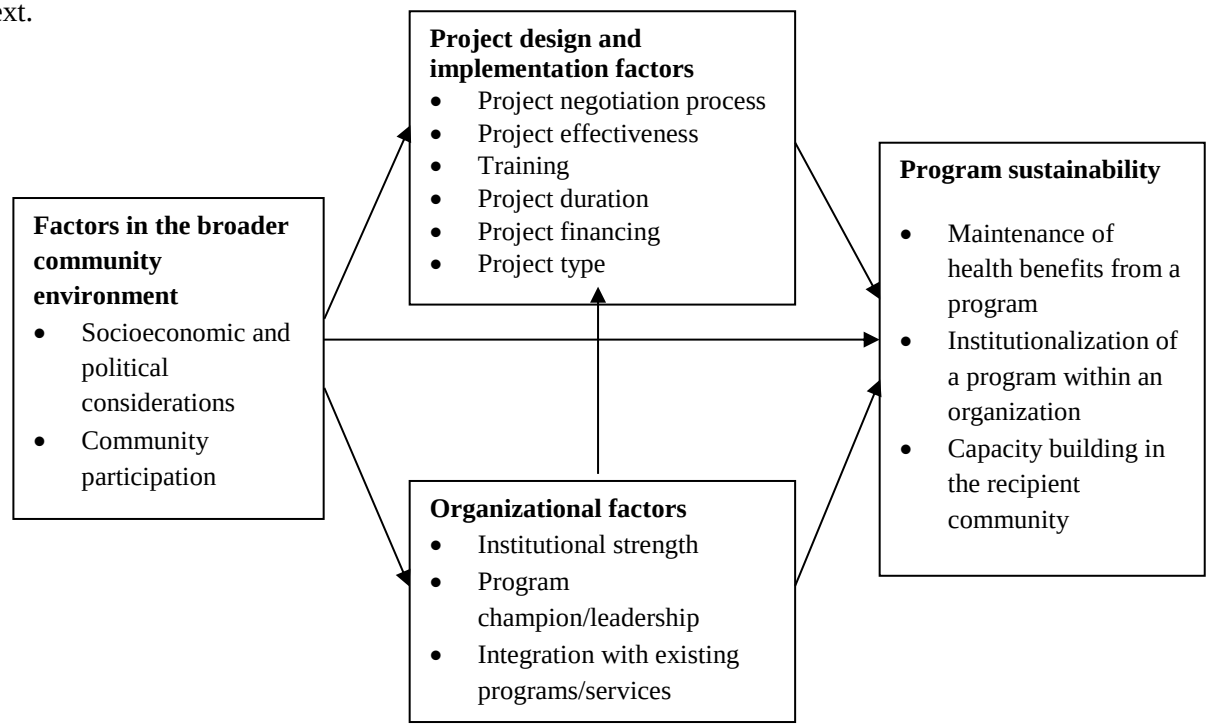

Figure 1. The Planning Model of Sustainability (Shediac-Rizkallah & Bone, 1998).

Factors in the broader community environment. Shediac-Rizkallah and Bone (1998) suggested that organizations must consider sustainability factors at play in the community (such as socioeconomic and political factors and community participation) that may be affected by the implementation of health promotion programs. They suggested that organizations draw from resources (like staff and funds) available in communities to implement and sustain innovations. In environments where poor socioeconomic conditions exist resources may be limited, making sustainability less likely; environments with good socio-economic, in contrast, have the resources necessary to implement and sustain innovations. When competing socioeconomic problems such as poverty, crime, and homelessness exist, the sustainability of an innovation such as a health promotion programs may not be a priority for a community and thus the community may not value or participated in. The participation of community members in which the project is implemented is another important factor of sustainability. That is, the degree to which community members participate in a program can influence whether or not information about the program is shared in a community. Also, the shared opinions of community members about the program in terms of how well it meets the needs of a community will impact acceptance of the program in a community.

Shediac-Rizkallah and Bone (1998) developed the PMOS as a framework for examining the sustainability of community-based health promotion programs. However, the focus of the current study was on the sustainability of RRTs in hospitals, which is more likely to be affected by federal regulations and national and state-wide initiatives than initiatives in local communities. For example, at the national level, the IHI's *100,000 Lives Campaign* served as a major impetus for RRT adoption in the U.S. At a state level, many hospitals in North Carolina (NC) participated in the NC Hospital Association (NCHA) RRT Collaborative (NC-RRTC), an initiative that also promoted the implementation of RRTs. Because the focus of this study was on innovations in hospitals, sustainability factors in the broader community were not included in the framework.

Project design and implementation factors. Project design and implementation factors pertain to the availability of resources such as the necessary staff and finances to support program activities and the utilization of these resources in the implementation of the program. In the PMOS, six factors relevant to project design and implementation are addressed: project negotiation process; project effectiveness; training; project duration; project financing; and, project type.

Project negotiation process. Shediac-Rizkallah and Bone (1998) argued that projects imposed by funding agencies may be more difficult to sustain than projects that are adopted and implemented through a "mutually respectful negotiating process" (p.98). Projects are more likely to succeed when the focus is on the needs and wants of the setting in which the project is adopted and implemented, rather than on project goals, objectives, and timeframes. To achieve sustainability of a project, the input of stakeholders is needed, and a consensus-building process, in which the wants and needs of those affected by the innovation is considered, should be included during implementation.

Several studies have found that including organizational members during the adoption and implementation of an innovation facilitates sustainability. In his multiple case studies of health projects implemented in organizations in Central America and Africa, Bossert (1990) found that projects imposed on organizations were less likely to be sustained than projects designed and approved through a negotiation process between the agency funding a particular innovation and the organizations implementing the innovation. Casey et al. (2009) found that including various stake holders in the development of the program promoted sustainability. However, when collaboration between stakeholders was limited, the program was viewed as a burden which weakened relationships between stakeholders and reduced the potential for achieving sustainability.

Similarly, in their case studies on the institutionalization of evidence-based practice (EBP) projects in healthcare organizations, Stetler et al. (2009) reported low levels of institutionalization of EBP initiatives in hospitals where the implementation of EBP was largely driven by external demands. These researchers suggested that including formal and informal leaders and staff nurses increased the likelihood of gaining their buy-in and subsequently, the sustainability of EBP initiatives. The importance of nurses' buy-in and ownership was also reported by Beitler, Link, Bails, Hurdle, and Chong, (2011), who reported that when nurses took ownership of the RRT, a higher number of RRT call activations and higher hospital-wide utilization rates resulted.

In this study, project negotiation referred to the actions taken by organizational leaders to engage nursing staff in the design and implementation of RRTs in hospitals. A project negotiation process might be demonstrated when organizational leaders included staff serving on the RRT (i.e., RRT members) as well as front-line staff who might activate an RRT call for their patients (i.e., RRT users) in the design and implementation process.

Project negotiation is relevant for RRTs because organizational leaders may engage nursing staff, particularly front-line nurses, in the RRT implementation process. What impact their involvement (or lack thereof) may have and how and why it may be important to RRT sustainability is unclear. However, prior research suggests that a key aspect of the successful implementation of RRTs is the involvement of front-line nurses who are responsible for identifying patients in crisis on acute care units and activating RRT calls, and the physicians who provide medical care to these patients (Alexander & Ferlise, 2004; Bertaut, Campbell, & Goodlett, 2008; Donaldson et al., 2009; Shapiro et al., 2010; Simmons, 2004). Scheirer (2005) argues that sustainability may be affected by all implementation activities. Therefore, involving front-line nurses may be important to achieve sustainability of RRTs.

Project effectiveness. Shediac-Rizkallah and Bone (1998) did not clearly define project effectiveness in their model, but they did note that projects can be sustained whether they are effective or not. In this study, RRT programs were considered effective when perceived benefits such improved patient outcomes, enhanced patient care, and patient satisfaction with an RRT program were reported. This approach was taken for several reasons. First, several studies have found that even in the absence of objective evidence of effectiveness, the *perception of benefit* of an innovation can serve as an impetus for sustainability. In her review of 19 sustainability studies, Scheirer (2005) identified benefits perceived by staff members and/or clients as one of the factors consistently considered important to sustainability. Commins and Elias (1991) conducted a multiple-case study of mental health programs in elementary schools to examine a set of conditions hypothesized to facilitate institutionalization. These conditions were derived from a review of the literature. The findings of empirical studies were corroborated through well-described case studies. These researchers found that when staff valued programs, and considered them as needed, innovation sustainability was more likely. The perceived value of a program was enhanced when there was congruence between staff values and the perceived values foundation of the program and the program was perceived to increase staff members' effectiveness. Similarly, Goodman and Steckler (1989), in their multiple-case study of factors contributing to sustainability, found that perceived benefits were a "critical precursor condition" (p.70) for sustainability. When a program fostered individuals' goals and personal aspirations, individuals were more likely to support the program.

The sustained use of RRTs in organizations is largely dependent on staff members' ability to recognize the need for an RRT and their willingness to activate an RRT call. These staff members may not be aware that organizational data on the effectiveness of the RRT program, (e.g., patient mortality rates, unanticipated intensive care unit [ICU] admissions, and cardiac arrest rates outside of the ICU) are being collected, and the results may not be communicated to them on a regular basis. Thus, staff decisions to call the RRT may depend

largely on their perceived benefits of the RRT to themselves and their patients when activating RRT calls rather than on objective measures of effectiveness. Benin et al. (2012) and Woith et al. (2013) reported several staff perceptions of benefits of RRTs including: improved staff morale and teamwork, redistribution of nurses' workload, and the escalation of care of patients who were acutely deteriorating on patient care units. Thus, perceived benefits of the RRT may serve as an indication of RRT effectiveness for staff members who do not have access to actual data or when data of RRT effectiveness are lacking.

Sarani et al. (2009) conducted a web-based survey of medical residents and registered nurses (RNs) working on general medical and surgical floors to determine resident and RN perceptions of the impact of an RRT. Content validity was established prior to administering the survey. The overall survey response rate was 79%. These researchers reported that the physicians and nurses who perceived RRTs to improve patient safety were more likely to activate and call the RRT than those who did not perceive these benefits. Salamonson, Van Heere, Everett, and Davidson (2006) conducted a descriptive study to explore nurses' satisfaction with the RRT, perceived benefits, and suggestions for improvements. The survey was examined for clarity and readability by RNs in the ICU before it was distributed. Nurses working on medical and surgical units in a regional hospital were invited to participate because the highest number of RRT calls was determined to originate from these units. When asked about the benefits of the RRT system, nurses included the immediate attention and early intervention that the RRT provided; having a backup system that was always available, particularly when staff were worried about the patient, because it gave them peace of mind and a sense of security; and access to medical experts who knew how to manage emergency situations. The findings of these studies could have been strengthened by use of the PMOS, and using different approaches for selecting participants, versus using convenience samples. Also, because both studies were conducted in one academic medical center and the survey was limited to medical and surgical floors only, the generalizability of the study is also limited to those populations.

Shapiro, Donaldson, and Scott (2010) improved on the work by Sarani et al. (2009) and Salamonson et al. (2006) by conducting a larger evaluation of RRT impact in hospitals using a mixed-methods approach. They interviewed 56 RNs from 18 hospitals in 13 states to gain staff perspectives on RRTs. These authors reported that nurses perceived benefits from RRT implementation, including the valuable expertise brought by RRT nurses; the facilitation of patient transfers to the ICU, and the rapid care of patients in crisis when RRTs were called.

Given these perceived benefits of RRTs, including improved patient safety, immediate attention and early intervention for patients, and additional support for nurses, even in the absence of empirical data to support RRT effectiveness, sustained use of RRTs may occur because of their perceived effectiveness by end users.

Training. Shediac-Rizkallah and Bone (1998) posit that projects with training for involved individuals are more likely to achieve sustainability that those that do not, because persons who receive innovation-specific training understand the innovation, can provide support for the project, and can train others in its use.

Pina (2008), who surveyed 170 distance education faculty and leaders about the sustainability of distance education programs, also examined 30 factors identified in the literature as being important for institutionalization. He found that comprehensive and ongoing staff training was highly important for the sustainability of an innovation. Casey et al. (2009) also found training (both formal and informal) to be a key factor in the sustainability of health promotion programs in sports and recreational organizations.

While training of organizational members is likely to be an important aspect of RRT sustainability, little is known about how training may affect the sustainability of innovations such as RRTs in hospital settings. Despite this gap in knowledge, several authors have argued that training of medical and nursing personnel is a crucial component of RRT implementation and use. In a prospective interventional study, Jones, Bates et al. (2006) examined the effect of an

education program on RRT utilization 3.5 years after the introduction of the RRT. Extensive training was provided to nursing and physician staff before, during, and after RRT implementation. RRT uptake was measured as the proportion of admissions that received an RRT call each month. These researchers found that RRT utilization increased progressively, with a significant increase from 12.3 RRT calls/1000 admissions to 40.6 RRT calls/1000 admissions after 3.5 years ($p < 0.0001$). In their study, however, they did not account for other factors that could have increased the number of RRT calls, such as a change in nurse and physician characteristics and patient characteristics and severity of illness that could have accounted for the increase in RRT calls.

Several RRT implementation reports also support the notion that training and education of staff members are important for the success of RRT implementation and sustained use (Garretson et al., 2006; Grimes, Thornell, Clark, and Viney , 2007; Jones, King, & Wilson, 2009; Kirk, 2006; Murray & Kleinpell, 2006; Jones, DeVita, & Bellomo, 2011). In a study of hospitals with varying levels of "success" in implementing RRTs (grouped by the researchers as either robust or challenged adopters of RRTs), Donaldson et al. (2009) found that training was a universal challenges between the two groups of hospitals in the study, however, the use of a multifaceted training approach distinguished the hospitals that were successful in implementing RRTs (described as "robust adopters") from those that were less successful (i.e., "challenged adopters"). Garretson et al. (2006) and Grimes et al. (2007) also recommended continual training of staff about the purpose and value of the RRT to promote staff comfort with initiating or responding to calls.

In this study, training was defined as the provision of information on the various aspects of the RRT program to organizational members before, during, or after RRT implementation to support their routine use of the RRT or support them in their role as RRT members. RRT training may be done through the use of various modalities—such as PowerPoint and poster presentations, in-services, or information sharing at staff meetings.

Project duration. Shediac-Rizkallah & Bone (1998) argue that the longer the period of funding of programs by external agencies and the longer programs are in operation, the more likely it is that innovations will achieve sustainability. However, their conceptualization of project duration conflates two different ideas: the length of a trial period and the length of a funding period. In her review of 19 empirical studies on sustainability (N = 19), Scheirer (2005) found studies to define project duration as either the time period a project had been in operation or as the length of time a project had continued after external project funding ended.

The role of project duration in the sustainability of innovations is inconsistent. In her study of the Fluoride Mouth Rinse Program in schools, Scheirer (1990) found that the number of years the program was in operation in the school was strongly and positively related to the program continuing and achieving sustainability. Evashwick and Ory (2003) found the sustainability of health and social support programs for the elderly in organizations that largely varied in project duration. However, they failed to indicate if there were any differences in the extent to which the programs were sustained between those with longer versus shorter durations. In a systematic review of the literature, Scheirer (2005) found studies to indicate both a positive relationship and no relationship between project duration and sustainability. These inconsistencies in findings may exist because of the different operational definitions for project duration used across studies or different methods or samples used to evaluate sustainability.

Project duration is an important factor for the sustainability of RRTs. Calzavacca et al. (2010) found that patient outcomes in a hospital improved as the RRT program matured, suggesting that time is potentially an important factor to consider when examining the sustainability of RRTs. It seems possible that the longer RRTs are in place, the more likely they are to become sustained.

Because of the importance of project duration, this variable was included in the study's framework; however, the variable was used only to select and describe the case study hospitals. RRT project duration was defined as the duration of RRTs from the time they were adopted and

implemented until the time of the research study. However, because hospitals may have adopted and implemented RRTs before, or any time up until the Joint Commission's mandate for RRTs became a standard requirement for certification in 2009, this variable was held constant by selecting hospitals that have had RRTs in place for relatively similar durations.

Project financing. Shediac-Rizkallah and Bone (1998) consider project financing to be the most important factor in the sustainability of innovations. Funding can come from external agencies through grants and fund-raising opportunities, or can be internal, from the organization itself. Organizations must have plans in place to fund innovations after the project implementation phase ends.

Several studies have found sustainability to be dependent on the availability of resources and funding for innovations. Casey et al. (2009) found the availability of finances to be essential for the sustainability of health promotion programs in sports and recreation organizations. Evashwick and Ory (2003) similarly found sustainability of health care programs to be more likely in organizations with viable funding for those programs. Adequate and stable financial resources allow organizations to implement and support innovations and provide a basis for the continuance of an innovation.

Sustainability is enhanced when there is less dependence on external funding for a project over time. In community settings, external funding is often the impetus for program adoption and implementation and termination of funding may have a large impact on program continuation. However, project financing was not included in this study because all hospitals in the study participated in a statewide RRT collaborative and had the same resources available for the adoption and implementation of RRTs. Also, in general, RRT adoption and implementation has not been supported through external funding to hospitals. Instead, the adoption and implementation of RRTs have been solely the responsibility of hospitals as a means of ensuring the safety of patients.

Project type. The type of project adopted and implemented may play a role in its sustainability. Shediac-Rizkallah and Bone (1998) argue that preventive programs are more difficult to sustain than curative ones because, in general, fewer resources are allocated to preventive programs.

Very little research exists on project type as a determinant of sustainability. One of the few studies to examine project type is by Evashwick and Ory (2003). These researchers examined twenty different types of health care projects (including preventive and curative projects) providing health care and social support services to older adults to determine the characteristics of organizations that were successful in sustaining health care programs. Only projects offered by organizations that received the Archstone Award (given by the Gerontological Health Section of the American Public Health Association in recognition of best practice models in the field of public health and aging) were selected for inclusion in the study. Although Evashwick and Ory (2003) found that a variety of health services projects were sustained in the study organizations, they did not differentiate, report, or categorize the types of projects that were sustained versus those that were not. The association between project type and sustainability in this study is therefore unclear.

O'Loughlin et al. (1998) demonstrated that project type could also be defined as the type of intervention (i.e., smoking cessation, physical activity or healthy eating course, and screening programs). The researchers examined the sustainability factors of 189 heart health promotion interventions. Projects funded over a 10 year period (1985-1995) by the federal and provincial governments, the National health Research and Development Program, the Heart and Stroke Foundation, and other smaller unknown funding agencies in Canada were included in the study. These projects were implemented in various settings such as schools, local community centers, healthcare facilities, residence for elderly persons, and grocery stores. O'Loughlin et al. (1998) reported that the type of intervention was associated with perceived sustainability ($p \leq 0.10$) by key informants from local providers that had implemented the intervention. These interventions

were all preventive in nature but varied in focus: interventions to screen for cardiovascular disease, structured courses for smoking cessation, physical activity, or healthy eating, unstructured support groups to promote and support increasing levels of physical activity, creating an environment favorable for healthy lifestyle habits, and dissemination of information through printed materials, the electronic media, conferences, guest speakers, or seminars. The researchers found that the type of intervention was not associated with sustainability ($p \leq .10$).

While Shediac-Rizkallah and Bone define project type as being either curative or preventive, this distinction is irrelevant for this study as RRT programs were implemented to prevent cardiac arrests and improve in-hospital mortality rates. Furthermore, whether an RRT call is curative or preventive may depend on the reason for an RRT call. If a patient has an acute episode that can be treated, RRTs may be curative in nature. However, if a patient's condition is prevented from evolving into something more harmful (e.g., mortality) it could be considered preventive in nature. There may also be situations where an RRT could be both curative and preventive. Nonetheless, because this study focuses on only one innovation which, in general, is implemented in hospitals with the same purpose, to care for patients in crisis, the distinction of project type as being curative or preventive is irrelevant to the purpose. Project type was, therefore, excluded from this study's framework.

Summary. In summary, several project design and implementation factors could affect the sustainability of RRTs in hospitals. Specifically, project negotiation processes, perceived effectiveness of the project, and project-related training are all likely to play a role in the sustainability of RRTs. Therefore these factors were included in this study.

Organizational factors. Shediac-Rizkallah and Bone (1998) argue that certain structures and processes are important for sustainability. Specifically, they note the importance of institutional strength, the presence of a program champion or leader, and the integration of an

innovation into existing programs as essential organizational factors in the sustainability of innovations.

Institutional strength. Shediac-Rizkallah and Bone (1998) posit that the 'strength' of an organization that implements a project is related to project sustainability. They define this strength based on the work of Bossert (1990), who found that projects were sustained in organizations where organizational goals were aligned with the project goals, where there was strong leadership and where there were relatively high skill levels. Unfortunately, neither Bossert (1990) nor Shediac-Rizkallah and Bone (1998) operationally defined strong leadership and high skill levels. Because of this lack of clarity, the definition of institutional strength had to be clarified for use in this study.

A few studies have examined aspects of institutional strength. For example, the importance of aligning goals between organizations and programs has been demonstrated. Barnett, Vasileiou, Djemil, Brooks, and Young (2011) conducted a qualitative study of how healthcare organizations perceived facilitators and barriers of innovation sustainability. Healthcare organizations that had implemented service innovations and that had received a Health Service Journal award for excellence in implementation were invited to participate. Semi-structured interviews were conducted with people who were directly engaged with the various healthcare service innovations. These researchers found that when there was congruence between the innovation and organizational norms, it was perceived to underscore the values and principles of the organization and thus, sustainability was possible. Unfortunately the study was limited by a low response rate (29.41%) and interviews were conducted with a single key informant in each organization, preventing triangulation of data or methods. The findings, however, are supported by others who similarly found innovation and organizational alignment to be important (Casey et al., 2009; Commins & Elias, 1991; Goodman & stickler, 1989; Kalafat & Ryerson, 1999).

Tibbits et al. (2010) also conducted one of the few empirical studies on sustainability, and reported that alignment between intervention goals and the goals of the organization was significant ($p < .01$) for the sustainability of an evidence-based delinquency program . As described earlier, in their studies of health promotion programs, Casey et al. (2009) and Commins and Elias (1991) similarly found that when the goals of the organization and the goals of the program were aligned, the program was sustained. Commins and Elias (1191), however, found that goal alignment was present in both schools that had achieved sustainability and also in schools that were moving towards achieving sustainability. Goal alignment enhances the "strength" of the innovation in the eyes of organizational members and therefore, it is more likely to gain their support. Because of the demonstrated importance of goal alignment, in this study alignment between the RRT program goals and the goals of hospitals that implemented RRTs was viewed as one aspect of institutional strength.

The importance of organizational leaders' competence in the sustainability of innovations has been noted in the literature. Mancini and Marek (2004) developed a Program Sustainability Index (PSI) with 6 subscales ($\alpha = .67 - .88$) to measure sustainability of a community-based support programs for at-risk children, youth, and families. The researchers found that leadership competence was correlated with all other sustainability elements (factor inter-correlation >.40). Such competence was demonstrated when leaders established clear innovation goals, actively planned and implemented those goals, implemented evaluation findings, and mobilized the funding for operations and retained quality staff. Curry et al. (2011) conducted eleven case studies of high-performing (n=7) and low-performing (n=4) hospitals in acute myocardial infarction (AMI) care in the U.S. to identify factors related to the sustainability of AMI care in U.S. hospitals. Hospitals were grouped in high/low hospitals based on national outcome measures by the Center for Medicare & Medicaid Services. These authors demonstrated that sustainability was facilitated when organizational leaders were competent in providing the necessary resources and evaluation processes to support the program and hold staff accountable

for poor performance. The strengths of the study included that those interviewed were most involved with AMI care in the organizations, a standardized interview guide was used, inter-coder reliability was established and debriefing sessions were conducted to inform subsequent data analysis.

Since numerous authors have demonstrated the important role of organizational leaders in creating structures, lines of authority, and accountability to support innovations such as RRTs, in this study strong leadership was defined as the creation, by organizational leaderS, of the necessary program structures and lines of authority and avenues of accountability to support RRT program continuation.

A third aspect of institutional strength suggested by Shediac-Rizkallah and Bone (1998) was high skill levels. However, they did not specify who should have high skill levels, how to determine "high" skills, or what the specific skills should be. No studies have specifically included high skill levels as a sustainability factor and further clarification of "high" skill level was necessary. Therefore, this study included this third aspect of institutional strength and defined high skill level as the educational level of nurses in hospitals that have adopted RRTs. Education level was operationalized as the proportion of nurses who held a baccalaureate degree compared to the proportion of nurses who did not hold a baccalaureate degree. Nurses' education level is a reflection of an organization's institutional strength. Baccalaureate degree nurses should have a higher level of knowledge and skills and thus be able to identify situations when an RRT intervention is needed, and they should have the confidence to activate RRT calls, all of which should translate into higher RRT calls. However, they should also be able to manage the critically ill patient and not need to call the RRT unless other interventions failed, resulting in more effective use of the RRT.

Wynn, Engelke and Swanson (2009) examined the relationship between nurses' educational preparation (baccalaureate degree in nursing [BSN] compared to associate degree in nursing[ADN]) and RRT call status. Specifically, they compared the educational level of nurses

who made an independent choice to activate an RRT with the education of those who consulted with others prior to activating an RRT. These researchers interviewed 75 nurses (45 held an ADN and 30 held a BSN) who had activated RRT calls within a 6-month timeframe and found that nurses who activated RRTs independently were more likely to hold the BSN ($p = .03$). Nurses with a ADN were more likely to call the RRT at the request of another nurse or physician whereas nurses with a BSN called the RRT independently. Their findings suggest that educational level is an important predictor of RRT activation and use, and thus RRT sustainability is more likely in organizations with a higher percentage of nurses who hold BSN degrees. The researchers did not explain why they thought educational preparation might have been important to RRT use. However, some explanations are possible for why baccalaureate prepared nurses activated RRT calls more readily than non-baccalaureate prepared nurses. Baccalaureate prepared nurses likely had a deeper knowledge base that they could have drawn from to identify patient deterioration and activate an RRT call. They may have been more assertive and confident and, therefore, more willing to activate RRT calls should physicians have instructed them not to call an RRT for a patient. Baccalaureate prepared nurses also may have had the personal confidence to overcome any uncertainty of how RRT members might respond once they arrive on the unit. Wynn et al.'s (2009) descriptive, cross-sectional study was conducted in a single institution and adult general and intermediate care units which limit the transferability of the study findings to other settings. Another limitation of the study is also that the researchers did not control for nurses' years of experience. Although they examined and found a relationship between nurses years of experience—nurses with less than three years of nursing experience were more likely to call the RRT at the request of another nurse or physician compared to nurses with more than three years of nursing experience ($p=.01$)—they did not examine the relationship between nurses' years of experience and educational level and RRT activation. If baccalaureate prepared nurses had more than 3 years of experience, these nurses'

activating the RRT could have been a function of their years of experience rather than their education level.

In the current study, institutional strength was therefore defined as the alignment of goals between the RRT program and the hospital that implemented the RRT, the presence of strong, competent leadership, and nursing staff with high education levels. Goal alignment was defined as alignment between RRT goals and the hospital's mission, vision, or goal statements. Strong, competent leadership was defined as the presence of program structures, lines of authority, and evaluation processes for the RRT program and RRT members. High education level was measured as the percentage of direct care nursing staff holding the BSN degree.

Program champion/leadership. Shediac-Rizkallah and Bone (1998) suggest that program champions play an important role in the sustainability of innovations. However, their definition of champion does not offer a clear description of the role or functions of these champions. Others have described program champions as strategically placed, influential individuals (Casey et al., 2009; Goodman & Steckler, 1989; Scheirer, 2005) and "opinion leaders" (Johnson et al., 2004) who advocate for the implementation, modification, and continuation of programs or innovations. Champions serve as advocates (Casey et al., 2009), form alliances among staff (Goodman & Steckler, 1989), coordinate implementation efforts, and keep the integrity of an innovation intact (Kalaft & Ryerson, 1999).

Some have suggested that for program champions to be effective, they should be in mid- to upper-level administrator positions (Evashwick & Ory, 2003; Goodman & Steckler, 1989). However, a few studies conducted in hospital settings have found that champions who were clinical experts, advanced practice nurses or nurse managers were essential for the sustainability of innovations (Bradley et al., 2005; Steckler et al., 2009). These researchers found that champions play important clinical roles in the implementation of an innovation and can serve as strong advocates with senior administration for the resources to maintain programs. In healthcare

organizations, the active support and involvement of champions have been considered important in the implementation and sustainability of innovations (Barnett et al., 2011). As mentioned earlier, Barnett et al. conducted interviews with staff who were directly involved with the innovation. They found that champions were passionate about and committed to the innovation. Barnett et al. argues that champions can be employees in various organizational positions; top and senior administrators are important champions because they can advocate for financial support, critical for sustainability; users of the innovation become strong champions because of their experiences. These findings are in contrast to those of Bradley et al. (2005) and Steckler et al. (2009) who recommended that champions should be in clinical roles. In small organizations without extensive hierarchies, however, upper level administrators have successfully served as champions (Casey et al., 2009). One reason for differences in findings may be that in Barnett et al.'s study the organizational size may have been small enough to compensate for champions at the administrator level. In contrast, Bradley et al. reported the size of organizations to be between 180 and 1800 beds. These organizations likely had more bureaucracy structures, making it more difficult for upper level administrators to be successful champions.

The impact of champions on RRT implementation has not been studied. However, some RRT implementation reports suggest that champions play an important role in RRT implementation. Bertaut, Campbell, and Goodlett (2008) evaluated the RRT program at a non-academic medical center one year after implementation. These authors found that an RRT champion or advocate, in particular, a physician champion, was important to facilitate the implementation and use of RRTs. Similarly, Halvorsen, Garolis, Wallace-Scroggs, Stenstrom, and Maunder (2007) reported their implementation experiences and strategies that facilitated the successful implementation of RRTs. A physician who was perceived as an opinion leader in the hospital held discussions, conducted presentations, and communicated the importance of the RRT to other physicians and staff members.

Program champions are individuals who help to develop internal support for a specific innovation, promote and support conditions necessary for a project's adoption and implementation, and address problems or resistance associated with a particular innovation (Commins & Elias, 1991). Thus, while organizational leaders are in formal positions of authority, project champions may or may not be in positions of authority. Rather, they may be individuals who have used the innovation or who have expert knowledge of the innovation.

In the studies to date, champions' roles and responsibilities, the reasons for their importance and the actions of champions that facilitate the sustainability of innovations have not been fully described. It is also not clear if champions are necessary only during the implementation of a program or also beyond implementation activities. However, the literature suggests that a champion who can maintain enthusiasm and "push" for the innovation *over time* is important for sustainability (Bradley et al., 2005).

This study defined a champion as someone who advocated for the RRT program and who was either considered by staff members as an expert on RRTs in the organization because of involvement with the RRT program in the hospital, or was a clinician who had previously used the RRT for patients in crisis and who could provide support to colleagues on the activation and use of RRTs.

Integration with existing programs or services. Shediac-Rizkallah and Bone (1998) suggest that innovations are more likely to be sustained when they are well integrated into existing systems or programs. Other studies have also found that the extent to which an innovation can be modified to the organization in which it is implemented and the fit of the innovation with the organization's mission and procedures are vital for innovation sustainability (Casey et al., 2009; Kalafat & Ryerson, 1999; and Scheirer, 2005).

Scheirer (2005), in her synthesis of sustainability studies (n=19), identified 12 studies that emphasized the ability of the innovation to be modified to fit with the existing organizations

mission and/or operating procedures as important for sustainability. Casey et al. (2009) found that the integration of an innovation within an organization was influenced by the innovation's compatibility with the core values and operations of the organization. Kalafat and Ryerson (1999) examined the institutionalization of a school-based youth suicide prevention program. The researchers surveyed 46 public schools in one county to determine the degree of implementation and institutionalization of the prevention program. Structured interviews were conducted with informants from the first 11 schools that had adopted the prevention program to identify factors that were associated with the retention or discontinuation of the program. Representatives of 31 of the 46 schools responded to the survey (67% response rate). Analysis of surveys and structured interviews with representatives of schools that participated in the initial implementation of the suicide prevention program indicated that adapting the program to fit with the various school settings contributed to the programs institutionalization. The study lacked well-defined definitions and details on the survey instrument such as psychometric properties and the analysis strategy were not reported. Because of the use of structured interviews, key information that might have informed the study may not have been captured. It is also unclear how the interviews were analyzed and what steps the researcher had taken to ensure the reliability and validity of the data. For example, steps to ensure the accuracy of transcriptions, inter-coder agreement, and how response bias (i.e., participants responding to interviewer questions to make a favorable impression) may have been reduced, were not described (Creswell, 2009).

In the context of RRTs, Huff (2011) argued that hospitals must design RRTs to fit with the demands of the organization within which they are implemented. According to Huff (2011) without designing RRTs or modifying existing ones to be consistent with the needs of the organization, RRTs will become obsolete, and thus, fail to achieve full integration and sustainability. Many hospitals have found the need for pilot studies to allow for adjustments prior to a full scale implementation and integration of these teams (Bertaut et al., 2008; Grimes et al., 2006). Integration of these teams, however, seems to continue to be a challenge. Donaldson et

al. (2009), in their study of robust adopter hospitals and challenged adopter hospitals and RRTs, reported that both groups of hospitals found the integration of RRTs difficult.

The integration of RRTs is likely more challenging because these teams differ so much from Code Blue teams who intervene when a patient experiences a respiratory and/or cardiac arrest. RRTs differ from these teams because the RRT is called to evaluate patients on acute care units and, if necessary, start treatment for patients who are deteriorating but not yet in full cardiac and/or respiratory arrest. Although the structure of RRTs allows for the use of existing staff members to serve on the team and organizational structures to oversee team activity, hospitals do not have existing programs and services into which RRTs can be fully integrated. Therefore, integration with existing programs and services was not used in this study as a variable of interest.

Summary. Several organizational factors have been identified in the literature as important to the sustainability of RRTs in hospitals. In this study, institutional strength and the presence of a program champion were examined in relation to the sustainability of RRTs in hospitals.

The Framework for This Study

Shediac-Rizkallah and Bone's (1998) planning model of sustainability (PMOS) has been referenced extensively in the literature (Stirman et al., 2012) and it is considered the most comprehensive model of sustainability available (Scheirer, 2005). It has also been used and tested in previous studies (Casey et al., 2009; Evashwick & Ory, 2003). Casey et al. (2009) used the PMOS framework to examine factors facilitating or inhibiting the sustainability of health promotion programs in sports and recreational organizations. The researchers found the factors specified in the PMOS facilitated sustainability; however, they noted that when project funding

was limited, sustainability was inhibited. The trustworthiness of the study was enhanced by the use of data and methodological triangulation, which was possible because of the use of in-depth interviews and focus group discussions with executive leaders and board members. Unfortunately, the operational definitions of constructs examined were not provided and it is unclear how factors were determined to be present or absent.

Evashwick and Ory (2003) hypothesized and subsequently verified that the factors specified in the PMOS were present in organizations where a program for older adults was sustained over time. Project financing was noted as the most challenging aspect of program sustainability; however, the greatest asset to sustainability was viewed as visionary leadership and community involvement. The strength of this study was that the PMOS was used and all factors of the model were operationalized. However, the researchers relied on only qualitative interviews which were limited to one respondent—usually the program contact person—at each organization which limited the study's findings.

Also, both Casey et al. (2009) and Evashwick and Ory (2003) examined only organizations that ranked highly on some organizational characteristics believed to be associated with sustainability in their study. For example, Casey et al. included organizations in two regions in the state of Victoria (Australia) that were assessed to have an organizational infrastructure that would support sustainability. Evashwick and Ory included only organizations that had received an external recognition (the Archstone Award) of their innovative programs to provide care to older adults. Because only organizations were studied that were rated well on some characteristics associated with sustainability, versus those that were actually rated well on sustainability, it is possible that the results of these studies may be skewed. That is, the sustainability factors in the PMOS may not necessarily have been absent in lower ranking organizations. The current study addresses the limitations of these two studies by more clearly operationalizing variables and triangulating data collection methods by gathering and verifying data from several organizational informants. Furthermore, by including both high- and low-

scoring sustainability hospitals, it would be more likely to determine if the PMOS factors were present with respect to the sustainability of RRTs in hospitals.

Therefore, the current study proposed that when the design and implementation factors (project negotiation process, project effectiveness, and training) and the organizational factors (institutional strength and program champion) in the adapted PMOS model are present in hospitals, sustainability of RRTs will be achieved. This conceptual framework is shown in Figure 2.

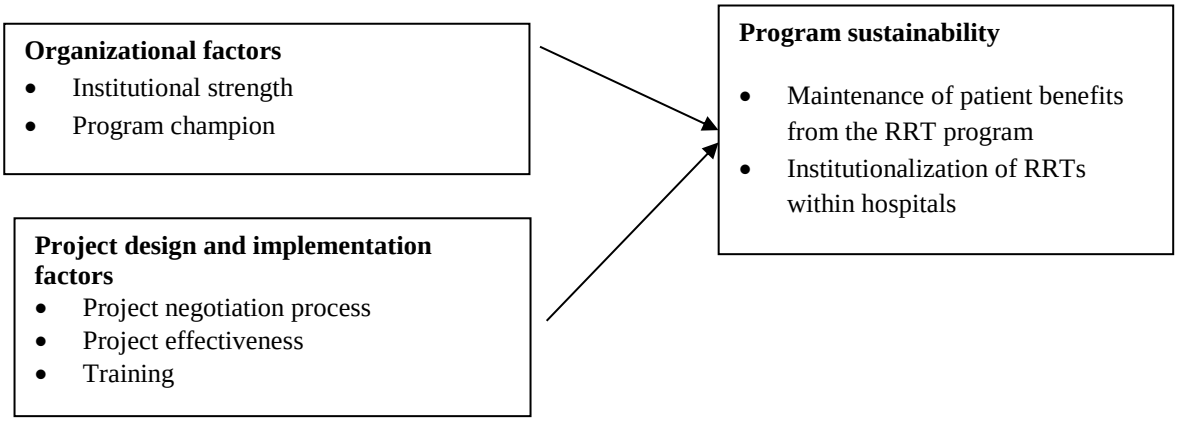

Figure 2. A Framework for Conceptualizing RRT Sustainability

Chapter Summary

The PMOS offers a framework that is relevant for studying the sustainability of innovations in health care organizations. While the framework has been used to examine the sustainability of health promotion programs in the community; its applicability to hospital settings has not been examined. However, several factors in the PMOS are relevant to examine the sustainability of RRTs in hospitals. These include project design and implementation factors (project negotiation process, project effectiveness, and training) and organizational factors (institutional strength and program champion). Therefore, this study adapted the PMOS to examine RRT sustainability in hospitals.

Two major outcomes of sustainability were of interest in the study: continuation of the activities surrounding an RRT program and maintenance of the actual and perceived benefits for individuals whom the RRT is intended to serve (clients, staff members, or patients) (Shediak-Rizkallah & Bone, 1998; Scheirer, 2008). Achieving the sustainability of innovations in organizations will likely increase the capacity of surrounding communities. However, an organizational perspective was the focus in this study. Thus, building the capacity of the community was not included as a sustainability outcome.

Achieving actual benefits from RRT implementation ensures that organizational resources necessary to continue the RRT program are not wasted. Perceived benefits from RRTs serve as an impetus for RRT call activation and use. Lack of perceived benefits reduces the likelihood that RRTs will be used to the fullest extent in hospitals. Therefore, this study expands Shediak-Rizkallah and Bone's (1998) conceptualization of sustainability as the continuation of innovations in organizations to include maintenance of the innovation's benefits. The aim was to provide organizational leaders with a guide for changes that may foster the sustainability of innovations in their organizations.

CHAPTER 3

RESEARCH METHODOLOGY

This study examined sustainability of innovations in healthcare organizations. The specific aims of this study were to determine the level of RRT sustainability achieved in a sample of North Carolina hospitals; identify if, how, and why factors support RRT sustainability within these hospitals; examine organizational contexts and processes associated with RRT sustainability; and develop a model of RRT sustainability in hospitals.

This chapter provides a description of the research methods used in the study: the study design, sample selection, data collection methods and procedures, and data management and analyses. The chapter concludes with a discussion of the protection of human subjects and the methods used to ensure the trustworthiness of data.

Study Design

This study was conducted in two, complementary phases (see Table 1). Phase One used survey methods to determine the sustainability in a sample of North Carolina hospitals. Hospital administrators or their designee completed the survey, which included some self-report information (e.g., views and perspectives) as well as more specific information on the RRT, organizational characteristics, and RRT outcomes. This information was used to derive a sustainability score for each hospital, and the scores were then used to rank hospitals from low to high sustainability.

