2015 Duke AHEAD Grant Proposal

Title: Simulation-based interprofessional resuscitation team training to improve code team knowledge, leadership, communication and patient outcomes.

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Focused question: Can implementation of an interprofessional, simulation-based resuscitation training program with a focus on crisis resource management improve code team leadership by the physician, and improve role clarity, effective communication and distribution of workload for all members of the team, and in so doing improve patient outcomes?

Background:
Cardiopulmonary resuscitations, or "code blues", are among the most stressful, highest pressure patient encounters that health professionals face with life-or-death outcomes for the patients. Adherence to the American Heart Association (AHA) resuscitation guidelines is crucial for patient survival.[1] However, observational studies have shown that these guidelines are not consistently followed during both training and in clinical practice.[2-5] A "well run" code blue requires both complex technical skills on the part of each individual member of the resuscitation team as well as a high-level of interaction amongst the team members. Studies have consistently shown that strong teamwork and effective team leadership improve adherence to the AHA guidelines, and the AHA now strongly recommends integrating teamwork and leadership training into resuscitation education.[6-14]

At Duke Hospital the only required prerequisite training for adult code team members is the Advanced Cardiac Life Support (ACLS) training course. This course teaches an algorithmic approach to the AHA guidelines and strictly focuses on knowledge and clinical skills. The course does not address human factors such as communication, task delegation and leadership that have been shown to be crucial to effective resuscitation.[15] Failures in these human factors are thought to contribute to the high rate of medical errors that is seen in the critically-ill patient population compared with patients in the general hospital population.[16-18] Other high-risk, high-reliability industries such as the airline industry and nuclear power have developed crisis resource management (CRM) training to enhance team performance and eliminate errors. This type of training focuses on planning, role clarity, leadership, effective communication, distribution of workload and appropriate allocation of attention. While CRM-

based training has been utilized by certain specialties within healthcare, [19-21] it has not yet become a universal aspect of resuscitation training despite mounting evidence that CRM-based training improves team communication during cardiopulmonary resuscitations.[22]

Notably, CRM-based training of just the code team leader improves performance of the entire code team in AHA guideline adherence.[23] At Duke Hospital, like most teaching hospitals nationwide, the code team leader is a resident physician. Traditionally, residency programs have relied on experience as their primary means of training residents in code blue leadership. However, over the last decade there have been several monumental changes in both patient care and residency training that have severely limited this reliance on experiential training. First, the quality improvement movement with its many hospital-based patient safety initiatives has resulted in fewer patients suffering cardiac arrest, and code blues have become relatively infrequent events. Second, resident duty hour restrictions have reduced resident exposure to hospital events including code blues. One study at a large academic medical center found an 83% reduction in potential code blue events for the first-year residents after implementation of duty hour restrictions.[24] Last year at Duke Hospital (excluding the emergency department and the ICU's) there were a total of only 87 code blue events. Given the low event frequency and rotating resident schedules, it is likely that a non-ER resident will lead fewer than 5 code blues during the entirety of his or her residency.

Given their limited training and infrequent exposure to real code blues, it is not surprising, therefore, that resident physicians report being unprepared to lead a code team. A study that surveyed 25% of all internal medicine residents in Canada found that only 52% of residents felt prepared to lead a code blue team.[25] When we conducted a similar survey of internal medicine residents at Duke this year, only 10% of respondents beginning their second year felt prepared to lead a code blue team. Upon completion of their second year of residency (during which they presumably led at least one code blue), 31% of respondents still felt the need for additional training in code team leadership.

Over the last decade simulation has emerged as a potential tool for training resuscitation teams in CRM. Simulation allows learners to engage in clinical scenarios that are infrequently encountered in real life, and to practice skills without endangering patients. It is felt to provide effective learning through deliberate practice by providing a mechanism for repeated practice with the ability to alter the degree of difficulty and clinical variation in a controlled environment. In addition simulation experiences can by individualized and adaptable to multiple learning strategies.

