Qualitative Assessment of Hot Debriefs for Code Teams at Seattle Children's Hospital

Dongyang Chen

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Science

University of Washington

2017

Committee:

John Gennari

Joan Roberts

Program Authorized to Offer Degree:

Biomedical and Health Informatics

University of Washington

Abstract

Qualitative Assessment of Hot Debriefs for Code Teams at Seattle Children's Hospital

Dongyang Chen

Chair of the Supervisory Committee:
Associate Professor John Gennari
Biomedical Informatics and Medical Education

Seattle Children's Hospital recently implemented 'hot debriefs' for code teams that respond to cardiac or respiratory resuscitation code events. Hot debriefs are meetings immediately after the code event where the code team members are able to discuss the details of the event that just transpired. These discussions generally revolve around aspects of the code event that went well as well as those that could be improved upon. Before the implementation of these hot debriefs, no such formal meetings with the entire code team were required. This meant that if any particular code team member did want to discuss a code event, participation was minimal and the meeting would often occur at a much later time such as the following day. Hot debriefs were implemented with the intent of increasing information review and improving the quality of future code events. I assessed the status of these hot debriefs using well-established qualitative research

methods and semi-structured interviews with clinicians who participated in them to understand their thoughts and feelings on the new process. I interviewed ten participants (including nurses, respiratory therapists, physicians, etc.) and qualitatively analyzed their responses. Four key themes emerged: the effectiveness of hot debriefs, process formalization, openness of communication, and dissemination of information. For the first theme, the participants unanimously approved of the hot debriefs as a process for increasing information review and improving the quality of code events. However, there were concerns revolving around the other three themes with mixed opinions. This study shows that in order to effectively implement a process such as hot debriefing, one should consider the needs and opinions of the participants themselves.

Table of Contents

Chapter 1: Overview of Thesis

The difficulties and challenges of patient safety in the United States healthcare system are now well-known thanks in part to two Institute of Medicine (IoM) reports. The first, published in 1999, was titled "To Err Is Human: Building a Safer Health System." This report detailed the alarmingly high rate of deaths that occur due to medical errors in the hospital - as many as 98000 every year (1). The second report, published in 2001, was titled "Crossing the Quality Chasm: A new Health System for the 21st Century. This report provided a detailed examination of the disparity between what is considered to be quality healthcare and what patients actually receive (2). The two reports together call for improved patient safety through the design of a better and safer healthcare system. To help ensure that the US healthcare system continually improves the quality of care their patients receive, the reports provide recommendations on how medical errors can be reduced as well as overall principles for the delivery of care.

In 2015, the National Patient Safety Foundation issued a progress report based on the IoM's metrics and recommendations (3). This report highlights the lack of progress that has been made in the delivery of quality care. While some improvements have been made, the extent and growth of patient safety has been limited and disappointing (3). And in fact, when accumulated, medical errors that lead to lethal harm account for more than 200,000 deaths in America every year (4). This should not come as a shock though because even though the push towards greater patient safety and improvements in healthcare have been galvanized because of the IoM reports (5), the deficiencies in these realms have been published since the 1950s (6). Historically then, the repeated announcements concerning medical errors and the harm to patients that it causes have had minimal effect on changing clinical practices. This lack of progress has been characterized in three ways. First, there was always the acceptance that a certain level of unintentional medical

error was inevitable, diminishing efforts to eliminate such errors (7). The reasoning was that doctors do not intend to inflict harm but because of the "technological complexity of modern medicine," accidents and risk will still be there (7). Second, when patient harm does arise due to preventable medical errors, the health care providers responsible were often reprimanded or stigmatized (8). This perpetuated a lack of error reporting due to fear and shame which in turn supported theories that errors could be rectified through discipline (8). Cost is another huge factor that limits efforts on safety, since efficiency promotes rapid and repetitive processes onto patients, who are inherently variable.

Despite the forces that have and continue to hinder patient safety improvement, a combination of forces outside of the medical profession such the media and politicians, as well as strengthened buy-in from medical institutions has shifted the priorities of this traditionally insular field (6). There is currently a tremendous amount of effort being put towards patient safety and improved outcomes as well as medical error reduction at every level of healthcare (9). Research in successful healthcare quality efforts is being driven by this increased prioritization and a heavier investment of resources. As requirements for transparency and reporting continue to grow as well, medical institutions are needing to learn and adopt plans for implementing strategies and mechanisms to monitor and evaluate such quality improvement measurements. This investment in infrastructure has been shown to directly improve patient outcomes and the quality of care (10). Seattle Children's Hospital is a prime example of the efforts currently being made by medical institutions to innovate and improve healthcare quality.

This research project looks at one of the processes for quality improvement that Children's has recently implemented. Quality improvement in the clinical setting is usually referenced when discussing medical errors and adverse effects (54). As I quickly found out while conducting this

study, there are more subtle and indirect ways to improve quality. Hot debriefs (See Section 3.2) were introduced as a new process for the code teams at Seattle Children's specifically for code events involving cardiac or respiratory arrest that required resuscitation. Hot debriefs are required meetings directly after a code event where code team members reflect and discuss the details of the code. This process was implemented in place of the previous, lesser used, cold debriefs which were less regular in occurrence and had lower participation rates because they were not required. The motivation of this thesis was to evaluate the impact that this development from cold to hot debriefs has had on the actual code team members. This was done by qualitatively assessing the team member's thoughts and feelings through one on one interviews. The combination of the fact that hot debriefs are so relatively new, that they are not widely used in other similar clinical institutions in the region, and that there has been minimal research done on the effectiveness of hot debriefs in particular, prompted me to take an in-depth look at this issue. While the importance of debriefing in these medical situations has been demonstrated and agreed upon, the manner in which they are performed has no set universal standard (33).