Table 1

Study Design

	Phase One	Phase Two
Design	Survey methods	Multiple-case studies
Sample selection	Convenience sample of hospitals participating in the North Carolina RRT Collaborative (NC-RRTC) (N=56)	Purposive sample of two hospitals in the highest quartile and two hospitals in the lowest quartile of RRT sustainability based on Phase One survey analysis
Data collection	Online survey to determine RRT sustainability	Interviews and documentation review; Hospital RRT Questionnaire
Data analysis	Self-reported data analyzed using descriptive statistics to determine levels of sustainability	Cross-case analysis of hospitals with high sustainability scores Cross-case analysis of hospitals with low sustainability scores Cross-case analysis and comparison of high-sustainability-scoring hospitals and low-sustainability-scoring hospitals

Phase Two used a multiple-case study approach (Yin, 2008), including both quantitative and qualitative methods, to examine factors, contexts and processes related to RRT sustainability in hospitals. Case studies allow for the use of a variety of data collection methods and data sources, making possible data triangulation, that is, comparison of data across the methods and sources used to obtain data (Yin, 2008). Multiple-case studies allow for the replication of cases and are therefore considered to be more robust than single cases (Yin, 2008; Gerring, 2007).

In this study, a "case" was defined as a hospital in North Carolina (NC) that participated in the North Carolina RRT Collaborative (NC-RRTC) and implemented an RRT. Four hospitals were selected for examination in Phase Two, based on the level of hospital RRT sustainability reported in Phase One: two hospitals with high RRT sustainability scores and two hospitals with low RRT sustainability scores were included in this phase. This approach made it possible to

compare hospitals with high RRT sustainability and those with low RRT sustainability. It also allowed for a comparison of hospitals with high RRT sustainability scores to those with low RRT sustainability scores. A variety of data collection methods and data sources were employed to facilitate comparisons (Yin, 2008). Both phases of the study are described in detail below.

Phase One Methods

The purpose of Phase One was to gather information on RRT sustainability from a sample of hospitals in NC who participated in the NC-RRTC of the North Carolina Hospital Association (NCHA). Information gathered during Phase One included questions to: screen the targeted sample of participants; gather hospital demographic information; identify the characteristics of RRTs; determine RRT sustainability; and identify outcomes reported following RRT implementation.

Sample selection. The target population for the study was hospitals that had implemented RRTs. The Phase One sample included all NC hospitals that participated in the NC-RRTC (N=56). The NC-RRTC was a 9-month collaborative conducted in 2006 and 2007 by the NCHA with funding from the Robert Wood Johnson Foundation. The objective of the NC-RRTC was to develop, implement, and sustain RRTs at 56 NC hospitals. Hospitals that participated in the NC-RRTC had access to resources, training, support, and data and outcome measurement services. Of the 56 hospitals that participated, 9% were critical access hospitals, 42% were rural hospitals, 55% were urban hospitals, 17% were teaching hospitals, and 32% were public hospitals (J. Spade, personal communication, June 18, 2010). As of May 2007, when the collaborative ended, 73% of the NC-RRTC hospitals offered RRT coverage 24 hours per day, 7 days a week.

The hospital sample was accessed with the assistance of a representative from the NCHA, who worked closely with the NC-RRTC. This representative provided the researcher with

contact information for all hospitals in the study sample, which was used to contact key hospital leaders to alert them to the study, and to send all study-related correspondence (i.e., invitations to participate, consent information, and thank-you cards) to prospective participants.

Because the purpose of the NC-RRTC was to develop, implement, and sustain RRTs, it was likely that some level of sustainability would have occurred in at least some of these hospitals, making this group of hospitals relevant to the study of RRT sustainability. Also, the group of hospitals represented a variety of hospital types, including rural, urban, teaching, and public hospitals in NC. While one might expect that sustainability among collaborative member hospitals would not vary greatly, personal communication with the NCHA representative indicated that variability in sustainability among these hospitals was likely. Further, sustainability was expected to vary among these hospitals depending on the degree to which the factors, contexts and processes examined in the study were present in each hospital.

Measurement. At the time this study was initiated, no reliable measures of sustainability were available or reported frequently in studies. Shediac-Rizkallah and Bone (1998) and Scheirer et al. (2008), however, recommended operationally defining sustainability in organizations as *institutionalization*, or the integration of an innovation within the organization and establishment of innovation-related activities as "accepted practice" in the organization (Goodman & Steckler, 1989; Goodman, McLeroy, Steckerl, & Hoyle, 1993). Following this recommendation, an adapted version of the Level of Institutionalization Scale (LoIn) (Barab, Redman, Froman, 1998; Redman & Barab, 1997), developed by Goodman, McLeroy, Steckler, and Hoyle (1993) to examine the institutionalization of innovations in organizations, was selected for use.

The LoIn was modified to measure the institutionalization of RRTs because the original LoIn did not measure some aspects of institutionalization specific to RRTs. The survey used in Phase One included therefore the RRT Institutionalization Scale (RRT-IS), based on the LoIn, as

well as items for sample screening, gathering organizational demographic information, and identifying RRT characteristics and outcomes.

The Institutionalization of RRTs. The LoIn was derived from the subsystems (production, maintenance, supportive, and managerial) described by Katz and Kahn (1978) and the degrees of institutionalization (passages, routines, and niche saturation) identified by Yin (1979). Goodman, McLeroy, Steckler, and Hoyle's (1993) Level of Institutionalization Matrix, shown in Table 2, illustrates how these approaches were integrated to constitute the original LoIn.

Table 2

The Level of Institutionalization Matrix

	Degree of institutionalization		
Organizational subsystems	Passages	Routines	Niche Saturation
Production			
Maintenance			
Supportive			
Managerial			

The left-most column of the matrix shows the subsystems into which an innovation such as an RRT can be integrated. The items in this column are based on Katz and Kahn's (1978) conceptualization of organizations as composed of the following subsystems[1]:

- **Production subsystem** or activities specific to organizational production, such as the implementation of product plans and procedures that focus on organizational throughput.
- **Maintenance subsystem** or how expectations for roles or performances of organizational members are met through recruitment, socialization, rewards, and sanctions.

- **Supportive subsystem** or the procurement of resources for production input, the export of end products, and establishment of legitimacy and favorable organizational relations within the larger social environment.
- **Managerial subsystem** or the functions of coordinating, adjusting, controlling, and directing all other subsystems, including conflict resolution between different hierarchical levels, and coordination of external requirements with consideration of organizational resources and needs.

For innovations to become institutionalized, they must be "rooted" (Goodman et al., 1993, p.165) to some degree in each of these organizational subsystems. To determine the degree to which innovations are rooted, or institutionalized, in organizations and their subsystems, Goodman et al. (1993) recommended examining the subsystems according to the stages, shown in the top row of the matrix in Table 2.

To achieve full institutionalization, innovations must progress from passages to routines and from routines to niche saturation:

- **Passages**—represent the first degree of institutionalization and signify the emerging embeddedness of the innovation as evidenced by the formalization and implementation of program plans, a shift of program funding from soft to hard money, or other formal transitions (Weiner, 2002).
- **Routines**—represent the second, or higher degree of institutionalization and signify innovation permanence (Goodman et al., 1993; Weiner, 2002). Every passage includes a routine that reinforces passage activities. The longer these routines exist, the greater the degree of institutionalization (Weiner, 2002).
- **Niche Saturation**—represents the third and highest degree of institutionalization that occurs when the innovation expands to its optimum limits within the host organization's subsystems. For example, not only does the RRT become a routine practice, but the staffing and resources

the team needs to function are also at an optimum level. The program has expanded in the organization to reach the maximum number of potential patients (e.g., adult and pediatric patients) and organizational units (e.g., medical-surgical units, labor and delivery units, and psychiatric units).

The adapted version of the LoIn used in this study, the RRT Institutionalization Scale (RRT-IS), includes these same organizational subsystem and degree of institutionalization components. Passages reflected the first phase that organizations would go through to employ RRTs; these RRT-related passages must occur before the next step, RRT-related routines, could occur. Routines signify the continuation of RRT-related passages over time and reflect the number of years that specific aspects of the RRT had been in place. Niche saturation would be achieved after RRT-related passages and routines were established, and as RRTs spread to reach all areas of a particular subsystem.

Table 3 illustrates how the RRT-IS reflects the degree of institutionalization (i.e., passages, routines, and niche saturation) across all subsystems (production, maintenance, supportive, and managerial). The more intensely the RRT is integrated into a given subsystem, the more that RRT-related passages, routines, and niche saturation become "embedded" in the subsystem, and the more intensely the RRT is expected to be integrated throughout the organization. Appendix A contains the full RRT-IS (i.e., the questions and response options) used in the Phase One online survey.

In this study, the RRT-IS was scored in keeping with the recommendations of Goodman et al. (1993). Items in the passages column were each scored 4 for "yes" responses and 1 for "no" responses. Consideration was given to scoring the items on a 4-point Likert scale, but most passage questions did not lend themselves to responses other than "yes" or "no". Passage questions served to determine whether organizations had taken the first steps towards institutionalizing RRTs. Organizations either had or had not taken these first steps. Using "yes"

and "no" responses was also consistent with the responses used in the original instrument created by Goodman et al. Once a "yes" response was selected, routine and niche saturation questions were designed to determine the scope of the steps that organizational leaders had taken to institutionalize RRTs. Routines were scored on a 4-point Likert scale (1 = no passage, 2 = passage + one year of a routine, 3 = two to three years of a routine, and 4 = four or more years of a routine). Three niche saturation questions were scored on a 4-point Likert scale and the remaining four questions were multiple choice questions that were not scored on a 4-point Likert scale. For example, one question asked: "Which of the following aspects of the RRT program does your hospital have a supervisor formally assigned to oversee?" Response choices, from which respondents could select all that applied, were: (a) education and training of staff members and RRT members; (b) purchasing equipment or supplies; (c) monitoring RRT call activations according to specific criteria; (d) evaluating the RRT, including data collection and analysis; and (e) other. Response choices for the three niche saturation items received a score of 4 if selected, and a score of 1 in no response choices were selected. Because items in the RRT-IS were not equally weighted, the mean score for each level of institutionalization was calculated across the three subscales. That is, a mean score was calculated separately for passage items across all subsystems; for routine items across all subsystems; and for niche saturation items across all subsystems. The overall score for each hospital was determined by summing these mean scores and then calculating a mean of the sum of mean scores to indicate the overall level of institutionalization (i.e., sustainability). The minimum score that could be reported was 1 and the maximum score was 7.23. These scores were then used to identify hospitals for inclusion in Phase Two of the study.

Additional questions. Other questions were included in the survey to ensure that only targeted participants completed the survey, and to obtain information needed to select hospitals for inclusion in Phase Two. These questions were included upon the recommendation of the

NCHA representative and faculty advisors to better understand (a) the organizations in NC that have deployed RRTs and (b) the ways in which hospital leaders in the NC-RRTC structured and deployed these teams in their organizations.

First, five screening questions (a1 – a5) were asked to ensure that the targeted sample completed the survey. Next, two additional questions (a6-a7) were used to determine organizational size and type. Finally, several questions related to RRT characteristics (questions 1 – 7) and outcomes (questions 31-33) were included. Outcome questions asked participants to report RRT outcomes that should have been readily available in the study hospitals. The preliminary information gained was categorized, evaluated descriptively, and used to help select the sample for inclusion in Phase Two of the study.

Survey testing. Before the survey was administered, it was evaluated for content validity, clarity, and interpretability. The RRT-IS was reviewed by several experts, including the NCHA contact, faculty content experts, CNOs from non-NC-RRTC hospitals, and survey experts from the Odum Institute for Research in Social Science at the University of North Carolina, Chapel Hill, to provide feedback on the survey and its content. These experts received information on the study, and an overview of the feedback desired (Appendix B), including instructions for accessing the survey and providing feedback, and the link to the electronic survey. Based on feedback from these experts, the survey was modified to include two additional questions related to the characteristics of RRTs. Also, RRT outcome questions were modified to more accurately reflect the measures advocated by the NC-RRTC as measures of RRT effectiveness.

The reliability of the RRT-IS was also examined. The RRT-IS scale consisted of 23 items with an acceptable Cronbach alpha of .786 (Brink & Wood, 1998). The passage subscale consisted of 8 items ($\alpha = .684$), the routines subscale consisted of 8 items ($\alpha = .732$), and the niche saturation subscale consisted of 7 items (0.485). There were no significant correlations ($p > .05$) between passages, routines, and niche saturation.

Table 3

The RRT Institutionalization Scale (RRT-IS)

Subsystem	Passage	Routines	Niche Saturation
Production	8. In your view, has the RRT program in your hospital made the transition from pilot status to permanent status?	9. How many years would you say the RRT program has been considered permanent status in your organization?	10. To what extent has the RRT achieved permanent status in your hospital?
Maintenance	11. Has your organization formalized the role of RRT members through the development of written, clearly delineated job/role descriptions or organizational policies and procedures?	12. For how many years have RRT member roles, expectations and performances been formalized through written, defined job/role descriptions or organizational policies and procedures?	13. For which of the following RRT staff members has your organization developed written, defined job/role descriptions or organizational policies and procedures?
	14. Does your hospital provide formal, specific, and ongoing education for staff who serve as members of the RRT?	15. For how many years have education and training been provided for staff who serve as members of the RRT?	16. How often do you provide formal, specific, and ongoing education for staff who serve as members of the RRT?
	17. Does your hospital provide formal, specific, and ongoing education related to the RRT program for all hospital staff members?	18. For how many years has education related to the RRT program been provided to all hospital staff members?	19. How often do you provide formal, specific, and ongoing education related to the RRT program to all hospital staff members?
Supportive	20. Have full-time equivalents (FTEs) been assigned to the RRT program?	21. For how many years have FTEs been assigned to the RRT program?	
	22. Have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	23. For how many years have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	24. For which of the following aspects of the RRT program are funds specifically allocated in your hospital's annual budget?
Managerial	25. Do you monitor/evaluate the RRT program offered at your hospital?	26. For how many years has the RRT program been monitored/ evaluated?	27. Which of the following aspects of the RRT program do you monitor/evaluate?
	28. Has a supervisor formally been assigned to the RRT program?	29. For how many years has a supervisor formally been assigned to the RRT program?	30. Which of the following aspects of the RRT program does your hospital have a supervisor formally assigned to oversee?

Note. Numbers in each cell correspond to items in the RRT-IS.

Procedures. After receiving Institutional Review Board (IRB) approval through the University of North Carolina at Chapel Hill, the NCHA representative was contacted to discuss all aspects of the study and procedures. The researcher was well-known to the NCHA representative because this person had advised the researcher on the feasibility of sampling hospitals for inclusion in the study from the population of hospitals that participated in the NC-RRTC. The NCHA representative provided the researcher with the names of hospital leaders and contact information for each of the hospitals that participated in the NC-RRTC. Throughout the research process, the NCHA representative served as a resource, was kept informed of the study's progress, and served as a "sounding board" when problems arose.

The NCHA representative sent an email pre-notification to all NC-RRTC participants to introduce the researcher to hospital leaders and alert them to the study. Two days following the NCHA representative's email communication, the researcher sent a recruitment letter with an electronic survey link by email to all hospitals in the NC-RRTC. This letter was sent to the appropriate administrator (CNO, Chief Executive Officer [CEO], or Chief Operating Officer [COO]) at each hospital and invited them to participate in the study. The letter included an overview of the study, the data collection methods, and the hospital administrator's role in the study. The RRT survey was administered as a web-based survey, using the electronic software program Qualtrics™. The program maintains data behind a firewall so that data are accessed only by the owner of the survey using a password and user ID. All pieces of data were keyed to that owner identification could not be accessed by anyone other than the owner, or technical assistance staff (such as server or Qualtrics software program administrators) at the owner's request. The Qualtrics system has been used by government agencies, hundreds of universities and in many dissertations involving human subjects, including those gathering sensitive information from disadvantaged and at-risk populations, and government sponsored studies collecting sensitive data.

The survey was managed using a modified version of the Tailored Design Method (TDM) by Dillman, Smyth, and Christian (2009). The survey started with a brief statement of the purpose of the study, and an informed consent "statement", including information about the confidential and voluntary nature of the study. Because the electronic link to the survey was sent to all NC-RRTC hospitals, open access to the survey was necessary. Therefore, after the brief purpose statement, three screening questions were asked to determine the presence of RRTs in the hospital and the respondent's position in the organization. Only those who indicated that RRTs were present in their organization and that they were either a hospital administrator or someone designated to complete the survey by a hospital administrator were given access to the survey. After these screening questions, participants were asked to give the name of their hospital and to indicate their position in the organization. These questions allowed the researcher to link the survey data to specific hospitals, verify their participation in the NC-RRTC, determine the position of the administrator who completed the survey, and facilitate future follow-up with non-responding hospital administrators. The remainder of the survey included the organizational demographic questions, RRT characteristics and outcome questions, and the RRT-IS. The survey ended by informing participants of the second phase of the study and inquiring about their willingness to participate in this second phase of the study.

Following the TDM (Dillman , Smyth, & Christian, 2009), a follow-up email was sent to thank those who had responded to the survey and to remind others that the opportunity to participate in the survey was still available to them. Two weeks after the initial recruitment letter was emailed, a hard copy of the recruitment letter and consent form, the survey, and the link to the electronic survey were mailed to the respective administrator of all hospitals that had not completed the electronic survey to remind them of the study and ask them to complete it. Sending both a hard copy and a link to the electronic survey gave hospital administrators the option to complete via the method of their choosing. A final contact was made by phone 1week after the hard copies were mailed to note the importance of the study again and remind

prospective participants of the opportunity to complete the survey. Response rates for web-based surveys have been reported to be close to this study's response rate of 52.4% (Hoonakker & Carayon, 2009). The targeted response rate for this study was between 60% and 70%, based on previous RRT and sustainability studies that have reported survey response rates of 67% (Pina, 2008) and 70% (Scheirer, Hartlink, & Hagerman, 2008). To increase the response rate, the researcher worked closely with the NCHA representative to personalize all mailings as much as possible. Other measures used to increase the response rate included using skip patters in the electronic survey, providing electronic indication of survey progress, thoroughly pre-testing the survey, and enabling respondents to report problems (Hoonakker & Carayon, 2009).

The survey was activated when the recruitment letters were distributed and remained active for 4 weeks from the anticipated date of receipt. Throughout this period, the researcher monitored the Qualtrics™ survey site to determine which hospital's administrators had completed the online survey. Analysis of the data commenced once the link was no longer active and the survey was no longer accessible.

Data management and analysis. The results from the survey were extracted from the Qualtrics™ software program into an Excel spreadsheet and uploaded into SPSS version 19.0.2 for analysis. Returned paper surveys were entered into the Qualtrics™ software program prior to export into the Excel spreadsheet. Electronic data were stored on a password-protected computer in a secure location at the researcher's home and on a secure computer back-up server.

To answer the study's first research question, "What is the level of RRT sustainability achieved in hospitals in North Carolina," survey data were analyzed using descriptive statistics. A mean sustainability score was determined for each hospital. Hospitals were then ranked based on their sustainability score from lowest to highest. Once ranked, hospitals were grouped into quartiles based on the sustainability score. After this process was complete, the second phase of the study commenced.

Phase Two Methods

The purpose of Phase Two was to gather information on the factors, contexts and processes facilitating RRT sustainability in hospitals. Multiple-case studies were conducted using several data collection strategies, including a Hospital RRT Questionnaire, interviews and documentation review. Data analysis techniques included Miles and Huberman's (1994) steps in data analysis (i.e., data reduction, data display, and conclusion drawing or verification) and cross-case analyses.

Sample selection. The results from the Phase One survey were used to select case hospitals for in-depth study. Two community hospitals in the highest quartile and two community hospitals in the lowest quartile were purposefully selected for inclusion in Phase Two. To reduce variability in the sample, organizations that were similar in type and size were selected. Except for community hospitals, only one academic medical center ranked in the lowest quartile. Therefore, to be able to select two hospitals in the lowest quartile, community hospitals had to be selected. The hospitals were selected in collaboration with faculty advisors and the NCHA representative. First, any hospital administrator who declined for his or her hospital to participate in Phase Two was excluded from consideration. To account for the possibility that one of the two facilities selected to participate in Phase Two might decline to participate, one additional hospital was identified as a back-up hospital from each quartile group.

Both low-scoring hospitals declined to participate. Because only one low-scoring hospital had been selected as a back-up hospital, another low-scoring hospital was needed for Phase Two. However, no other hospitals of similar size and type were available in quartile one; therefore, the lowest scoring hospital in quartile two that was similar in size and type to the hospitals was selected for inclusion, in collaboration with faculty advisors and the NCHA representative.

In Phase Two, data on RRT sustainability were systematically gathered from individuals and groups in the hospitals selected for in-depth study. In each case hospital, individuals from three groups were interviewed because of their knowledge and experience and their potential to share information about the implementation of RRTs from different organizational perspectives. The first group was a leadership group that included key organizational administrators who might have been instrumental in the initial decision to adopt RRTs; the planning, execution, and evaluation of the implementation of RRTs; administrative oversight and continued evaluation of the RRT program; and the continuation of RRTs in their organization. This leadership group included physicians, nursing unit managers and directors of acute care areas, hospital quality improvement specialists, implementation and/or oversight groups, hospital educators, and unit-based clinical leaders. The second group, RRT members, consisted of RNs who previously or currently served on the RRT and responded to calls. They were interviewed because they had relevant experience as "first responders" and were likely to have interacted with patients, nurses, and other caregivers during the process. Finally an RRT user group consisting of RNs and physicians affiliated with patient care units where RRT calls could be activated were interviewed because they had access to the RRT for any patients under their care. These RRT users were likely faced with making decisions about whether or not to call an RRT, and they may have interacted with RRT members. While RRT users might not have activated an RRT call for a patient under their care or been a part of an RRT called by others on their unit, they were considered an important group because they had access to the RRT and could activate an RRT if needed.

Data collection methods. Phase Two data were gathered from the four hospital cases using three approaches. First, a Hospital RRT Questionnaire (see Appendix C) was used to gather specific facts about the hospitals and their RRT. Second, semi-structured interviews were conducted to gain richness about the proposed sustainability factors outlined in the conceptual

framework, and whether they were present in the hospital. The interviews also allowed for an in-depth exploration of the contexts and processes that facilitated RRT sustainability. Finally, organizational documents were reviewed to gather additional descriptions and explanations of issues mentioned during data collection. Data collected through the administration of the hospital RRT questionnaire, individual interviews, and documentation reviews were augmented by hand-written field notes and interview notes.

Hospital RRT Questionnaire. The RRT questionnaire was designed to gather descriptive information on the RRT at each case hospital, and to facilitate examination of differences in RRTs across case hospitals. The hospital RRT questionnaire contained a number of factual questions on the RRT program at each hospital. The administrator or administrative designee was asked to complete the questionnaire after consent to participate in the study was received and before the researcher visited the organization.

Individual interviews. Interviews are generally considered to be the "gold standard" for qualitative data collection (Sandelowski, 2002) and one of the most important sources of information in case studies (Yin, 2008). In this study, individuals from three distinct groups (hospital leadership, RRT members, and RRT users) were interviewed.

Interviews lasted approximately 30 – 45 minutes and were conducted during on-site hospital visits, at a time that was convenient for participants and in a meeting room that was made available to the researcher. Every effort was made to conduct in-person interviews. Forty-five in-person interviews were conducted across the four study hospitals. However, some scheduling conflicts prevented in-person interviews with five individuals; in this situation telephone interviews were conducted. The telephone interviews lasted about the same length of time as in-person interviews and were also scheduled at a convenient date and time for participants.

Purposive sampling was used to identify potential participants for interviews. Specifically, the researcher collaborated with organizational leaders and administrators to identify and purposively recruit study participants. Snowball sampling was also used, as individuals who participated in interviews referred other potential study participants. Because of the introduction of the referring person, snowball sampling facilitated the establishment of a trusting relationship between the researcher and potential participants (Polit & Beck, 2004).

Interviewees were recruited via email or list-serv announcements (distributed through hospital administrators), in-person presentations made to relevant organizational meetings, direct personal contact, personalized follow-up letters distributed electronically (by hospital administrators), and a reminder phone or email contact a few days before the interview (Krueger & Casey, 2009). A study flyer was also distributed in each hospital and to individuals and groups identified by organizational leaders as potential participants.

An incentive was offered to stimulate interest and participation in the interview (Krueger & Casey, 2009: Polit & Beck, 2004). Specifically, a small plastic bag containing a pen, notebook, and a note pad, or a selection of pens, a water bottle, mug, or a gift card to a local store were offered to each interviewee. At the end of the interview individuals were given an opportunity to choose one of these incentives.

Procedures. The CNO in the hospitals selected for inclusion in Phase Two was contacted by email to confirm willingness to participate in the study. The rationale for contacting the CNO was that this person generally oversees nursing staff who call the RRT and had probably been involved in implementing the RRT.

The initial contact gave the researcher an opportunity to discuss the study with the CNO, answer questions, and arrange the first on-site hospital visit. At all four sites, the CNOs indicated that their hospitals were willing to participate but referred the researcher to another person in a

leadership role (hereafter called designated administrator) to provide written consent and collaborate with the researcher.

Following the call, the researcher sent the hospital recruitment letter and study consent form by email to the designated administrators to confirm their hospital's willingness to participate. The researcher received the signed consent form by email or, in some instances, during the first on-site visit.

Once the CNOs had confirmed willingness for their hospitals to participate in the study, the researcher sent them via email the Hospital RRT Questionnaire for completion. The questionnaire was returned to the researcher either by email or in-person during the first site visit.

First on-site visit. The first on-site visit was used to organize and plan subsequent site visits and study activities. Prior to the visit, the researcher sent the designated administrator an email summary of the purpose of the visit to inform them of planned activities, allow them to gather information prior to the visit, and ask them to invite appropriate persons to the first on-site meeting.

During the first visit, a 1-hour meeting was held with the designated administrator and others identified by the CNO or the administrator as important to the study because of their expertise with RRTs or research activities in the organization. The meeting included (a) a summary of key results of the Phase One survey; (b) a review of the information reported in the Hospital RRT Questionnaire; (c) the data collection methods to be used (i.e., individual interviews and a documentation review); and (d) the request for a conference or meeting room where interviews could be conducted. Hospital administrators were informed of the selection of their hospital based on organizational and RRT characteristics and the hospital's RRT sustainability survey results. However, to reduce response bias administrators were not informed of the actual sustainability score for their hospital.

The individuals attending the first site visit meeting were asked to identify and provide contact information for important individuals in each of the three key groups to be interviewed—leadership, RRT members, and RRT end-users. However, because of organizational policies and procedures, except in one organization, direct access to individuals employed in the organization could not be obtained by the researcher. Instead, the designated administrator served as an intermediary to make the initial contact with participants on behalf of the researcher. Arrangements were made to send the study recruitment letter and flyer to this administrator for distribution to key individuals in the organization, along with an email soliciting their participation. The designated administrators also identified meetings where the researcher could be introduced to key individuals in the organization to gain access to appropriate individuals for interviews. For example, meetings of nurse leaders and multidisciplinary committees in all organizations were identified as important, and the date and time of these meetings were obtained. Subsequent site visit dates were set during this initial meeting.

Accompanied by an organizational member, the researcher then posted the study flyer on patient acute care units where nurses and others activated RRT calls for their patients, and on critical care units where staff members responded to RRT calls. Visits to these units allowed the researcher to be introduced to staff members and to answer any study-related questions. Flyers were also posted on organizational bulletin boards identified as relevant by hospital leaders.

Follow-up to first on-site visit. In the one hospital which provided the researcher with the contact information for individuals, an email was sent to these individuals within 7 days of the first on-site visit, along with a copy of the recruitment letter and study flyer. Within a week following the first email solicitation, the researcher emailed those individuals who had not yet responded to the first email solicitation to verify that they had received the recruitment letter and study flyer. Individuals who responded to the email solicitations and indicated their willingness to participate were sent the individual consent form, and an interview was scheduled. Once an

interview date and time were confirmed, a personalized follow-up letter was sent via email with the date, time, and location of the interview.

In the other hospitals, within 7 days after the first on-site visit, the researcher contacted the designated administrator and other relevant persons identified during the first on-site visit to verify that the email solicitation, recruitment letter, and study flyer were received and to remind the administrators to distribute information to relevant group members. If the solicitation had not been sent, their assistance was again requested in sending the email and documents to individuals in the three key groups.

In all the hospitals, only a few individuals responded to the study flyer; thus, the recruitment email was distributed by the designated administrator in each hospital. Seven days after the first email solicitation, the administrator was asked again to send the recruitment letter and study flyer to individuals in the three key groups. Two to three weeks following the first email solicitation, the response rate at each organization remained poor. In collaboration with the research mentor and designated administrator, and following approval of an IRB modification, an additional recruitment email was sent to individuals in each of the three key groups at 4-6 weeks after the initial email solicitation.

Despite these efforts the number of participants scheduled for interviews remained low at all hospitals. However, during the second on-site visit the designated administrators communicated the researcher's presence to nurse leaders and nursing staff through unit team huddles, staff meetings, and emails. Several individuals subsequently contacted the researcher to schedule an interview. Also, through snowball sampling several additional individuals were identified as potential participants. These individuals were all provided a copy of the recruitment letter and consent form and, if they were interested, an interview time was scheduled.

Subsequent on-site visits. Following the first on-site visit, the researcher spent an additional 2 – 8 days on-site in each hospital to attend meetings and to conduct individual

interviews. Whenever possible, site visits were scheduled on consecutive days to increase the continuity of data collection within the organization. During these visits, the researcher was provided with hard copies of organizational documents related to the RRT program at each hospital (including RRT policies and procedures and RRT standard order sets).

At 1 - 7 days prior to site visits, all individuals scheduled to participate in interviews were emailed to verify that they had received the recruitment letter and consent and were willing to participate in the study; confirm the date, time, and location of the interviews; and answer questions. To protect the identity of participants, prior to the on-site interview, the researcher assigned a 3-digit code to prospective participants to indicate the hospital, the group, and the prospective participant. This code was used to identify all data gathered from each individual during and subsequent to data collection.

At the start of each interview, participants were welcomed and they were asked to verify that they had received and read the informed consent information and agreed to participate in the study interview. If they had not reviewed the consent form prior to the interview, they were given an opportunity to review the form and ask questions before the interview began. Participants thus had an opportunity to agree or decline to participate in the interview prior to and at the time of the interview. Participants were also told that they had the right to withdraw from participation at any time during the interview and they could refrain from answering any particular questions they did not wish to answer during the interview. Individuals were informed that their participation was voluntary and the researcher would keep their names and identities confidential.

The researcher reviewed with the participant the purpose of the study, the focus of the questions to be asked, the amount of time needed to complete the interview, and the proposed use of the study results. Participants' permission was obtained to digitally record the interview for later transcription to ensure that all comments were captured.

After the interview process was discussed, a semi-structured interview guide (SSIG) (see Appendix D) was used to guide questions and record answers. This guide allowed the researcher to follow a set of common questions prepared in advance of the interview, but remain flexible to pursue new ideas raised by participants as they shared their thoughts and experiences on the topics covered (Polit & Beck, 2004). The SSIG started with broad questions, followed by questions focusing on the factors, contexts and processes that facilitated or inhibited sustainability. The SSIG concluded with questions that gave participants an opportunity to provide additional information they considered important to the study. The interview guide ended with a final thank-you statement, and also contained space for documenting field notes taken during the interviews. The SSIG also included questions asking participants to rank the five factors in the PMOS in order of importance.

Participants were also asked two questions related to RRT sustainability. These were: "How confident are you that RRTs will still be active in 5 years?" which was scored on a 3-point Likert score (Not at all, somewhat, and very); and "In your opinion, to what extent do RRTs meet the needs of patients" which was scored on a 4-point Likert score (Not at all, somewhat, moderately, and fully). These questions were asked as a measure of sustainability and to compare the results of these questions with the sustainability score that were reported in Phase One for each hospital. A two-sample t-test assuming equal variances using a pooled estimate of the variance was performed to test the hypothesis that the resulting mean score of (a) RRTs still being active in 5 years and (b) meeting the needs of patients for the high- and low-sustainability groups will be different. It was expected that the high-sustainability hospitals would have a higher mean score than the low-sustainability hospitals as this would have reflected the sustainability scores reported in Phase One for these hospitals.

At the conclusion of the interviews, the researcher asked participants for permission to contact them later if needed to clarify their comments during the transcription and data analysis process. Having their contact information also facilitated "member checking"—providing

feedback to participants on the researcher's interpretation of the data—to enhance the credibility of the study. Participants were also asked for referrals to other prospective study participants

Immediately following the interview, the researcher recorded preliminary thoughts, ideas, comments, and questions in the field notes section of the semi-structured interview guide. This helped the researcher to identify aspects of the interview that might need further clarification and follow-up with the participant. Field notes were also maintained to allow for reflection and "bracketing" and to identify potential researcher biases that could have threatened the credibility of the findings.

Member checking was conducted once the data were analyzed and preliminary conclusions drawn. At each hospital, a participant who was very much involved with the RRT adoption and implementation process and/or was overseeing the RRT program was contacted and asked to verify the researcher's interpretation of the data.

Data management and analysis. Several steps were used to manage and safeguard the data collected during Phase Two of the study. A high-quality digital recorder was used to record individual interviews. A second digital recorder was used as a backup measure to prevent the loss of data. Interview data were downloaded to a password-protected computer in the researcher's home following each site visit and were also saved on a secure server through online backup by Carbonite™. Handwritten notes were stored in a locked fireproof safe. Participants' names and assigned codes were stored separately from the hard copies of the data, also in a locked fireproof safe in the researcher's home.

Interview data were transcribed by professional, reputable transcription service companies that ensured data protection. Because of time constraints and the inaccuracy of some transcribed documents by transcription companies, a total of three transcription companies were used. The method for confidentially transferring raw and transcribed data between the researcher and the transcription services was negotiated with the transcription company, and included cloud-based

networking, email, or file transfer protocol (FTP) upload. Sensitive or confidential data were encrypted for data transmittal. Transcription service employees were either Health Insurance Portability and Accountability Act trained or had signed non-disclosure agreements.

Transcribed interviews were reviewed for accuracy by listening to the audio file while reading the interview transcript. When corrections were made, the accurately transcribed interviews were uploaded into the qualitative data analysis software, Atlas ti. To assist the researcher with data management, a data management tracking sheet (Appendix E) was developed (Bloomberg & Volpe, 2008).

Data analysis. Miles and Huberman's (1994) steps in data analysis (i.e., data reduction, data display, and conclusion drawing or verification) were used to guide the data analysis. The first step in the data analysis was data reduction, a process that simplifies and makes data more manageable prior to analysis (Miles & Huberman, 1994). By systematically reading through each transcript as data were collected, the researcher identified data relevant to the research questions and conceptual framework. This step also helped to identify needed adjustments in subsequent data collection efforts to ensure that data to answer the research questions were captured (Auerbach & Silverstein, 2003; Grbich, 2007; Miles & Huberman, 1994).

Data reduction was completed case by case. Once each case's data were reduced, content analysis began (Grbich, 2007). This process to systematically code and categorize the data was facilitated through the use of the Atlas ti. software program. Content analysis allowed the researcher to "hear what was said" in the data, to assign "labels of meaning" to sections of the data and to further reduce data. A provisional list of codes was developed prior to fieldwork based on the study's conceptual framework and research questions (Miles & Huberman, 1994; Sandelowski, 1995).

Three levels of coding (see Figure 3) were used during the content analysis to analyze the data collected through interviews, document review, and field notes.

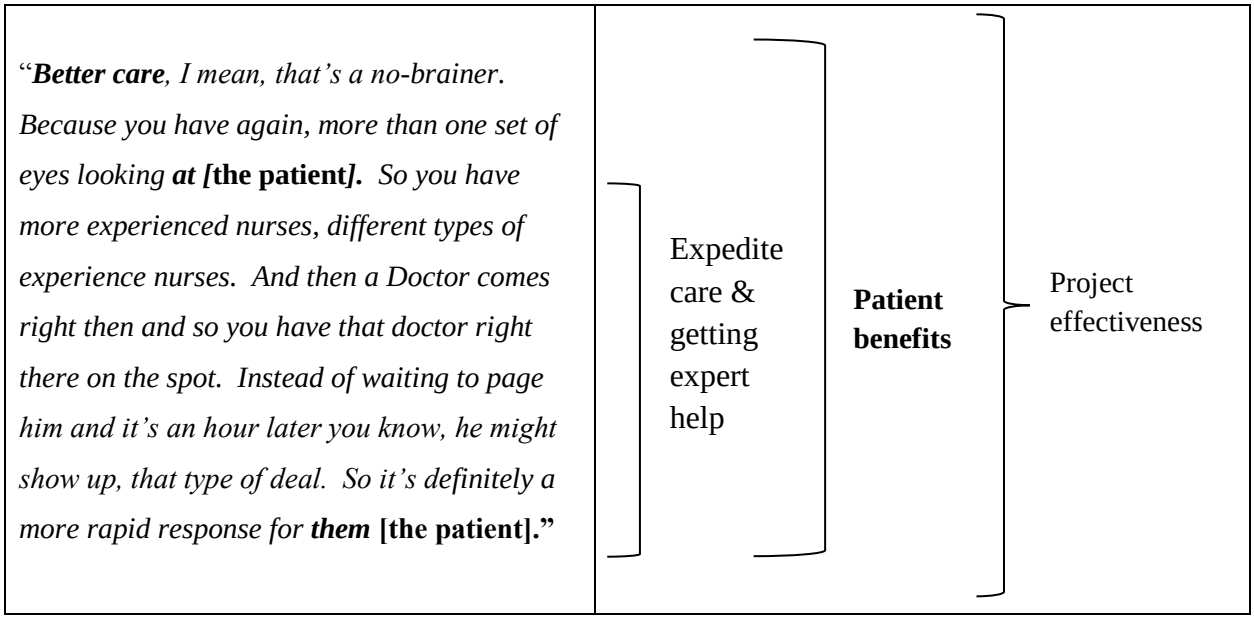

Figure 3. Illustration of three-level coding of participant comments.

First-level coding was used to summarize segments of the data based on the study's conceptual framework and research questions (i.e., project effectiveness). Descriptive codes were assigned to the data segments during second-level coding to capture what the researcher was learning from the data (i.e., patient benefits). Third-level, or pattern coding, was used to group second-level coded summaries into a smaller set of categories and themes (i.e., expedite care and getting expert help). Pattern coding is particularly helpful in multiple-case studies because it helps to prepare data for cross-case analysis (Miles & Huberman, 1994). During the data coding process, the researcher collaborated closely with faculty advisors and a qualitative research expert at The Odum Institute. Once all interviews, field notes, and documents were analyzed, the data display process was initiated.

Data display techniques allowed study data to be presented in an organized, compressed way and enabled the researcher to draw conclusions and verify information (Miles & Huberman, 1994). Using the analysis function in Atlas ti., data were displayed in tabular format for all four

hospitals. This enabled cross-case analysis by allowing the researcher to record and visually display the sustainability factors identified during content analysis and then to establish whether factors proposed in the conceptual framework were present. This analysis process also helped to identify new factors, as well as the contexts and processes that facilitated RRT sustainability.

Within each case, data obtained through various methods and sources were compared (Miles & Huberman 1994; Polit & Beck, 2004), then examined to identify and confirm RRT sustainability factors in each hospital. A factor was considered a sustainability factor if the factor was identified in at least two of the three interview groups (leadership, RRT members, and RRT users) in each case. If a factor was not identified by more than one data source, it was not considered an RRT sustainability factor. Once the data display of each hospital was complete, the next step, drawing conclusions and verifications, was undertaken.

The last step in the analysis process involved drawing conclusions from the data and verifying the data. Verification of findings was possible because four case studies were conducted, which allowed for the cross-case comparison of the two high sustainability scoring hospitals and the two low sustainability scoring hospitals.

Cross-case analysis was used to identify factors, contexts and processes that might have facilitated RRT sustainability in high sustainability scoring hospitals or prevented it in low scoring hospitals. In the high RRT sustainability hospitals, cross-case analysis allowed the researcher to determine whether emerging patterns and themes could be replicated or matched. In some instances, findings from the second highest scoring RRT sustainability hospital were used to verify the findings uncovered in the first hospital when factors were similar; in other instances, new information uncovered in the second highest scoring RRT sustainability hospital was used to identify the absence of a particular occurrence in the first hospital.

Once this process was completed, the same process was used to conduct cross-case analyses of the low RRT sustainability scoring hospitals and to draw conclusions about these hospitals. Again, the second highest scoring low sustainability hospital enabled the verification

of patterns in the highest-scoring hospital in the low RRT sustainability quartile, and examination of phenomena not found in the highest-scoring low RRT sustainability hospital.

Using pattern-matching logic (i.e., looking for patterns in the data based on the patterns expected by the study's conceptual framework), each hospital was examined to determine how findings addressed the research questions (Yin, 2009). When sustainability factors identified during the data analysis process did not match the conceptual framework, alternative explanations were sought, and the conceptual framework was modified to represent the findings uncovered in the data. This strategy helped to focus attention on certain data, organize cases, and identify alternative explanations (Yin, 2009).