Simulation-based resuscitation training for resident physicians has been shown to improve self-confidence and adherence to AHA guidelines.[26-28] Simulation has also been shown to be an effective tool for teaching CRM skills, and notably, CRM skills learned in a simulation environment have been shown to transfer to real clinical settings.[29] However, the impact of simulation-based, CRM training specifically for interprofessional teams has primarily been studied in trauma situations. Extrapolating from the available evidence suggests that simulation-based training in CRM skills for inpatient code teams, would also result in improved teamwork and leadership, adherence to AHA guidelines and consequently patient outcomes. However, to our knowledge this has not yet been published.

Specific aims:

- We will develop and implement a case-based, interprofessional simulation curriculum for the code team members with structured debriefing focused on both technical and non-technical (CRM) resuscitation skills.
- By improving code team leadership and teamwork, we will measurably improve code team adherence to AHA resuscitation guidelines and patient survival of code and survival to discharge.

Methods:

We will first develop and conduct Qualitrics-based individual surveys of each of the professional groups that participate in adult code blue events in the hospital (resident physicians, code team nurses, pharmacists, and respiratory therapists). In these surveys we will assess current knowledge of AHA resuscitation algorithms, confidence in individual role definition within the code blue team, and perception of teamwork and leadership of the code blue team. We will also ask open ended questions to identify other issues with code blue team resuscitations not previously surveyed. To augment the results of these surveys, we will also conduct several focus groups with each professional group to complete a needs assessment for the simulation-based code team training sessions.

We will establish a baseline measure of adherence to AHA guidelines during real patient resuscitations by performing a chart review of 10 documented patient resuscitations. Using data captured in the electronic health record, we will measure time to first defibrillation, and time to first epinephrine/vasopressor. We will also measure baseline code survival rate, as well as patient survival to discharge post-code.

For the intervention we will develop a minimum of 6 simulation-based code blue cases (1 for each ACLS algorithm – ventricular fibrillation, ventricular tachycardia, pulseless electrical activity, asystole, bradycardia and tachycardia). A Laerdal training manikin will be used to simulate the patient, and we will utilize isimulate (previously purchased) to provide simulated patient vital signs, cardiac monitoring and to defibrillate the patient, if needed. We will then conduct monthly code blue training sessions utilizing the cases we developed. The sessions will be roughly two hours long and will include 2-4 second-year internal medicine residents, 1-2 cardiac care unit (CCU) nurses who rotate on the code blue team, a pharmacist and a respiratory therapist. Ideally, these training sessions will be conducted within an unoccupied patient room in Duke Hospital in order to improve the fidelity of the sessions.

We will videotape the simulation sessions in order to allow for more detailed evaluation of both the technical and nontechnical outcomes of the resuscitation. We will measure the technical skills demonstrated in the resuscitation including adherence to AHA guidelines (utilizing CASTest[30]), time to first debrillation, time to first epinephrine/vasopressor, hands off the chest time, chest compression rate and ventilation rate. We will utilize the validated Leadership Behavior Description Questionnaire (LBDQ[31]) to measure code team leadership, and we will evaluate team performance using the validated Team Emergency Assessment Measure (TEAM[32]).

Following implementation of our intervention we will then conduct a repeat analysis of real code data by performing a repeat chart analysis of 10 documented patient resuscitations again looking at time to first defibrillation, and time to first epinephrine/vasopressor. We will also continue to measure rate of patient survival of code blues, and patient survival to discharge post-code.
One year into the implementation of our program, we will also repeat our initial survey of physicians, nursing, respiratory therapists and pharmacists to reassess knowledge of AHA resuscitation algorithms,

confidence in individual role definition within the code blue team, and perception of teamwork and leadership of the code blue team.

A database will be created in REDCap for the purpose of data collection and review. Survey data will also be housed in Qualtrics. The database and its contents will be managed securely in accordance with hospital policies that include storage on password-protected Duke computers on Duke internal servers. Specific data elements to be collected include healthcare provider scores during each clinical scenario along with de-identified survey data. Data will be analyzed in aggregate and is kept on the Duke server behind Duke Firewall, available only to the project team. No information will be stored directly on personal laptop hard drives or any portable form of data storage.