After the cross-case analysis of (the high- and low-scoring RRT sustainability) hospitals was completed, the same process was used to compare the results of the two groups of hospitals with each other. The researcher sought to determine whether similar patterns were found in both groups, with regard to sustainability factors, and the contexts and processes that pertained to RRT sustainability.

To answer the two questions related to sustainability, interview data were transferred into an Excel spreadsheet and uploaded into SPSS (version 21). Descriptive statistics were obtained and a two-sample t-test assuming equal variances using a pooled estimate of the variance was performed.

Protection of Human Subjects

Institutional review board approval was obtained before data collection activities, and specific steps were taken to protect human subjects during each phase of the study. Informed consent was obtained from all who participated in the study. In Phase One, the electronic survey included a "statement of consent", and consent was assumed in all instances in which a survey was completed. In Phase Two, CNOs at all four hospitals gave approval for their organization to participate in Phase Two of the study. An informed consent form was also given to each participant, and consent obtained prior to interviews. For each person who was to be interviewed,

informed consent information was emailed or delivered in person. The researcher explained the study in the informed consent letter as well as at the beginning of all interviews, to prevent any misunderstanding (Silverman, 2006). It was emphasized that participation was voluntary.

Several steps were taken to protect the identity of participants. The Phase One survey was administered using the Qualtrics software program, which maintained data behind a firewall where data could be accessed only by the owner of the survey with a password and user ID. All hard copies of the survey returned to the researcher were also entered into this electronic database upon receipt.

In Phase One, participants who completed the survey were not required to indicate their names or give contact information unless they were willing to participate in the second phase of the research study. Even though many hospitals provided contact information in Phase One, the information used was only to contact those hospitals selected for inclusion in the second phase of the study. When survey participants indicated interest in participating in the second phase of the study and provided their names and contact information, the information was removed from the electronic data set after the on-line survey was closed and the data had been exported. Participants' names, their contact information, and the pseudonym of the hospital they represented were stored separately from the data set, to ensure that the right persons were contacted when a hospital was selected for inclusion in the second phase of the study.

All data collected in the survey were de-identified. Hospital names were replaced with pseudonyms, which were assigned to each hospital for which a response was received (each hospital was assigned the name of a color). Groups within hospitals were assigned the hospital's pseudonym plus the number 1 for the leadership group (e.g., Blue 1), the number 2 for the RRT member group (e.g., Blue 2), and the number 3 for RRT users (e.g., Blue 3). Individuals within groups were assigned their hospital's pseudonym, their group within the hospital's code, and a letter of the alphabet (e.g., Blue 1.A). Documents that were reviewed and hard copies of the survey that were returned to the researcher were also de-identified and the hospital's pseudonym

used. A linkage file with the assigned pseudonym for each hospital, the code number for each group within the hospitals, and each individual within hospital groups was kept separate from the dataset, and from any identifying information contained in interview notes, on a password protected computer at the researcher's home office. The linkage file will be destroyed once the researcher's interpretations of the data have been verified by participants and the findings of the study have been compiled, but no longer than 12 months after the interviews were conducted.

Hard copies of all study data and documents were also kept in a locked file cabinet at the researcher's home office. Electronic data were on a password-protected computer in a secure location in the researcher's office and were also protected through the on-line backup services of Carbonite ™. Carbonite ™ encrypts files before they are transmitted over a secure socket layer (SSL) connection for storage at Carbonite ™ data centers. Files remain encrypted at these data centers, and security and protective measures are in place to safeguard data (http://www.carbonite.com/en/v2/online-backup/safe-and-secure). Access to the files required entering a password which was known only to the researcher. Electronic interviews that were transcribed were encrypted when files were transmitted via email communication. Transcribed interview files were also made available to the researcher via FTP upload and Cloud based networking, both of which required a username and password.

Digital recordings were erased from the recorder as soon as they were downloaded to the researcher's password-protected computer. Original notes and hard copies of documents were stored in a secure fireproof cabinet at the researcher's home. All field notes were de-identified and coded to ensure that hospitals, groups, and individual participants could not be deductively identified. All relevant text files, documents, and analytic files were password protected. Access to and sharing of electronic copies of notes and transcripts were limited to the investigator and faculty advisor.

Issues of Trustworthiness

Trustworthiness in qualitative research is measured by how credible, dependable, and transferable the study findings are (Bloomberg & Volpe, 2008; Polit & Beck, 2004). Credibility in this study was enhanced through researcher reflection and "bracketing" when writing field notes after interviews and hospital visits, and through "peer debriefing" sessions held during the study with the researcher's doctoral committee to help the researcher be aware of personal biases (Shenton, 2004). "Member checking", i.e., providing feedback to participants on the researcher's interpretations of the data and obtaining their input, was done with participants at all sites to further enhance the credibility of the findings (Roberts et al., 2006; Shenton, 2004). Through data triangulation (i.e., the use of multiple data sources) the researcher was able to verify her interpretation of data (Polit & Beck, 2004; Yin, 2009). Triangulation occurred through comparison of data collected from different groups of participants (leaders, RRT users, and RRT members) and through cross-case analysis of the four cases.

Several mechanisms were used to establish dependability, i.e., the reliability of the study and the ability to track the processes and procedures used (Bloomberg & Volpe, 2008). First, an audit trail (Roberts et al., 2006) was established by keeping detailed notes of the decisions made throughout the research process. Second, a case study database (Yin, 2009) was developed by uploading all electronic files related to the study into the software program Atlas ti. Hard copies of documents that could not be uploaded to Atlas ti were stored in a secure location. This case study database will allow other researchers to further examine the data in future. Third, transcripts were reviewed to ensure that no mistakes were made during transcription, and a shift in the meaning of codes during the analysis was prevented by regularly checking the data against the codes (Creswell, 2009). Finally, rich description of the details of each case study will allow others to determine whether the study's findings are transferable to their organizations.

Methodological Limitations

This study shed some light on what is necessary for RRT sustainability and an RRT Institutionalization Scale and Model of RRT sustainability were developed which can be tested or further developed in future studies. Some limitations should, however, be recognized.

Advantages of the use of self-administered web-based surveys include the low cost of administration and the speed and accuracy of data collection (Fleming & Bowden, 2009). Disadvantages, however, include non-response bias and the inability of the researcher to discern whether all respondents completed the survey or if a single responder completed multiple surveys using different computers (Fleming & Bowden, 2009; Lewis-Beck, Bryman, & Liao, 2007). Non-response bias occurs when respondents in the sample are different in attitudes or characteristics from those who do not respond to the survey, or when all participants do not have access to computers or the technical ability to complete the web-based survey. In this study, all hospitals in the NCHA had implemented computer technologies, and administrators were specifically targeted to complete the survey. It is also highly likely that prospective participants would have access to computers, valid email addresses and thus knowledgeable in the use of computers. By tracking the IP addresses of respondents, the researcher was able to discern that only one computer was used by each respondent who completed the web-based survey. While random selection of hospitals and a larger sample size may have further reduced the risk of non-response bias, this study does offer leaders, in those hospitals that have participated in the NC-RRTC, the opportunity to use the findings of this study to enhance RRT sustainability in their organizations.

In Phase One, an instrument to measure sustainability that was relevant to this study was not available. So, the RRT-IS was developed. Content validity, clarity and interpretability were established by an expert panel with in-depth knowledge and understanding of organizations and RRTs. Given that a Cronbach alpha of .70 is desired for scales that are not new, the reliability testing of the instrument revealed lower than desired Cronbach alphas for the subscales.

However, due to the limited sample size, power may not have been reached and the data for purpose of analysis may have been insufficient. Another limitation is the use of only one method to measure sustainability and that only one administrator completed the survey. The use of a second measure to determine the level of sustainability in hospitals and having more than one person completed the survey would have strengthened the findings of the study. However, to further explicate sustainability, the researcher included questions related to sustainability in the second phase of the study. It was therefore possible to compare the sustainability results of the four hospitals included in Phase Two with their sustainability scores reported in Phase One and helped to address the reliability of the sustainability scores derived from the RRT-IS.

Some additional limitations are specific to Phase Two of the study and are important to discuss. Case studies offer researchers the opportunity to answer questions such as "why" and "how" (Jacelon & Dell, 2005; Yin, 2009). However, because of the small sample size of case studies, and qualitative studies in general, some limitations are inherent to both. The generalizability of the study findings to other hospitals and settings is limited. However, the case study approach enables the researcher to offer a rich description of each case and setting that others may be able to use as they consider the implementation of RRTs in their organization or as they design future studies. Given that little is known about sustainability in hospitals, or how and why these related factors work, selecting only four cases was appropriate because it facilitated a more in-depth examination of the factors specific to RRTs than might have been possible otherwise.

Other Phase Two limitations include the use of in-person interviews and having only one person to collect and code the data. In-person interviews allows for in-depth questioning and the clarification of responses during data collection (Polit & Beck, 2004). However, interviewer bias is a concern because of the possibility that the interviewer's tone of voice and body language may influence respondents' answers and that the interviewer may distort the study's findings (Polit & Beck, 2004). Steps taken to reduce interviewer bias included: (a) using a semi-structured

interview guide, (b) keeping a neutral, professional tone in voice and behavior during questioning, and (c) using a digital recorder to capture participants' exact words. Through reflection and bracketing, attempts were made by the researcher to remain cognizant of potential biases. Trustworthiness of data was also enhanced through close collaboration with faculty advisors and qualitative experts at The Odum Institute to ensure adherence to the research methods.

Response bias is a limitation that is applicable to both Phase One and Phase Two. Response bias—the tendency for respondents to provide answers to questions that may be perceived favorably by the interviewer—is a common limitation of survey research and in-person interviews (Polit & Beck, 2004; Lewis-Beck, Bryman, & Liao, 2007). In Phase One, efforts to reduce the risk of response bias included ensuring participants of the confidentiality of their responses and carefully wording the survey questions to avoid leading respondents to answer in particular ways (Polit & Beck, 2004; Lewis-Beck, Bryman, & Liao, 2007). In Phase Two, interviews were conducted in a conference room where participants could safely share their thoughts and feelings, and redundancy was built into the semi-structured interview guide (Rubin & Rubin, 2005) by asking the same questions to persons in different roles in the organization to allow for a comparison of responses to these questions between groups.

Summary

This chapter provides a detailed description of both phases of the study. In Phase One, a web-based survey was developed, pilot tested, and administered to gather descriptive data on hospitals and their RRTs and to determine a sustainability score for each hospital in the sample. Based on the findings in this phase, four cases were selected for in-depth analysis in Phase Two: two hospitals that had high levels of RRT sustainability and two hospitals that had low levels of RRT sustainability. Data collection methods included the administration of a Hospital RRT Questionnaire to gather demographic information about the hospitals and their RRTs. Then,

during on-site visits to each hospital, in-person interviews (or phone interviews when necessary) were conducted, and relevant documents were reviewed to gather more detailed information about the sustainability of the RRT innovation.

Data were analyzed using cross-case analysis, based on the study's conceptual framework and research questions to identify patterns and themes. Miles and Huberman's (1994) steps in data analysis (data reduction, data display, and conclusion drawing or verification) were used to guide the data analysis process. Various methods were used to protect human subjects and to enhance the study's trustworthiness during data collection and analysis. The results of Phases One and Two are presented in the next two chapters.

ENDNOTES

[1]Katz and Kahn (1978) identified one additional subsystem, the adaptive subsystem, which focuses on activities related to monitoring relevant changes in the environment and modifying organizational structures and processes to fit with external demands. However, Goodman et al. (1993) incorporated only the production, maintenance, supportive, and managerial subsystems based on their previous work , which formed the basis of the Level of Institutionalization Matrix, and was used to develop the RRT-IS and corresponding survey items.

CHAPTER 4

RESULTS: PHASE ONE

In Phase One, a survey was administered to North Carolina hospital administrators to determine the level of rapid response team (RRT) sustainability they had achieved. All the hospitals that participated in the North Carolina Rapid Response Team Collaborative (NC-RRTC) were asked to complete the self-report survey. Screening questions were first asked to ensure that those who completed the survey were the targeted groups. The screening questions were followed by questions to gather information on organizational characteristics, RRT characteristics, and RRT-related outcomes; then participants completed the RRT Institutionalization Scale (RRT-IS) from which the researcher derived a sustainability score for each hospital. This chapter begins with a description of the sample, followed by a presentation of organizational and RRT characteristics, and RRT outcomes. The chapter concludes with a description of RRT sustainability.

Sample Characteristics

Fifty six hospitals (N=56) were invited to participate in the survey, and 33 participated: 32 surveys were completed on-line and 1survey was returned as a paper copy by mail. Two hospitals were excluded from the analysis, one was excluded because, except for organizational characteristics, no questions were answered; the other indicated that the hospital did not have an RRT. Therefore, the final sample of hospitals in Phase One was 31. The overall survey response rate was 58 %.

Those completing the survey were asked if they were hospital administrators or were assigned to complete the survey by a hospital administrator. Twenty-seven hospital

administrators completed the survey, and 4 were completed by others assigned by an administrator. Six Chief Nurse Officers (CNOs) and two Chief Operations Officers completed the survey. Various others (i.e., director, nurse manager, patient safety officer, or quality expert) completed the remaining twenty-three surveys.

Organizational Characteristics

Organizations that participated in the study included academic health centers (AHC), community hospitals (CHs), corporate health systems (CHS) and a critical access hospital (CAH) (see Table 4). Hospital size varied from 24 to 870 (average of 295) licensed and staffed beds. Only limited descriptive details on hospital size are provided to protect the identity of both the small and large hospitals that participated in the survey.

Table 4

Organizational Characteristics

Type	N	%
Academic Health Center	6	19
Community Hospital	22	71
Corporate Health System	2	6
Critical Access Hospital	1	3
Size		
≤ 150	16	52
151-300	4	13
301-500	4	13
501 – 750	2	6
≥ 751	5	16

RRT Characteristics

The survey included questions on the characteristics of RRTs as well as the outcomes (actual and perceived) associated with these teams. The number of RRTs varied, and the size (i.e., number of staff members) of the RRT also varied from one to five persons, in different organizations (see Table 5). In all 31 hospitals RRTs could be activated by registered nurses; in

30 hospitals (99%) other hospital staff members could also activate RRTs; in 19 hospitals (62%) families could activate RRTs; and in 17 hospitals (55%) patients could activate RRTs.

Table 5

Number of Teams and Persons on Team

	N	%
Number of teams		
1	26	84
2	2	6
3-5	3	10
Persons on team		
1 – 3	19	61
4-5	10	32
Unspecified	2	6

All hospitals provided 24/7 RRT coverage. Twenty hospitals (65%) had nurse-led teams, 3 (10%) had physician-led teams, and 3 (10%) had teams that were co-led by a nurse and a physician. Five hospitals (16%) did not specify the leadership of their RRTs. Nineteen hospitals (61.3%) reported the presence of an RRT oversight committee, and 12 hospitals (39%) reported not having an RRT oversight committee.

The composition of RRTs (see Table 6) also differed in different hospitals. However, Intensive Care Unit (ICU) registered nurses (RN) and respiratory therapists (RTs) were most often part of the team. Nine hospitals (29%) included a hospitalist as part of the team and 6 (19%) reported the presence of a dedicated RRT nurse.

Hospitals reported engaging in several RRT follow-up activities. Some hospitals conducted debriefing sessions following RRT calls, and reassessed patients within 24 hours following an RRT calls. Some hospital staff (i.e., nurses and other staff members who were involved with an RRT call) evaluated the RRT, shared RRT outcomes data with the nursing staff,

and provided RRT members with performance feedback. Eighteen hospitals (58%) reported the presence of an RRT oversight committee (see Table 6).

Table 6

RRT Composition, Follow-up, and Oversight

	N	%
RRT composition		
ICU/ ED Physician	2	6
ICU RN/ ED RN	29	94
Hospitalist	9	29
Respiratory Therapist	27	87
Nursing House Supervisor/ Clinical Coordinator	13	42
Dedicated RRT nurse who also rounds on patients on units	6	19
RRT nurse (not necessarily an ICU nurse)	1	3
Unspecified	1	3
RRT follow-up activities		
RRT debriefing sessions	10	32
Patients reassessed within 24 hours	13	42
Staff evaluates RRT	19	61
RRT outcomes are shared	21	68
RRT member performance feedback	18	58
RRT oversight committee	19	61

Note. ICU = intensive care unit; ED = emergency department; RN = registered nurse.

RRT Outcomes

The RRT-IS survey included questions on outcomes associated with RRTs as well as respondents' perception of how patient outcomes had changed since RRTs made the transition from a pilot program to permanent status in the organization. To allow for consistent data reporting, participants were asked to report RRT outcomes for 1 year prior to the survey date (October 2010 to October 2011), and to report the number of RRT calls in the month prior to the survey date (October 2011).

Unfortunately, outcomes were not reported by a large number of hospitals. Furthermore, because of inconsistency in the ways in which hospital administrators reported RRT outcomes, it

is difficult to compare acute care inpatient mortality rates, codes per 1000 discharges, and the percentage of codes outside of ICU. For example, RRT outcomes were reported as a percentage value, as a numerical value, or as an increase or decrease. However, 17 hospitals reported the number of RRT calls in the year prior to the survey was reported. In Table 7, the number of RRT calls per bed is reported by hospital size and type.

Table 7

RRT Calls by Hospital Size and Type

	RRT calls/bed
Hospital Size	
0-100	0.304
101-250	0.625
251-500	2.144
501-750	3.10
≥ 751	1.38
Hospital Type	
Academic Health Center	1.23
Community Hospital	0.98
Corporate Health System	3.34
Critical Access Hospital	0.42

The RRT-IS survey also included questions about administrators' perceptions of the benefits of RRTs. Table 8 reflects their reports of perceived benefits in acute care inpatient mortality rate, unplanned ICU transfers, codes outside of the ICU, codes per 1000 discharges, and total number of RRT calls in the year prior to the survey. Several hospital administrators did not report their perceptions of changes in patient outcomes. Because of the inconsistent way actual outcomes were reported in the survey by administrators, these reports of perceived changes cannot be verified with actual data. Therefore, the data in Table 8 should be cautiously interpreted.

Table 8

Perceived Changes in Outcomes Following RRT Implementation

	Increased	Decreased	No Change	Not Reported
	N (%)	N (%)	N (%)	N (%)
Acute Care Inpatient mortality rate	0 (0)	20 (65)	3 (10)	8 (26)
Unplanned intensive care unit transfers	5 (16)	15 (48)	2 (6)	9 (29)
Codes outside of the intensive care unit	0 (0)	23 (74)	1 (3)	7 (23)
Codes per 1000 discharges	0 (0)	17 (55)	5 (16)	9 (29)
Total number of RRT calls	20 (65)	3 (10)	1 (3)	7 (23)

Decreases following RRT implementation in the acute care inpatient mortality rate, unplanned ICU transfers, codes outside of the ICU, and codes per 1000 discharges are in alignment with the goals of RRT implementation. Also, as RRTs become more integrated within hospitals, one would expect to see an increase in RRT calls, as reported by 20 hospitals (65%). Three hospitals (10%), however, reported a decrease in RRT calls, and some hospitals reported no changes in acute care inpatient mortality rates, unplanned ICU transfers, codes outside of the intensive care unit, and codes per 1000 discharges since RRTs were implemented (see Table 5).

RRT Sustainability

The last set of questions in the RRT-IS survey addressed the level of RRT sustainability achieved by hospitals in North Carolina. The RRT Institutionalization Scale (RRT-IS), based on the Level of Institutionalization Scale (LoIn) developed by Goodman, McLeroy, Steckler, & Hoyle (1993), was used to calculate RRT sustainability. The RRT-IS reflects the degree of institutionalization (i.e., passages, routines, and niche saturation) across all subsystems (production, maintenance, supportive, and managerial).

First a sustainability score was calculated for each hospital, and then hospitals were ranked from lowest to highest sustainability scores and grouped into quartiles. The sustainability scores of all the hospitals in the study ranged from a minimum of 1.0 to a maximum of 5.19 (see

Table 9). The mean sustainability score was 3.71 with 13 hospitals achieving lower scores than the mean and 17 hospitals achieving scores higher than the mean. The mean sustainability score was 2.32 for hospitals in the first quartile, 3.46 for hospitals in the second quartile, 4.19 for hospitals in the third quartile and 4.76 for hospitals in the fourth quartile. The theoretical minimum and maximum scores were 1.0 and 7.0 respectively.

Table 9

Sustainability Scores by Quartile

Quartile	Sustainability Score[a]
	M (Range)
1 (n = 7)	2.32 (1.00 – 2.94)
2 (n = 8)	3.46 (2.97 – 3.94)
3 (n = 7)	4.19 (3.98 – 4.52)
4 (n = 8)	4.76 (4.55 – 5.19)

Note. a = mean of the sum of mean scores.

Organizational Demographics and Sustainability Scores

Within each quartile, hospitals varied in size. Quartile 1 included small (< 300 beds) and large hospitals (> 500 beds), quartile 2 and quartile 3 included small, mid-size (300- 500 beds), and large hospitals, and quartile 4 included small and large size hospitals (see Table 10). Academic Health Centers (AHCs) were present in the first, third, and fourth quartiles. However, 50% of AHCs (n=3) were in the third quartile. Community hospitals were spread across the four quartiles but 32% (n=7) of these hospitals were in the second quartile. One CHS participated in the survey and ranked in the highest quartile. One CAH also participated in the study and ranked in the second quartile (see Table 10). The largest percentage (35%) of small hospitals was found in the second quartile, the largest percentage of mid-size hospitals (75%) was in the third quartile, and the largest percentage of large hospitals (57%) was in the fourth quartile. There were no significant correlations between sustainability score and hospital size or hospital type.

Table 10

Hospital Size and Type by Quartile

	Quartile			
	1	2	3	4
	N	N	N	N
Hospital size				
Small (<300 beds)	6	7	3	4
Mid-size (301-500 beds)	0	1	3	0
Large (> 500 beds)	1	0	2	4
Hospital type				
Academic Health Center	1	0	3	2
Community Hospital	6	7	5	4
Corporate Health System	0	0	0	1
Critical Access Hospital	0	1	0	0

Note. Number of hospitals in quartile reported. a = mean of the sum of mean scores.

Sustainability across Subsystems and across Passages, Routines, and Niche saturation

The RRT-IS addresses the three aspects of institutionalization: passages, routines, and niche saturation as each of these pertains to a particular subsystem: production, maintenance, supportive, and managerial. The more RRT-related passages, routines, and niche saturation occur in any given subsystem, the more fully integrated into that subsystem the RRT is expected to become; the more RRT-related passages, routines, and niche saturation occur across subsystems, the more extensively the RRT is expected to become integrated throughout the subsystems.

Table 11 presents, by quartile, the overall scores on RRT sustainability in the various subsystems. Hospital administrators scored the managerial subsystem highest (5.52), indicating that the highest level of RRT integration was achieved in this subsystem. The production subsystem scored 3.29 and the maintenance subsystem 2.92. The lowest score was achieved in the supportive subsystem (2.76) indicating that the lowest level of RRT integration had occurred in that subsystem.

RRT integration in the managerial subsystem was made possible by the hospitals' engagement in activities related to RRT monitoring, evaluation, and oversight. The low score for the supportive subsystem suggests that hospital administrators may not have assigned the necessary FTEs and dedicated funds in their annual budget to foster RRT integration in the supportive subsystem. The mid-range scores reported for the production and maintenance subsystems indicated that hospitals had taken some steps to put RRT procedures in place, to formalize the role of RRT members, and to provide education to RRT members and RRT end-users. However, RRT integration had not yet fully occurred in these subsystems.

Table 11

Quartile Mean Scores by Subsystem

	Quartile				
	1	2	3	4	*M*
Subsystem		*M(Range)*			
Production	2.43 (1.0 – 4)	3.46 (3.0 – 4.0)	3.71 (3.0 – 4.0)	3.58 (2.0 – 4.0)	3.29
Maintenance	1.83 (1.0 – 2.39)	2.92 (2.22 – 4.22)	3.33 (2.67 – 4.28)	3.62 (3.06 – 4.89)	2.92
Supportive	1.97 (1.0 – 2.8)	2.33 (2 – 2.8)	2.80 (2.6 – 3.0)	3.95 (2.6 – 6.4)	2.76
Managerial	2.86 (1.0 – 5)	4.71 (3.03 - 5.8)	6.72 (4.9 – 8.5)	7.79 (5.75 – 9.28)	5.52
M	2.27	3.35	4.14	4.74	

Note. Mean of the sum of mean scores.

Table 12 presents hospital administrators' reports of the achievement of passages in the four subsystems. Hospitals either had or had not achieved integration (passage) of the RRT in these various subsystems. The highest percentage of passage achievement (94%) was reported for formalization of RRT member roles and RRT program monitoring and evaluation. The

lowest percentage of passage achievement (19%) was of permanently dedicated funds for the RRT program in a hospital's annual budget.

Table 12

Passages Achieved by Subsystem

		N (%)	
Subsystem	Passage (Integration)[a]	Yes	No
Production	In your view, has the RRT program in your hospital made the transition from pilot status to permanent status?	28 (90)	3 (10)
Maintenance	Has your organization formalized the role of RRT members through the development of written, clearly delineated job/role descriptions or organizational policies and procedures?	29(94)	2 (6)
	Does your hospital provide formal, specific, and ongoing education for staff who serve as members of the RRT?	21 (68)	10(32)
	Does your hospital provide formal, specific, and ongoing education related to the RRT program for all hospital staff members?	24(77)	7 (23)
Supportive	Have full-time equivalent (FTEs) been assigned to the RRT program?	25 (81)	6 (19)
	Have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	6 (19)	25 (81)
Managerial	Do you monitor/evaluate the RRT program offered at your hospital?	29 (94)	2 (6)
	Has a supervisor formally been assigned to the RRT program?	18 (58)	13 (42)

Note. a = passage questions in the RRT-IS.

The second level of RRT integration is the establishment of routines for RRTs in various subsystems. Routines were scored on a 4-point Likert scale (1 = no passage, 2 = passage + one year of a routine, 3 = two to three years of a routine, and 4 = four or more years of a routine). Table 13 presents hospital administrators' reports of the achievement of RRT program routines. Twenty-four hospitals (77.4%) reported that RRTs had achieved permanent status and have been monitored and/or evaluated for 4 years or more. However, only four hospitals (12.9%) reported

that permanently dedicated funds had been assigned to the RRT program in the hospital's annual budget for 4 years or more, and only five hospitals (16.1%) indicated that FTEs had been assigned to the RRT program for 4 years or more.

Table 13

Routines Achieved by Subsystem

Subsystem	Routine (Continuation)	N (%) Likert			
		1	2	3	4
Production	How many years would you say the RRT program has been considered permanent status in your organization?	3 (9.7)	0 (0.0)	4 (12.9)	24 (77.4)
Maintenance	For how many years has education and training been provided for staff who serve as members of the RRT?	10 (32.3)	0 (0.0)	3 (9.7)	18 (58.1)
	For how many years has education related to the RRT program been provided to all hospital staff members?	7 (22.6)	2 (6.5)	3 (9.7)	19 (61.3)
	For how many years have RRT member' roles, expectations and performances been formalized through written, defined job/role descriptions or organizational policies and procedures?	2 (6.5)	2 (6.5)	4 (12.9)	23 (74.2)
Supportive	For how many years have FTEs been assigned to the RRT program?	23 (74.2)	2 (6.5)	1 (3.2)	5 (16.1)
	For how many years have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	25 (80.6)	2 (6.5)	0 (0.0)	4 (12.9)
Managerial	For how many years has the RRT program been monitored/ evaluated?	2 (6.5)	0 0.0)	5 (16.1)	24 (77.4)
	For how many years has a supervisor formally been assigned to the RRT program?	13 (41.9)	1 (3.2)	2 (6.5)	15 (48.4)

The third level of RRT integration is niche saturation (i.e., penetration). Three niche saturation questions were scored on a 4-point Likert scale and the remaining four questions were multiple choice questions that were not suited to a 4-point Likert scale. Response choices for

these items were checked by participants, and each checked item received a score of 4; a score of 1 was assigned if no response choices were checked. Table 14 presents hospital administrators' reports of the achievement of RRT niche penetration.

Twenty four hospital administrators (77.4%) indicated that RRTs responded to all inpatient and outpatient units, while those at 3 hospitals (9.7%) reported that RRTs responded to only a selected few inpatient units across multiple service lines (such as medicine services, surgical services, or women's services). Ten hospital administrators (32.3%) reported providing formal, specific education for RRT members both yearly and on an ongoing basis, 10 (32.3%) provided education initially when new RRT members joined the team, and 10 (32.3%) provided it on a yearly basis. Only one hospital administrator (3.2%) indicated that education for RRT members was provided on a monthly basis. Seventeen hospital administrators (54.8%) reported providing formal, specific, and ongoing education related to the RRT program to all hospital staff members on a yearly basis.

At two hospitals (6.5%), written, defined job/role descriptions or organizational policies and procedures were developed for all RRT staff members (registered nurses, physicians, respiratory therapist, and others), but at six hospitals (19.4%) written job/role descriptions or organizational policies and procedures were developed only for registered nurses. Twenty-five hospital administrators (80.6%) reported that no funds were specifically allocated to the RRT program in their hospital's annual budget, while in three hospitals (9.7%), funds were allocated for four or more of the following aspects of the RRT program: FTEs of RRT members, purchase of equipment, purchase of supplies for use during RRT calls, data collection and analysis, education of RRT members and staff, and ongoing training for all hospital staff.

At 14 hospitals (45.2%), many aspects of the RRT program were monitored and/or evaluated, including RRT call activations, RRT member performance, RRT team performance, and RRT effectiveness. However, at two hospitals (6.5%), no aspects of the RRT program were monitored or evaluated. Also, at 13 hospitals (41.9%) no supervisor was formally assigned to

oversee the RRT program; however, at 8 hospitals (25.8%), a supervisor was formally assigned to several aspects of the RRT program, namely education and training of RRT members and staff members, purchasing equipment or supplies, monitoring RRT call activations, and evaluating the RRT, including data collection and analysis.

Table 14

Niche Saturation Achieved by Subsystems

Subsystem	Niche Saturation (Penetration)	N (%) Likert			
		1	2	3	4
Production	To what extent has the RRT achieved permanent status in your hospital?	3 (9.7)	0 (0.0)	4 (12.9)	24 (77.4)
Maintenance	How often do you provide formal, specific, and ongoing education for staff who serve as members of the RRT?	10 (32.3)	10 (32.3)	10 (32.3)	1 (3.2)
	How often do you provide formal, specific, and ongoing education related to the RRT program to all hospital staff members?	7 (22.6)	7 (22.6)	17 (54.8)	0 (0.0)
		Number of items selected			
		0	1	2	3	≥4
	For which of the following RRT staff members has your organization developed written, defined job/role descriptions or organizational policies and procedures?	0 (0.0)	6 (19.4)	13 (41.9)	10 (32.3)	2 (6.5)
Supportive	For which of the following aspects of the RRT program are funds specifically allocated in your hospital's annual budget?	25 (80.6)	2 (6.5)	1 (3.2)	0 (0.0)	3 (9.7)
Managerial	Which of the following aspects of the RRT program do you monitor/evaluate?	2 (6.5)	3 (9.7)	7 (22.6)	5 (16.1)	14 (45.2)
	Which of the following aspects of the RRT program does your hospital have a supervisor formally assigned to oversee?	13 (41.9)	1 (3.2)	3 (9.7)	6 (19.4)	8 (25.8)

Summary

This chapter has presented the results of Phase One of the study, including organizational characteristics, RRT characteristics and outcomes of hospitals in the sample. In addition, sustainability scores were presented by hospital size and type and by quartile. RRT sustainability was also reported in organizational subsystems (i.e., production, maintenance, supportive, and managerial) and in regard to passages, routines, and niche saturation. Phase One results were used to select hospitals for inclusion in Phase Two of the study. In the next chapter, the results of Phase Two are described.

CHAPTER 5

RESULTS: PHASE TWO

In Phase Two, a multiple-case study approach was used to gather information on RRT implementation and sustainability from four NC hospitals that participated in Phase One of the study. This phase gathered additional information to complement the data gathered in Phase One and to gain more in-depth understanding of the factors, contexts, and processes facilitating RRT sustainability. Two community hospitals in the highest quartile and two in the lowest quartile were purposefully selected for inclusion in Phase Two. This chapter describes the sample and presents the case study report, which includes a cross-case analysis of the two high-sustainability hospitals, followed by a cross-case analysis of the two low-sustainability hospitals, and a comparison of high-sustainability and low-sustainability hospitals. Finally, discussion of contexts and processes focuses on those aspects of RRT implementation that are thought to facilitate or inhibit sustainability.

To ensure that hospitals and participants could not be identified, hospitals were randomly assigned the names High-1 (hospital with the highest score in the high-sustainability group), High-2 (hospital with the lowest score in the high-sustainability group), Low-1 (hospital with the highest score in the low-sustainability group), and Low-2 (hospital with the lowest score in the low-sustainability group) to enable discussion without revealing site identities; and hospital, RRT, and nurse characteristics and participant information are reported here as a group.

Description of Sample

Descriptive information gathered via the Hospital RRT Questionnaire completed by hospitals that participated in Phase Two was augmented by data gathered during participant interviews and document reviews. Characteristics of the four hospitals that participated in the second phase of the study, including their nursing staff, are reported in Table 15.

Hospitals High-1 and High-2 are the "high" sustainability hospitals, while Hospitals Low-1 and Low-2 are the "low" sustainability hospitals. The four participating hospitals were community hospitals that ranged in size from 100 to 400 beds, with sustainability scores between 2.97 and 4.67, and RRTs in place for 5-6 years. Similarities in RRT implementation processes and characteristics were observed in all the hospitals (see Table 15). Similar implementation processes included funding of the RRT program using only internal resources and collaboration with other hospitals and organizations that had implemented RRTs, or with individuals who were experts on RRTs. All other hospitals except Hospital Low-2 had conducted RRT pilot studies and provided staff members with training prior to launching the RRT program. Also, all hospitals except Hospital Low-1 had expanded their RRT program beyond the initial adult populations, to include such areas as Labor and Delivery and Psychiatry.

All hospitals in the sample had RN-led RRTs, allowed staff members, patients, and family members to activate RRT calls; stipulated RRT calling criteria; documented the number of RRT calls in the hospital each month as well as the outcome of each RRT call (e.g., patient transferred to ICU or patient remained on unit); and provided some RRT program information to patients and family members (see table 15). In all four hospitals, the nurse who requested the RRT (hereafter called RRT end-user) was considered an integral part of the RRT call and was responsible for providing the RRT with information on the patient's condition and any other patient-related information the team might need.

Table 15

Hospital and RRT Program Characteristics

Characteristics	High-1 (High)	High-2 (High)	Low-1 (Low)	Low-2 (Low)
Hospital				
Sustainability Score[a]	4.67	4.55	2.97	2.94
Size[b]	160	258	312	101
Number of direct care RNs	233	428	476	195
Number of years RRT in place	5	6	6	6
External funding	No	No	No	No
Current budgeted internal funding	Yes	Yes	Yes	Yes
Collaboration with other hospitals and organizations	Yes	Yes	Yes	No
Collaboration with individuals outside of the hospital	No	Yes	No	Yes
RRT pilot/duration (months)	Yes/≤ 12	Yes/ ≤ 6	Yes/≤ 3	No
Expansion to specialty areas	Yes	Yes	No	Yes
RRT Program				
RRT model	RN-led	RN-led	RN-led	RN-led
RRT calling criteria stipulated	Yes	Yes	Yes	Yes
RRT order set	Yes	Yes	No	Yes
Number of RRT calls/patient outcomes tracked	Yes	Yes	Yes	Yes
RRT end-user involved in call	Yes	Yes	Yes	Yes
RRT information received by patients	Yes	Yes	Yes	Yes
Staff training provided prior to RRT launch	Yes	Yes	Yes	No
Annual staff training	Yes	Yes	Yes	Yes

Note. RN = registered nurse; DNT = hospital did not track. a = sustainability scores ranged from 1.0 to 5.19 with 5.19 representing "high sustainability"; b = Number of beds licensed and staffed. Case hospitals are distinguished as: High-1= hospital with the highest score in the high-sustainability group; High-2= hospital with the lowest score in the high-sustainability group; Low-1= hospital with the highest score in the low-sustainability group; Low-2= hospital with the lowest score in the low-sustainability group

In all four hospitals, RRT program documents included an RRT policy and an RRT call documentation form. RRT policies stipulated the RRT calling criteria (including physiologic information such as a heart rate less than 40 or greater than 125 or systolic blood pressure less than 90 mmHg, and subjective information such as the fact that the nurse was worried), the persons who could activate RRT calls (nurses, physicians, patients, or families), the responsibilities of the RRT during the call (e.g., monitoring the patient and completing documentation) and the documentation that had to be completed during and after the RRT call. An RRT call documentation form was also used at all four hospitals to record activities that occurred during and immediately following the RRT call (e.g., the person initiating the call, reasons for the call, patient vital signs, any interventions used, and patient outcome).

All hospitals except Hospital Low-1 had an RRT standing order set that included interventions to guide team activities during and after the RRT call, such as administering supplemental oxygen or obtaining a portable chest X-ray. Only Hospitals High-1 and Low-1 included an RRT end-user evaluation/satisfaction form as a required document. This form allowed nurses who called the RRT to indicate whether the team responded quickly and whether team members were respectful. Hospital Low-1 was the only hospital where RRT members could evaluate their RRT experience—for example how their work assignments were reassigned when they had to leave their unit to go on an RRT call. All hospitals except Hospital Low-2 had provided staff training prior to launching the RRT program, and all hospitals now provided annual staff training on the RRT program.

Three groups of participants (leadership, RRT members, and RRT end-users) were interviewed. The number of participants in each of the three groups varied (see Table 16). Overall, 19 leaders, 11 RRT members, and 20 RRT end-users were interviewed in the 4 cases. Characteristics of the hospitals' nursing staff are shown in Table 17. Across hospitals, the highest percentage of nurses held an ADN, followed by nurses with a baccalaureate degree. Only a small percentage of nurses held a diploma in nursing. This distribution of nurses based on their

education level in the hospitals in Phase Two is consistent with findings of the 2008 National Sample Survey of Registered Nurses (http://bhpr.hrsa.gov/healthworkforce/rnsurveys/rnsurveyfinal.pdf) . Specifically, 45.4% nurses in the U.S. held an ADN, 34.2% held a baccalaureate degree, and 20.4% held a diploma in nursing. In the study sample, an average of 59.5% nurses held an ADN, 30.8% held a baccalaureate degree, and 4.5% held a diploma in nursing.

Table 16

Number of participants by Hospital and Participant Group

	High-1 (High)	High-2 (High)	Low-1 (Low)	Low-2 (Low)	Total by Group
Leadership	3	8	5	3	19
RRT members	6	1	2	2	11
RRT end-users	4	5	5	6	20
Total by hospital	14	12	13	11	50

Table 17

Characteristics of Hospitals' Nursing Staff

	High-1 (High)	High-2 (High)	Low-1 (Low)	Low-2 (Low)	Mean
Percent of direct care RNs holding specialty certification	51	52	DNT	DNT	51.5
Percent of direct care RNs holding the following degrees					
Diploma	9	3	‹ 1	5	5.7
ADN	57	45	61	75	59.5
Baccalaureate degree	28	42	33	20	30.8
Master degree	2	10	6	0	4.5
DNP	‹ 1	1	‹ 1	0	0.5
PhD	0	0	0	0	0
Number of board certified physicians	88	99	87	92	91.5

Note. Percentages reported. DNT = did not track; ADN = associate degree in nursing; DNP = doctor of nursing practice; PhD = doctor of philosophy.

The four hospitals are described below in the order of their sustainability scores. The two high-sustainability hospitals, Hospital High-1 and Hospital High-2, are presented first, followed by the two low-sustainability hospitals, Hospital Low-1 and Hospital Low-2.

Hospital High-1

Hospital High-1's sustainability score of 4.67 was the highest in the sample. This was also the second smallest hospital in the study with 160 beds, and 233 direct care RNs (see Table 15). This hospital was one of two hospitals in the sample to have received a national recognition for excellent patient care delivery. (To protect the identity of the hospital, information about the type of recognition and the organization awarding the recognition has been withheld.) Fifty-seven percent of nurses had an associate degree in nursing (ADN), 28% had a baccalaureate degree and fewer than 3% had a graduate degree (see Table 17). Fifty-one percent of nurses had a specialty certification. Fourteen nurses from Hospital High-1 participated in the study: three were in leadership positions, six served as RRT members, and four were RRT end-users (see Table 16). Despite extensive recruitment efforts and support from hospital personnel, no physicians affiliated with Hospital High-1 agreed to participate in the study.

During the RRT implementation process, hospital leaders responsible for implementing the RRT collaborated with another network of hospitals to gather information and insights into RRT implementation. The RRT at Hospital High-1 consisted of an RN, with a respiratory therapist (RT) as back-up. When the RRT was initially developed, a dedicated RRT nurse responded to calls. However, because of cost constraints at Hospital High-1, there was no longer a dedicated nurse for the RRT; instead, the RRT was staffed out of the critical care unit. Other changes made to the program after implementation included expansion beyond adult medical-surgical patient care units to the psychiatry department, authorization of families and patients to call, and modification of the RRT calling criteria and RRT order set to reflect current practices in the hospital.

Hospital High-2

Hospital High-2's sustainability score of 4.55 was the second highest score in the sample (see Table 15). This hospital was the second largest hospital in the sample, with 258 beds, and it was the second hospital in the sample to have received a national recognition for excellent patient care delivery. Twelve nurses from Hospital High-2 participated in the study: eight were in leadership positions, one served as an RRT member, and five were RRT end-users (see Table 16). Despite recruitment efforts and support from hospital personnel, no physicians and no other RRT members agreed to participate.

The number of direct care RNs at Hospital High-2 was 428. Fifty-two percent were reported to have a specialty certification. Forty five percent had an ADN, 42% had a baccalaureate degree, and fewer than 12% held a graduate degree in nursing (see Table 17).

The RRT program in Hospital High-2 consisted of an RN from the critical care unit and an RT. During the implementation process, hospital leaders responsible for implementing the RRT collaborated with another hospital in the region and also with other organizations (e.g., North Carolina Hospital Association [NCHA]). When the decision to adopt RRTs was made by leaders at Hospital High-2, there was common awareness of the Joint Commission's National Patient Safety Goal (NPSG) calling for a method (such as RRTs) to support patients in crisis on acute care units. However, hospital leaders who participated in the study also noted that the hospital joined the *100,000 Lives* Campaign because new, inexperienced nurses on acute care units needed additional support to care for patients in crisis, and hospital leaders wanted to improve overall patient outcomes.

Several changes had been made in the RRT program at Hospital High-2 since the RRTs inception. These included expanding the program to include all other nursing units (such as the Labor and Delivery unit) and all adult and pediatric patients. The RRT is also activated if patients meet pre-determined criteria for calling a Code because they are having a stroke or an

acute myocardial infarction (AMI). Additional changes to the program have included allowing patients and families to call and developing an RRT protocol and an RRT routine order set that includes medications which may be given by the RRT.

Hospital Low-1

Hospital Low-1's sustainability score of 2.97 was the second lowest score in the sample. This hospital was the largest hospital in the sample, with 355 beds (see Table 15). Thirteen nurses participated in the study: five were in leadership positions, two served as RRT members, and five were RRT end-users. Again, despite extensive recruitment efforts and the help of hospital personnel, no physicians or other RRT members agreed to participate in the study (see Table 16).

The number of direct care RNs at the hospital was 476, but the hospital did not track the number with specialty certification. Nurses with an ADN (61%) comprised the largest percentage of nurses in the organization, followed by baccalaureate prepared nurses (33%) (see Table 17). Less than 1% of nurses had a diploma in nursing and fewer than 7% had a graduate degree in nursing.

During the RRT implementation process, hospital leaders collaborated with quality experts at other hospitals and with organizations such as the NCHA. The RRT currently consisted of an RN from one of the critical care units and an RT. The nursing house supervisor, i.e., the nurse "on call" who managed patient flow processes and patient or nurse staffing emergencies in the hospital, also responded to RRT calls. Initially, only staff members could activate RRT calls; however, over time, patient and family calling was included in Hospital Low-1's RRT policy. The RRT call documentation form was also changed to include additional parameters for calling the RRT and space to document the team's interventions.

Hospital Low-2

Hospital Low-2's sustainability score of 2.94 was the lowest score in the sample. It was also the smallest hospital, with 101 beds (see Table 15). Eleven nurses participated in the study: three were in leadership positions, two served as RRT members, and six were RRT end-users. Hospital Low-2 was the only hospital with physician participation: one physician, in a leadership position, agreed to participate (see Table 16). Hospital Low-2 had 195 direct care RNs. The majority of these nurses (75%) had an ADN; 20% had a baccalaureate degree; and 5% a diploma in nursing. No direct care nurses were reported to have a graduate degree in nursing (see Table 17).

During implementation of RRTs at Hospital Low-2, hospital leaders responsible for implementation collaborated with individuals at the Institute for Healthcare Improvement. Hospital Low-2's RRT consisted of an RN from the critical care unit and an RT. The nursing house supervisor also responded to RRT calls. A physician hospitalist also responded, if the call was made for a patient under his or her care. Over time, the program had been expanded to all specialty areas of the hospital, including Labor and Delivery, and patient and family calling. In addition, changes were made to the RRT policy and RRT order set to reflect the expansion of the program and inclusion of patient and family calling.

Summary

Hospitals in the sample differed in size and number of direct care RNs. However, they all reported having nurse-led RRTs, similar RRT program documents, and RRT end-user participation in RRT calls. The hospitals had also followed similar RRT implementation processes, including use of internal resources to fund the program, and three had collaborated with other organizations or individuals in the implementation process. However, in Hospital Low-2, the hospital with the lowest sustainability score, participants did not report collaboration with other organizations; further, no pilot study was conducted prior to full-scale implementation

of RRTs; and no initial RRT training was provided to staff members. Interestingly, in all four hospitals, the highest percentage of nurses held an ADN. However, high-sustainability hospitals employed a lower percentage of nurses with an ADN than low-sustainability hospitals.

The Case Study Report

As noted above, participants in three groups (leadership, RRT members, and RRT end-users) were interviewed about factors identified in the Planning Model of Sustainability (PMOS) (Shediac-Rizkallah & Bone, 1998). Sustainability reflected the extent to which each of the PMOS factors was present in the hospitals. PMOS factors were anticipated to be more richly represented in hospitals with higher sustainability scores than in hospitals with lower sustainability scores. Participants at each hospital were asked how PMOS factors contributed to the sustainability of RRTs in their hospital, and what other factors might have fostered or inhibited RRT sustainability. To understand the context and processes that might have facilitated or inhibited RRT sustainability, participants were also asked how and why factors in the PMOS, as well as additional factors they identified, contributed to RRT sustainability.

This section presents the case study report, with detailed information addressing the two questions that guided this phase of the study. A cross-case analysis was conducted, for several reasons. Cross-case analysis has been described by Yin (2009) as one approach for reporting multiple cases. In this approach, information from individual cases is dispersed throughout the report. This type of report has been successfully used to report case studies in hospital organizations (Curry et al. 2011 & Stetler et al. 2009). The other type of report that Yin (2009) suggested for multiple-case studies first presents each case and then presents cross-case analysis. However, because the purpose of this study was to compare high-sustainability hospitals with low-sustainability hospitals, the first approach to cross-case analysis was considered most appropriate for answering the research questions. Findings of each research question are

presented below. Findings are supported through the use of quotations which are inserted in table format in subsequent sections throughout the chapter.

Research Question One: What sustainability factors are present in hospitals with high and low levels of RRT sustainability?

Factors from the PMOS that reflected the extent to which sustainability had been achieved in case hospitals and additional factors identified by participants are listed in Table 18 and are discussed below. In each section, results from the two high-sustainability hospitals are presented and compared first, followed by a presentation and comparison of results for the two low sustainability hospitals. A comparison of the high and low sustainability hospitals is then provided, followed by a brief concluding summary of each factor.

Project design and implementation factors. Three project design and implementation factors from the PMOS were addressed by participants: project negotiation process, project effectiveness, and training. Participant comments related to each of these factors are presented in Table 19.

Project negotiation process. The project negotiation process refers to the actions taken by organizational leaders to engage nursing staff when considering the design and implementation of RRTs in their hospital. According to Shediac-Rizkallah and Bone (1998), involving staff in the implementation process rather than using a top-down approach is important if an organization is to achieve RRT sustainability.

Table 18

Presence of factors facilitating or inhibiting RRT sustainability in Phase Two hospitals

Factor	High		Low	
	High-1	High-2	Low-1	Low-2
Project Design and Implementation Factors				
Project Negotiation Process	+++	++++	+	++
Project Effectiveness	++++	++++	++++	++++
Training	++++	++++	++	++
Organizational Factors				
Institutional Strength	+++	+++	+++	+++
Program Champion	++++	+++	++	++
Individual Factors				
Experiencing RRT calls	++	++	-	-
Using RRT to overcome fear	-	+	-	-
Nurses' relevant knowledge, skills, and experience	++	+	+	+
Working with medical staff	-	-	+	+
Team Factors				
Perceiving RRT effectiveness	++	++	+++	+++
RRT member attitude and behavior	++	+	+	+
Other Organizational Factors				
Collecting data and disseminating results	+	++	+	+
Leadership support	-	++	-	-
Nurse autonomy	-	++	-	-
Perceiving cost effectiveness	-	-	+	+
Providing RRT call feedback	+	+	+	+
Lacking organizational resources and program oversight	++	+	+	+
Staffing inadequate	-	-	++	++

Note. Table reflects the presence or absence of a factor. The following notation is used to describe the extent to which a factor was present: + = less or equal to one quarter of participants indicated a factor was present; ++ = more than one quarter but less or equal to one half of participants indicated a factor was present; +++ = more than half but less or equal to three quarters of participants indicated a factor was present; ++++ = more than three but less or equal to four quarters of participants indicated a factor was present; - = factor was not mentioned by participants or participants indicated a factor was absent.

High-sustainability hospitals. At both Hospital High-1 and Hospital High-2, staff involvement in the RRT implementation process was reported as important in facilitating the acceptance and use of RRTs. At both hospitals the majority of participants mentioned that a multi-disciplinary team was formed to implement the RRT program, although the number of members on the implementation team differed between the two hospitals (see Table 19). At Hospital High-1, the team consisted of nurse managers, nursing supervisors, critical care nurses, respiratory therapists, and laboratory personnel. At Hospital High-2, the team included representatives from critical care, respiratory care, quality experts, and the education department. The teams developed the basic aspects of the RRT program, including, RRT policies, RRT calling criteria, and methods for calling the team.

In both Hospital High-1 and Hospital High-2, nursing staff played an active role in the RRT design and implementation process. In Hospital High-1, the majority of participants noted that nurse directors and nursing supervisors and critical care staff played a prominent role in implementation of the RRT program. In this hospital, RRT end-users said that they did not have any input in the implementation process and their involvement was limited to receiving education on the RRT. In Hospital High-2 RRT implementation occurred similarly to Hospital High-1, with staff nurses being actively involved in implementation of the program. In this hospital, critical and acute care charge nurses played an active role whereas leaders were involved on a limited basis only. However, the only end-users involved in the implementation process were charge nurses.

Low-sustainability hospitals. At both Hospital Low-1 and Hospital Low-2, some participants reported that the implementation process was a top-down approach, with administrators making all the decisions. At Hospital Low-1, nursing leaders and RRT members were involved in implementation, but RRT end-users input was not sought. Hospital Low-1 used a prescriptive roll-out to implement the program (see Table 19). Initially, implementation

activities were guided by the corporate office's quality management department. Nurse managers in charge of units where staff members responded to RRT calls, a hospital-based educator, and a quality expert participated in the initial implementation activities. During the process, critical care staff members' involvement was limited to creating RRT guidelines on the persons who would respond to RRT calls, the qualifications of RRT members, and the education necessary for hospital staff.

At Hospital Low-2, a multi-disciplinary team that consisted primarily of nursing staff (a nurse educator, a supervisor, and a critical care staff member) was responsible for implementing the RRT. Neither the charge nurses nor the clinical staff of the critical care and acute care units participated in RRT implementation process. More recently, however, critical care staff members' involvement had been sought to update RRT program documents and to review and update the RRT order set.

High-sustainability hospitals and low-sustainability hospitals. The majority of participants in the high-sustainability hospitals noted a bottom-up approach to RRT implementation. In contrast, some participants at the low sustainability hospitals perceived the RRT implementation process to be top-down. However, the majority of participants in both high- and low sustainability hospitals reported that staff members were engaged in the RRT implementation process though staff engagement was far greater at the high-sustainability hospitals than at the low sustainability hospitals. At the high-sustainability hospitals, larger, multi-disciplinary teams were used; more nurse leaders (nursing supervisors and nursing directors/managers) were engaged; and other disciplines (respiratory therapy, laboratory staff, and quality experts) were included in implementation activities. At the low sustainability hospitals, RRT implementation was limited to a "select few" staff members; nurse involvement was limited to nurse managers at Hospital Low-1 and a nurse supervisor at Hospital Low-2; and other disciplines were not engaged in RRT implementation activities at either of these hospitals.

RRT end-users were either not engaged or were engaged very little in RRT implementation at all the hospitals. At Hospitals High-1, Low-1, and Low-2, end-users were not involved in RRT implementation. At Hospital High-2, end-user involvement was limited to the charge nurses from the acute care units where RRT calls could originate.

Summary. A project negotiation process that engaged staff members in RRT design and implementation activities was viewed as important by participants at all hospitals examined in this study. A broader range of nurse leaders and a multi-disciplinary team were involved, however, at high-sustainability hospitals than at the low-sustainability hospitals. In these hospitals, using multi-disciplinary teams and including a large segment of nurse leaders were viewed as very important to achieve RRT sustainability.

Project effectiveness. Project effectiveness refers to benefits from RRT implementation perceived by organizational members, rather than the actual benefits that might be reflected by patient, staff, or organizational outcomes. That is, even in the absence of empirical evidence of RRT effectiveness, sustained use of RRTs may have occurred because staff members perceived that there were benefits of the RRT. See Table 19 for participant comments.

Table 19

Participant comments: Project design and implementation factors

Factor	Participant Comments
Project Negotiation Process	Everyone that was involved in the Rapid Response Team, everyone that was going to be a member, a responder, they were all involved in developing the policy and procedure. They were all involved with - well even down to what telephone number do you think would be easy for other staff, additional staff throughout the hospital to be able to remember easily so they were all involved from the very beginning and not just the nurses but also the respiratory team. The lab team was involved related to what the labs that we would be drawing for the Rapid Response. Our case managers and our supervisors were all involved. This was a situation where everyone felt that they had a piece of this project and so it wasn't just a change that one person made and then said hey guys we're going to do this. Everybody was involved. (High-1; Leadership)
	Well as far as being involved in the process other than education, probably not because it was a part of a pilot. So we had a prescriptive method of roll out, the forms to use etcetera. Now over time we have involved the staff because the critical care staff is that you know that the form we should put this so we should put that on it for a variety of reasons and then we implemented even though it's pretty limited an order set through suggestion. So I think at the beginning it wasn't because it was part of a pilot and we were had to follow the guidelines from that but over time we've kind of improved upon it with that. (Low-1; Leadership)
Project Effectiveness	I do think the learning. I believe that it's an opportunity for our CCU and respiratory staff to teach at the moment, so it's a live lab. It's not a simulation, it's the real thing, and even if they're not talking and doing a didactic teaching, the nurses are watching them and they're watching how they do an assessment, and they watch the communication. They hear the communication with the physician, so it is a very rich learning environment for the next event, next patient. (High-2; Leadership)
	I think they get a much more rapid treatment than waiting on a physician to maybe come from their office. The Rapid Response Team has standing orders that they can initiate so sometimes you can have several things done before the physician even gets there. You can have blood work. You can have a chest x-ray. You can have blood gases. That's certainly beneficial and they can transfer to the ICU. . . then that's a much more earlier intervention for the patient. (High-1; RRT end-user)

Table 19

Participant comments: Project design and implementation factors

Factor	Participant Comment
	Security knowing that there's someone there. Their days are hard enough and stressful enough with the caseload they have, and you have your set of patients and you know you have someone that's getting unstable and you're trying to allot your time. Having that safety net, that expert to come and help you identify a problem, um, helps with their whole work flow and their ease. (Low-2; Leadership)
	I feel more comfortable knowing that I have a specialized person there. It makes you more confident. It makes you more -- feel better that your patients are going to be taken care of, that nothing's going to go wrong; everything's going to be okay. For a nurse that's a big deal. (Low-2; RRT end-user)
Training	I think that people being aware of it is huge because they're not going to use it obviously if they're not aware of it and so with every new RN coming in, getting that kind of organizational orientation and this is what we have and this is how you can use it, I think that that makes them aware of it. . . kind of say okay this is when you would use it, oh, we got this guy going down, let's, you know, so. (High-1; Leadership)
	Here I think the training has been terrible. . . I think this hospital needs to revamp their RRT for staff. I think the people who come to help you are excellent but for the nursing staff, I think they need more education. But from previous experience with RRT in two other hospitals, I thought it was excellent. They told you exactly how you're supposed to have, have the chart in the room, have the doctor name and number, have everything ready, what's going on with the patient basically SBAR style of what you're supposed to tell them, what do you think needs to happen and -- they need to revamp that here, I think. (Low-2; RRT end-user)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1= hospital with the highest score in the high-sustainability group; High-2= hospital with the lowest score in the high-sustainability group; Low-1= hospital with the highest score in the low-sustainability group; Low-2= hospital with the lowest score in the low-sustainability group

High-sustainability hospitals. Most of the participants in all three interview groups at Hospitals High-1 and High-2 perceived a variety of benefits from the RRT program for patients, staff, and the organization. Perceived benefits for *patients* included recognizing and intervening when patient deterioration occurred, preventing patient decompensation, and enhancing the timeliness of care. Ultimately, participants at both Hospitals High-1 and High-2 felt that these benefits saved patients' lives. Participants at both hospitals noted that RRTs improved patient care and patient safety by reducing or preventing patient trauma and length of stay that might have resulted if a patient's deterioration had led to a cardiac or respiratory arrest. RRT implementation was also thought to facilitate better care for patients. At Hospital High-2, participants said that they believed patients and their families felt greater security and trust because additional assistance was available to them if a crisis occurred during the hospitalization. This perceived benefit was, however, not reported by participants at Hospital High-1.

Participants at both hospitals also perceived benefits for *staff*, including getting help to their patients quickly and accessing the expertise of RRT members to assist in caring for patients in crisis. Some participants also reported that their work stress was reduced because they had help to care for a patient in crisis, so they could still manage the care of their other patients. Nearly half of the participants at both hospitals perceived that by participating in RRT calls, end-users gained nursing knowledge, skills, and expertise and increased their confidence in caring for patients in crisis. Participants at Hospital High-2 reported that RRT members also increased their knowledge, skills, and expertise, by experiencing different patient conditions and situations when they responded to calls and needed to manage patients in crisis outside of the ICU.

At both high-sustainability hospitals, organizational leaders, in particular, perceived that RRT calls provided teaching and mentoring opportunities for RRT members, and they viewed these opportunities as valuable aspects of the program. They also noted that increased knowledge, skills, and expertise of RRT end-users came from the teaching and mentoring that RRT members provided to end-users in the context of RRT calls. The experience of calling an

RRT may also have helped to build staff members' personal confidence and critical thinking skills.

Many participants at both high-sustainability hospitals also thought that the organization had benefitted from RRT implementation. At both hospitals, perceived organizational benefits included improved quality of care, quick transfer of patients to a higher level of care, reduced failure-to-rescue rates, and reduced organizational risk for litigation. At Hospital High-1, participants reported a decrease in the hospital outcome of critical care ventilator days and improved patient morbidity and mortality. At Hospital High-2, participants reported reduced ICU admission rate and reduced cardiac and/or respiratory arrests. Improved patient satisfaction and patient and family confidence in care were also mentioned. However, only at Hospital High-2 was RRT implementation reported to improve nurse and family satisfaction. Participants at both Hospital High-1 and Hospital High-2 noted positive perceptions of the hospital by the community as a benefit, because patient and family members shared their positive RRT experiences with others in the community.

Since Hospital High-1 was working to obtain additional recognition for excellence in quality care delivery at the time of data collection, having the RRT was considered as an advantage because it signaled the organization's goal of improving patient care. Participants in all three groups at Hospital High-1 reported that the RRT enhanced cost-effective care delivery. Cost was perceived to be reduced at Hospital High-1 because of decreased patient lengths of stay, prevention of cardiac arrest, and reduction in critical care transfers. This benefit was not mentioned at Hospital High-2, however.

Low-sustainability hospitals. At both Hospitals Low-1 and Low-2, participants perceived benefits associated with the *patient,* including early recognition and intervention in patient problems, prevention of further patient deterioration, improved timeliness of care, enhanced patient safety, and better patient care (see Table 19). Patient safety and timeliness of care were

thought to be important because the RRT promoted early recognition of patient problems and interventions to address them. At Hospital Low-2, participants reported the benefit of patients and family members' added sense of security since additional staff members were available if a medical crisis developed. No participants at Hospital Low-1 reported patient and family member security as a benefit.

At both Hospital Low-1 and Hospital Low-2, RRT implementation also had perceived benefits for *staff*, enabling RRT end-users to get expert help, manage their workload, and reduce work stress. Work stress was reported to result when staff members attempted to manage a patient in crisis on their own while also juggling the care of other patients. This stress was believed to be reduced because a critical care expert stepped in to help manage the patient in crisis.

At Hospital Low-1 participants reported that the RRT offered support to end-users by having RRT members evaluate the patient and recommend interventions. Participants also reported that RRT members and RRT end-users gained knowledge, skills, and expertise from participating in RRT calls. At Hospital Low-2, participants reported that RRTs provided staff a sense of comfort and helped to build their confidence because a critical care nurse was there to assist them and they knew the patient would be taken care of.

At both hospitals, participants noted several perceived benefits for the *organization.* Positive patient outcomes included decreased cardiac arrests, decreased patient mortality rates, and decreased critical care admissions. Cost-effective care delivery was perceived as a benefit by participants at both hospitals, because patients' length of stay was reduced by early intervention and prevention of additional deterioration, and because patients and family members were more confident in the quality of care they received. At both hospitals, positive organizational outcomes of RRT implementation included improved patient safety and reduced risk of organizational liability. At Hospital Low-1, participants also reported increased nurse, patient, and family satisfaction and improved quality of care, and noted that implementing the RRT also enhanced

the community's perceptions of the hospital. These benefits were not mentioned by participants at Hospital Low-2.

High-sustainability hospitals and low-sustainability hospitals. At all four study hospitals, participants perceived benefits for patients, staff, and the organization from RRTs. Participants at both high and low sustainability hospitals reported similar patient benefits, including early recognition of crisis and early intervention, enhanced patient safety, and patient and family security. Participants also reported staff benefits such as reduced RRT end-user work load and work stress. However, participants at the high-sustainability hospitals placed more emphasis on the learning aspect of RRT calls: they mentioned the knowledge, skills, and expertise that both RRT end-users and RRT members gained from RRT call experiences. Participants at the low-sustainability hospitals highlighted getting expert help by calling the RRT more than participants at the high-sustainability hospitals.

Organizational benefits were reported by participants at both high and low-sustainability hospitals, including promoting positive community perceptions of the hospital and improving patient and family confidence in care. Nearly half of the participants at the high-sustainability hospitals reported that RRTs improved nurse, patient, and family satisfaction; however, very few participants at the low-sustainability hospitals reported improvements in nurse, patient, and family satisfaction.

Summary. At all four hospitals, RRTs were reported to be effective and participants at all hospitals perceived benefits from RRT implementation for patients, staff members, and the organization. One important benefit reported by participants in the high-sustainability hospitals was the learning that occurred when RRT end-users and RRT members participated in RRT calls. This was not mentioned in the low-sustainability hospitals; participants in low-sustainability

hospitals focused on the benefits of having more staff to ease workload, help with patients in crisis, and decrease stress.

Training. Training in this study was defined as provision of information on the various aspects of the RRT program to organizational members before, during, or after RRT implementation to support them in their role as RRT members and to support their routine use of the RRT. Table 19 provides related participant comments.

High-sustainability hospitals. At Hospitals High-1 and High-2, nurses, physicians, and other hospital staff received RRT-specific information prior to the launch of the program. Training included in-services, poster presentations, and fliers. Nurses at these hospitals also received ongoing RRT-specific training. At Hospital High-2, participants reported the use of an Institute for Healthcare Improvement specific training module to guide staff members' training. This training module was not mentioned at Hospital High-1; instead, the hospital developed and used training sessions developed in-house to educate staff about the RRT.

At both Hospitals High-1 and High-2, RRT end-users' training consisted of defining the RRT program, and stipulating the RRT calling criteria and ways to activate an RRT call. RRT member training at both hospitals focused on the desired behavior of members during RRT calls, rather than on developing their clinical skills. It was assumed that RRT members had the necessary knowledge and skills to serve as RRT members. However, at Hospital High-1, RRT members' initial training also included attendance at conferences and visits to other hospitals that had an RRT program in place.

At Hospital High-1, RRT end-users and RRT members received *ongoing* RRT-specific training annually via the hospitals online learning system. At this hospital, ongoing training of end-users was reported as necessary because of high turnover on acute care units. At Hospital High-2, RRT end-users received training annually through poster presentations, fliers, and

informal unit-based staff discussions. RRT members received RRT-specific training every other year and as needed.

The majority of participants in the RRT end-user and member groups at both hospitals reported that there was room for improvement in the RRT-specific training provided to staff members. Participants offered several suggestions for improving the training: (a) clarifying expectations of RRT end-users and RRT members when they activated or responded to RRT calls; (b) formalizing RRT end-users' and RRT members' role requirements; (c) providing a refresher course for RRT members on RRT documentation and RRT order set; (d) incorporating interactive scenarios of various types of calls; (e) adding RRT-specific training to the hospital-wide annual nurse competency review; and (f) incorporating RRT-specific training into the hospitals new employee orientation.

At Hospital High-1, participants in the leadership group thought that the training provided to nurses was adequate, and did not see a need for additional training for staff and patients. In contrast, at Hospital High-2, participants in the leadership group suggested adding more didactic education by providing RRT-related articles to staff members and by adding unit-specific patient scenarios to the RRT-specific training.

Low-sustainability hospitals. Prior to launching the RRT, Hospital Low-1 provided training to nurses and other hospital staff through RRT-specific in-services, poster presentations, and posting fliers on patient care units. In contrast, at Hospital Low-2, the RRT policy was simply reviewed with staff nurses. However, both Hospitals Low-1 and Low-2 provided *ongoing* RRT-related training. At Hospital Low-1, nurses and other hospital staff received annual classroom-based training, and at Hospital Low-2, nurses received annual RRT training via the hospital's online learning management system.

Participants at Hospital Low-1 and Hospital Low-2 varied widely in their assessment of the training they received. At Hospital Low-1, some participants in the RRT end-user and RRT

member groups reported that the *initial* training they had received was sufficient. However, other participants in these groups reported that the initial training was insufficient or non-existent. Participants in the RRT end-user and RRT member groups at Hospital Low-2 reported that the *initial* RRT-specific training was either completely absent or minimal, probably because the initial training consisted only of a review of the RRT policy with staff members. Interestingly, the majority of participants in the RRT end-user group at both Hospital Low-1 and Hospital Low-2 reported that learning occurred largely through experiences gained during RRT calls or the informal training they received from RRT members following RRT calls.

Participants in all three interview groups at the two low-sustainability hospitals recommended several improvements to the RRT training. Suggestions included more education (especially on the communication process of Situation-Background-Assessment-Recommendation [SBAR] used during RRT calls); more information sharing with staff on the goals of the RRT program; and more "upfront" training during hospital orientation of new staff. Participants also recommended repeating educational activities after new employees had completed the orientation process—particularly in areas where staff turnover was high—and adding RRT-specific training to nurses' annual competency review (see Table 19). Participants in the RRT end-user and RRT-member groups also suggested that RRT member role requirements be formalized, and expectations of RRT members and RRT end-users during RRT calls be clarified. It was also noted by a participant in the RRT member group at Hospital Low-1 that guidelines were needed to train future RRT members.

High-sustainability hospitals and low-sustainability hospitals. Except at Hospital Low-2, training was provided to nurses, physicians, and other hospital staff (such as RTs) at both the high- and low-sustainability hospitals. Similar training modalities were used at the hospitals. At all four hospitals, ongoing RRT-specific training was also provided annually. RRT members' skills in caring for patients in crisis were largely assumed at all four hospitals. At the high-

sustainability hospitals, RRT members were trained on ideal RRT member behaviors rather than on ideal RRT member clinical skills. RRT members at the low-sustainability hospitals did not receive RRT-specific training. Hospital High-1 had invested more in training RRT members, by sending them to conferences and other facilities to learn more about the RRT program.

Participants in the RRT end-user and RRT member groups at all four hospitals reported that there was room for improvement in the initial RRT training provided, and offered suggestions for improvements. These improvements included… Except in Hospital High-1, participants in the leadership group also offered improvements to the RRT training, to include…. Participants in all the other hospitals reported that the experience of learning-by-doing enhanced RRT end-users' and RRT members' learning.

Summary. Despite participant reports of the need for improvements in the RRT-specific training provided to nurses, Hospital High-1 and Hospital High-2 were able to achieve high sustainability scores. Hospital Low-2, where no RRT-specific training was provided prior to the launch of the RRT program, had the lowest sustainability score of all case hospitals. These findings suggest that (a) the integration RRT-specific education may be important and (b) the *timing* of the education may also be important aspects of training. The content of the training and the quality of the training provided, as well as the modalities used to provide the training, appears to be less important.

Organizational factors. Two factors—institutional strength and program champion—were identified in the PMOS as organizational factors that facilitate RRT sustainability. These are discussed next in relation to the sustainability of RRTs in case hospitals. Participant comments related to both of these organizational factors are provided in Table 20.

Institutional strength. Institutional strength was defined as the alignment of goals of the RRT program and the mission, vision, or goal statements of the hospital that implemented the

RRT; the presence of strong, competent leadership with program structures, lines of authority, and evaluation processes for the RRT program and RRT members, and the presence of nursing staff with a high education level, operationalized as the percentage of direct care nursing staff holding a baccalaureate degree..

High-sustainability hospitals. In both high-sustainability hospitals, RRT program goals and organizational goals related to patient care were perceived to be in alignment. These goals were to provide patient-centered care, to increase positive patient outcomes (decreased cardiac arrests), and to enhance patient safety and the quality of care. Two participants at Hospital High-1 reported that the RRT goal to provide patient-centered, quality care was also aligned with the organization's goal to be recognized nationally for achieving excellence in patient care.

Participants at Hospital High-2 reported goals that were related to patient care and the nursing work environment. They noted that RRT goals were to provide quality care, better serve patients and save patient's lives, and these were aligned with the organization's goal to provide patient-centered care. Nurse autonomy was also mentioned as an RRT goal that aligned with the organizational goal of nurses "owning" their practice.

Both of the high-sustainability hospitals had structures and lines of authority to support the RRT program (see Table 20). Participants at these hospitals reported that an RRT policy, an RRT documentation form, and an RRT order set were created to provide structure to the program. At both hospitals, the RRT program was integrated into an existing line of authority. Oversight of the program was delegated to a nurse leader, who oversaw the collection of data on the number of calls and the outcome of each call and reported these data to two existing committees, the Code Blue Committee and the Nurse Leadership Committee. At both of these high-sustainability hospitals, the individuals who provided RRT program oversight were affiliated with nursing departments. Participants reported that these individuals were actively involved in the overall

RRT program. Participants also reported that RRT program data were shared with RRT end-users and RRT members.

At the two high-sustainability hospitals both the RRT program and RRT members were evaluated on a monthly basis through data tracking and case reviews to identify performance improvement and risk management issues related to each RRT call. RRT members received informal feedback from these RRT case reviews. Participants at Hospital High-2 reported the use of RRT data to make program improvements and to give feedback to staff members involved in RRT calls. Participants at Hospital High-1 were slightly less aware of formal RRT data collection and analyses. The data were used to give feedback to RRT members, but not to RRT end-users.

Participants at Hospital High-1 reported that RRT members were evaluated using formal evaluation forms that were completed by RRT end-users after each RRT call. The forms were collected and reviewed monthly to identify areas for improvement. Participants in the RRT member group also reported that the RRT member evaluation process was closely tied to critical care nurses' career advancement program (e.g., a clinical ladder program). At Hospital High-2, formal evaluation forms, completed by RRT end-users after each RRT call, had been used initially to evaluate RRT members, but these were no longer used. A few participants at the hospital noted the need for a structured evaluation form to allow RRT end-users to evaluate RRT calls and RRT members, and to provide a basis for program improvements.

The last measure of institutional strength was the education level of nursing staff in the organization, operationalized as the percentage of direct care nurses holding a baccalaureate degree. At Hospital High-1, the hospital with the highest sustainability score (4.67), 28% of direct care nurses held a baccalaureate degree, and 57% an ADN. At Hospital High-2, with a sustainability score of 4.55, 42% of direct care nurses held a baccalaureate degree and 45% held an ADN.

Low-sustainability hospitals. Participants at both low-sustainability hospitals reported that the RRT program goals were aligned with the goals of the organization. Participants at Low-1 and Low-2 hospitals reported goals related to patient care, but only participants at Hospital Low-1 reported goals related to the nursing workforce. Specifically, participants at both hospitals reported that RRT program goals and organizational goals included increasing positive patient outcomes (such as decreased cardiac arrests) and enhancing patient safety and patient satisfaction. However, only at Hospital Low-1, did participants mention that RRT program goals aligned with the goals of the nursing workforce to provide quality patient care and the organization's goal to communicate a message of valuing its nursing workforce.

At both Hospital Low-1 and Hospital Low-2, participants reported that the RRT program was mostly integrated into existing organizational structures and lines of authority. Participants reported that RRT program documents, such as an RRT policy, an RRT documentation form, and an RRT order set, were created to provide structure to the program. Staff members from the critical care units were recruited to serve as RRT members.

At both low-sustainability hospitals, no new lines of authority were created. Participants at the two hospitals reported that data collection and analysis, and sharing of information with selected committees guided RRT program evaluation. At Hospital Low-1, a nursing staff member (department name withheld to protect the identity of the organization and the individual) oversaw the RRT program, conducted data collection and analyses, and reported the results to the Code Blue Committee and the Nurse Leaders Committee. The person reported being given this responsibility after another employee, who had previously overseen the RRT program, left the organization. At Hospital Low-2, a non-nursing leader was responsible for overseeing RRT data collection and analysis and reporting the results to the Code Blue Committee. At both these low-sustainability hospitals, participants in the RRT end-user and RRT member groups said that they did not receive RRT program data. However, RRT-end users did receive informal feedback from their nurse managers on the RRT calls that they had participated in.

At Hospital Low-1, RRT members were evaluated by RRT end-users with an evaluation form to describe their RRT call experiences. At Hospital Low-2, there was no formal evaluation form for RRT end-users to evaluate RRT members, and there were no formal RRT member evaluation processes other than RRT members' annual performance reviews.

At Hospital Low-1, with a sustainability score of 2.97, 33% of direct care nurses held a baccalaureate degree, and 61% an ADN. At Hospital Low-2, with a sustainability score of 2.94, 20% of direct care nurses held a baccalaureate degree, and 75% an ADN degree (see Table 17).

High-sustainability hospitals and low-sustainability hospitals. Participants at all hospitals reported goal alignment between the RRT program and the organization. At all four hospitals, goals focused on patient care (e.g., quality of care and serving patients). At Hospitals High-2 and Low-1, goals also centered on the nursing work environment.

Strong, competent leadership—defined as the presence of program structures, lines of authority, and evaluation processes for the RRT program and RRT members—was reported at both high- and low- sustainability hospitals. All four hospitals integrated the RRT program into existing structures and lines of authority. Existing critical care nurses and RTs were used to staff the RRT, and existing committees provided RRT program oversight. New structures in the form of RRT program documents were created at all four hospitals to support the program. Specific individuals also provided RRT program oversight by collecting and analyzing RRT program data and reporting the results to organizational committees. At the high-sustainability hospitals, these individuals were employed in nursing departments; at the low sustainability hospitals, the individuals, although they were nurses, were employed in non-nursing departments. At the two high-sustainability hospitals, participants perceived these individuals to be passionate about the RRT program. However, this was not reported at the two low sustainability hospitals.

At all four hospitals, participants reported that some type of evaluation was done for the RRT program. Nursing or non-nursing staff collected and analyzed related data. Participants at

the high-sustainability hospitals reported that RRT program data were shared with nursing staff, but this was not mentioned by participants at the low-sustainability hospitals. Thus, participants at the high-sustainability hospitals were more aware of RRT data collection and analysis activities than participants at the low-sustainability hospitals. Participants in the leadership and RRT member groups at all four hospitals reported that RRT member evaluation was part of their annual review process. At Hospital High-1, RRT member evaluations were tied to critical care nurses' career advancement program. Formalized RRT end-user feedback on RRT members was reported at Hospital High-1, a high-sustainability hospital, and Hospital Low-1, a low-sustainability hospital.

At the four hospitals, there was variation in the education level of nurses, defined as the percentage of direct care nursing staff holding a BSN degree. The percentage of nurses who had a BSN degree was not necessarily higher at the high-sustainability hospitals than at the low-sustainability hospitals. However, high-sustainability hospitals reported a lower percentage of direct care nurses with an ADN than the low-sustainability hospitals.

Summary. All four case hospitals reflected some level of institutional strength. Goals of the RRT program and the goals of the organization were aligned at all four hospitals. Strong, competent leadership, with structures to support the RRT program, lines of authority to provide oversight, and mechanisms to evaluate the RRT program and RRT members, were present at both the high- and low-sustainability hospitals. However, institutional strength was augmented in organizations where there was a focus on RRT-related performance improvement (PI) activities, and where information was shared with staff members. Institutional strength was also amplified in organizations where the person responsible for PI activities was in a nursing department and participants reported that this person was passionate about the RRT program.

Program Champion. In this study, a program champion was defined as someone who advocated for the RRT program, who was either an RRT expert in the organization or a clinician who had previously used the RRT for patients in crisis, and who provided support to colleagues on the activation and use of RRTs.

High-sustainability hospitals. Participants at both Hospital High-1 and Hospital High-2 reported the presence of a champion when RRTs were initially implemented. At Hospital High-1, a nursing director, who was no longer with the organization, was identified as having been the initial champion. Participants at Hospital High-2 identified an expert clinician as having been the champion.

The majority of participants at both hospitals reported that a champion was currently present in the organization. At Hospital High-1, participants reported RRT members as champions, and made several references to two critical care nurses as the biggest champions of the RRT. At Hospital High-2, participants identified charge nurses and expert clinicians working in acute care units, RRT members, and RTs as champions. One striking difference between Hospital High-1 and Hospital High-2 was the fact that acute care nurses were not identified as champions at Hospital High-1. At Hospital High-2, in contrast, there was a general sense that all staff members who had used the RRT and had a positive experience served as RRT program champions. Participants at both high-sustainability hospitals reported that champions marketed, promoted, and advocated for the RRT program. They were enthusiastic about the RRT program and displayed a positive attitude towards RRT end-users and other staff members.

Low-sustainability hospitals. Participants at both low-sustainability hospitals reported that a champion was present when RRTs were initially implemented. At Hospital Low-1, participants consistently identified one individual nurse as having been the initial program champion. At Hospital Low-2, two individuals (a nursing director and a nurse manager) were identified as having been the initial champions. However, some participants at Hospital Low-2 were unaware of the presence of a champion when RRTs were initially implemented.

Table 20

Participant comments: Organizational factors

Factor	Participant Comments
Institutional Strength	If you do not have structure, it is hard to have the processes in place and the nice outcomes that you want. Unless you have structure, it starts at the top of the structure, and you have got to define that and define your processes so you can have the outcomes that you want. I think that is the gain. If you do not have any oversight at all, then you lose sight of those things. (High-2; Leadership) I'm all for organization and I believe that it would help keep us focused on the right processes. There is somebody there that is going to recognize that there is something not quite right with what was done or we are letting something drop that shouldn't be and you know somewhere along the line somebody is catching that hopefully and letting us know you know it comes back down to us, oh yeah remember you need to do so and so or such and such. . . that's where organization or lines of authority come in play. They are there to make sure that we haven't dropped the ball on something. (Low-2; RRT end-user)
Program Champion	I think I could safely say that there's probably several and I definitely think there are some doctors that could be but I would think most of the ICU staff that goes on the Rapid Response calls would champion the program and I definitely think that several of the nurses who have used it, especially if they've had a good experience. I've been thanked several times by nurses for coming up there even if it means getting the patient out of there or making things better so I think nurses who have benefitted from the program would champion it as well. (High-1; RRT member) Well, that makes a difference no matter what it is. Whether it was RRT or anything, you always need that one person who has that passion for whatever it is who can keep people excited, keep people wanting to learn, keep coming in with new information that they learned to keep it fresh in everybody's mind and just -- you get stagnant, you die. You don't want to do that. So that person keeps things new and keeps things fresh. (Low-1; Leadership)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1= hospital with the highest score in the high-sustainability group; High-2= hospital with the lowest score in the high-sustainability group; Low-1= hospital with the highest score in the low-sustainability group; Low-2= hospital with the lowest score in the low-sustainability group.