If the program is funded via a Duke AHEAD grant, then an IRB will be submitted.

Challenges:
First, this project will require significant faculty time both to develop the cases and to implement the monthly training sessions, and this time will be uncompensated. Second, finding times that meet the scheduling demands of all four professional groups will also be challenging. Third, the success of the intervention will require buy-in from all four professional groups and a commitment from the leadership of each of these professional groups to a shared goal of improving code team performance and dynamics.

Sustainability:
To get this program up and running will require some upfront equipment purchases including an updated ACLS simulator manikin, a video camera and two tablet computers. However, this equipment will not likely require replacement for several years. Therefore the bulk of the cost of this program will occur in year one. Similarly a large portion of the time investment required to implement this program will be spent developing the survey instrument and the cases. Both the survey and the cases can then be utilized multiple times during further iterations of the program. Once the cases have been vetted, and the program is successful, it is possible that the simulations sessions could then be orchestrated and led by senior residents within the medicine program with some oversight still provided by faculty. This would then eliminate the heavy investment of faculty time needed to run the sessions.

Opportunities for subsequent scholarship:
Most of the published studies looking at the impact of interprofessional, CRM-based resuscitation training have focused in the emergency room treatment of trauma victims. Therefore, there is an opportunity to better inform inpatient resuscitation training with the outcome of our study. Additionally, there are very few studies looking at the impact of simulation-based training programs on actual patient outcomes.

Broader Impacts:
While this first phase of the program will focus on the residents in the internal medicine residency program and nurses from the CCU (because they are the code team leaders for adult patients in Duke Hospital) there would be an opportunity to replicate this program within other areas of Duke where patients are treated for cardiac arrest such as in the emergency room and in the intensive care units.

In addition the development of interprofessional, CRM-based simulation cases does not need to focus solely on resuscitation medicine. If this type of program is successful, then similar programs could be developed to train healthcare providers in other types of patient encounters in which interprofessional

teamwork is important. For example, cases could be developed in which a team of healthcare providers must conduct a difficult family meeting, or reveal a medical error to a patient. Once the concept of interprofessional simulation-based training has been accepted and piloted, the opportunity to expand to many other types of patient encounters is endless.

Timeline:

By the end of month 1:

- Write and submit IRB
- Create Qualtrics survey instrument and send to internal medicine residents, CCU code team nurses, code team pharmacists and CCU respiratory therapists
- Order and obtain necessary equipment (Laerdal simulator, video camera and tablet computers)
- Conduct chart review of 5 code blue events to obtain baseline data

By the end of month 2:

- Complete development of at least 3 simulation-based cases
- Conduct chart review of additional 5 code blue events (for a total baseline of 10 events)

By the end of month 3:

- Conduct first simulation session targeting the medicine residents one month prior to their CCU rotation.
- Complete development of the remaining simulation-based cases
- Schedule future monthly training sessions

Months 4-12:

- Continue to conduct monthly simulation sessions targeting the medicine residents one month prior to their CCU rotation.

By the end of month 12:

- Resurvey the internal medicine residents, CCU code team nurses, code team pharmacists and CCU respiratory therapists

By the end of month 13:

- Conduct chart review of 10 code blue events from the prior 2 months
- Compile data to evaluate the impact of the intervention

Resource needs and budget:

		Estimated Cost
PI Effort		$0.00
Consultant Costs	Statistical support	$2000.00
Equipment	Laerdal Resusci Anne QCPR with Airway Head Torso	$3643.00
	Laerdal Male Multi-Venous IV Training Arm	$673.00
	GoPro HERO 3+ video camera	$299.99
Computer	Hardware Microsoft Surface Tablet ($330 X 2)	$660.00
	Software	$0.00
Supplies		$0.00
Travel	*(1,000/trip)*	$0.00
Other Expenses		$0.00
Total Costs for Proposed Project		**$7275.99**

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