At the two low-sustainability hospitals, participants reported that a champion was currently present in the hospitals. At Hospital Low-1, participants identified RRT members (nurses from the emergency department and critical care units) as champions. A few participants identified a nurse leader from one specific department (department name withheld to protect the identity of the individual) as a champion. At Hospital Low-2, some participants reported that clinical experts on acute care units and RRT members were the biggest champions of RRTs in the organization. Two participants also identified a physician as a champion. Very few participants thought that a champion was not needed in the organization. Those participants said that RRT calling has become the norm in the hospital and, therefore, a champion was no longer needed. Participant at both low-sustainability hospitals reported that champions organized, improved, marketed, and promoted the RRT program. Also at both hospitals, participants identified champion behaviors as demonstrating a positive attitude, enthusiasm and passion for the RRT program, and fostering relationships between RRT members and RRT users. At Hospital Low-2, participants reported that champions were respected and served as role models for nurses, advocated for nurses, and listened to their recommendations for changes to the RRT program.

High-sustainability and low-sustainability hospitals. In all the hospitals, a champion was present when the RRT program was initially implemented. This champion was in a leadership role (for example, a nurse manager, nurse director, or a nurse educator). Participants at all the hospitals identified RRT members as champions. At Hospital High-2 and Hospital Low-2, participants also identified expert clinicians on acute care units as champions. A physician was identified as a champion at Hospital Low-2.

Participants at both the high- and low-sustainability hospitals reported that champions marketed, promoted, and advocated for the RRT program. The role of the champion in organizing and improving RRT program was emphasized by participants at the low-sustainability hospitals, but this was not reported at the high-sustainability hospitals. Participants at all four

hospitals felt that champions should have a positive attitude, and be enthusiastic and passionate about the RRT program. Fewer participants in the low-sustainability hospitals agreed a champion was currently present in the low-sustainability hospitals than in the high-sustainability hospitals.

Summary. Although participants at all hospitals identified RRT program champions, there was far greater awareness of champions at the high-sustainability hospitals. The champion's position in the organization (leader, expert clinician, or RRT member) did not appear to be important to RRT sustainability. Greater emphasis was instead reported by participants at all hospitals on the actions and behaviors of champions than on their specific position in the hospital.

Other sustainability factors. In addition to the factors in the PMOS, participants reported several factors that were important to RRT sustainability. These factors were clustered into individual factors, team factors, and other organizational factors. Participant comments illustrating the presence of these factors are presented in Table 21.

Individual factors. Individual factors that participants identified pertained to nurses' experiences with RRT calls, nurses' attitudes toward calling the RRT, and nurses' clinical knowledge, skills, and experiences that might impact their decisions to call the RRT.

High-sustainability hospitals. Participants at the two high-sustainability hospitals said they were more likely to call the RRT if they had a positive experience with an RRT call (see Table 21). Because individuals shared their RRT call experiences with their colleagues, positive stories were considered by participants to foster RRT calling, and negative stories to inhibit RRT calling.

Participants also reported that nurses' attitude towards calling the RRT influenced their decision to call the RRT. For example, some participants at Hospital High-2 reported that RRT end-users used the RRT as a mechanism to circumvent communicating with physicians. These participants reported that RRT end-users activated RRTs because of their fear of calling physicians late at night. This was an unanticipated consequence of RRT implementation. However, calling the RRT did reduce the risk of delayed patient care, which was possible when nurses delayed calling the physician.

Participants at both high-sustainability hospitals identified nurses' relevant knowledge, skills, and experience needed to identify patients who could benefit from an RRT call as a factor inhibiting the use of RRTs.

Low sustainability hospitals. Participants at Hospital Low-1 reported that RRT end-users' experience with RRT calls facilitated future RRT calling. This was not mentioned by participants at Hospital Low-2. Participants at both low-sustainability hospitals reported that nurses lacked the knowledge, skills, and experience to identify subtle changes in their patients that would warrant an RRT call. Participants in the RRT end-user groups at these hospitals also reported that some nurses did not know how to activate an RRT call.

High-sustainability hospitals and low-sustainability hospitals. Except for Hospital Low-2, the factor "nurses experiencing RRT calls" was mentioned in both high-and low-sustainability hospitals. It is possible that participants at these hospitals experienced RRT calls differently: that is, those at the high-sustainability hospitals may have had more positive experiences with RRT calls than participants at the low-sustainability hospitals.

Participants at both high- and low-sustainability hospitals reported that nurses on acute care units lacked the knowledge, skills, and experience needed to know when an RRT call was necessary. Nurses' skill level may have differed between the two groups of hospitals, since a

higher percentage of nurses at the low-sustainability hospitals had an ADN. Participants at Hospital High-2 reported that RRT use was increased when nurses were afraid to call physicians, but this was not reported at the other hospitals.

Summary. Nurses' experiences with RRT calls, their knowledge, skills, and experiences, and their attitudes toward RRTs affected RRT sustainability. These factors were present in both the high- and low-sustainability hospitals

Team factors. Important team factors that were identified at the four hospitals in the sample included perceived RRT effectiveness and RRT member attitudes and behavior.

High-sustainability hospitals. Participants at Hospital High-1 and Hospital High-2 reported that the use of RRTs was fostered by the team's effectiveness. At Hospital High-1, participants said that calling the RRT helped get patients transferred to a higher level of care and successfully prevented patients from deteriorating to a Code Blue event. At Hospital High-2, participants also reported that the RRT expedited patient transfers to a higher level of care. Participants at the high-sustainability hospitals noted that because of the presence of an RRT standing order set at the hospital, RRT members could institute interventions (medication administration or laboratory tests) that expedited patient care. This, in turn, enhanced participants' perception of RRT effectiveness and fostered RRT calling.

Another important team factor reported by participants at both high-sustainability hospitals was team members' attitude. That is, RRT members' behaviors and communication with RRT end-users when they responded to an RRT call affected the end-users' choice to again use the RRT. Positive RRT member behaviors calling the RRT; negative, derogatory behaviors inhibited RRT calling because end-users felt unsupported by RRT members.

Table 21

Participant comments: Other sustainability factors

Factor	Participant Comment
Individual factors Experiencing RRT calls	Or if they use it one time and they have an experience where a nurse comes down and they're like, really, you called me for this? Not that that happens very often, but I think if they use it and they don't have a good experience, next time they need it they're not going to call it. (High 2; Leadership) I think that the response that the staff nurses get when someone comes to help them, if they looked down on them or they are not positive with them and congratulate them a good job, I think that impacts them calling them again. I think success that they see someone listen to them. (Low-2; Leadership)
Nurses overcoming their fear	I think there is a bit of nurses don't want to call doctors. That fear exists today and I don't think it will ever go away. I've been in this for thirty-eight years and I don't think that will ever go away. You've got to grow a backbone to be able to call doctors in the middle of the night at home, the on call doctors, and take their slack because first of all, they don't like to be woken up but they're on call but these nurses on the floor are young, they're naïve, they're scared and they're afraid for their license and they don't want to call a doctor so they call Rapid Response and you go and you call the doctor for them. I think some nurses use it that way. (High -1; RRT member)
Lacking knowledge, skills, and experience	I still think just staff hesitancy and staff insecurity, and whether or not they should call in. I don't think at all there's a fear of getting in trouble for calling it, but I think there's still that fear of what are they going to think about me? Are they going to think I'm weak if I ask for help? I work a lot directly with nurses, and I see that a lot with nurse and personalities, with new nurses and I walk away, they have to do it all themselves, and that it's a sign of weakness if they call for help. So I think just instilling that phenomenon, to say you do need help and it's okay. (High-2; Leadership) Knowledge. The nurses on the floor. . . Nurses on the floor will sometimes feel like if they get the doctor and they tell them what's going on and they give them a new order and they do it but it doesn't fix it, they will tend to call the doctor back and keep going with the doctor instead of, you know, saying, "Okay, now, I've tried this. I need other eyes to look at this, because the doc's not coming to look at it. He's just going with what you tell him on the phone. So I think most of the time if we feel like an RRT has not been called quickly enough, a lot of time, that's the reason. It's because the nurse has been in contact with a doctor and they're doing what they're saying but they're not seeing the change in the patient; but because they've had that doctor contact, they don't feel like they should call the RRT yet, so...(High-1; Leadership)

Table 21

Participant comments: Other sustainability factors

Factor	Participant Comment
Team factors Perceiving RRT effectiveness	So, you know, I think anytime you can get somebody and another set of eyes when you see a change in a patient that can stop it; you know, you can stop right where it's at and keep it from getting worse, that's what it's about and, you know, the ICU nurses know that. They know it's their chance to say, "Okay, it's my set of eyes. It's my expertise. What do I see going on with the patient? Do I see them going down? Do I see changes? From what they're telling me, the patient wasn't, what can we do to fix this? (High-1; RRT end-user)
	I think it's success. We have helped patients and a lot of times the patients get transferred to [ICU] but it does--it helps a patient from declining, especially our full code patients that have changed over the course of the nursing shift. The Rapid Response Team here definitely has shown some great value to the patients. So, that would be your good reason for them to continue doing it. (Low-2; RRT end-user)
RRT member Attitude/ behavior	I think if the ICU nurses go in and just kind of like are derogatory or negative about why'd you call us or stuff like that, I think that that then, you're not going to call them again but if it's teamwork and hey okay I'm here, let's focus on this patient, let's get him fixed, you know, then I think that that definitely makes a difference in repeat calls and utilization. (High-1; Leadership)
	I think that the response that the staff nurses get when someone comes to help them, if they looked down on them or they are not positive with them and congratulate them a good job, I think that impacts them calling them again. I think success that they see someone listen to them. (Low-1; Leadership)

Table 21

Participant comments: Other sustainability factors

Factor	Participant Comment
Organizational factors RRT data collection and analysis	I think that once we implement a new initiative and we see that it works, we collect data, and we report the data and we share the data at the higher level committees, so then our administration can also speak to it. In some of those higher committees there are some physicians present, not as much as I would like to see, but it is communicating to physicians this type of evidence, this type of data. I think once we implement, we collect the data, we take a look at it to say did it make a difference and improvement, and it did, then it's easier to push it through. (High-2; leadership). I think that looking at our numbers and seeing that we've had an increase in Rapid Response calls and decreasing our codes. That's what you want outside the unit, codes decreasing which we have had. I think that's probably the two main things. They'd see that the process works. . . . And the fact that we do follow up it goes, we have the staff goes to special care, the data and sometimes the doctors ask questions, they're interested. (Low-1; Leadership)
Leadership support	We just had that 2011[RRT data] review in our leadership council meeting a couple weeks back. I also shared that meeting with my charge nurse staff, so I think leadership as a whole is fostering it.. . . they support it and they encourage calling it, and not to be made like the nurse is incompetent or anything, but to be better safe than sorry. You really utilize your resources, is what they are fostering.(High-2: Leadership) Our management. I mean they push for us that if we feel like something's wrong, don't hesitate to call it. Don't wait till the patient is really bad off before you call it.(Low-2: RRT end-user)
Organizational resources	Probably budget I would think because nowadays with everybody as concerned as they are with money and cutting costs. We have extra supplies available. We usually staff our unit accordingly to where one person has an assignment but is still able to leave the unit and go on the Rapid Response calls so I think that, I'm not sure but I think money at some point could play a role in that. Money. Money is always a barrier. (High-1; RRT member) Well our economy is so bad, I mean, they make cuts. I don't know that [RRT] would be cut, that that would be the only thing that I would think of - that would hold it [RRT] up is money. (Low-1: RRT end-user)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1= hospital with highest score in high-sustainability group; High-2= hospital with lowest score in high-sustainability group; Low- 1= hospital with highest score in low-sustainability group; Low-2= hospital with lowest score in low-sustainability group.

Low-sustainability hospitals. Participants at the low-sustainability hospitals also reported that RRT effectiveness fostered RRT use. RRT members were able to expedite patients' transfer to the critical care unit and prevent patient deterioration through quick interventions. Participants at Hospital Low-1 placed greater emphasis on RRT effectiveness than participants at Hospital Low-2. Interestingly, at Hospital Low-2 an RRT order set guided RRT members' interventions but not at Hospital Low-1.

At these hospitals, positive RRT member behaviors fostered RRT use, and negative behaviors inhibited RRT use. Positive member behaviors included helping and reassuring RRT end-users during a call, and giving them positive feedback following the call. RRT end-users felt unsupported when RRT members were rude towards them and called into question the need for an RRT call.

High-sustainability hospitals and low-sustainability hospitals. Participants at both high- and low-sustainability hospitals reported that RRT effectiveness and RRT members' attitudes and behaviors were important for RRT sustainability. Participants at all four hospitals said they used the RRT because they saw the RRT as effective in providing care to patients who were experiencing a medical crisis.

Summary. Participants in all hospitals reported that RRT effectiveness and RRT members' attitude were important in RRT sustainability. It may be that RRT sustainability is influenced by the degree to which RRT end-users in a given organization perceive RRTs as effective, and RRT members' attitudes as positive.

Other organizational factors. Several organizational factors were reported by participants to facilitate RRT sustainability, including RRT data collection and analyses, nurse

autonomy, leadership support, and the availability of resources. Please see Table 21 for participant comments.

High-sustainability hospitals. At both Hospital High-1 and Hospital High-2, participants saw the collection and analysis of RRT data and sharing of these data with staff members as important because this enhanced nurses' knowledge and awareness of the team. At both hospitals, RRT data were collected and disseminated at monthly meetings such as the Code Blue Committee meeting and the Nurse Leadership (CNO, nursing directors, nurse managers, and nurse educators) Committee meeting. Nurse leaders, in turn, disseminated data to their charge nurses and frontline staff.

Participants at both hospitals also reported that they were more likely to activate RRT calls because they felt their leadership supported using the RRT. Nurse leaders encouraged staff to use the RRT, disseminated RRT program results such as the number of RRT calls and the outcomes associated with the RRT calls for their nursing units, and provided feedback to RRT end-users on the calls they participated in.

At Hospital High-2, participants reported that an environment in which nurse autonomy was valued and promoted fostered the use of RRTs. Participants said that nurse leaders supported nurses' autonomy and their philosophy was that nurses "owned" their practice. Participants also said that RRT member autonomy was enhanced because, according to the organization's RRT policy and RRT order set, team members could intervene to provide care to the patient without the presence of a physician. Participants said that team members could also transfer a patient to a higher level of care if the situation warranted without a physician's transfer order. RRT end-users reported that they had the autonomy to call an RRT if a patient's condition required it even though a physician might object to calling the RRT; a physician's order was not needed.

Participants at Hospital High-1 said that a lack of organizational financial resources to support a dedicated RRT member who could round on nursing units and evaluate patients RRT

end-users were concerned about inhibited RRT sustainability. They believed that having a dedicated RRT member would have would have helped to build positive relationships between RRT members and RRT end-users and increase RRT end-users' awareness of the RRT program.

Low-sustainability hospitals. The majority of participants at the two low-sustainability hospitals was not aware that nurse leaders collected and analyzed RRT data. Participants also did not report that RRT outcomes data were shared with staff members. Participants in the RRT member group at the two hospitals reported that lack of funding to support a dedicated RRT nurse who could round on the units negatively affected the use of RRTs because a dedicated RRT nurse could have helped to build rapport with nurses on acute care units and increased these nurses' willingness to call the RRT when needed. A dedicated RRT nurse might also have been able to round on units and assess and identify patients who could potentially have benefited from a RRT call. Another major concern reported by some participants was a lack of experienced critical care nurses who could serve as RRT members. The participants noted that the development of RRT members took time and effort. New, inexperienced nurses had to first gain knowledge and skills as critical care nurses and meet the requirements for serving as RRT members, before they could appropriately respond to RRT calls. Participants said that because of the absence of a qualified critical care nurse on each shift who could serve as an RRT member, responding to RRT calls was sometimes very difficult. The RRT nurse was also assigned to take care of patients in the critical care unit, and handing off patients under the RRT nurse's care took time and further delayed RRT responses sometimes. These delayed responses, in turn, may have affected the degree to which end-users felt supported by RRT members.

High-sustainability hospitals and low-sustainability hospitals. RRT data collection and analysis and dissemination of RRT program results were reported only by participants at the high-sustainability hospital. Also, nurse autonomy and leadership support were reported in the high-

sustainability hospitals, but not the low-sustainability hospitals. Lack of a dedicated RRT nurse was mentioned as an inhibiting factor by participants at both high- and low-sustainability hospitals. However, a lack of skilled critical care nurses who could serve as RRT members was mentioned only at the low-sustainability hospitals.

Summary. Several organizational factors were reported as being important to RRT sustainability: nurses' awareness of RRT data collection and analysis activities; sharing of RRT outcomes data; leadership support; and an environment in which nurse autonomy is valued and promoted. Organizational factors that were reported to inhibit RRT sustainability included a lack of skilled, experienced critical care nurses who could serve as RRT members, and the lack of a dedicated RRT member who could round on units and collaborate with frontline staff members to detect patient problems even earlier than an RRT might be called, and prevent further patient deterioration.

Summary of factors. This study found that PMOS sustainability factors were present in hospitals that reported high levels of RRT sustainability as well as in hospitals that reported low levels of sustainability. Other individual, team, and organizational factors that facilitated or inhibited RRT sustainability were also identified by participants, sometimes in both groups of hospitals. Thus, the presence of any one or the combination of several sustainability factors appeared to be insufficient to achieve high levels of RRT sustainability. Interestingly, sustainability appeared to depend on (a) the degree to which sustainability factors were present; (b) staff members' awareness and perception of the factors; (c) the involvement of leaders from nursing or non-nursing departments; and (d) the other organizational aspects such as information sharing, leadership support, and nurse autonomy.

Comparison of sustainability factors identified and passages, routines, and niche saturation reported. Once factors that facilitated or inhibited sustainability were identified and compared between the high-sustainability and low-sustainability groups of hospitals, findings were compared with the survey results reported in Phase One. This comparison helped identify similarities and differences between these two data sets to enhance the credibility of research findings. The survey consisted of questions related to the characteristics of the organization and the RRT and the RRT-IS. The RRT-IS consisted of questions related to four organizational subsystems (i.e., production, maintenance, supportive, and managerial) and addressed organizational production, clarification of roles or performances of organizational members, the procurement of resources, and the coordination, adjustment, and control of the subsystems to enhance RRT institutionalization. Therefore, the survey provided information that could validate the presence or absence of some of the factors in each of the four hospitals as reported by participants in Phase Two.

Participants at each of the four hospitals reported in Phase Two that their RRTs had been in place for five to six years. When compared with the Phase One findings, except for Hospital Low-2, all hospitals reported that the RRT program had achieved the passage of transitioning from pilot to permanent status in the hospital (see Table 22). The RRTs at these hospitals were considered to have achieved at least three routines, with the RRT having achieved permanent status for three or more years (see Table 23). Niche saturation was also achieved with the RRT responding to all inpatient and outpatient units (see Table 24). In contrast to what was reported in Phase Two, Hospital Low-2 reported in Phase One that the RRT had not achieved permanent status. One explanation for this finding may be that the RRT had made the transition from pilot to permanent status in the time period between when the survey was completed (September 2011) and when the interviews were conducted (May 2012).

The factor "Institutional Strength" was found to be present in high- and low-sustainability hospitals. Specifically, participants at all four hospitals indicated that structures, lines of

authority, and evaluation processes were in place to support the RRT program. Structures included the development of RRT policies that described the roles and responsibilities of RRT members. This finding was supported by administrators of all hospitals reporting in Phase One that passages, routines, and niche saturation were achieved in the maintenance subsystem related to the presence of written, clearly delineated job/role descriptions or organizational policies and procedures for RRT members (RN, RT, and nursing house supervisor) (see Tables 22 - 24).

Participants also reported that the RRT program and RRT members were evaluated through data collection and analysis procedures (RRT program) and annual performance evaluations (RRT members). Except at Hospital Low-1, this finding was also supported by administrators reporting that passages, routines, and niche saturation were achieved in the managerial subsystem, with the RRT program being monitored/evaluated and a supervisor being assigned to provide program oversight (see Tables 22 - 24). At hospital Low-1, the person who initially provided oversight of the RRT program had left the organization and another person had not yet been appointed as a program administrator at the time of data collection. Therefore, RRT program data were being monitored and evaluated by someone who also oversaw other programs in the organization. Therefore, the report that an RRT program supervisor was not present in Hospital Low-1 was likely related to the absence of an individual to oversee only the RRT program. It is also possible that the a person to oversee the program was appointed during the time that lapsed between Phase One and Phase Two of this study.

The factor "Training" was also found to be present at Hospitals High-1, High-2, and Low-1, and only partially present at Hospital Low-2. Except for Hospital Low-2, all hospitals provided training for staff members prior to launching the RRT program and on an ongoing basis. These findings are consistent with hospital administrators' reports in Phase One that passages, routines, and niche saturation were achieved in the maintenance subsystem with regards to formal, specific, and ongoing education for staff members and RRT members. At Hospital Low-2, no training was provided to staff members prior to launching the RRT program, but training

was provided after implementation, and on an ongoing basis. At Hospital Low-2, the report that neither passages, routines, nor niche saturation were achieved in the maintenance subsystem related to staff and RRT member education, was likely related to the absence of training prior to launching the RRT program (see Table 22 - 24).

The lack of organizational resources was found in this study to be one factor that inhibited sustainability. Specifically, the lack of funds to support a dedicated RRT member position in each hospital was reported as inhibiting RRT sustainability. A dedicated RRT member could have served as an informal champion and enhanced the visibility of the RRT program in hospitals. This finding was supported by administrators' report that passages, routines, and niche saturation were not achieved in the supportive subsystem. FTEs were not assigned to the RRT program and dedicated funds were not available in each hospital's annual budget to support the RRT program (see Table 22 – 24).

Table 22

Passages Achieved by Subsystem for hospitals in Phase Two

		High		Low	
Subsystem	Passage (Integration)[a]	High-1	High-2	Low-1	Low-2
Production	In your view, has the RRT program in your hospital made the transition from pilot status to permanent status?	+	+	+	-
Maintenance	Has your organization formalized the role of RRT members through the development of written, clearly delineated job/role descriptions or organizational policies and procedures?	+	+	+	+
	Does your hospital provide formal, specific, and ongoing education for staff who serve as members of the RRT?	+	+	+	-
	Does your hospital provide formal, specific, and ongoing education related to the RRT program for all hospital staff members?	+	+	+	-
Supportive	Have full-time equivalent (FTEs) been assigned to the RRT program?	-	-	-	-
	Have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	-	-	-	-
Managerial	Do you monitor/evaluate the RRT program offered at your hospital?	+	+	+	+
	Has a supervisor formally been assigned to the RRT program?	+	+	-	+

Note. a = passage question in the RRT-IS; (+) = passage achieved; (-) = passage not achieved

Table 23

Routines Achieved by Subsystem for hospitals in Phase Two

Subsystem	Routine (Continuation)	High-1	High-2	Low-1	Low-2
		Likert rating 1- 4			
Production	How many years would you say the RRT program has been considered permanent status in your organization?	4	4	3	1
Maintenance	For how many years has education and training been provided for staff who serve as members of the RRT?	4	4	3	4
	For how many years has education related to the RRT program been provided to all hospital staff members?	4	4	3	1
	For how many years have RRT member' roles, expectations and performances been formalized through written, defined job/role descriptions or organizational policies and procedures?	4	4	3	1
Supportive	For how many years have FTEs been assigned to the RRT program?	1	1	1	1
	For how many years have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?	1	1	1	1
Managerial	For how many years has the RRT program been monitored/ evaluated?	3	4	3	4
	For how many years has a supervisor formally been assigned to the RRT program?	4	4	1	4

Note. 1 = No passage achieved; 2 = passage + one year of routine achieved; 3 = passage + two to three years of routines achieved; 4 = passage + more than 3 years of routines achieved.

Table 24

Niche Saturation Achieved by Subsystem for hospitals in Phase Two

Subsystem	Niche Saturation (Penetration)	High-1	High-2	Low-1	Low-2
		Likert rating 1- 4			
Production[a]	To what extent has the RRT achieved permanent status in your hospital?	4	4	4	1
Maintenance[b]	How often do you provide formal, specific, and ongoing education for staff who serve as members of the RRT?	3	3	2	1
	How often do you provide formal, specific, and ongoing education related to the RRT program to all hospital staff members?	3	3	2	1
		Number of items selected[c] (0 - ≥ 4)			
	For which of the following RRT staff members has your organization developed written, defined job/role descriptions or organizational policies and procedures?	2	3	2	3
Supportive	For which of the following aspects of the RRT program are funds specifically allocated in your hospital's annual budget.	0	0	0	0
Managerial	Which of the following aspects of the RRT program do you monitor/evaluate?	4	2	2	2
	Which of the following aspects of the RRT program does your hospital have a supervisor formally assigned to oversee?	4	4	0	2

Note. a = score of 4 = the RRT responds to all inpatient and outpatient units of the hospital and score of 1 = niche saturation not achieved. b = score of 3 = formal education on a yearly basis, score of 2 = formal education is provided during new employee orientation only, and score of 1 = niche saturation not achieved; c = the higher the number, the higher the degree of niche saturation.

Research Question Two: What are the contexts and processes that facilitate or inhibit RRT sustainability?

Contexts and processes associated with each factor from the PMOS as well as other individual, team, and organizational factors are listed in Table 25 and discussed below. The results from the two high-sustainability hospitals are then compared with the results from the two low-sustainability hospitals, with a brief concluding summary of each factor. A cross-case analyses of the two high-sustainability and the two low-sustainability hospitals is not reported because of the similar contexts and processes that were identified within each of these groups. However, the cross-case analysis of the two groups of hospitals (high-sustainability hospitals versus low-sustainability hospitals) is reported.

Project Design and Implementation Factors. Three project design and implementation factors were thought to facilitate RRT sustainability: project negotiation process, project effectiveness, and training. Participant comments regarding the contexts and processes that facilitate or inhibit RRT sustainability with respect to these factors are discussed in the section that follows and presented in Table 26.

Project negotiation process. The project negotiation process used at both the high- and low-sustainability hospitals facilitated RRT sustainability in that it increased staff members' buying into and ownership of the RRT program, increased awareness and knowledge of the RRT in the organization, created effective teams, and increased staff members' security, trust, and value. Participants at both the high- and low-sustainability hospitals reported that staff involvement aided in gaining staff members' buy-in and created a sense of ownership which, in turn, facilitated RRT use because staff members became "informal" champions who encouraged the use of the RRT.

Table 25

Contexts and processes that facilitate or inhibit RRT sustainability

	High		Low	
	High-1	High-2	Low-1	Low-2
Project Negotiation Process				
Buy-in and ownership	+	+	+	-
Increased awareness/knowledge of RRT	+	+	+	+
Creation of effective teams	+	+	+	+
Sense of security, trust, and value	+	+	-	+
Positive patient outcomes facilitated	+	-	-	-
Lack of role expectations and support	-	-	-	+
Project Effectiveness				
Expert consultant as resource	+	-	+	+
Knowledge that care is provided	+	+	+	-
Continuation and expansion of the RRT program	+	+	-	-
Work as a team	+	-	+	-
Training				
Generation of knowledge	+	+	+	+
RRT awareness and presence enhanced	+	+	-	+
Comfort in serving and calling the RRT enhanced	+	-	-	+
Facilitation of effective use	-	-	-	+
Institutional Strength				
RRT program organization facilitated	+	+	+	+
RRT program accountability and safety established	+	+	+	+
Improvement of the RRT program	+	+	+	+
Program Champion				
Respect as expert clinician	+	+		
Organizational knowledge of the RRT enhanced	+	+	+	+
Positive behaviors	+	+	+	+
Assessment and evaluation	+	+	+	
Individual factors				
Insecurity and lack of confidence in calling	+	+	+	+
Team factors				
Confidence in RRT	+	+	+	+
Perceived teamwork and collegiality	+	+		
Lack of RRT member support	+	+	+	+
Other organizational factors				
Education and knowledge of team	+	+		
Lack of experienced critical care nurses			+	+

Note. + = present in hospital; - = not present in hospital

Participants at all four hospitals also reported that knowledge development and increased awareness of the RRT program were important gains from involvement in the implementation process. Staff involvement generated RRT "experts" who could serve as resources for end-users when they were uncertain whether a RRT call was warranted. Staff members' knowledge of the RRT program was thought to increase their comfort in calling the team because they knew when and why to call the team and the underlying goals of the program.

Participants at both high- and low-sustainability hospitals said that involving staff such as critical care nurses who were experts in their field also helped to identify the best practices for RRTs. These best practices, in turn, guided the development of the RRT program to fit the needs of the organization and its members and also contributed to the development of effective teams.

A sense of security, trust, and value facilitated RRT sustainability; also, staff members' understanding of the organizational processes necessary to sustain the program was important. Because participants did not fear negative consequences of activating an RRT against physician wishes or in a patient situation that might not warrant the call, future calling was encouraged. Also, participants did not fear being looked upon negatively for activating a call, and as a result, future RRT calling was more likely. Participants at Hospital High-1 reported that involving staff members and developing effective teams facilitated positive patient outcomes, and these outcomes were viewed as a patient benefit of the RRT, which encouraged end-users to call an RRT.

At Hospital Low-2, some participants reported that the absence of staff involvement resulted in uncertainty about the roles of both RRT members and RRT end-users before and during an RRT call, as well as uncertainty about support for the RRT program. Participants said that because RRT members felt uncertain about their role, this resulted in some push-back from RRT members and lack of support for RRT end-users. These behaviors negatively affected RRT end-users call experiences, which inhibited RRT calling and thus, RRT sustainability.

Table 26

Participant comments: Project design and implementation factors (Research Question Two)

Factors	Participant comments
Project Negotiation Process	
Buy-in/ownership	Like the staff being like vested in it, being personally attached to it. I don't know how you would say that – like it's their baby or something like that's their idea. (High-1; RRT end-user)
	Because they feel like it's theirs to own. If you involve them from the floor or the ground up, then they have a say in how you develop that program and what needs to be done and you get their expertise and how they can help and what can go faster and just different things. . . (Low-1; Leadership)
Gaining knowledge/ skills/expertise	First of all, I think everybody will know how they're to respond, what the rules of engagement are. I mean what we can and cannot do safely and I think what would help the unit is when you have to leave the unit and you leave your two ventilated patients sick to another nurse to take care of, everybody has to be accepting of that. (High-1; RRT member)
	They are the ones that are going to be doing that. They are the ones that are going to learn, I mean if they have a say on how they should -- number one, what to look for and when to call, they would be more tuned when to actually use rapid response, if they have an input on, you know, we're going to use it from this, this and this. And this is the reason why you've got to use rapid response or why we want to use rapid response. It would flow better from them if they have input in it. . . . they would know not to wait until the patient is so acutely ill that they're going to end up having to go the ICU. If they see the signs prior to -- if they see the changes but they're not quite sure, they might feel -- if they're told at the beginning, don't wait until they get so sick or their blood pressure drops all the way to here before you call or they get diaphoretic If you see a difference in somebody or somebody's complaining, then that's when you should call. (Low-1; RRT member)

Table 26

Participant comments: Project design and implementation factors (Research Question Two)

Factors	Participant comments
Creating effective teams	Because, unless you're doing the job, you really don't have the perspective. I have been a practicing nurse for many, many years, but I have been in practicing administration for a long time, and so being at the bedside, I'm not at the bedside, and so I wouldn't want someone who doesn't do what I do to tell me how to do my work or to change my work. So we have that same appreciation for what it's like to be at the bedside, and that's important because there are barriers at the bedside that we're not aware of. You don't get the buy-in . It's not going to go unless you have them there. If you try to do it without, it's going to fail and you're going to spend more time trying to fix it. Once something fails, it's more difficult to then implement it. You want it on a good start, and then you can change it up (High-2; Leadership)
	Because we could, I think, what, that's like a fresh set of eyes on it, you know? It might be like this is the idea, this is the layout, this, you know, this is our outline of what we're going to do, but when you present it to the person that's actually doing it, they can say, "Well, I think it would be better done this way," you know, they can, when you get, I guess, to the frontline staff that are actually going to be doing them, then they can give you a different view of, you know, something that would work (Low-2; RRT member)
Project effectiveness	
Getting expert help	I think it's having somebody that's there to help you that has the knowledge. It's somebody there to help you with that issue that you're having with that patient, the medical problem or whatever is going on. It's somebody to share that with and you can look to their knowledge and you're still helping and you're learning too. (High-1; RRT end-user)
	Having an extra set of hands to assist with them anytime, changes in their conditions, it's always good to have a respiratory therapist there when you see somebody in respiratory distressed. It's always good to see an ICU nurse if somebody is like complaining with chest pain and they're not sure what to do.. . . their [RRT member} expertise and what they can bring into the situation.(Low-1; Leadership)

Table 26

Participant comments: Project design and implementation factors (Research Question Two)

Factors	Participant comments
Sense of security, trust, value	I don't think it's really ignorance but I think it's nurses not being proactive to initially like if you call the doctor and they do not decide to give any orders that you have that option to call the Rapid Response . . . I have seen in the past a couple of nurses that will not do that. It's just not having enough security behind them or knowledge that they can do that.. . .Maybe not enough experience to where they would want, you know, if a doctor said well we'll just do this, this and this and you figure your patients are really crashing and they need better care right then to get them stable that's where the Rapid Response Team comes in. (High-1; RRT end-user) The added security. When I was a new nurse, I probably used Rapid Response several times in my first year here. I was still new, but I wasn't on orientation anymore so I didn't have that preceptor nurse standing right beside me. But the Rapid Response Team can come out, assess your patient, give you the added input on what maybe is wrong or what you may be able to do for your patient to prevent any further decline. So, it's definitely an added security.(Low-2; RRT end-user)
Recognizing resource/expert	I think that if you have a successful outcome for your patient and you say oh they came in and helped me and it was good teamwork and we got him back without him coding and all that kind of stuff then you're going to use it again and you're going to feel like it was beneficial to you as the nurse and to your patient.. (High-1; Leadership) I think that the nurses do use the program as a clinical resource for them.. (Low-2; Leadership)

Table 26

Participant comments: Project design and implementation factors (Research Question Two)

Factors	Participant comments
Training	
Comfort calling	Because the staff nurse who does not have as much expertise as the team member, they have no anxieties about calling. So, they are more likely to call it earlier when they identify something instead of waiting until the patient is in crisis, which is a positive outcome, patient, organization, and the nurse. (High-2; Leadership)
	I think as it has evolved, the training has made it easier to use the rapid response team. I think as it's gone along, they've gotten more comfortable with both the role as a team member and activating the rapid response and using the rapid response. (Low-2; Leadership)
Augment knowledge/skills	Well I mean I think pretty much all of the nurses that respond to a Rapid Response Team's call are critical care certified and are very knowledgeable and have been able to really walk us through with some of the patients so I think that that's probably why it's continued to be utilized.. . .when the nurses respond, when the critical care nurses respond, they really challenge the thinking of the staff that's on the floor. The staff has to essentially walk them through and give them the history and physical. How were they two hours ago? When did this happen? What is going on? What do you think it is? So they really have to challenge their thinking which is increasing their critical thinking skills as well. (High-2; RRT end-user)
	It keeps it in the view. It keeps it readily accessible. People, or the staff members, know it's available. You know, we're so used to it that, I mean, it's there, it's just like a part of every day. You know it's there. It's like your ink pen in your pocket. If you need it and you know it's there. (Low-2; Leadership)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1=hospital with the highest score in the high-sustainability group; High-2=hospital with the lowest score in the high-sustainability group; Low-1=hospital with the highest score in the low-sustainability group; Low-2=hospital with the lowest score in the low-sustainability group.

Project effectiveness. Participants at both the high- and low-sustainability hospitals reported various benefits for patients, staff members, and the organization. Participants at all hospitals reported that RRT calling was facilitated by RRT end-users' recognition that team members were expert consultants who were available as a resource and to whom they had access 24/7. Participants said that they felt supported because they could consult with an expert nurse when they had patient care questions that fell outside the scope of an RRT call. These experiences also helped to build relationships between RRT members and RRT end-users, reducing end-users' fear of calling the team and increasing end-users' feelings of being effective and efficient in caring for their patients. This, in turn, translated into a sense of "knowing" that care was provided to their patients, and they had done everything they could for the patients. This "knowing" that care was provided increased RRT end-users' comfort in deciding to call the RRT, their job satisfaction, and the probability that they would again use the RRT (see Table 26).

Participants at one high-sustainability hospital, Hospital High-2, and one low-sustainability hospital, Hospital Low-1, reported that working as a team during RRT calls enhanced RRT use. By including the end-user in the call, a sense of cohesiveness developed between RRT members and RRT end-users. This cohesiveness enhanced RRT end-users' comfort in interacting with the team, reduced their fear of activating RRT calls, and increased their willingness to consult with RRT members.

Participants at the high-sustainability hospitals said that RRT effectiveness led to the continuation and expansion of the RRT program. Seeing the benefits of the program gave organizational leaders and staff members the evidence they needed to advocate for continuation of the RRT program and enhanced the perception that RRTs were a worthwhile project. Seeing the program benefits also facilitated expansion of the program to other types of patients, such as patients displaying stroke-like symptoms or symptoms associated with an acute myocardial infarction. Expansion of the program to other patient populations increased the pool of patients

who might need an RRT call, and thus increased the number of RRT calls in the organization and the opportunities for staff members to interact with and experience the benefits of using the RRT.

Training. Participants at both the high and low-sustainability hospitals reported that RRT-specific training facilitated RRT sustainability. Training generated knowledge of the RRT, increased awareness of the presence of RRTs in the hospital, and enhanced staff members' comfort in serving as RRT members or calling the RRT (see Table 26).

Participants at all four hospitals said that training had generated knowledge of the RRT program in the organization; for example, RRT end-users knew how and when to activate an RRT call and RRT members knew their roles prior to and during a call. Knowing the RRT calling criteria enabled RRT end-users to identify patients who were experiencing a medical crisis and could benefit from an RRT call. A few participants reported that RRT training augmented RRT end-users' existing knowledge and enhanced their critical thinking skills. Training also enhanced RRT end-users' assessment skills and their ability to quickly recognize the signs and symptoms of patient deterioration, which, in turn, facilitated RRT calling.

Participants at both high- and low-sustainability hospitals reported that training increased staff members' awareness of the RRT program and enhanced the visibility of the RRT program in the organization. However, this point was emphasized more by participants in the high-sustainability hospitals. Training was also reported to help to keep the RRT program "in view" and "readily accessible".

At both the high- and low-sustainability hospitals, training enhanced RRT end-users' comfort in calling the RRT and RRT members' comfort in serving on the RRT. Participants in all three groups interviewed at Hospital High-1 and Hospital Low-2 reported that knowing what to expect from the RRT, once they had activated a call, reduced end-users' uncertainty about calling the RRT, as well as their fear of negative consequences once the team arrived on the unit. Reducing their fear, in turn, enhanced RRT calling. Participants in the RRT member group also

reported that training enhanced their comfort in serving as RRT members, because they knew what was expected of them during RRT calls, which, in turn, gave them a more positive attitude when they responded to RRT calls. As noted earlier, RRT members' behavior during RRT calls was an important factor in sustainability. Over time, training RRT members also provided a pool of critical care nurses in the hospital that could be drawn on to staff the RRT on any given shift.

At one low-sustainability hospital, Hospital Low-2, RRT training was reported to facilitate effective use of the RRT, because participants knew when and how to activate an RRT call and they understood the goals of the RRT program. Effective use of the RRT, in turn, increased the likelihood of positive patient outcomes.

Summary of project design and implementation factors. In both the high- and low-sustainability hospitals, participants reported contexts and processes that facilitated RRT sustainability. These contexts and processes included staff members' buy-in and ownership of the RRT program, their awareness and knowledge of the RRT in the organization, and their sense of security, trust, and value. RRT sustainability was also facilitated by RRT-specific training, which resulted in effective teams and facilitated positive patient outcomes. However, when RRT end-users and RRT members lacked clear role expectations and felt unsupported, RRT sustainability was inhibited.

Participants at both the high- and low-sustainability hospitals reported that perceiving benefits from the RRT program facilitated RRT sustainability in several ways: specifically, RRT members were recognized as expert consultants and resources, staff knew that care was provided, and they worked as teams. Participants at the two high-sustainability hospitals also said that continuing and expanding the RRT program in the organization enhanced RRT sustainability.

Organizational factors. Two organizational factors were captured in the PMOS, namely institutional strength and program champion. Participant comments regarding the contexts and

processes that facilitate or inhibit RRT sustainability with respect to these factors are discussed in the section that follows.

Institutional strength. Institutional strength was defined in this study as the alignment of goals between the RRT program and the hospital implementing the RRT, the presence of strong, competent leadership, and the presence of nursing staff with high education levels. Participants at all four hospitals reported that institutional strength enabled RRT sustainability by facilitating the organization of and within the RRT program, establishing processes for RRT program accountability and safety, and improving the RRT program. Participants at Hospital High-2 also reported that empowering nurses in the organization reflected institutional strength and facilitated RRT sustainability (see Table 27).

At all four hospitals, participants reported that the presence of RRT program structures and lines of authority brought organization to the RRT program. Specifically, a process was created through which nurses could activate an RRT call; an RRT policy and an RRT order set guided the activities that occurred during a call, and reduced staff nurses' uncertainty about what to expect from each other during an RRT call; and RRT end-users were sure that an RRT member would respond once an RRT call had been made. Participants also reported that having someone oversee, "own", and monitor the RRT program through data collection and analysis helped to address program-related problems and develop strategies to make program improvements. Furthermore, organization of the RRT program ensured the availability of resources (like staffing and equipment) to support continuation of the program.

Participants at both the high- and low-sustainability hospitals said that structures and lines of authority, as well as RRT program and RRT member evaluations, created processes to keep RRT end-users and RRT members accountable for calling and serving on the team. Except in Hospital Low-2, participants in the RRT end-user group reported that knowing that RRT members were evaluated and held accountable reduced their fear that RRT members would belittle them for calling the team or discourage them from calling again. This, in turn, increased

end-users' comfort in calling the RRT. RRT end-user evaluations created a safety net for the end-users to give feedback on the RRT calls they participated in without fear of repercussions. Participants in the RRT member group reported that being evaluated encouraged them to work within their guidelines and scope of practice. The evaluations also informed them if their interactions with RRT end-users were perceived as threatening or belittling and allowed for correction of these behaviors.

Participants at all four hospitals also reported that formal RRT program evaluations—through data tracking and case reviews—provided hospital leaders with an opportunity to make program improvements that could enhance the effectiveness of the program. Increased program effectiveness, in turn, fostered calling. Knowing that RRT data were collected and shared with staff members created a sense of accountability in the organization for using the team and serving on the team. Data reviews also allowed for feedback to RRT end-users and RRT members, which fostered RRT end-users' calling and RRT members' service on the team. Participants also said that because RRT members' interventions were guided by an RRT order set, which reduced the risk for errors, the safety of patients was enhanced. At all the hospitals, participants reported that RRT program evaluations led to program improvements. Areas for improvement were identified and the necessary steps taken to correct problems that had the potential to inhibit calling such as limited staffing or lack of equipment. Evaluations of the RRT also provided evidence of RRT effectiveness and helped to show the need for resources to support the program and its continuation.

In Hospital High-2 participants said that nurses were empowered to activate RRT calls because the goals of the RRT program aligned with the organization's mission. When using the RRT, nurses had a sense of "owning" their practice and serving their patients, and since nurse autonomy and patient-centered care were organizational goals, nurses did not fear repercussions when they used the RRT.

Table 27

Participant comments: Organizational factors (Research Question Two)

Factors	Participant comments
Institutional strength	You have to have enough centralization so that you get the same outcome no matter where you are at. You have to enough decentralization that allows people to say, "Okay, that is great, but we are going to tweak it a little bit."
Program organization	Yes, you have to have that overall confidence level, that the administrative level no matter where it is at supports the processes so it is going to be a consistent process no matter where you at. (High-2; Leadership) I think it's more like a -- it's more organized, more stable. You know what's going on. You know what they're going to do when they come. It's not chaotic, not generally, not more than what it needs to be. You know what I'm saying? It's always chaotic. It's always chaotic but it's not extraordinarily chaotic. (Low-2; RRT end-user) But [X] was the person that owned the data and owned evaluating. Did we have a near-miss? Did we have a failure to rescue? So having somebody that kind of was accountable. (High-2; Leadership)
Program accountability and safety	Well, everything has to have guidelines. If we don't -- if we don't have someone somewhere in charge saying this is how you do it, then people tend to start going outside the lines and doing what they think is best rather than what, you know, maybe best practice says is best or you get yourself caught, you know, going outside the lines of what your practice says you should and could do so. (Low-1; Leadership)
Program champion	Well, I think they're respected clinically, and if they're going to promote it and advocate it, then staff's going to say this is okay. I know they've called it, because I've had conversations with them that they've actually called it.
Respect as expert clinician	So when they see the expert patient care coordinator on their unit calling an RRT, they're not afraid to call it. Then I think they mimic, well, if she's going to call it, if C. going to call an RRT, and she's pretty smart and I respect her, then it's okay. That's what it's there for. (High-2; Leadership) I love that she's part of it and I love that she always comes for the rapid response because I think she's very smart. I think she knows what she's talking about. I like her opinions. I like everything that she has to say. I think -- I don't know how long she's been a nurse but I look up to her as a new nurse. So I'll -- even when I don't need to use rapid response, I'll still call and say, "Hey, what do you think about this?" So having -- I think having the experienced nurse who people trust in it makes you feel a little bit better too. (Low-2; RRT end-user)
Display positive behavior	Because they have an inner fire, an inner excitement and they're able to encourage. They're able to teach in a way that they just seem to put equal staff at a level below them; they're able to provide that support. We know that we can go to them and ask questions for knowledge. We also know that we can go to them if we feel like there's a change that needs to be made. They're very open so yeah I think that that is definitely a benefit of the program champion. (High-1; RRT end-user)

Table 27

Participant comments: Organizational factors (Research Question Two)

Factors	Participant comments
Display positive behavior	Well, you know, just… Number one, he always responds. He listens to the staff, he's not pushy or bossy, he takes recommendations. If you say, "Hey, have you thought about this?" He's like, "Yeah, that's a good idea." I guess he's a staff advocate [Laughter] which is what I think a lot of hospitals need. . . Just someone who supports the nursing staff, recognizes that "Hey, I know you're working your butt off. I might not be able to help you any, but I recognize that and we appreciate it." It makes a big difference. (Low-2; RRT end-user)
Enhance organizational knowledge of RRT	I think because they would promote the use of RRTs then you would probably see even more Rapid Response Teams calls and again education for the staff. We've had a lot of new staff that have come up to our unit recently who are not familiar with the RRT program so I think that would be a huge benefit. More training of staff members and even promote the RRT and what it's designed for. (High-1; RRT end-user)
	Whether it was RRT or anything, you always need that one person who has that passion for whatever it is who can keep people excited, keep people wanting to learn, keep coming in with new information that they learned to keep it fresh in everybody's mind and just -- you get stagnant, you die. You don't want to do that. So that person keeps things new and keeps things fresh. . . . If you keep it fresh -- if you keep it fresh and you keep it exciting, then it's not the humdrum every day; "Yeah, there's an RRT, let me go." You know, if you're learning new stuff, and medicine is always changing so, you know, then you have -- the more knowledge you have, the more power you have to figure out what's going on with the patient. (Low-1; Leadership)
Assessment and evaluation	Of course because that would allow for someone to provide repetitive education, evaluate more in depth. Sure. (High-2; Leadership)
	Right now I get the forms every day, we keep up to make sure the documentation is right and if I see anything like equipment that wasn't there for the people or they took too long to respond anything like that, we do follow up to see what the issue was and if it looks like, "Geez I wonder what happened, should they have picked up on this sooner?" But we have follow up there but it's a monthly meeting and me just looking over the forms. (Low-1; Leadership)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1=hospital with highest score in high-sustainability group; High-2=hospital with lowest score in high-sustainability group; Low-1=hospital with highest score in low-sustainability group; Low-2=hospital with lowest score in low-sustainability group

Champion. Participants at all four hospitals reported that RRT champions facilitated RRT sustainability when they displayed positive behaviors, enhanced organizational members' knowledge of the RRT, and evaluated the RRT program. Participants at the two high-sustainability hospitals also said that champions facilitated RRT sustainability because they were respected as expert clinicians. Participants in one high-sustainability hospital reported a need for champions who were in positions of leadership as well as clinical experts.

Participants at all four hospitals reported that when champions marketed, promoted, and advocated for the RRT program, they communicated to RRT end-users the importance of the program and inspired these end-users to "do their best" in caring for their patients, including activating an RRT for a patient in crisis. RRT end-user confidence in using the RRT was also enhanced.

Except at Hospital Low-2, participants at all of the study hospitals reported that champions enhanced organizational members' knowledge of RRTs. They kept the program in view and reminded staff that the RRT was available as a resource when they needed it. Informal education often occurred when the champion rounded on nursing units and talked to staff members about the RRT. Informal education also occurred when RRT end-users received feedback from RRT members following RRT calls.

Participants at the two high-sustainability hospitals and one low-sustainability hospital (Hospital Low-1) reported that champions evaluated the RRT program through data collection and analyses and interpretation of the results, which allowed them to make improvements and enhance the effectiveness of the RRT program. Participants at the high-sustainability hospitals reported that champions, who were viewed as expert consultants facilitated RRT sustainability. Participants in the RRT end-user group reported that when champions called the RRT for their patients in crisis, it re-assured them that calling the RRT was not a sign of incompetence and it was correct to call. In effect, champions role-modeled the desired behaviors for RRT end-users, and reduced their fear of repercussion if they activated an RRT call.

Summary of organizational factors. Participants at the high- and low-sustainability hospitals reported similar institutional strengths that facilitated RRT sustainability: RRT program organization, processes for RRT program accountability and safety, and improvements in the RRT program. The only difference between the two high- and low-sustainability hospitals was that nurses felt empowered to activate the RRT in the high-sustainability hospitals.

Participants' at all four hospitals reported similar processes by which champions facilitated RRT sustainability: they displayed positive behaviors, enhanced organizational members' knowledge of the RRT, and assessed and evaluated the RRT program. However, only participants at the high-sustainability hospitals reported that champions were respected and viewed as expert clinicians.

Individual, team, and other organizational factors. Participants identified several individual, team, and organizational factors that were not present in the PMOS. These factors also facilitated and/or inhibited RRT sustainability.

Individual factors. As noted earlier, participants at both high- and low-sustainability hospitals reported that three individual factors facilitated or inhibited RRT sustainability: experience with RRT calls; nurses' relevant knowledge, skills, and experiences; and nurses' attitudes towards RRT use. At all four hospitals, participants reported that when RRT members' attitudes were positive and they were perceived by RRT end-users to be supportive, end-users were more likely to call and the experience thus facilitated RRT sustainability. When the team members were derogatory or questioned RRT end-users' decision to call the team, RRT call experiences inhibited RRT calling.

Participants at both high- and low-sustainability hospitals reported that when RRT end-users lacked the relevant knowledge, skills, and experience to identify when and how to activate an RRT call, they felt insecure and lacked the confidence to call. At the high-sustainability

hospitals, participants noted that RRT end-users' insecurities stemmed from fear about how they would be perceived by RRT members. Some participants said they were afraid that RRT members might think they were weak because they needed help to take care of a patient in crisis. Participants also said that they were afraid their peers might think they could not manage the care of their patients. At the low-sustainability hospitals, participants in both the RRT member and RRT end-user groups reported that end-users felt insecure and fearful to activate RRT calls because they did not want to "bother" the critical care nurse who would respond to RRT calls, and they were afraid of negative team member attitudes.

Participants in the RRT member group at the high-sustainability hospitals noted RRT end-users lacked the personal confidence to decide to call the RRT for a patient in crisis because they lacked relevant nursing knowledge, skills, and experiences. They also said that RRT end-users lacked the personal confidence to be proactive and call the RRT in situations where a physician's order might not be forthcoming.

Team factors. Important team factors that were identified at the four hospitals included confidence in the effectiveness of the RRT, perceived teamwork and collegiality, and RRT member support. Participants reported that when they observed how effective the RRT was, for example, quickly intervening and treating the patient in crisis, or transferring the patient to a higher level of care, their confidence in the team was enhanced, thus facilitating future calling.

At high-sustainability hospitals, participants in the RRT end-user group said that when RRT members' attitudes towards them were positive, they experienced a sense of collegiality and teamwork. Positive RRT member attitudes and behaviors such as collaborating with and involving RRT end-users during an RRT call created a sense of collegiality and teamwork that reduced the fear of calling. This was not mentioned by participants at the low-sustainability hospitals.

Table 28

Participant comments: Other sustainability factors identified (Research Question Two)

Factors	Participant comments
Individual factors Insecurity and lacking personal confidence in calling	I don't think it's really ignorance but I think it's nurses not being proactive to initially like if you call the doctor and they do not decide to give any orders that you have that option to call the Rapid Response . . . I have seen in the past a couple of nurses that will not do that. It's just not having enough security behind them or knowledge that they can do that.. . .Maybe not enough experience to where they would want, you know, if a doctor said well we'll just do this, this and this and you figure your patients are really crashing and they need better care right then to get them stable that's where the Rapid Response Team comes in. (High-1; RRT end-user)
	Maybe nurses' insecurities about calling. A lot of--we try to encourage the new nurses, "You don't have to have the answers. You just have to know your patient is different, you have to know that something is wrong." We do try to really foster that. Just call them and ask them; they'll come out, they'll asses the patient. If it's nothing, then your patient gets to stay where they are and you just get to update the doctor. If it's something big, then you've helped that patient, you may have saved that patient. So, the nurses' insecurity probably may get in the way, but that would be the only thing I know of. (Low-2; RRT end-user)
Team factors Confidence in RRT	Being a noncritical care nurse, I think it is a comfort to know that you can get help quickly from---you could bring that critical care expertise to the bedside, and I think that a lot of staff nurses feel that way that there is somebody that they can call. (High-2; Leadership)
	Just because not that we use it as a crutch. . . but I think it makes all of us nurses feel so much better that all I have to do is to pick up a phone and we can get our patient taken care of. You know what I mean? If our patient is just not doing good because of course, your anxiety level's through the roof and you're stressing out and you can't get the doctor. But if you call rapid response, then the people that come, they can take care of what you need taken care of. It just -- it makes me feel better that my patient is going to be where they need to be or -- you know what I mean? (Low-2; RRT end-user)
Perceived teamwork and collegiality	Another thing it fosters is when we go to a call, especially how you handle it and including, emphasizing that you're a part of their team. You're not the Lone Ranger coming in and taking over the whole situation. You're a part of the team and an extra hand that just happens to have lots of ability to order testing and do a few things and stuff like that and ideas. This has made people feel more comfortable about calling and so they don't feel like you're coming in and going "why you did not that", so they are very comfortable with calling. (High-1; Leadership)

Table 28

Participant comments: Other sustainability factors identified (Research Question Two)

Factors	Participant comments
	It's probably just the level of--well, we like to think that we have that sense of camaraderie with the nurses on the RRT Team because they were in our position once. So, feeling supported by them, they're very quick to offer support, you don't feel like they're judging you for the decision that you've made. (Low-2; RRT end-user)
RRT member Support	I talked about how we instill upon nurses to use it, but I think sometimes just that fear of, they'll think I'm weak. That's my opinion. Or if they use it one time and they have an experience where a nurse comes down and they're like, really, you called me for this? Not that that happens very often, but I think if they use it and they don't have a good experience, next time they need it they're not going to call it. But I think that fear of, they think I'm weak, that would be my opinion. (High-2; Leadership)
	I think that the response that the staff nurses get when someone comes to help them, if they looked down on them or they are not positive with them and congratulate them a good job, I think that impacts them calling them again. I think success that they see someone listen to them. Them saying that the patient, oh we intervened, we got something done," or maybe they didn't have to move [the patient] any place but kind of reinforces they're doing okay, they're doing the right thing. (Low-1; Leadership)
Other organizational factors	I think just better education from the nurses, and we are doing that. When we go to an RRT and we have that happen, then, you know, we tell them, "You know, just because you got in touch with the doc and you got new orders, when that didn't work, you know, don't hesitate to call. You're not calling the code on the patient; you're just calling for another set of eyes, and that's what we're here for because we might pick up something that you haven't seen yet," you know, so – but, we are educating. . .(High-1; Leadership)
Education and knowledge of the team	Well, right now, is our staff and we don't have a whole lot of staff and I know in the [ICU] unit, the people are very young and they just come in to the unit, and they have not been trained yet to go to RRT. . . . Getting qualified people. (Low-1; Leadership)

Table 28

Participant comments: Other sustainability factors identified (Research Question Two)

Factors	Participant comments
Lack of experienced critical care nurses	Factor was not present at high sustainability hospitals. Like I said, right now we have the extra nurse but that was a major problem we had and we only have it on day shift that when we don't have it, that was the major problem we have was being able to drop our patients to go down there because …There were some days that you couldn't do that or you're in the middle of a procedure and Rapid Responses must be rapid and you can't get down there in time. Plus, the lack of nurses that we have that is able to go to the Rapid Responses because we have had turnover back here also. So, it's not uncommon for night shift not to have someone that is Rapid Response. If my Rapid Response person called out because we only have one on a shift and if she calls out, then the supervisor's responsible for doing the Rapid Responses. So, that can be a problem. (Low-2; RRT member)

Note. Content in parentheses indicates the case hospital from which the comment originated, followed by the type of participant (i.e., leadership, RRT member, RRT end-user) who made the comment. Case hospitals are distinguished as: High-1=hospital with the highest score in the high-sustainability group; High-2=hospital with the lowest score in the high-sustainability group; Low-1=hospital with the highest score in the low-sustainability group; Low-2=hospital with the lowest score in the low-sustainability group.

Participants at both groups of hospitals reported that when RRT members' attitudes were negative, end-users felt they lacked RRT member support, and reduced end-users sense of security, trust, and value, which in turn inhibited calling.

Other organizational factors. The majority of participants at the high-sustainability hospitals reported that collecting RRT data and disseminating the results increased staff members' knowledge of the team and organizational members' awareness of the availability of the RRT program. This was not mentioned at the low-sustainability hospitals.

As noted earlier, only participants at the low-sustainability hospitals reported that a lack of available skilled, experienced critical care nurses inhibited RRT sustainability. This lack resulted in delayed RRT member responses, and thus RRT sustainability was inhibited because RRT end-users felt unsupported, particularly when the patient situation was critical and required immediate intervention. Delayed RRT calls also reduced RRT end-users' confidence in the team, which further inhibited RRT sustainability.

Summary of individual, team, and other organizational factors. RRT sustainability was inhibited when nurses lacked the knowledge, skills, and experiences to activate an RRT call, or they felt insecure and lacked the personal confidence to activate a call. Two team factors reported by participants to facilitate RRT sustainability at both high- and low-sustainability hospitals were participants' confidence in the RRT, and their perceptions of teamwork and collegiality during RRT calls. RRT sustainability was inhibited when RRT end-users felt unsupported by RRT members during RRT calls. RRT sustainability was facilitated in the two high-sustainability hospitals by staff members' education on the RRT program and their knowledge of the team. RRT sustainability was inhibited at the low-sustainability hospitals by a lack of experienced critical care nurses who could serve as RRT members.

RRT Sustainability

Participants at both the high- and low-sustainability hospitals, when asked if they believed that the RRT program would continue to exist as a service to patients and staff, reported that the program would continue.

Two questions, used by Mancini and Marek (2004) to measure sustainability, were adapted and used in this study (see Table 29). Eighty-five percent of participants in the high-sustainability hospitals, and 87% of participants in the low-sustainability hospitals, were very confident that the RRT at their organization would still be active in 5 years. The reasons that participants at the high-sustainability hospitals gave to explain why they were only somewhat confident that RRTs would still be active in 5 years were a continually changing healthcare system, the development of new programs at their hospitals that might nullify the RRT program, and competing organizational demands such as implementation of a new computer software programs and/or information systems. Participants at the low-sustainability hospitals said the poor economic climate and availability of limited funds might put the RRT program at risk, and they noted that they had seen innovations fade away over time.

Fifty-nine percent of participants in the high-sustainability hospitals and 70% of participants in the low-sustainability hospitals reported that RRTs fully met the needs of patients. Forty-one percent of participants in the high-sustainability hospitals and 22% of those in the low-sustainability hospitals said that RRTs met the needs of patients only moderately. No participants in the two high-sustainability hospitals said that RRTs met the needs of patients only somewhat or not at all. However, 9% of participants in the low-sustainability hospitals reported that RRTs met the needs of patients only somewhat.

Responses to these two aforementioned questions were compared for the two high- and low-sustainability hospital groups student's t-test. The mean for responses to the question "active in five years" for the high-sustainability hospitals (M = 2.85, SD = 0.362, N=27) was not significantly different than the low-sustainability hospitals (M = 2.86, SD = 0.344, N = 23), t(48)

= 0.176, p = .430. The mean for responses to the question "extent to which RRTs meet the needs of patients" for the high-sustainability hospitals (M = 3.07, SD = 1.29, N=27) also was not significantly different than the low-sustainability hospitals (M = 3.60, SD = 0.656, N = 23), t (48) = -1.787, p = 0.08.

Table 29

Views of the Continuation of RRTs

	High-Sustainability N=27 N (%)	Low-Sustainability N=23 N (%)
How confident are you that RRTs will still be active in 5 years?		
Very	23 (85)	20 (87)
Somewhat	4 (15)	3 (13)
Not at all	0	0
In your opinion, to what extent do RRTs meet the needs of patients?		
Fully	16 (59)	16 (70)
Moderately	11 (41)	5 (22)
Somewhat	0	2 (9)
Not at all	0	0

Reasons why participants at the high-sustainability hospitals thought that RRTs only somewhat or moderately met the needs of patients included the fact that RRTs were not called for all patients who could have benefitted from the RRT, there was a limited RRT order set restricted to the care of patients with certain conditions, and the organization had failed to include other disciplines besides nursing and respiratory therapy (e.g., physicians? Who?) on the RRT. Participants at the low-sustainability hospitals also suggested that RRT end-users may not have called an RRT for patients who could have benefitted from the RRT because more training was needed to increase nurses' awareness of the RRT program, and that often experienced nurses on

units were sought out by those nurses who might have called the RRT to help them address the immediate needs of the patient instead of calling the RRT.

Two questions were used to examine the maintenance of the perceived and actual benefits by RRTs. First, participants were asked whether the benefits they perceived from RRT implementation had persisted in the organization since the initial implementation of the program. The overwhelming majority of participants responded "yes". All participants at the high-sustainability hospitals reported that these benefits had persisted and 83% of participants at the low-sustainability hospitals reported that the benefits have persisted.

Second, at each hospital, the staff members who collected and analyzed the RRT program data were asked if the patient outcomes associated with RRTs had been maintained in the hospital. These persons were asked to report the maintenance of specific patient outcomes that had been used to measure RRT effectiveness, including acute care inpatient mortality rates, unplanned intensive care unit transfers, codes outside of the intensive care unit, and codes per 1000 discharges. Both the high- and low-sustainability hospitals reported that three of these patient outcomes were maintained: decreased unplanned intensive care unit transfers, codes outside of the intensive care unit, and codes per 1000 discharges. In all of the organizations, however, acute care inpatient mortality rates were reported as unchanged.

Factor Rankings and Relationships

Participants were asked to rank the five factors in the PMOS (i.e., project negotiation process, project effectiveness, training, institutional strength, and program champion) in order of importance, from most to least important. The participants rated program champion as the most important, followed by the project negotiation process, training, and institutional strength. Project effectiveness was ranked as the least important factor.

As shown in Table 30, there were differences between the high and low-sustainability hospitals. In the high-sustainability hospitals, participants ranked the presence of a program

champion as most important, whereas participants in the low-sustainability hospitals ranked training as most important, and the presence of a program champion was ranked third. The only factor that was ranked the same in both the high- and low-sustainability hospitals was the project negotiation process, which was ranked second.

Table 30

A Comparison of Factor Rankings

Rank	Overall	High-Sustainability Hospitals	Low-Sustainability Hospitals
1	Program Champion	Program Champion	Training
2	Project Negotiation Process	Project Negotiation Process	Project Negotiation Process
3	Training	Training	Program Champion
4	Institutional Strength	Institutional Strength	Project Effectiveness
5	Project Effectiveness	Project Effectiveness	Institutional Strength

Participants were also asked whether the factors in the PMOS were inter-related; 44% of participants responded "yes". Eight (29%) participants at the high-sustainability hospitals and 14 (61%) participants at the low-sustainability hospitals said that the factors were inter-related (see Figure 4).

Participants reported that four factors affected project effectiveness: the project negotiation process (n=9), training (n=8), institutional strength (n=6), and the program champion (n=4) (see Figure 6). At the two high-sustainability hospitals, participants said that the project negotiation process affected training (n=3), and institutional strength affected training (n=2), the project negotiation process (n=2) and program champion (n=2). At the two low-sustainability hospitals, few participants identified relationships between factors; one said a program champion affected training, one said the project negotiation process affected institutional strength, and one said the project negotiation process affected program champion. A few participants at either the high- or low-sustainability hospitals reported other relationships, namely the project negotiation

process affected the program champion; project effectiveness affected the project negotiation process; and training affected institutional strength (see Figure 4).

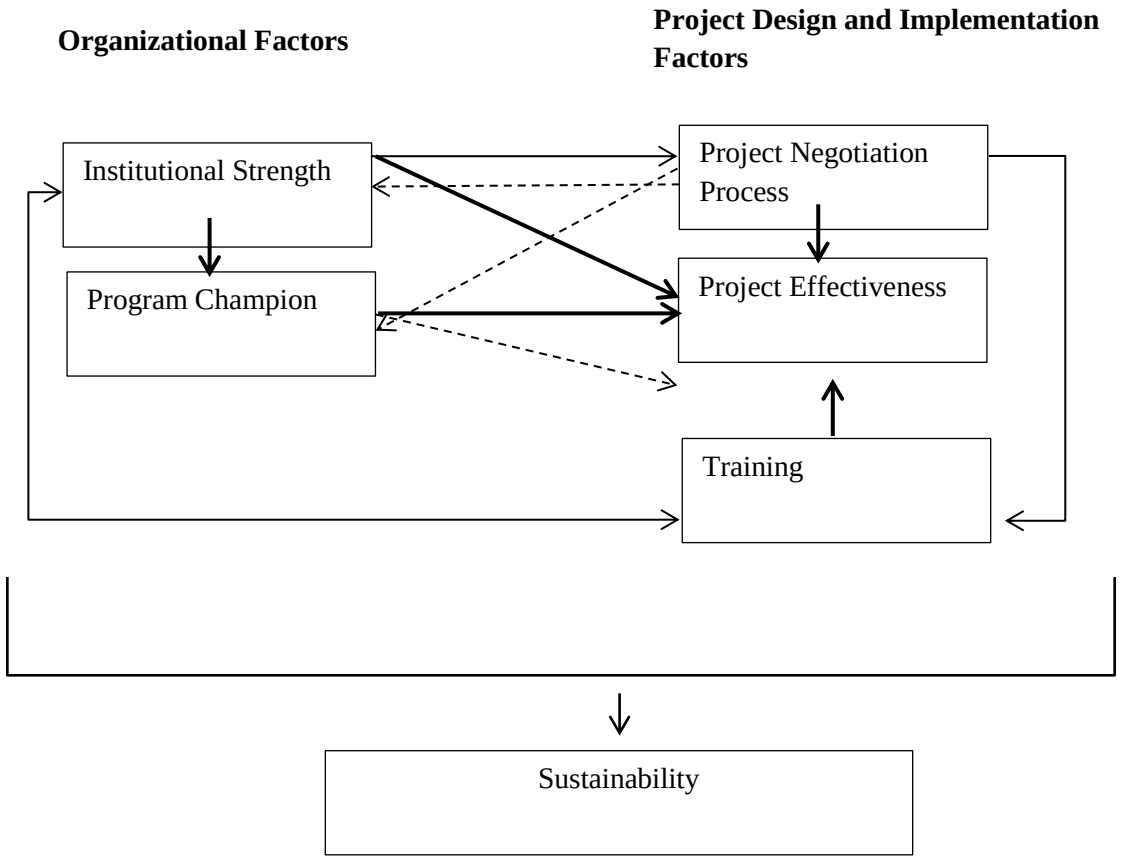

Figure 4. Schematic drawing of reported relationships between PMOS factors. (a) Bold lines represent factor relationships reported by participants in both the high- and low-sustainability hospitals. (b) Solid black lines represent factor relationships reported by participants in the high-sustainability hospitals. (c) Broken black lines represent factor relationships reported by participants in the low-sustainability hospitals

Summary

This chapter presented the results of the second phase of the study. Specifically, in this chapter, the results of a multiple case study examining four hospitals (two hospitals in the highest and two in the lowest quartiles of sustainability scores) were reported. Data were gathered using a brief hospital questionnaire, interviews with key stakeholder groups (leadership, RRT members,

and RRT end-users), and documentation review to gather information on RRT program sustainability. Both differences and similarities were found between high- and low-sustainability hospitals in terms of the presence of PMOS and other sustainability factors within these hospitals, as well as the contexts and processes that facilitated or inhibited RRT sustainability in these hospitals. Relationships between sustainability factors were also identified. The next chapter discusses the research results and presents a theory of RRT sustainability.

CHAPTER 6

DISCUSSION

This multiple-case study examined the factors, contexts and processes that promoted the sustainability of RRT programs in hospitals. The specific aims of this study were to determine the level of RRT sustainability achieved in a sample of NC hospitals; identify the presence of factors that do and do not support RRT sustainability; identify the organizational contexts and processes that facilitate or inhibit RRT sustainability; and develop a model of sustainability for RRT programs in hospitals. This chapter presents a summary and discussion of key study findings relative to the findings reported in previous studies. The summary is followed by a discussion of the limitations of the study, the identification of areas for future research, and study conclusions.

Key Study Findings

The current study was conducted in two phases. Phase One used an online survey to determine the level of RRT sustainability achieved in a sample of NC Hospitals. In Phase Two, case studies were conducted with four hospitals in NC to determine the presence of sustainability factors, and the contexts and processes that facilitated or inhibited RRT sustainability. Data collection strategies in Phase Two included interviews and documentation review. The key findings in each Phase will be presented next.

Phase One: The Level of RRT Sustainability in NC Hospitals

Data were collected on the organizational characteristics, RRT characteristics and RRT outcomes. These data provided in-depth information of the hospitals and were used to select and describe hospitals included in Phase Two. In-depth information of the hospital characteristics and the characteristics of their RRTs and RRT outcomes were described in Chapter 4. A few findings are highlighted here. Variations in the RRT characteristics such as the type of team (RN-led versus MD-led), team composition, team activation (patients, families, and staff), and number of teams suggest hospital administrators adopted RRT models that best fit with the needs of the organization and the resources available, a reflection of flexibility that is crucial for the success of RRT programs. This finding is consistent with other sustainability studies that have reported that the ability of an innovation to be adapted to fit with the needs of an organization was important for the sustainability of the innovation (Bradley et al., 2005; Commins & Elias, 1991). Some hospital administrators reported perceived benefits of RRT implementation; however, some reported no changes in outcomes (i.e., acute care inpatient mortality rate, unplanned ICU transfers, codes outside of the ICU, and the number of codes per 1000 discharges). These findings are similar to the inconsistencies in outcomes reported in the research literature of improvements in patient outcomes (Bellomo et al., 2003; Jones et al., 2005) versus no improvements (Chan et al., 2010). The perceptions regarding the efficacy of RRTs were similarly mixed in the current study.

To determine the level of sustainability in NC Hospitals, data were gathered on RRT sustainability from 31 hospitals that participated in the NC-RRTC. The RRT-IS consisted of 23 questions and were administered to hospital administrators in Phase One. The results of the survey are discussed next.

RRT sustainability. Sustainability scores for the 31 hospitals, whose leaders returned surveys in Phase One, were calculated using data gathered via the RRT-IS. The RRT-IS was

developed from the LoIN, a scale originally developed by Goodman, McLeroy, Steckler, and Hoyle (1993) to measure the institutionalization of innovations in organizations. Sustainability scores derived from the RRT-IS ranged from the lowest score of 1.0 to the highest score of 5.19 (the possible range of scores was 1 to 7). These findings suggest that, despite participating in the NC-RRTC, RRTs have not yet become fully integrated and sustained in the hospitals that participated in this study. Thus, it is likely that more work is necessary to facilitate RRT sustainability in other hospitals as well.

Several possible reasons for the lack of RRT sustainability may exist. The NC-RRTC was a 9-month collaborative conducted in 2006 and 2007. Parsons (2011) argues that "holding the change" (p.37) is difficult once the initial excitement from implementing a project has died down. Also, as Donaldson et al. (2009) previously reported, prioritization of the RRT initiative in the face of other competing initiatives and priorities was challenging for leaders at both "robust" and 'challenged" hospitals (classified as" robust adopters" and "challenged adopters" by grantees in the Robert Woods Johnson Foundation RRT evaluation project). Therefore, it is possible that once the collaborative ended, hospitals may have lost the impetus for RRT sustainability that participation in the collaborative initially provided. Competing organizational priorities may have shifted organizational leaders' focus away from the RRT program and the mobilization of the resources needed to sustain the RRT program.

The RRT-IS was also used to determine how extensively and fully integrated RRTs had become in hospitals. The extent of RRT integration was determined in four subsystems: production (i.e., focuses on organizational production such as RRT plans and procedures), maintenance (i.e., focuses on the roles and performance of staff members), support (i.e., focuses on the procurement of resources to support the RRT program), and management (i.e., focuses on directing all other subsystems and includes the coordination of external demands). Hospitals in the sample were most successful with the integration of RRTs in the production and managerial subsystems. This was evident because hospitals expanded their RRT programs to most inpatient

and outpatient units (production subsystem). They monitored and evaluated RRT call activations and RRT member and team performance (managerial subsystem), and they assigned a supervisor to the RRT program (managerial subsystem).

Hospitals in NC were least successful with the integration of RRTs into the maintenance and support subsystems. The maintenance subsystem was deficient in formal, specific education for RRTs and hospital staff members, and lacked written, defined job/role descriptions for RRT policies and procedures. In the supportive subsystem, many aspects of the RRT program, such as FTEs for dedicated RRT member positions (i.e., a critical care nurse who did not take patients or who rounded on acute care units), purchase of equipment and supplies for use during RRT calls, and data collection and analysis activities, remained unfunded and was not a part of ongoing integration activities related to RRTs.

The level of RRT integration was determined by examining the presence of integration across three subsystems: passages (i.e., the first degree of institutionalization that signifies the emerging embeddedness of RRTs in hospitals), routines (i.e., the second degree of institutionalization signifying RRT permanence), and niche saturation (i.e., the highest degree of institutionalization that signifies optimal expansion of the RRT program in hospitals). The current study found that passages, routines, and niche saturation were achieved by many hospitals in certain areas of the RRT program, but were lacking in other areas of the RRT program. For example, twenty-nine hospital administrators (94%) reported the formalization of RRT member role expectations and RRT policies and procedures, but only six hospitals (19%) reported achieving passages in the supportive subsystem in the area of permanently dedicated funds that have been designated to the RRT program. Twenty-four hospital administrators (77.4%) reported that routines of four or more years were achieved in both the production subsystem (RRTs considered permanent status in the hospital) and the managerial subsystem (RRTs being monitored or evaluated). However, only four hospitals (12.9%) achieved routines of four or more years in the supportive subsystem. On a Likert rating of one to four, 24 (77.4%) hospitals scored

four, having achieved complete niche saturation in the area of RRTs becoming permanent status in the hospital. However, only one hospital (3.2%) achieved complete niche saturation with formal, specific, and ongoing education of staff who served as RRT members. These findings are similar to the work of Commins and Elias (1991), one of the few studies that examined passages and cycles (i.e., routines; niche saturation was not included in the study) who found that organizations have either achieved passages and cycles or were in the process of achieving passages and cycles.

Phase Two: The Presence of Sustainability Factors, and the Contexts and Processes that Facilitated or Inhibited RRT Sustainability

The Phase One sustainability scores of the four hospitals that comprised the sample of case hospitals in Phase Two ranged from 2.94 to 4.67. These hospitals shared similarities but also differences. For example, all four hospitals had RRTs that were RN-led, and staff, patients, and family members were allowed to activate RRTs. However, only hospitals that scored high on the RRT-IS had been recognized for excellence in patient care delivery by an external entity.

Phase Two of the study examined the factors, contexts, and processes that facilitated RRT sustainability by comparing high- and low-sustainability hospitals. It was expected that PMOS factors would be more richly represented in the high-scoring sustainability hospitals than in the low-scoring sustainability hospitals.

The PMOS proposed that certain project design and implementation factors (project negotiation process, project effectiveness, and training), and organizational factors (institutional strength and the presence of a program champion) facilitated RRT sustainability. Casey et al. (2009) and Evashwick and Ory (2003) used Shediac-Rizkallah and Bone's (1998) model to explore the sustainability of health promotion programs and reported that the factors in the PMOS facilitated the sustainability of programs. The current study, however, found that the factors of

the PMOS that were included in this study (project negotiation process, project effectiveness, training, institutional strength, and the program champion) were present in both high-sustainability hospitals and low-sustainability hospitals.

Some reasons for the differences in findings between the two aforementioned studies and the current study exist. First, a different measure of sustainability was used in previous studies and the current study. Casey et al. (2009) and Evashwick and Ory (2003) did not use a specific scale to measure sustainability as institutionalization—or the continuation of a program or program activities in organizations—of the health promotion program. The current study, instead, used a newly developed instrument, the RRT-IS, based on the Level of Institutionalization Matrix developed by Goodman et al. (1993), to measure sustainability as the integration and continuation of RRTs into becoming accepted practice in hospitals. The RRT-IS was developed by modifying an existing scale (namely the Level of Institutionalization Scale) that was initially developed by Goodman et al. (1993). Second, Casey et al. (2009) conducted their study in four organizations with the highest capacity score (indicative of their capacity to sustain the program over time), which suggested that their capacity scores may have been somewhat similar with regard to sustainability of innovations. In the current study, a sustainability score was determined and used to purposefully select the sample based on sustainability scores. Third, the PMOS factors were defined differently in each of the aforementioned studies than they were in this study, which may have contributed to the difference in findings.

The current study also uncovered factors that contributed to RRT sustainability in the study hospitals that have not been identified in previous studies (i.e., team factors, individual factors, and other organizational factors). The current study also expands the body of research on sustainability because it determined why and how the PMOS factors facilitated RRT sustainability.

Project design and implementation factors. The three project design and implementation factors that were examined (project negotiation process, project effectiveness, and training) were all present, to varying degrees, in both high- and low-sustainability hospitals. No additional project design and implementation factors were identified in the study. However, as will be discussed next, differences were found between high- and low-sustainability hospitals that may explain why some hospitals achieved high levels of sustainability and others achieved low levels of sustainability.

Project negotiation process. Similar to other studies (Casey et al., 2009; Patterson et al., 2013; Stetler, 2009) the current study found that engaging staff in the implementation process facilitated sustainability. This finding is consistent with other studies that have evaluated the implementation of RRTs in hospitals (Alexander & Ferlise, 2004; Donaldson et al., 2009). However, high-sustainability hospitals project negotiation process included: a bottom-up approach where staff members on acute and critical care units played an active role in RRT implementation processes; and the use of a large multi-disciplinary team that included a large segment of organizational nurse leaders in the RRT implementation process. The importance of involving staff members has been highlighted in the literature (Alexander & Ferlise, 2004; Bertaut, Campbell, & Goodlett, 2008; Donaldson et al., 2009; Shapiro et al., 2010; Simmons, 2004). However, the current study found that involving frontline staff (i.e., RRT members and RRT end-users) was particularly important for RRT sustainability. In addition, collaboration across multiple disciplines and the engagement of organizational nurse leaders during the development and implementation of an RRT program was also important.

The current study also identified contexts and processes that were important to the project negotiation process. Gaining staff members' buy-in and ownership by involving them in implementation activities was important for RRT sustainability at both the high- and low-sustainability hospitals. Beitler et al. (2011) also found that nurses' buy-in and ownership

resulted in higher numbers of RRT call activations and higher hospital-wide utilization rates. RRT end-users, who care for patients on acute care units, are likely responsible for making the majority of RRT calls. Thus, lack of RRT end-user involvement likely limited their buy-in and ownership in low-sustainability hospitals. In many ways, the staff members who were involved became informal champions who could advocate for the program and its continuation. They became RRT program "experts" and could promote the program and articulate the importance of the program to others. They also had a vested interest in seeing the program be successful. Being involved in the program also generated a belief with staff that effective teams were created because of the input of clinical staff that was knowledgeable of current clinical practices and procedures.

The study also demonstrated that an increased awareness and knowledge of the RRT program as well as a sense of security, trust, and value related to RRTs were critically valuable to the project negotiation process. These specific aspects have not been reported in previous sustainability studies. Staff involvement created opportunities for staff to learn more about the program and enhanced their knowledge and awareness of the teams that generated a sense of security, trust, and value that fostered future RRT calling. Their sense of security was enhanced because they understood the goals of the RRT program and the structures (RRT policy with calling criteria and staff members' roles and expectations during calls) that provided a safety net for activating the RRT and participating in calls. Nurses also learned that their input was valued and trusted by organizational leaders and that they could trust the RRT process. Donaldson et al. (2009) found that, in hospitals where RRTs were called routinely, nurses did not fear activating RRT calls because of the perceived support from RRT members and organizational leaders.

The learning that occurs from staff members' involvement in the RRT design and implementation process most likely augments the RRT program-related training staff members received during the RRT implementation process. Learning that occurred through involvement could also potentially alleviate deficits in the training that was provided. A relationship between

the project negotiation process and training is likely, with project negotiation processes positively affecting training. If, through the project negotiation process, informal champions are raised up in the hospital then the need for formally appointed program champions may also be reduced. These informal champions, who are expert clinicians, may carry more "weight" advocating for the RRT program to other clinicians than nonclinical, formally appointed champions like hospital administrators. Therefore, a relationship between the project negotiation process and program champions is possible.

RRT sustainability was, however, inhibited when RRT implementation processes failed to: (a) clarify role expectations for RRT members and RRT end-users, and (b) facilitate positive, supportive RRT members who responded to RRT calls. Several researchers indicated the need for program structures, such as policies, to facilitate sustainability (Curry et al., 2011; Chalker-Scott & Tinnemore, 2009). Program structures were also suggested as important for successful implementation of RRTs (Randhawa et al., 2011; Simmonds, 2005). But, the current study found that clearly defined role expectations for RRT members and RRT end-users were an important ingredient of RRT policies. Clarifying role expectations removes the uncertainty staff may otherwise experience during an RRT call and likely fosters better working relationships between RRT end-users and RRT members. The importance of a good working relationship between RRT members and RRT end-users was also demonstrated by Donaldson et al. (2009) in their study on RRT adoption.

***Project effectiveness*.** Similar to other sustainability studies reporting that sustainability is possible when staff perceived benefits from the implementation of an innovation (Commins & Elias, 1991; Finch et al., 2006), the current study found that staff members at both high- and the low-sustainability hospitals perceived RRT benefits that were important for RRT use. Studies have demonstrated that nurses were confident in the benefits they believed RRT implementation offered (Salamonson et al., 2006; Shapiro et al., 2009). Such benefits included access to medical

experts and backup support (Salamonson et al., 2006) and increased nursing knowledge (Williams et al., 2011). The current study further expanded the RRT literature by explicating the specific benefits staff perceived RRTs offered for patients, staff members, and the organization. For example, patient benefits reported by participants included early recognition and intervention and enhanced patient safety. Staff member benefits, reported by participants, included reduced RRT end-user work load and work stress. Organizational benefits included cost-effectiveness, reduced organizational liability, and improved nurse, patient, and family satisfaction.

Sustainability was enhanced when hospitals capitalized on the learning opportunities an RRT call offered and it was perceived as a benefit of RRTs, suggesting that an environment of learning may foster sustainability. In high-sustainability hospitals, RRT members would instruct end-users about the patient's clinical situation and the reasons behind the team's interventions. This finding is consistent with reports that nurses' awareness and knowledge of the RRT were increased when the RRT was used to promote learning (Williams et al. 2011). The importance of learning, in the context of RRT calls, was demonstrated by Williams et al. (2011), who reported that using the RRT as a learning tool facilitated staff members' awareness and knowledge of the RRT. Studies on innovation sustainability have not reported on the presence of a learning environment as a determinant of innovation sustainability. Using RRTs as a learning tool may foster sustainability because users' knowledge and skills were enhanced and, in turn, likely reduce their uncertainty and fear to use the team. RRT members teaching and mentoring staff members likely also helped to build the relationship between staff and RRT members, thus enhancing the cohesion between staff and RRT members and facilitating RRT utilization and sustainability.

The teaching and mentoring that occurred in the context of the RRT call likely fostered sustainability because it augmented the formal training staff received about the RRT program. When hospitals capitalize on the learning opportunities that RRT calls provide, organizations may

be able to overcome training vacuums that may exist when the initial training that was provided or ongoing training are inadequate.

Perceived RRT benefits, in conjunction with certain organizational contexts and processes, facilitated RRT sustainability. These included the recognition of RRT members as a resource for RRT end-users and teamwork and collegiality. Working with and observing the effectiveness of RRT members during a call underscored their expertise and their availability to help end-users to take care of the patient in crisis. This resource recognition fostered consultation and collaboration between RRT end-users and RRT members outside of the context of an RRT call which, in turn, built relationships between end-users and team members and increased staff cohesion. Cohesion was also enhanced when RRT members included RRT end-users in the RRT response and calls were characterized as collegial. Because staff members' fear and uncertainty about activating RRT calls were reduced, their sense of security and trust were enhanced, facilitating the utilization and sustainability of RRTs. The RRT call environment, as a facilitator of RRT calling, was also highlighted by Shapiro et al. (2010) and Williams et al. (2011) who reported on the importance of the interaction that occurs between RRT members and end-users during a call to reduce nurses' anxiety and fear of calling RRTs. The current study further demonstrates that a sense of cohesiveness between RRT members and RRT end-users was also important.

Perceived RRT benefits also fostered the continuation and expansion of the RRT program to other patient populations such as psychiatry and labor and delivery. It is unclear why RRT continuation and expansion were mentioned only by high-sustainability hospitals. High-sustainability hospitals were, however, characterized by an environment that valued information sharing among leaders and staff members. Therefore, it is possible that participants in the high-sustainability hospitals had a greater awareness of RRT continuation and expansion because RRT program information and outcomes were shared with staff members. Also, as the RRT program was expanded to other areas, the number of patients that might potentially need an RRT call

increased and the number of staff members that learned about the RRT program and could call the RRT for their patients increased. These staff members were also likely, over time, to perceive benefits from RRTs which, in turn, further contributed to RRT sustainability. Thus, perceived benefits may contribute to organizational sustainability of RRTs by fostering staff awareness through the sharing of RRT program information with staff members, and the expansion of the RRT program to other patient populations (e.g., adult and pediatric patients).

Training. The current study demonstrated that training contributed to RRT sustainability in different ways. At the two high-sustainability hospitals, training was provided prior to launching the RRT program as well as on an ongoing basis. At the two low-sustainability hospitals, participants reported that the pre-launch RRT training was either insufficient (Hospital Low-1) or did not occur (Hospital Low-2). However, at both of these hospitals, RRT training was provided after RRTs were already operating. Therefore, the training provided *prior to* launching the RRT program appears to have contributed to RRT sustainability in the high-sustainability hospitals. Several reasons may explain why training prior to launching the RRT might have been important. RRT implementation was likely initially an organizational priority, thus more resources may have been used to train staff members, enhancing the quality and comprehensiveness of the training program. Such comprehensiveness might have translated into staff members initially being able to better identify patients who needed an RRT call compared to those who might not have received comprehensive training. Training prior to launching RRTs likely also led to nurses adopting RRTs sooner than those who received training later and this might have translated into earlier perceptions of benefits of RRTs, which fostered RRT use.

Participants in all four hospitals indicated that improvements were necessary in the RRT training that was provided (e.g., teaching staff members about how and when to activate an RRT call and clarifying the role expectations for RRT members and end-users), suggesting that none of the RRT training programs were comprehensive. Yet, two hospitals achieved high levels of RRT

sustainability. This finding is in contrast to the work by Pina (2008), who demonstrated that a comprehensive and ongoing training program was necessary to achieve the sustainability of innovations. Others have similarly demonstrated that training was an important factor for program sustainability (Bossert, 1990; Casey et al., 2009; Parrish et al., 2009; Stolee et al., 2009) and for RRT implementation and use (Garretson et al., 2006; Kirk; 2006; Murray & Kleinpell, 2006). Specific to RRTs, training has been reported as important in establishing a sound knowledge base of the RRT program and reducing nurses' uncertainty and fear of calling the RRT (Donaldson et al., 2009; Kirk, 2006).

Lack of training could negatively impact staff members' use of the RRT, as was suggested from participants who reported feeling insecure and lacking personal confidence in calling the RRT. Conversely, learning about RRT calling criteria and the roles and responsibilities of the RRT and other staff during RRT calls likely facilitated the rapid identification of situations when an RRT call was necessary. Furthermore, role uncertainty during the RRT call is removed because staff members know what was expected of them during calls, enhancing the effectiveness of all team members and the RRT program. The more staff members learn about RRTs, the more they are likely to come to understand the usefulness of RRTs in their daily practice of caring for patients. Therefore, providing staff training prior to launching RRTs and providing ongoing training with the program may contribute to sustainability through staff members': (a) understanding of the purpose of RRTs, (b) knowing when and how to call RRTs and role expectations, and (c) gaining the personal confidence to call RRTs.

Some new factors, namely team factors and individual factors, were identified in this study: confidence in the effectiveness of the RRT, lack of RRT member support and perceived teamwork and collegiality; and individuals experiencing RRT calls and feeling insecure and lacking personal confidence in calling the team. Training RRT members to facilitate positive RRT member behavior is essential for RRT sustainability because RRT members play an incredibly important role in facilitating RRT end-users' experiences with RRT calls. Nurses'

experiences during RRT calls can be both a facilitator and inhibitor to RRT calling. When RRT members are positive, supportive, and encouraging with RRT end-users, end-users' experiences with the team were seen as positive and facilitated future calling. However, demeaning, resentful or rude behavior was inhibiting. A high level of RRT sustainability was reported in hospitals where RRT end-users perceived teamwork and collegiality between them and RRT members during RRT calls. These findings are consistent with Astroth et al.(2013), who reported that RRT calls were fostered when RRT members were positive, provided immediate assistance, and mentored RRT end-users. RRT calling was inhibited when RRT members' communication was perceived as unsupportive, condescending, or questioning of the nurses' decision to call the team. This aligns with similar reports of the important role that RRT members play in facilitating RRT calling (Kirk, 2006; Shapiro et al., 2010; Williams et al., 2011). Thus, when there is an attitude of teamwork and collegiality between RRT members and RRT end-users, sustainability may be promoted. Poor RRT member behavior, lack of teamwork and collegiality, and individuals' experiences with RRT calls are likely a symptom of poor training. When the training of RRT members is insufficient in producing RRT member behavior that fosters calling, the perceived benefits of RRTs may be reduced. Therefore, training and project effectiveness are likely related.

The current study also found that training generated knowledge of the RRT program, improved staff awareness of the presence of RRTs in the hospital, and enhanced staff member's personal confidence in calling the RRT or serving as an RRT member. However, these processes were reported to be present in both high- and low- sustainability scoring hospitals. No specific contexts or processes were found that differentiated the high-sustainability hospitals from the low-sustainability hospitals with respect to the existence of ongoing training.

Given the importance of training, finding a low-level of sustainability in a hospital where no initial training was provided, and where the initial and current training was perceived as inadequate, might be expected. One might also expect that, when training was inadequate or absent, staff members' knowledge of using the teams effectively would be limited. However,

despite inadequate training, participants in one low-sustainability hospital still reported that they were using RRTs effectively. Some explanations for this finding exist. Some participants at this hospital did note that the training they received for the RRT program as new hires was adequate and of good quality. They noted that leaders had made improvements in the RRT member training over the prior six months (before the interviews), had incorporated annual RRT training in the on-line learning system, and had implemented the use of message boards in patient rooms that posted the RRT call number, which reminded staff of the availability of the RRT. It is also possible that the negotiation process that was used during design and implementation of the RRT program may have augmented nurses' knowledge of the program and generated informal champions who promoted the program and fostered an awareness of RRTs in the hospital.

Organizational factors. Two organizational factors were examined in this study: institutional strength and the presence of a program champion. The current study found that the factors "institutional strength" and "program champion" were present in all hospitals. However, some differences were observed between the hospitals.

Institutional strength. The four hospitals in this study's sample all demonstrated some level of institutional strength in goal alignment, strong, competent leadership, and/or nurses' education levels. Because institutional strength was specifically defined for this study, an overall comparison of institutional strength with other research reports is not possible. However, a comparison of the study's findings with respect to the different aspects of institutional strength—goal alignment, strong, competent leadership, and education level—with other studies is presented.

Participants in all hospitals perceived several goals that aligned between the hospital and the RRT program such as providing better patient care and enhancing patient safety. Thus, goal alignment between the RRT program and hospitals was not limited to only those who attained

high levels of sustainability. Although Barnett et al. (2011) and Casey et al. (2009) found goal alignment present in high-sustainability organizations, similar to the findings of this study, Commins and Elias (1191), demonstrated that goal alignment was also found in organizations that had not yet fully achieved sustainability. Given that the underlying mission of most hospitals is to provide excellent patient care, and RRTs are espoused as a vehicle that promotes excellent care, it is not surprising that participants at both high- and low-sustainability hospitals reported goal alignment. . The alignment of RRT program goals with those of the organization underscores the importance and value of the RRT program to the organizational leaders, staff members, and patients and fosters the mobilization of funds and resources to support the RRT program and its continuation. Perceptions of value also increase staff members' personal confidence and sense of security to activate RRT calls.

Leaders' roles are critical for organizational change, which is often required when innovations are adopted and implemented. Leaders set organizational goals, provide direction, create the necessary structures to support programs, and manage the resources that are crucial to the program's success (Parrish et al., 2009). Mancini and Marek (2004) and Curry et al. (2011) demonstrated the importance of competent leaders who create the necessary program structures (such as policies and guidelines), oversight, and evaluation processes to facilitate the sustainability of innovations. Sustainability was achieved when creating structures and lines of authority led to RRT program organization and accountability (by collecting and analyzing RRT data) and when RRT program outcomes were shared with staff members. Program organization and accountability processes facilitated the opportunity to identify and address program problems and thus to enhance the effectiveness of the RRT program. Sharing program results with staff members likely motivated and empowered them to call the RRT and increased staff members' perception of program benefits (i.e., project effectiveness) and their support for the RRT program. Thus, a positive relationship may exist between institutional strength and project effectiveness

This study found that another important organizational factor was leadership support, which might be seen as a fourth dimension of strong, competent leadership, along with establishing structures to support the program, creating lines of authority, and implementing evaluation processes. High levels of RRT sustainability were achieved in organizations where there was perceived leadership support for staff members to use the RRT program. This finding was consistent with Donaldson et al.'s (2009) report of nurses' perception that their leaders supported the RRT program because they encouraged nurses to call the RRT. RRT calling was facilitated when leadership support fostered nurse autonomy. Because nurse leaders encouraged nurses to practice autonomously and call the RRT when they identified the need, nurses felt that they would be supported should their decision to activate an RRT call be questioned. Nurses did not fear or hesitate to call the RRT, particularly when they encountered physician resistance to RRT calling. Thus, leadership support translated into autonomous practice that fostered nurses' sense of security and trust to use the RRT.

Education level is the last aspect of institutional strength. The current study found that the percentage of nurses with a baccalaureate degree in the high-sustainability hospitals was very similar to the percentage found in low-sustainability hospitals. This is inconsistent with other studies. For example, Wynn et al. (2009) found that nurses' educational preparation was an important predictor of RRT activation and use. Specifically nurses who would activate RRTs more independently were more likely to hold a BSN. In contrast, the current study found that the percentage of nurses with a baccalaureate degree in each of the high-sustainability hospitals (28% and 42%) was not higher than the percentage of nurses with a baccalaureate degree in each of the low-sustainability hospitals (20% and 33%). Several reasons for the differences in findings may be possible. First, Wynn et al. (2009) sampled only 75 nurses in an academic medical center, which may not have been a full representation of the nurse characteristics of the organization. Second, because autonomous practice was fostered and supported in the high-sustainability hospitals, nurses in the high-sustainability hospitals were likely more autonomous practitioners

than their counterparts in the low-sustainability hospitals, resulting in increased RRT utilization and use. Third, it is also possible that nurses with a baccalaureate degree in the high sustainability hospitals had more nursing experience than nurses with a baccalaureate degree in the low-sustainability hospitals, accounting for the different level of sustainability.

The current study found that nurses' experience (i.e., years of experience) helped them to identify patients who would benefit from the activation of an RRT call and promoted RRT sustainability. A major premise of RRT calling is that nurses will recognize the signs and symptoms of patient deterioration warrants an RRT call. But, without the knowledge and skills to identify patients who are in need of RRT intervention, RRTs may not be activated when needed. This will naturally result in RRT underutilization. This finding underscores the critical role RRT program-related training plays in fostering RRT sustainability. When comparing years of experience and RRT activation, Salamonson et al. (2006) found that nurses with high levels of experience (11 years or more) were more likely than nurses with low levels of experience (0 – 5 years) to activate an RRT call ($p = 0.018$). This finding is likely because seasoned nurses are more able to quickly identify subtle changes in their patient because of advanced assessment skills that only come from experience. They may be more confident in their nursing skills than less experienced nurses.

In summary, RRT sustainability is possible when there is alignment between RRT program goals and the goals of the organization, and when leaders are perceived to be competent, and create the necessary structures and lines of authority to support the RRT program. Furthermore, RRT program organization and accountability through evaluation and the sharing of program results with staff members, facilitates high levels of sustainability. RRT sustainability is also possible when nurses have the knowledge, skills, and nursing experience to identify patients who are in need of RRT interventions.

Program champion. Several studies have demonstrated that program champions play an important role in the sustainability of innovations (Bradley et al., 2005; Casey et al., 2009; Commins & Elias, 1991; Evashwick & Ory, 2003; Stetler et al., 2009) and the successful implementation of RRTs (Bertaut et al., 2008; Scott & Elliot, 2009). The current study also found that program champions were important for RRT sustainability in all four hospitals. Similar to Barnett et al. (2011), this study found that staff members from various positions (leaders and clinical staff) were identified as champions. Except for one participant report of a physician champion, all other champions in this study were nurses. This finding is in contrast to the reports by Bertaut et al. (2008) and Halvorsen (2007) who found a physician champion to be crucial to the successful implementation of RRTs.

The current study also found that there was an increased awareness of RRT champions and that they were more highly valued in the high-sustainability hospitals. This finding underscores those of Bradley et al. (2005) who demonstrated that program champions played a vital ongoing role in organizations once implementation activities ceased. The finding suggests also that a high level of sustainability is possible when program champions are visible and valued by staff members.

The role and responsibilities of champions and the positions they held in the hospitals were also examined in this study. A high level of sustainability was facilitated when champions promoted and marketed the RRT program, displayed positive behaviors (e.g., being enthusiastic about the program), and conducted RRT assessments and evaluation. Studies have reported that doctors and nurses can play very important roles as champions in the sustainability of innovations in hospital settings (Bradley et al., 2005). Champions are important because they can enhance staff members' knowledge and skills on how and when to activate the RRTs, and clarify their roles and responsibilities during calls, thereby reducing nurses' uncertainty and fear of calling and enhancing their personal confidence to call the RRT. Program champions can also play an

important role in program assessment and evaluation activities that serve to enhance RRT program accountability and subsequent effectiveness.

The current study also found that the champion's position in the organization (i.e., organizational leadership, expert clinicians, or RRT members) was perceived as less important than their specific actions and behaviors (i.e., passionately marketing and promoting the program). Therefore, organizations with a program champion who enthusiastically promotes and markets the RRT program and who are energetic and positive about the RRT program, and conducts RRT assessments and evaluations may have an advantage in achieving RRT sustainability in hospitals.

The factor program champion may be inter-related with institutional strength and the project negotiation process. There are several explanations for these possible relationships. First, the role of program champions may be reduced when strong, competent organizational leaders develop the necessary structures, lines of authority, and evaluation processes to allow for program organization and accountability. Second, leaders who are valued and visible in organizations and who show support for the RRT program may further reduce the need for formally appointed program champions. Finally, when staff members are involved in the design and implementation of RRTs, take ownership of the RRT program, and become informal champions, the need for formally appointed program champions may be reduced.

Program funding and resources. The current study found that the lack of funds to support a dedicated RRT member was an important inhibitor of RRT sustainability reported by the case hospitals. This finding is supported by Grimes et al. (2007) who suggested that the use of a dedicated RRT nurse was crucial to the sustainability of the RRT program. Dedicated RRT members could help to increase the visibility of the RRT program, to build rapport with RRT end-users and enhance cohesion between RRT members and RRT end-users, and aid in the early identification of patients who needed the RRT to intervene.

The lack of skilled, experienced critical care nurses who could serve as RRT members was another inhibiting factor at the low-sustainability hospitals. Kirk (2006) and Garretson et al. (2006) argued that critical care nurses with advanced assessment skills are essential to an RRT program's success. The current study similarly found that the lack of experienced critical care nurses made staffing the RRT out of the critical care unit difficult. It also increased the risk that a well-experienced critical care nurse who was trained as an RRT member was unavailable to respond to the RRT call. In fact, at one of the low-sustainability hospitals, a nurse with limited critical care nursing experience who did not receive any RRT member-specific training responded once to an RRT call because no one else was available. When inexperienced critical care nurses respond to RRT calls, they may not accurately identify the patient problem or institute the correct interventions to treat the problem, thus reducing the effectiveness of the team and increasing the risk for treatment errors and adverse patient events. Therefore, the lack of a dedicated RRT member and skilled, experienced critical care nurses who can serve as RRT members may be detrimental to achieving RRT sustainability in hospitals.

Factor Rankings and Relationships

The current study found that participants did not consider all PMOS factors as equally important to RRT sustainability. When participants were asked to rank the importance of PMOS factors, the program champion was perceived as being the most important factor, followed by the project negotiation process, training, and then institutional strength. Project effectiveness was ranked as the least important factor.

The important role that program champions play in sustainability—advocating, promoting, and marketing the program or innovation—is consistent with previous reports in the literature (Dopson et al., 2010; Casey et al., 2009; Goodman & Steckler, 1989; Scheirer, 2005) as well as in studies focused on RRTs (Donaldson et al., 2009). Therefore, finding that program champion ranked as the most important was not unexpected. However, the ranking of project

effectiveness as the least important factor was surprising. While it is true that programs can be sustained in organizations whether they are effective or not, Scheirer (2005) reported that the perceived benefits of staff members was one of the factors that was consistently considered important to sustainability.

When comparing the high- and the low-sustainability hospitals, participants in the high-sustainability hospitals ranked program champion as the most important and project effectiveness as the least important factor; participants in the low-sustainability hospitals, however, ranked training as the most important factor and institutional strength as the least important factor. In the high-sustainability hospitals, the ranking of program champion as most important seems fit because champions were highly visible, respected, and valued, and they shared RRT outcomes data with staff members. Because nurse autonomy was fostered in these hospitals, the driving force behind RRT calling may have been nurses' autonomous practice rather than their perception of RRT benefits. The ranking of training as most important in the low-sustainability hospitals also seems fit because the initial training provided in these hospitals was reported as inadequate. Thus, participants in these hospitals felt the need for more training compared to participants in the high-sustainability hospitals. Institutional strength may not have been perceived as important because leaders may have been less visible in the organization and RRT evaluation and outcomes data were rarely shared.

Stirman et al. (2012), in his review of sustainability studies, found that many studies suggested an interrelationship among sustainability factors. The current study identified some possible relationships among factors: program champion is inter-related with project negotiation process, training, and institutional strength; project effectiveness is inter-related with training and institutional strength. These relationships were reflected by participants' reports that the PMOS factors were all inter-related. In contrast to participants, a possible relationship between project negotiation process and institutional strength and between project negotiation process and project effectiveness appears less obvious.

RRT Sustainability

In Phase Two of the current study, two measures of sustainability were used: continuation of RRTs in organizations and the maintenance of benefits for the groups and individuals that RRTs were intended to serve. It was anticipated that the sustainability levels of hospitals in Phase Two would mirror the findings of Phase One. That is, compared to the low-sustainability hospitals, the number of participants who reported RRT continuation and the mean score of RRT continuation would have been higher at the high-sustainability hospitals. Also, in the high-sustainability hospitals, RRT program benefits would have been maintained, whereas in low-sustainability hospitals benefits would either not have been maintained, or would have been maintained for a shorter period of time compared to high-sustainability hospitals.

With regard to RRT continuation and contrary to expectations, this study found that 85% of participants in the high-sustainability hospitals and 87% of participants in the low-sustainability hospitals were very confident that RRTs would still be active, 5 years into the future. No significant differences were found in the mean score between high- and low-sustainability hospitals for "active in five years" ($p = .860$). One potential reason for very this lack of variation between the high- and low-sustainability hospitals may be that RRTs have become standard and accepted practice in hospitals because of the Joint Commission's requirement for such a team to exist for certification.

There was some variation in participant response regarding whether RRTs fully met the needs of patients: 59% of participants in the high-sustainability hospitals and 70% of participants in the low-sustainability hospitals reported that RRTs fully met the needs of patients. Forty-one percent of participants in the high-sustainability hospitals and 22% of those in the low-sustainability hospitals said that RRTs met the needs of patients only moderately. No participants in the two high-sustainability hospitals said that RRTs met the needs of patients only somewhat or not at all. However, 9% of participants in the low-sustainability hospitals reported that RRTs met the needs of patients only somewhat. No significant differences were found between the

mean scores of high- and low-sustainability hospitals for "extent to which RRTs meet the needs of patients" ($p = .08$). This finding is contrary to Phase One's findings in which two hospitals reported high sustainability scores and two hospitals reported low sustainability scores. Potential reasons for the differences in scores between Phase One and Phase Two exist. For example, Phase One results reflected the opinions of only one administrator in each hospital whereas Phase Two results reflected the opinions of several organizational participants, including RRT members and end-users. Participants from these groups likely have very different views of the program because of their first-hand interactions and experiences with the RRT program. On the other hand, because snowball sampling was used, the persons interviewed in Phase Two may not have the same level of information on the overall RRT program in their hospitals, whereas the administrators who completed the surveys in Phase One maintained RRT program data and oversaw the RRT program in the hospital. In both of these cases, it may likely be that the vantage points from which participants responded affected their views of RRT sustainability.

A difference was reported in the maintenance of perceived benefits in high- and low-sustainability hospitals. One hundred percent of participants in the high-sustainability hospitals and 92% in the low-sustainability hospitals believed RRTs met patient needs either fully or moderately. Furthermore, 100% of participants at the high-sustainability hospitals reported that the benefits they perceived from RRT implementation had persisted compared to 83% of participants at the low-sustainability hospitals. The reasons why RRTs were not perceived to fully meet patient's needs may therefore be related to insufficient RRT structures and underutilization.

To measure the maintenance of *actual* benefits, staff members who collected and analyzed the RRT program data at each hospital were asked to complete a report indicating if the initial improvements in actual patient outcomes had continued since the RRT program was implemented. Both the high- and low-sustainability hospitals reported that initial improvements in three of the intended patient outcomes were maintained: decreased unplanned intensive care

unit transfers, codes outside of the intensive care unit, and codes per 1,000 discharges. In all of the organizations, however, acute care inpatient mortality rates were reported as unchanged. The findings are relatively consistent with the Phase One reports, as well as research reports indicating that RRT implementation reduced cardiac arrest rates outside of ICU and unplanned ICU admissions but not overall mortality rates (Bellomo et al., 2004; Buist et al., 2002; Chan et al., 2008). Despite this finding about actual benefits, the perceived benefits of RRTs were high in both high- and low-sustainability hospitals.

Discussion of Findings

Findings of the current study provide some support for the PMOS, but also suggest that the PMOS model may need to be expanded. That is, the study found that the organizational factors (i.e., institutional strength and program champion) and project design and implementation factors (i.e., project negotiation process, project effectiveness, training, and project funding) were important for RRT sustainability. Although not initially included in the study's conceptual framework, this study also found that another PMOS factor, the availability of funding and resources, was also important to RRT sustainability. Therefore, it is recommended that this factor is included in future studies of program sustainability in hospitals, including RRT sustainability.

An underlying premise of the PMOS is that organizations must plan for sustainability once an innovation or program is adopted. Pluye, Potvin, Denis, Pelletier, and Mannoni (2005) similarly proposed that sustainability "activities" should begin as soon as a project begins. This study found that organizational leaders must plan for sustainability by designing and implementing innovations in such a way that sustainability is made possible.

The current study, however, extends the work of Shediack-Rizkallah and Bone (1998) in several ways. First, it brought clarity to the definitions of factors (NAME THEM HERE in parens) which were not clearly defined conceptually and/or operationally in the PMOS. Second, the current study found that the operationalization of factors in organizations was also important

to sustainability. Staff involvement in the project negotiation process was important, but it was the involvement of nurse leaders and a multi-disciplinary team that fostered high sustainability levels. Although training, in general, was important, providing the training *prior to* the launching of programs was more important for sustainability. This is likely because training prepared organizational members for upcoming changes associated with the innovation, such as the changes that occurred in the policies for managing patients with acute, avoidable deterioration on acute care units.

Shediack-Rizkallah and Bone (1998) also did not clarify project effectiveness to include both actual or perceived benefits. However, several other researchers have suggested that, even in the absence of actual benefits, the perception of benefits may facilitate innovation sustainability (Commins & Elias, 1991; Goodman & Steckler, 1989; Sarani et al., 2009; Scheirer, 2005). The current study supports the notion that project effectiveness could be operationalized as perceived benefits, and that the perception of benefits, even if they differed from actual benefits, could facilitate sustainability. The current study also demonstrated that institutional strength should include leadership support and staff members' years of experience because these elements reflect the added power derived by the organization through leaders' competence and staff members' knowledge and skills. Strong, competent leaders not only establish the necessary structures, lines of authority, and evaluation processes to support the RRT program, they also provide support to end-users who must use the innovation. Leadership support is important because a power relationship exists between leaders and staff members, and leaders can influence others to change their behaviors to meet the goals of the organization (Braynion, 2004). Also, program champions' actions and behavior were demonstrated to be more important for sustainability efforts than their positions in these hospitals.

The findings of the current study that sustainability was fostered through leadership support and the actions and behaviors of champions (both formal organizational leaders and expert clinicians) is consistent with French and Raven's (1959) Bases of Social Power Model.

According to this model, leaders can use five different power bases to influence "followers". These include coercive power, reward power, legitimate power, referent power, and expert power (Braynion, 2004). Formal leaders (as leaders or champions) likely could have used legitimate or referent power by demonstrating encouragement and charisma to build RRT end-users' trust and confidence to change their behavior to facilitate RRT use. In contrast, clinicians exerted expert power to influence and change RRT end-users' behavior. However, coercive power may also have been at play because RRT end-users were often afraid to use RRTs because of the fear of how they would be perceived by their peers (such as being incompetent) for calling the team.

The PMOS, however, is insufficient in explaining why some hospitals achieved high levels of sustainability and others did not. The PMOS does not offer any explanatory or causal mechanisms through which the factors might work, or explain the contexts within which these factors may be successful at facilitating sustainability. Thus, the findings from this study can contribute to the literature by offering some explanation as to why and how factors work to facilitate sustainability. Specifically, this study found that certain organizational contexts and processes were important for RRT sustainability. Organizational contexts and processes have long been recognized in the literature as important to innovation adoption, implementation, diffusion, and effectiveness (Alexander, Wiener, Shortell, & Bker, 2007; Fitzgerald, Ferlie, Wood & Hawkins, 2002; Weiner, Savitz, Bernard, & Pucci, 2004). In a study of quality implementation, Alexander et al. reported that the effect of quality improvement implementation was due to the organizational and environmental context. Weiner et al., in a study of the integration of clinical information systems, demonstrated that the use of the systems varied due to the adoption and implementation processes used by an organization. Given the importance of organizational contexts and processes in innovation and implementation, and the inclusion of project design and implementation factors in the PMOS, the finding that contexts and processes were also important in the current study is, therefore, not surprising. In general, however, the sustainability literature has focused on examining the relationship between a few specific

sustainability factors and sustainability rather than focusing globally on organizational contexts and processes. The findings of the current study thus contribute to the sustainability literature by demonstrating the importance of organizational contexts and processes for sustainability.

Findings from this study also suggest that the effect of the PMOS factors on sustainability is likely mediated by the presence or absence of certain contextual and process elements. In effect, sustainability factors may serve as antecedents to an organizational environment in which sustainability was possible. While contrary to the PMOS and other studies that suggested a direct relationship between the factors and sustainability (Bradley et al., 2005; Casey et al., 2009; Commins & Elias, 1991; Goodson et al., 2001; Shediac-Rizkallah and Bone, 1998), the notion that the effects of sustainability factors are mediated by contexts and processes is supported by two models of sustainability that proposed the effect of factors on sustainability may be mediated rather than direct. Mancini and Marek (2004) proposed that sustainability factors are mediated by middle-range program results. In their model of community-based program sustainability, these authors proposed that the sustainability elements of leadership competence, collaboration, program results, funding, staff involvement, and program responsivity are mediated by middle-range program results (i.e., participant needs are met, confidence in program survival, effective sustainability planning, and other program results).

In another sustainability planning model (based on intervention program theory), Johnson et al. (2004) similarly proposed that sustainability factors (i.e., infrastructure, capacity-building, and sustainable innovation confirmation) were mediated by sustainability actions (i.e., assessment, planning, implementation, evaluation, and modification) that resulted in the immediate outcome of sustainability readiness. Sustainability readiness was demonstrated by, for example, adequate expertise related to the innovation, adequate long term positive relationships between stakeholders such as implementers, evaluators, and decision-makers, and process evaluation methods to assess the quality and integrity of the innovation. Sustainability readiness, in turn, led to the distal outcomes of innovation integration and stakeholder benefits.

Although some of these proposed mediators are different than the context and process elements found in the current study, there are also similarities. For example, the sustainability actions of assessment, planning, implementation, evaluation, and modification may be related to program organization and accountability and Mancini and Marek's (2004) "participant needs are met" may be similar to staff member attributes which include knowledge, skills, and experience. Despite some differences the current study's findings support these other studies that propose a mediating rather than direct effect of factors on sustainability. Johnson et al.'s theory that sustainability factors and actions lead to the sustainability readiness of an organization offers further support for an organization's environment as being important to sustainability.

Another contribution of this study to the sustainability literature is the finding that individuals play an important role in RRT sustainability. End-users' personal confidence and sense of security and trust determined if they would activate an RRT call. Users' personal confidence was promoted because the PMOS factors enhanced their knowledge and skills regarding how and when to activate an RRT call, promoted autonomous practice, signified support for the RRT program, and provided RRT organization and accountability. When the PMOS factors promoted RRT end-users' personal confidence, they called the RRT for their patients in need. The Technology Acceptance Model (TAM) (reference) may offer some insight as to why confident RRT end-users were more likely to call the RRT. TAM posits that perceived usefulness and perceived ease of use determine an individual's intention to use a technology, with intention to use serving as a mediator of actual system use (Wixom & Todd, 2005). Perceived usefulness and perceived ease of use are inter-related. According to this theory then, highly confident, informed RRT end-users would call the RRT for patients in need likely because they understand the usefulness of the RRT program to serve the needs of their patients. Coupled with the organization having systems in place that foster easy access to activating calls (such as having calling criteria in place and one phone number to call), RRT utilization should increase.

End-users were also afraid to use RRTs because of the fear of how they would be perceived by their peers (such as being incompetent) for calling the team. This lack of security and trust has been referred to in the literature as psychological safety—a belief that it is safe to take interpersonal risk (Edmondson, 1999, 2004). Psychological safety reduces staff members' concerns about how they will be judged when seeking help from others (Carmeli, Brueller, & Dutton, 2009) and creates a psychological climate (i.e., an individual's perception of the work environment) that fosters positive work behavior (D'Amato & Zijlstra, 2008). Previous studies have linked psychological safety with successful technology (i.e., innovation) adoption and implementation. The perceived usefulness and ease of use of an innovation (such as new technologies) are important drivers of innovation adoption. Schepers, de Jong, Wetzels, and de Ruyter (2007) found psychological safety to positively affect users' perception of the ease of use and the usefulness of technology. These researchers found that staff members with high levels of psychological safety displayed a positive attitude towards the utility of technology (in this case groupware). Edmondson (2004) demonstrated that psychological safety was an important driver behind the successful implementation of an innovative technology for cardiac surgery. Psychological safety is important because it fosters learning behavior and the organizational change that is necessary for successful implementation (Edmondson, 2004). Staff members who experienced a high degree of psychological safety were more effective in working together and were more satisfied with the use of technology (Edmondson, 2004). Psychological safety has also been linked with employee work engagement (Halbesleben & Rathert, 2008).

The psychological safety of RRT end-users is important in achieving RRT sustainability for several reasons. Without psychological safety, staff is less likely to call the RRT and integrate RRT calling into their daily practice. Any learning that might have occurred in the context of the RRT call is inhibited. RRT calling will also be less likely because the RRT may not be perceived as useful or easy to use. The role of individuals and their psychological safety (i.e., a hospital's psychological climate) has not previously been examined as a sustainability element. Of all the

factors Stirman and colleagues (2012) identified in a recent systematic review of sustainability research, individual factors were not mentioned and culture and climate were rarely mentioned in studies. Therefore, an important contribution of this study to the sustainability literature is the finding that individuals' fear of using the RRT – or their psychological safety -- may have played an important part in the sustainability of innovations.

A Model of RRT Sustainability

Given the findings of the current study, a model of RRT sustainability is proposed (see Figure 5). The model consists of the following constructs: sustainability factors, sustainability environment, and sustainability climate, and the outcome of sustainability. Sustainability factors are consistent with the factors proposed in the PMOS and include organizational factors and project design and implementation factors. Organizational factors include institutional strength, program champion, and funding and resources. Project design and implementation factors include project negotiation process, project effectiveness, and training. These two sets of factors are also inter-related.

The effect of sustainability factors on outcomes is also proposed to be mediated by a sustainability environment. The sustainability environment encompasses the concepts of context and process. The context includes workforce attributes (staff member knowledge, skills, and experience), team attributes (team member behavior and presence of a dedicated RRT member), perceived benefits? of the RRT and program champions, and cohesion between RRT members and RRT end-users. Processes include program organization and accountability through the evaluation processes used (including RRT data collection and analysis), the sharing of program results and RRT data with staff members, capitalizing on learning opportunities presented by the RRT experience, and teamwork and collegiality between RRT members and RRT end-users related to RRT calls.

Sustainability climate mediates the relationship between sustainability environment and the outcome of sustainability. The literature on organizational climate was used to define sustainability climate. Organizational climate refers to the *shared perceptions* of staff members regarding the behavior that is expected and rewarded and the procedures and practices that are valued in organizations (Schneider, 1990). Sustainability climate is therefore defined as the shared perceptions of staff members of the practices and procedures, as well as the types of behaviors that are rewarded and supported in the hospital related to RRT use. Sustainability climate includes the concepts psychological safety and staff member confidence to use the RRT, which mediates the relationship between sustainability context and process and sustainability. Psychological safety and staff member confidence is proposed as being inter-related because psychological safety is likely to enhance staff members' confidence to use the RRT, yet users' confidence in using the RRT may also enhance psychological safety. Psychological safety and staff member confidence have a direct effect on sustainability. When psychological safety and confidence are high, perceptions of the usefulness of RRTs are likely increased. Sustainability is achieved when RRTs are institutionalized and the benefits, actual and perceived, of the RRT program following their implementation are maintained over time.

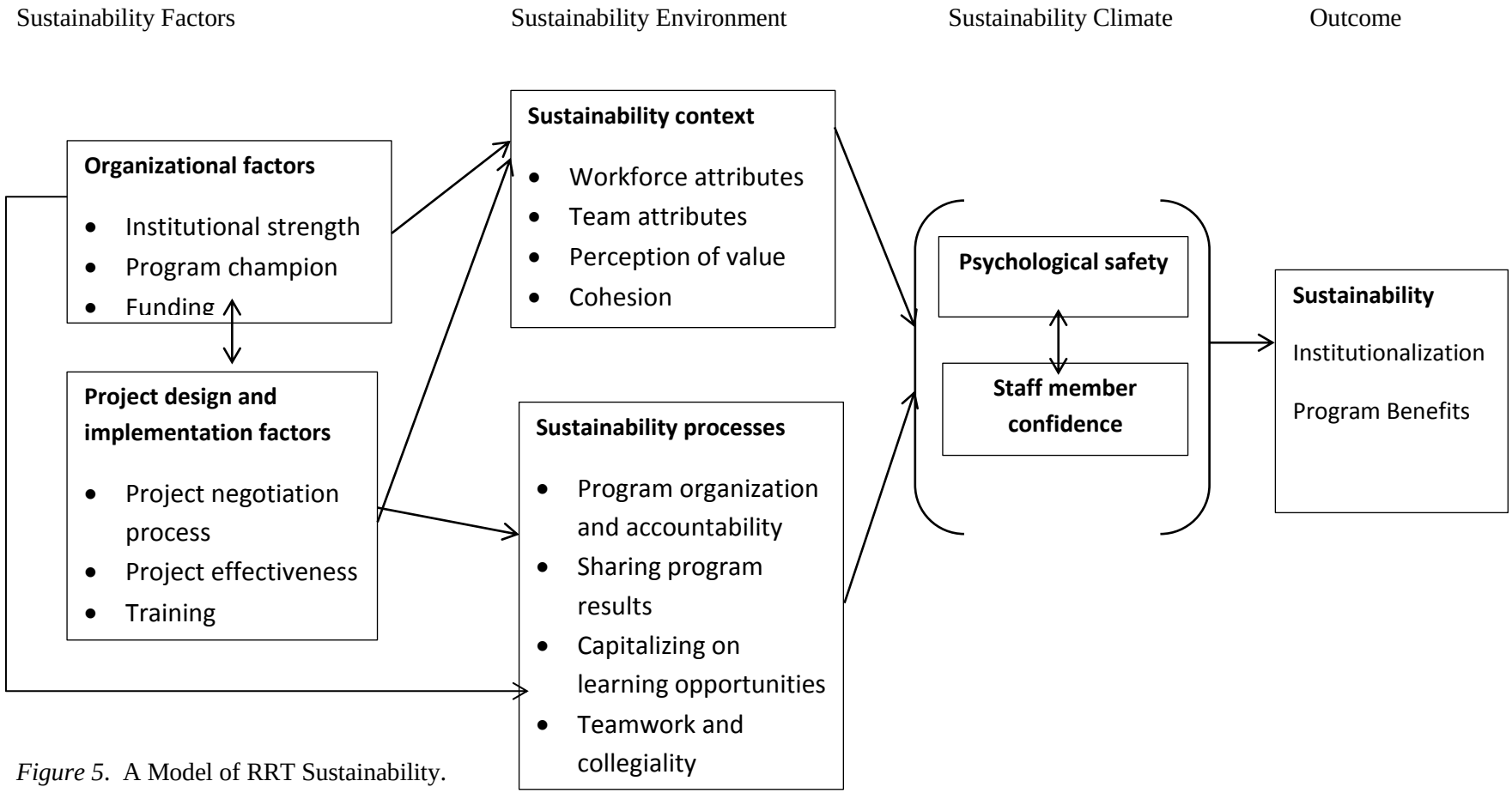

Figure 5. A Model of RRT Sustainability.

Study Limitations

To the author's knowledge, the current study is the first to examine RRT sustainability in organizations and therefore warrants replication and further investigation. The Shediac-Rizkallah and Bone (1998) model has been used in previous studies, but it was adapted here to include new conceptual and operational definitions that were tailored to fit with the purpose of this study. However, the applicability of these conceptual and operational definitions are limited to only one study and further investigation is necessary to examine the applicability of these concepts in other settings and research questions.

This study used self-reports of key participants (i.e., leaders, RRT members, and RRT end-users) to measure the continuation of RRTs and the maintenance of patient benefits. Although self-reports are widely used in research, their use increases the risk of introducing bias that stems from, for example, participants selective memory or exaggeration. Participants may not accurately recall events or their responses may be influenced by the context of the study (Holbrook, 2008).

Another study limitation is the selection of a hospital in Phase Two in the second quartile, versus the first (i.e., lowest) quartile. This was necessary because the two low-scoring hospitals that were initially selected to participate in the study from the first quartile declined to participate. The findings from the group of low-sustainability hospitals may therefore be biased. However, the following steps were taken to overcome this bias by selecting a hospital in the second lowest quartile that: (a) had the lowest sustainability score of hospitals in that quartile and closest to the scores of first quartile hospitals; (b) was relatively similar in size to the other hospitals in the study sample; and (c) represented a similar type of hospital to the ones in the sample.

Of the three groups of participants interviewed in this study (i.e., leaders, RRT members, and RRT end-users), a limited number of RRT members and only one physician participated in the study. Therefore, the findings may not adequately or accurately reflect the views of RRT members and physicians. However, the purpose of the study was not to specifically examine differences in perspectives between the three groups of participants. More research is needed to examine potential

differences. One other limitation of the study is that inter-rater reliability of the coding of all interviews was not established as all interviews were reviewed and coded by the researcher (Creswell, 2009). It is recommended that this step be taken in future studies to overcome the potential biase that is introduced by using a single interviewer.

The generalizability of this study's findings may be limited. However, according to the Proximal Similarity Model (PSM) (http://www.socialresearchmethods.net/kb/external.php) generalizability can be justified by theorizing about the different contexts to which a study's findings may be applicable. In this regard, the generalizability of the current study's findings to other hospitals may be possible. The rationale for this approach is that the sample consisted of community hospitals in North Carolina that were situated in rural locales and were relatively small (i.e., less than 350 licensed and staffed beds). Staff characteristics included a higher proportion of ADN nurses compared to baccalaureate prepared nurses, which is consistent with the educational level of U.S. employed nurses, in general. Based on the PSM, the findings of this study may potentially be applicable to non-community hospitals located in rural areas or that are similar in size, and U.S. hospitals that have a similar proportion of ADN and baccalaureate prepared nursing staff.

Two particular contextual elements that are important to the generalizability of the study's findings include the reason behind RRT adoption and the implementation and participation in the *100,000 Lives* Campaign and NC-RRTC. The hospitals in the study sample self-selected to adopt and implement RRTs and they may share similarities (e.g., organizational priorities) with other hospitals who self-selected to adopt and implement RRTs. The hospitals in the sample may also share similarities (such as valuing collaboration across organizations) with other hospitals that participated in the *100,000 Lives* Campaign or that participated in community collaboratives (such as the NC-RRTC) that focused on fostering RRT adoption and implementation. Generalizability of the study's findings may therefore be possible to hospitals that self-selected to implement RRTs or who participated in the *100,000 Lives* Campaign or a community collaborative to enhance RRT adoption and implementation.

Recommendations for Future Research

Several recommendations for future research are suggested. To date, sustainability has been measured mostly as the continuation of programs in organizations. Valid instruments to measure sustainability have been lacking. Measuring sustainability is, however, important because sustained, effective innovations offer organizational leaders the opportunity to improve organizational outcomes (Manfredi et al., 2001; Young, 2006). The availability of a valid and reliable measure of sustainability would provide researchers and organizational leaders with an instrument that can be used to determine the sustainability of innovations in organizations. The psychometric properties of the RRT-IS were examined in this study. However, a power analysis was not conducted which may have impacted the reliability analysis of the RRT-IS. In future, the psychometric properties of the RRT-IS should be examined with a sample where power was achieved. A factor analysis of the RRT-IS should also be conducted.

To the researcher's knowledge, this study is the first to examine RRT sustainability. However, because of the use of a convenience sample in Phase One and only four cases in Phase Two, the generalizability of the findings of the study is limited. Additional studies in which the sample is randomly selected and the data are gathered from a larger sample will increase the generalizability of future research to hospitals by being representative of the broader population of hospitals in the U.S. Thus, researchers can learn more about the sustainability of innovations in settings such as academic medical centers and corporate health systems and hospitals located outside of NC.

Two aspects of sustainability, as suggested by Shediac-Rizkalla and Bone (1998) and Scheirer (2008), were examined in this study: the continuation of RRTs in hospitals after implementation activities ceased and the maintenance of patient benefits from the RRT program. However, the self-reports of key participants (i.e., leaders, RRT members, and RRT end-users) were used to measure the continuation of RRTs and the maintenance of patient benefits. Future studies are

needed to more closely examine the maintenance of RRT sustainability through the use of large quantitative data sets.

Programs that are implemented in hospitals often have the potential to enhance organizational outcomes other than patient outcomes. For example, researchers have suggested that nurses' future employment decisions may be influenced by the presence (or absence) of RRTs in the organization (Donaldson et al., 2009). Hospitals may have deployed RRTs only in medical and surgical units rather than expanding the scope of the teams to include all inpatient units (such as labor and delivery and psychiatry). These teams may also not be available in outpatient and clinic settings. Thus, the presence of RRTs may serve to retain nurses on medical and surgical units. Several perceived organizational benefits were also reported in this study; namely reduced organizational liability, and patient and family satisfaction. Further research is needed to uncover the specific organizational benefits that are derived from the sustainability—or continuation—of RRTs in hospitals.

This study also identified factors in addition to the PMOS and shed some light on the ranking of, and relationships between, factors in the PMOS. Stirman et al. (2012) suggested that sustainability factors are likely inter-related. Future studies are needed to further explore the ranking of and relationships between PMOS factors.

Study findings suggest that sustainability of innovations is possible in organizations, but it is dependent on factors, contexts, and processes that are necessary to establish the proper environment. This study found that the factors proposed in the Shediac-Rizkallah and Bone (1998) model were important to sustainability. However, additional factors were also identified as important. An updated model of sustainability was suggested which can offer leaders a framework to guide their decisions toward creating an environment which strongly supports sustainability. Only one innovation, RRTs, was examined in this study and a model of sustainability proposed. Further research is necessary to examine the applicability of the updated sustainability model to other innovations.

Implications for policymakers and organizational leaders

The largest issue surrounding RRT adoption and implementation is the lack of evidence of RRT effectiveness in improving patient outcomes. RRTs initially had high face validity, but the only randomized trial showed no benefit (Hillman et al., 2005). Yet, the IHI pushed their adoption and implementation, and it was later fueled in 2009 by The Joint Commission's mandate for a process facilitating the early recognition and treatment of patients experiencing acute, avoidable deterioration on nursing units. Moving into the future, regulatory bodies and federal agencies will need to develop policies that address the type and amount of evidence that will be sufficient to prompt mandating innovation adoption and implementation. Furthermore, government bodies and federal agencies may not be able to directly regulate the actions of private enterprises—such as the IHI who may directly benefit from innovations implemented in hospitals—that push for the implementation of innovations with limited evidence of effectiveness. However, indirect regulation is possible with the implementation of policies that prohibit the distribution of funds from the Centers for Medicare & Medicaid Services (CMS) to hospitals for treatments of services that were delivered to patients without sufficient evidence of the effectiveness of such treatments or services.

Because of the Joint Commission's mandate, RRTs are likely here to stay. This study found that mandating RRT implementation was not enough to achieve RRT sustainability. Without sustainability the outcomes hoped from RRT implementation may continue to elude organizations. Yet, RRTs may improve the timeliness and safety of care of patients on acute care units. Therefore, federal policies need to move accrediting reviews beyond examining the evidence of innovation implementation to include evidence of organizational actions to facilitate innovation sustainability, including patient and organizational benefits derived. Federal regulators could also help to create an environment that facilitates sustainability by providing guidelines and action steps for organizations on how to sustain innovations, particularly when its implementation is mandated. Such guidelines and action steps should, however, have some slack to give hospitals the ability to adapt innovations to fit with the needs of the organization as this was an important factor for RRT sustainability.

Furthermore, federal policies can focus more on the availability of funds to train healthcare providers and organizational leaders in sustainability efforts and to promote research studies on sustainability. Furthermore, given that staff members' knowledge and skills may impact sustainability efforts, federal policies should promote funding for the training of staff members on innovations prior to and following their implementation, and particularly before and after the implementation of RRTs.

Community collaborations, such as the NC-RRTC, often foster innovation adoption and implementation. During such collaboratives, guidelines or action steps that promote sustainability should be included in toolkits that are provided to hospitals and should also be included in discussion sessions. Nurse leaders who are visible in the organization and clinical staff—particularly key clinicians viewed as experts—should be selected to participate in these collaborative as they can serve as informal champions of the innovation.

The sustainability of innovations also requires thoughtful consideration and action from organizational leaders. Organizational policies should be in place that clearly delineate the roles of leaders and staff members (both RRT members and end-users) with regard to RRT implementation and sustainability. Leaders need to be in place who have the ability to establish structures and lines of authority to support the RRT program and to oversee implementation efforts. Moreover, oversight of the RRT program should be provided by staff from the nursing department, particularly when the users of the innovation are predominantly nursing staff.

Strong support for RRTs should be demonstrated by leaders who are visible and who can effectively communicate their support of the program. Such leaders can be extremely effective as RRT program champions. If informal champions step up to promote and advocate for RRTs, they should be encouraged to function as champions as they can be a tremendous asset to hospitals to foster sustainability. Policies should be in place that clearly define staff member roles and expectations during RRT calls. Hospitals must provide training to staff members and those serving on the RRT and should address not just knowledge and skills, but also behaviors exhibited before, during, and after the call. Hospitals must also allocate resources to support RRT implementation and

sustainability, including the collection and communication of RRT program data to staff members in order to guide RRT program expansion in hospitals. Leaders should define the hospital's mission and should communicate RRT program goals in the context of that mission. They must create an atmosphere of psychological safety where staff members feel free to speak up and voice their concerns without fear of punishment. Policies that foster autonomous nursing practice and information sharing between leaders and staff members may facilitate staff members' sense of psychological safety and promote the sustainability of innovations. When innovations encompass a group of individuals such as RRTs, policies should address expected team behavior and activities that will enhance teamwork.

Conclusion

This two-phase study examined the sustainability of RRTs in hospitals. In Phase One, a survey was administered to determine organizational and RRT characteristics, and the level of sustainability of hospitals that participated in the NC-RRTC. In Phase Two, four case studies were conducted in two hospitals with high levels of sustainability and two hospitals with low levels. This study found that achieving sustainability requires a thoughtful, deliberate implementation process and a context that is supportive of implementation efforts. Several factors are important for sustainability. These can be classified as organizational and project design and implementation factors. In addition, some finer nuances related to the organizational environment and members' behaviors suggest that underlying beliefs, values and norms may also be important to sustainability. Information gleaned from this study can help improve the sustainability of RRTs and other innovations in hospitals and potentially increase their likelihood of achieving hoped-for outcomes.

APPENDIX A

RAPID RESPONSE TEAM INSTUTIONALIZATION SCALE SURVEY
Hospital survey (electronic survey)

Introduction (First Screen)

Thank you for taking the time to complete this survey about Rapid Response Teams (RRTs). Please use the navigation arrows located at the bottom right corner of each screen to move forward or backward through the survey. Do not use the back arrow located in your internet browser. If you experience any difficulty completing this survey, contact Deonni Stolldorf via email at deonniv@unc.edu

Statement of Consent (Second Screen): (Header)

Your participation in this survey is voluntary and you can skip any question you choose not to answer. To participate in the study you or your administrative delegate will simply complete this electronic survey. The survey includes questions about your organization, the RRT program, and specific activities related to RRT use in your organization. Completing the survey will take less than 15 minutes. If you need to stop before finishing the survey, you can return to the survey later by returning to the website provided in the study email you received. Consent to participate in the study is assumed in all instances where a survey is completed and returned to the researcher.

If you have questions regarding this study, you may contact (Deonniv@unc.edu) or at 919-641-9450. If you have questions you do not feel comfortable asking the researcher, you may contact Dr Cheryl Jones, PhD, RN, FAAN (Faculty Adviser) at 919-966-5684 or cabjones@email.unc.edu.

THIRD SCREEN ONWARDS: THE SURVEY

Screening questions

Before you begin the survey, please answer the following questions.

a1. Do you have rapid response teams in your hospital?

Yes
No

[IF RESPONSE = NO, THEN RESPONDENT WILL SEE THE FOLLOWING MESSAGE:
Thank you very much for providing this information. Unfortunately, our records incorrectly identified your hospital as having a rapid response team in place, which is a requirement for participating in our study. Thank you for your time and willingness to participate.]

a2. Are you a hospital administrator/leader?

Yes (go to question a4.)

No (go to question a3.)

a3. H*ave you been assigned by a hospital administrator/leader to complete the survey on behalf of an administrator?*

Yes (proceed to question a4.)

No

[IF RESPONSE = NO, THEN RESPONDENT WILL SEE THE FOLLOWING MESSAGE: Thank you very much for providing this information. Unfortunately, only hospital administrators/leaders or their designees are eligible to participate in the study. Thank you for your time and willingness to participate]

a4. Please select your hospital from the menu below. *If the name of your hospital has changed in the last few years, please select the old name from the list provided. Indicate the current name of your hospital in the space provide.*

- Alleghany County Memorial Hosp
- Angel Medical Center
- Annie Penn Hospital
- Betsy Johnson Regional Hospital
- Blowing Rock Hospital
- Broughton Hospital-Med Unit
- Brunswick Community Hosp
- Cape Fear Valley Med Center
- Carolinas Med Center - Lincoln
- Carolinas Medical Center
- Carolinas Rehab Hospital
- Carteret General Hospital
- Catawba Valley Medical Center
- Davis Regional Medical Center
- Dept of Veterans Med Center-Asheville
- Duke Health Raleigh Hospital
- Durham Regional Hospital
- Firsthealth Montgomery Memorial Hosp.
- Firsthealth Richmond Memorial Hosp
- Frye Regional Medical Center
- Harris Regional Hospital Inc
- High Point Regional Hospital
- Hugh Chatham Memorial Hospital
- Iredell Memorial Hospital Inc
- Johnston Memorial Hospital
- Kings Mountain Hospital Inc
- Lenoir Memorial Hospital
- Lexington Memorial Hospital Inc
- Margaret R Pardee Memorial Hospital
- Maria Parham Medical Center

- Mission Hospitals Inc
- Morehead Memorial Hospital
- Moses H Cone Memorial Hospital
- Murphy Medical Center Inc
- Nash General Hospital
- New Hanover Regional Medical Center
- North Carolina Baptist Hospital
- Northeast Medical Center
- Onslow Memorial Hospital
- Pitt County Memorial Hospital
- Randolph Hospital
- Roanoke Chowan Hospital
- Sampson Regional Medical Center
- Scotland Memorial Hospital
- Southeastern Regional Medical Center
- Spruce Pine Community Hospital
- Stokes-Reynolds Memorial Hospital
- Thomasville Medical Center
- Transylvania Community Hosp
- University of NC Hospitals
- WakeMed Cary Hospital
- WakeMed Raleigh Campus
- Watauga Medical Center
- Wayne Memorial Hospital
- Wesley Long Hospital
- Hospital name has changed
    - New name _____
- Hospital name is not on the list but participated in the NC-RRTC
    - _____

a5. Please select your job title from the drop-down menu below.

Chief Nurse Officer
Chief Executive Officer
Chief Operations Officer
Other, *please specify*_____

a6. Which of the following best describes your organization? *Please select all that apply.*

- Academic health center
- Community hospital
- Specialty hospital
- Corporate health system
- Other, *please specify* _____

a7. Please provide the number of beds for which your hospital is currently licensed and staffed.

_____number of licensed and staffed beds

In this section of the survey, we would like to ask you some general questions about the characteristics of RRTs at your hospital. *If your hospital has an adult and pediatric RRT, please limit your responses to the adult RRT.*

1. What is the composition of the RRT at your hospital? *Select all that apply.*
   - Intensive Care Unit Physician
   - Intensive Care Unit Registered Nurse
   - Emergency Department Registered Nurse
   - Nurse Practitioner
   - Hospitalist
   - Intensive Care Unit Resident
   - Intensive Care Unit Fellow
   - Respiratory Therapist
   - Pharmacist
   - Chaplain
   - Nursing House Supervisor
   - Dedicated RRT nurse who also rounds on patients on units
   - Others, *please specify* _____

2. How many RRTs are in operation in your hospital?
   - 1
   - 2
   - 3
   - 4
   - Other, please specify_____

3. How many people staff the RRT at any given time in your hospital?
   _____number of team members

4. Who in your hospital may activate or call an RRT to a patient's bedside? *Select all that apply.*
   - Staff RNs
   - Other hospital staff members
   - Families
   - Patients
   - Other, *please specify* _____

5. From the checklist below, please select the items that best describe the organization of the RRT at your hospital. *Select all that apply.*
   - RRT coverage is provided 24/7
   - RRT coverage is provided only after 7pm on week nights
   - RRT coverage is provided only on weekends i.e., Friday night 7 p.m. through Monday morning 7 a.m.
   - RRT is led by a Registered Nurse

- RRT is led by a Physician
- RRT is co-lead by a Registered Nurse and a Physician
- Other, *please describe* _____

6. From the checklist below, please select all that apply.
   - ☐ RRT debriefing sessions are conducted following RRT calls
   - ☐ Patients who were evaluated/treated by the RRT are reassessed within the first 24 hours following the RRT call
   - ☐ Staff have the opportunity to evaluate the performance of the RRT
   - ☐ RRT outcomes are shared with staff on a regular basis
   - ☐ RRT members receive feedback on their performance
7. Do you have a RRT oversight committee?
   a. Yes
   b. No

Now we would like to ask you some specific questions about the RRT <u>program</u> in your hospital.

8. In your view, has the RRT program in your hospital made the transition from pilot program to permanent status? *RRTs achieve permanent status when all pilot testing and evaluation of the RRT program are completed, all preliminary adjustments to the program are made, and staff and/or patients and families can, per organizational policy, activate RRT calls for patients in crisis.*
   - Yes
   - No (skip to question 11)

9. How many years would you say the RRT program has been considered permanent status in your organization?

   ____Number of years

10. To what extent has the RRT achieved permanent status in your hospital? *Select all that apply.*
    - The RRT responds to all inpatient and outpatient units of the hospital
    - The RRT responds to only inpatient units of the hospital
    - The RRT responds to only inpatient units of a specific service line (e.g., medicine, surgery, psychiatry, women's health, children's units)
    - The RRT responds to only a select few inpatient units across multiple service lines

Now we would like to ask you some questions about issues pertaining specifically to RRT members.

11. Has your organization formalized the role of RRT members through the development of written, clearly delineated job/role descriptions or organizational policies and procedures?

- Yes
- No (skip to question 14)

12. For how many years have RRT member' roles, expectations and performances been formalized through written, defined job/role descriptions or organizational policies and procedures?
    ___ Number of years

13. For which of the following RRT staff members has your organization developed written, defined job/role descriptions or organizational policies and procedures?
    - Registered Nurse
    - Physician
    - Respiratory Therapy
    - Other, *please specify*_____

14. Does your hospital provide formal, specific, and ongoing education for staff who serve as members of the RRT? *(We ask later about the education on the RRT program you provide to staff in your hospital)*
    - Yes
    - No (skip to question 17)

15. For how many years has education and training been provided for staff who serve as members of the RRT?
    ____Number of years

16. How often do you provide formal, specific, and ongoing education for staff who serve as members of the RRT?
    - RRT members receive formal education on a monthly basis
    - RRT members receive formal education on a yearly basis
    - Formal education is only provided initially when new RRT members join the team
    - Other, *please specify*_____

Now, we'd like to ask you a few questions about the education and training of other hospital staff members.

17. Does your hospital provide formal, specific, and ongoing education related to the RRT program for all hospital staff members?
    - Yes
    - No (skip to question 20)

18. For how many years has education related to the RRT program been provided to all hospital staff members?

    ____Number of years

19. How often do you provide formal, specific, and ongoing education related to the RRT program to all hospital staff members?

    - Staff members receive formal education on a monthly basis
    - Staff members receive formal education on a yearly basis
    - Formal education is provided during new employee orientation only
    - Other, *please specify*_____

Now we would like to ask you a few questions about resources that support the RRT program in your organization.

20. Have full-time equivalent (FTEs) employees been assigned to staff the RRT program?
    - Yes
    - No (skip to question 22)

21. For how many years have FTEs been assigned to staff the RRT program?
    ____Number of years

22. Have permanently dedicated funds been designated to support the RRT program in your hospital's annual budget?

    - Yes
    - No (skip to question 25)

23. For how many years have permanently dedicated funds been designated to the RRT program in your hospital's annual budget?

    ___Number of years

24. For which of the following aspects of the RRT program are funds specifically allocated in your hospital's annual budget? *Select all that apply.*

    - The FTEs of RRT members
    - The purchase of equipment (i.e., EKG monitor, Defibrillator, Non-Invasive Blood Pressure Monitor) used during RRT calls
    - The purchase of supplies for use specifically during RRT calls (i.e., IV fluid, IV starter kits, lab drawing, defibrillator pads, etc.) on an ongoing basis

- The evaluation of the RRT including data collection and analysis
- Ongoing training on the RRT program for all hospital staff
- Education of RRT members and staff
- Other, *please specify*_____

Now we would like to ask you some questions about activities performed to coordinate and direct RRT activities.

25. Do you monitor/evaluate the RRT program offered at your hospital?
    - Yes
    - No (skip to question 28)

26. For how many years has the RRT program been monitored/ evaluated?
    ____Number of years

27. Which of the following aspects of the RRT program do you monitor/evaluate?
    - RRT call activations according to specific criteria
    - RRT member performance specific to their role on the team
    - RRT performance that is, how effective members work together as a team during calls
    - RRT effectiveness (i.e., number of RRT calls, unplanned intensive care unit transfers, codes outside of the intensive care unit, and acute care inpatient mortality rate)
    - Other, *please specify*_____

28. Has a supervisor formally been assigned to the RRT program?
    - Yes
    - No (skip to question 31)

29. For how many years has a supervisor formally been assigned to the RRT program?
    ____Number of years

30. Which of the following aspects of the RRT program does your hospital have a supervisor formally assigned to? *Select all that apply*
    - Education and training of staff members and RRT members
    - Purchasing equipment or supplies
    - Monitoring RRT call activations according to specific criteria
    - Evaluating the RRT including data collection and analysis
    - Other, *please specify*_____

The next four questions are related to RRT outcomes at your hospital.

31. Please provide the following information about RRT outcomes **in the past year** *(free text box after each indicator)*

- Acute care inpatient mortality rate _____
- Codes per 1000 discharges _____
- Percentage of codes outside of the intensive care unit _____
- Number of unplanned ICU transfers_____

- Total number of calls to the RRT _____
- Other, *please specify*_____

32. How many RRT calls were activated in your hospital during the past month?
_____Number of RRT calls during past month

33. In your view, since RRTs have been used in your hospital, how has each of the following outcomes changed?

Since RRTs have made the transition from pilot status to permanent status in the hospital, the following changes are perceived:	**Increased**	**Decreased**	**No Change**
31a. Acute care inpatient mortality rate			
31b. Unplanned ICU transfers			
31c. Codes outside of the intensive care unit			
31d. Total number of RRT calls			
31e. Codes for 1000 discharges			

Thank you for taking the time to participate in this survey. Your input is very much appreciated. The findings of this survey will be important as we select hospitals for participation in the second phase of the research study. The second phase of the study entails two to four on-site visits by the researcher to conduct interviews with leaders and staff members about RRTs, and review organizational documents. The findings of the second phase of the study will serve to better understand how the sustainability of innovations, such as RRTs, can be achieved in hospital settings.

b1. Would your hospital be willing to participate in this in-depth study of RRTs in North Carolina? This part of the study will begin in approximately 1-2 months following the completion of this survey.

- Yes, my hospital is willing to participate in an in-depth study of RRTs
- No, my hospital is not willing to participate in an in-depth study of RRTs
- Maybe, my hospital might be willing to participate in an in-depth study of RRTs

[IF ANSWER =YES or MAYBE, THE FOLLOWING QUESTION WILL APPEAR]
b2. Please provide your name and/or email address so we can contact you *(free text box after each indicator)*

Name:_____ Position in organization: _____

Phone: _____ Email: _____

APPENDIX B
EXPERT PANEL REVIEW LETTER AND FEEDBACK FORM

Your name (optional): _____

Dear colleague:

You have received this correspondence because I need your help! I am a PhD student at the University of North Carolina at Chapel Hill and for my dissertation I will be conducting a study on RRT sustainability. The study seeks to broaden our understanding of the factors that lead to the sustainability of RRTs in hospital settings and the context and processes by which these factors facilitate RRT sustainability.

The research study will be conducted in two phases. Phase one will be used to administer an on-line survey to gather demographic information of hospitals and their RRTs and to determine the level of RRT integration achieved in hospitals. Based on the results of this phase, the hospitals will be selected for inclusion in phase 2 of the study.

So far, I have worked with colleagues at the Odum Institute and other content experts to develop an online survey for gathering information from hospital administrators. However, this is where I need your help. I am seeking expert advice on the survey I specifically designed for gathering information from hospital administrators before I administer it to the targeted sample of hospitals. ***I am writing to ask if you or your administrative designee would please complete the survey and send feedback to me about its format and usability.*** I would like to gather your feedback on the survey because I want to make the survey as easy and appealing to prospective participants as possible. Would you please take a few minutes to help me?

If you are willing to complete and give me feedback on the survey Web link, the instructions and everything you need to get started is provided on the next page. ***I request your feedback by close of business on July 15, 2011.***

If you know others who would be willing to serve as an expert reviewer, please let me know or have them contact me directly at deonniv@unc.edu or at 919-641-9450. However, to minimize the risk of having the survey distributed widely before the "real" survey is launched, I ask that you please do not share or forward the survey Web link to others.

I hope you will take the survey and give it a good work out to help me uncover any problems. Please know that your responses to survey items will be used only to refine the survey; the survey system will not save your responses, so your responses will not be included in the data analyses, used in reports, or included in publications. If you feel comfortable doing so, please identify yourself on your response sheet so I can follow-up with questions. However, that is not necessary if you would prefer not to.

Thank you for your support of and interest in this survey. ***Thank you so very much!!!***

My Best Regards,

Deonni Stolldorf, M.CUR, RN
Doctoral Candidate, UNC Chapel Hill

Information for Expert Reviewers: RRT Survey
July 7, 2011

The following information is provided because you are willing to review the survey developed to capture the institutionalization, characteristics, and outcomes of RRTs as well as to capture hospital demographic information from hospital administrators. The target population for this survey is hospital administrators who are informed about RRTs in their hospitals, so please evaluate the survey based on your knowledge of RRT adoption and implementation processes and structures.

To access the password protected survey, please point your Web browser to the following location: https://uncodum.qualtrics.com/SE/?SID=SV_1HSQvGlW8rtgvLm. The **password** to the survey is NC-RRTC (case sensitive & no spaces). Again, please do not share this Web link or password with others.

The "review guide" below is provided to assist you in your review. Please put a check in the box that corresponds to your answer, and write comments in the spaces provided. As you go through the survey, please feel free to make notes on the guide or make any other comments in the space provided at the end of the survey.

Please send your comments to me electronically (as an email attachment). I would greatly appreciate your feedback ***as soon as possible, or by close of business on July 15, 2011.***

	Yes	No
Look, format, and overall "aesthetics" of the survey		
Was the survey easy to read?		
Was the survey visually appealing?		
If you were a participant taking the survey, would you think that the survey was about you?		
Please make suggestions for improving the look of the survey:		
The "usability" or "functionality" of the survey		
Was it easy to navigate (go forward, backward, etc.) and complete the survey?		
If you found the survey difficulty to navigate or complete, please indicate problems encountered, and make suggestions for improving:		
The wording of items		
Were the questions/items easy to understand?		
If you found certain items complicated or hard to understand, please identify the problems you encountered, the items that were poorly worded, and/or make suggestions for improving:		
Did the grouping of items "fit" together, and seem logical?		
Did the items and sections flow well from one to the next?		
If the flow of items was problematic, please note the items or problems encountered:		

	Yes	No
Content		
Were issues relevant to RRTs missed in the survey?		
If important content or issues was omitted that is relevant to RRTs and/or the RRT program, please tell me the content/issues that should be added:		
Were any questions/items included in the survey that should be eliminated?		
If content or issues was included in the survey that is irrelevant to RRTs, please identify the items or the content/issues to be eliminated:		
Time to go through the survey		
Did the survey length seem too long?		
Please note how long it took you to go through or "complete" the survey (in minutes):15		
If you have anything else you'd like to tell us about the survey, we would GREATLY APPRECIATE your feedback:		

Thank you so very much!!! Your insights and guidance are a tremendous help. Please return to deonniv@unc.edu.

APPENDIX C

HOSPITAL RRT QUESTIONNAIRE

HOSPITAL NAME: _____

Thank you for taking time to provide this information about your hospital, its staff, and the use of Rapid Response Teams (RRTs). The data you provide is confidential; neither your name nor your hospital's name will be associated with any information you provide. All data reported in manuscripts or other publications from this study will be reported in groups. This questionnaire should take about 20 to 30 minutes to complete. The information you provide will be used to describe RRT adoption and implementation in hospitals.

General information about staff in your hospital:

Number of direct care Registered Nurses (RN): _____

Number of direct care RNs holding specialty certifications: _____

Number (or percent) of direct care nursing staff holding the following as their highest earned degree:

ADN	Diploma	BSN	MSN	DNP	PhD

Number of physicians who are affiliated with or have admission privileges in your hospital: _____

Number of Board Certified Physicians affiliated with your hospital: _____

General background information on the RRT at your hospital:

1. What year was the RRT(s) implemented in your hospital? _____
2. Was a pilot program carried out in your hospital prior to the permanent implementation of RRTs?
   Yes/No
   a. If so, how long did the pilot program last? _____
3. Did your hospital participate in the
   a. Institute for Healthcare Improvement's (IHI's) 100 000 Lives Campaign *Yes/No*
   b. IHI's 5 Million Lives Campaign
      Yes/No
4. Was the start-up of your RRT program funded by:

a. External funding

Yes/No

b. If the RRT program was supported by external funding, what was the funding source of this funding (e.g., CMS, Grants)? _____

c. Internal hospital resources *Yes/No*

5. How is your RRT currently funded (Please circle one)?
   a. External funding, please specify: _____
   b. Budgeted through internal organizational resources
   c. Other, please specify: _____
6. During the implementation of RRTs, did your hospital
   a. collaborate with other hospitals and organizations *Yes/No*
   b. collaborate with leaders or quality improvement experts outside of the hospital *Yes/No*

   Please describe these collaborations. _____
   _____
7. Questions in the following table relate to the kind of RRT training that was provided to staff members. Please circle your selection.

RRT specific training		**Method of training** (Select all that apply)	**Staff trained** (Select all that apply)
Was RRT-specific training provided prior to launching the RRT?	Yes/No	Classroom In-services Posters/flyers Other: *please explain:* _____	Nurses Physicians Other hospital staff Patients and families Other: *Please explain:* _____
Is RRT-specific training provided on an ongoing basis?	Yes/No	Classroom In-services Posters/flyers Other: *please explain:* _____	Nurses Physicians Other hospital staff Patients and families Other: *Please explain:* _____

8. What information is provided to patients about the RRT program offered at your hospital?

   _____
9. Is there an individual (s) who personnel in your hospital would point to as being a champion of the RRT? In this case, a champion is considered to be or an expert clinician who is not in a formal authority position but who strongly advocates for the use of RRTs in your hospital. *Yes/No*

   a. If so, was this person appointed in this role? *Yes/No*

Calling the RRT:

1. Have specific RRT calling criteria been instituted (i.e., identified, formalized, and used) -- throughout your hospital*?* *Yes/No*
2. If so, what are the calling criteria for activating RRT calls? (Please specify or attach a copy of the RRT calling criteria to the questionnaire)_____

   _____
3. Does your hospital document RRT calls made and the outcomes of each call?

   Yes/No

RRT composition:

1. Do members of the RRT receive any specific training prior to serving as a RRT member? *Yes/No*
2. How often is training provided to RRT members? _____
3. Are certain qualifications or criteria required before serving as a RRT member? *Yes/No*
4. Is it standard procedure for the nurse who is caring for a patient for whom an RRT call is made patient to be involved during a RRT call? _____

   _____

The future of the RRT in your hospital:

1. Are any plans in place to expand the scope of the RRT program in your hospital (i.e., implement RRTs in specialty areas such as Psychiatry or Labor and Delivery, increase the number of RRTs, etc.)?

   Yes/No
2. If so, please explain. _____

Thank you for taking the time to participate in this survey. Your input is very important, and will be used to describe the use of RRTs in this study.

APPENDIX D
SEMI-STRUCTURED INTERVIEW GUIDE

Date: _____ Time: _____

Hospital Code: _____ Group Code:_____ Participant code: _____

Welcome participant and give overview of the topic

Questions	*Notes*
Welcome participant and give overview of the topic **Broad, opening questions:** Let's start. 1. Think back to when you first learned about RRTs. What were your first thoughts or impressions about the RRT initiative in your hospital? 2. Why did your organization make the decision to adopt RRTs? 3. How has the RRT program changed or evolved since its implementation? 4. Why were these changes made? **Main questions:** 1. In your view, what fosters the continued use of the RRT in your hospital? 2. What, if anything, gets in the way of continuing the use of the RRT in your hospital? a. If something is identified as getting in the way→ what do you think might have been done to prevent this? How could this have helped? b. If something is not identified as getting in the way→ why do you think this is the case? The literature identifies several factors that facilitate the continued use of innovations such as RRTs. These factors are PROJECT NEGOTIATION PROCESS, PROJECT EFFECTIVENESS, TRAINING, INSTITUTIONAL STRENGTH, AND PROGRAM CHAMPION. NEXT, I'D LIKE TO ASK YOU SOME QUESTIONS ABOUT EACH OF THESE FACTORS. *Project Negotiation Process* 1. How were staff members (such as nurses, physicians, nurse managers or quality experts) involved in the RRT implementation process? a. If staff members were involved→what, if anything, do you think was gained from involving staff members? b. If staff members were not involved→what, if anything, do you think was lost from not involving staff members? *Project effectiveness* 1. What, if any, do you think are the benefits of RRTs to patients?	

a. To staff? b. To the organization as a whole? 2. How do you think these benefits have affected the use of RRTs since the implementation of RRTs? Please explain. 3. In your opinion, have these benefits since the RRT(s) was implemented? a. If so→why do you think these benefits have persisted? b. If not maintained→Why do you think these benefits have not persisted? *Training* 1. Please describe the quality of the training that was provided to staff members about RRTs. 2. Please describe the extent to which you believe the training was adequate. 3. Please describe the extent to which you believe the training was relevant. 4. What role do you think RRT specific training has played in the ongoing use of the RRT? 5. What changes would you like to see made to the RRT training provided to staff? Please describe. *Institutional Strength* 1. How did the goals that were formulated for the RRT program fit with the goals of the organization as a whole? Please explain. 2. Please tell me about the specific structures and lines of authority that were created to support the use of the RRT. a. If structures and lines of authority were created→ i. What do you think was gained from having these structures and lines of authority in place? ii. What do you see as disadvantages with these structures and lines of authority in place? b. If structures and lines of authority were not created→ i. What do you think was lost from not having these structures and lines of authority in place? ii. What do you think was gained from not having these structures and lines of authority in place? 3. Please tell me how the RRT program is evaluated. How about RRT members? 4. What are your thoughts about the processes used to evaluate the RRT program? And RRT members? 5. What role would you say these processes have played in the ongoing use of the RRT? *Program champions* 1. Is there an individual(s) who you could point to as being a champion (i.e., an expert clinician who is not in a formal authority position) who strongly advocates for the use of RRTs in your hospital? 2. If champion is identified → a. Who is the champion(s) of the RRT program?	NOTE RANKINGS HERE

b. Was this person(s) formally appointed in this role?

3. Does this person make a difference in the ongoing use of the RRT?
    a. If making a difference→
        i. Please tell me how this person makes a difference in the ongoing use of the RRT.
    b. If not making a difference→
        i. How would you like to see this person make a difference in the ongoing use of RRTs?

So far, we have discussed several factors identified as important for RRTs. These factors are: [PROJECT NEGOTIATION PROCESS, PROJECT EFFECTIVENESS, TRAINING, INSTITUTIONAL STRENGTH, PROGRAM CHAMPION].

Would you please rank each of these factors in order of importance? [INDEX CARDS WITH THE NAME AND DEFINITION OF EACH OF THE FOLLOWING FACTORS WILL BE PLACED ON THE TABLE FOR PARTICIPANTS TO RANK: PROJECT NEGOTIATION PROCESS, PROJECT EFFECTIVENESS, TRAINING, INSTITUTIONAL STRENGTH, PROGRAM CHAMPION].

1. Please explain why you chose [FACTOR RANKED AS NUMBER 1] as most important.
2. Do you think the presence of any one of these factors is dependent on the presence of any one of the other factors? If so, which factor (s) do you think are dependent on other specific factor(s)? Please explain your choices.
3. Do you think <u>all</u> of these factors need to be present to achieve the ongoing use of RRTs? Or, is it sufficient if only one or a few of these are present? Please explain.

Sustainability

4. What efforts are made to identify patients who met the RRT calling criteria but the RRT was not called? Please explain.
5. Thinking about the future of the RRT in your hospital:
    a. What are your thoughts about the continued use of RRTs in your organization?
    b. How confident are you that RRTs will still be active in five years? [*Not at all /Somewhat/ Very*] [*Adapted from Mancini and Marek (2004)*]
    c. In your opinion, to what extent do RRTs meet the needs of patients? [*Not at all /Somewhat/ Moderately/Fully*] [*Adapted from Mancini and Marek (2004)*]

Concluding questions

1. Is there anything else that you believe has been helpful in the current and ongoing use of RRTs in your hospital? Please explain.
2. Is there anything else that stands in the way of the continued use of the RRT in your hospital hat needs to be addressed? Please explain.
3. Finally, is there anything that I have not asked that you would like to add

about the continued use of RRTs in your hospital?

Thank you very much for participating. The data collected from this interview will be used to shed some light on how RRT sustainability can be fostered in future in hospitals that have adopted these teams.

- Are you willing to be contacted should further clarification be needed on some of what was discussed today?
- Consent given to be contacted again: Yes/No
- Contact information (*if not already on file)*

_____

_____

FIELD NOTES *(More space will be assigned as needed)*

APPENDIX E

DATA MANAGEMENT TRACKING SHEET

Hospital Code: _____

Action Steps			
Number of individual interviews: Leadership			
Number of individual interviews: RRT member group			
Number of individual interviews: RRT end-users			
Number of documents reviewed			
Hand-written field notes on file	□		
Interview notes on file	□		
All interviews sent to Transcription Company *(List interview codes below in order conducted)* *1.* _____ *2.* _____ *3.* _____ *4.* _____ *5.* _____ *6.* _____ *7.* _____ *8.* _____ *9.* _____ *10.* _____ *11.* _____ *12.* _____ *13.* _____	Send □ □ □ □ □ □ □ □ □ □ □ □ □	Returned □ □ □ □ □ □ □ □ □ □ □ □ □	Analyzed □ □ □ □ □ □ □ □ □ □ □ □ □
Hand-written field notes / interview notes on file	□		
Hospital RRT Questionnaire on file	□		
Hospital Phase One Survey results on file	□		

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