I chose to conduct this study through a qualitative lens to allow an inductive and emergent angle. With some knowledge about the process itself, I had ideas about the general topics I wanted to investigate, but the key themes would arise from the thoughts and feelings of the participants themselves. These ideas reside on a continuous spectrum, making it difficult to quantify or categorize well in a survey or questionnaire for example. I instead thought to have the participants explain and describe themselves, leaving me with the task of exploring in a more holistic orientation. In addition, my topic of study involves emotion and feeling and this type of environment is better studied through a more qualitative procedure. This combination of factors pointed me towards interviewing as the primary mode of data collection, allowing my

participants to better portray the deeply complex personal and interpersonal phenomena associated with the debriefing process.

After I interviewed the code team member participants, I found four major themes of interest that my participants detailed. The first was the effectiveness of hot debriefs and the importance that they had in terms of quality improvement for all code team members. This was a unanimous conclusion made by all those interviewed. The other three themes evoked mixed feelings and thoughts. Those themes revolved around the formalization of the debriefing process, the openness of communication by all team members in the debrief, and the dissemination of learnings to all code team members after debriefs even if they were not present at the specific code and subsequent debrief. Key excerpts are used to demonstrate these themes and the opinions that they elicit, and then recommendations are given that will potentially improve the hot debriefing process and maintain its effectiveness while balancing the needs expressed by members of the code team. Before I go into the details of my study methods and results, we need to first understand the environment my subjects inhabit.

Chapter 2: Setting - Seattle Children's Code Teams

In this chapter, I describe some of the history of Seattle Children's Hospital, and provide details about the culture, people, and working environment of Children's. I focus especially on Children's use of team-based care because my participants are deeply connected with teams, specifically the code team which lies at the center of my study on hot debriefing.

2.1 Seattle Children's Hospital

Seattle Children's Hospital started in 1907 as an association spearheaded by Anna Herr Clise and 16 other women to provide "surgical care for children with orthopedic disorders regardless of patients' race, religion, or gender. (11)" This care was quickly expanded to cover patients regardless of their ability to pay. Since then, it has grown to be the fifth best children's hospital in the country (12) receiving top rankings for all 10 ranked specialty areas. Seattle Children's provides for over 40000 patient visits per year with board-certified pediatric experts in nearly 60 sub-specialties. The main campus houses 371 licensed beds with wings that include Pediatric ICU, Neonatal ICU, Medical/Surgical Unit, Cancer Care Unit, Rehabilitation Unit and Psychiatry and Behavioral Medicine Unit (11). Financially, the hospital annually grosses over $2 billion in revenue with over $100 million in research funding. With an active workforce of 6600 and 1466 medical staff, Seattle Children's has developed considerably from its early beginnings. This growth can be partly attributed to Seattle Children's values and commitment to high quality patient outcomes.

Throughout its history, Seattle Children's has based its decision making on whether or not those decisions will improve the quality of care that it provides. Examples include minor changes such as new lighting in operating rooms to help provide better surgery, to large impact decisions that

have drastically affected patient care such as its adoption of Airlift to provide for region-wide emergencies and the establishment of a formal relationship with the University of Washington.

The affiliation agreement between the two organizations was formally adopted in 1974 aimed to benefit both parties. Seattle Children's became the primary teaching, clinical and research site for the UW's Pediatrics Department in the School of Medicine. Children's also benefited from the UW's medical faculty and student interns. With the UW's Pediatric Residency Program centered at the hospital, the physicians in training include 126 pediatric sub-specialty residents and fellows and 114 pediatric residents. Residents rotate through a number of community clinics and affiliated teaching hospitals around the area in addition to their rotations at Children's. Through these rotations, residents gain experience in both inpatient and ambulatory settings with exposure to a "wide variety of both normal development and pediatric pathology in primary care, acute care and critical care." I was able to interview one resident directly after her PICU rotation.

In 2005, in alignment with Children's emphasis on patient safety and quality, the trustees approved a plan for a new board entity titled the Quality Committee which integrated all the QI initiatives occurring throughout the hospital. This came at a time when the hospital began adopting the Toyota Production System (TPS) principles to "increase patient safety, improve family satisfaction, streamline workflow and reduce costs," an effort known as Children's Continuous Performance Improvement (CPI). Seattle Children's was one of the first medical institutions to apply to healthcare the methods and scientific rigor of the TPS and in doing so, helped to eliminate waste from processes and systems by improving five specific aspects of healthcare: Quality, Cost, Delivery, Safety, and Engagement. CPI is all about improving processes through small but continuous improvements (15). This process of detailed examination not only takes a large amount of time and effort, but requires a cultural shift and cooperation

between administration and medical staff. Not every institution meets these requirements to sustain such CPI but Children's has made it work quite successfully. By adapting and building on this system, Children's CPI program has reached many achievements with some examples being:

- TPN medication error rates reduced by 66%
- Reduced average time in the Inpatient Psychiatric Unit from 20 to 10 days (can now serve 600 vs. 400 children a year)
- Blood stream infections in our Intensive Care Unit declined by 50%
- Patients see doctors sooner: appointment centralized scheduling times dropped 50%
- Fewer emergency department patients leave without being seen at peak times (achieving a 0.7% rate, compared to a 2.4% national rate)
- Patients remained on ventilators 20% fewer days
- Patients spent 20% fewer days in the Intensive Care Unit
- $2.5M reduction in supply costs
- 30,000 square foot reduction to save $20M on new Bellevue Clinic and Surgery Center design and construction
- 3.7% reduction in direct cost per patient, resulting in $23M in savings
- $180M in capital cost avoidance
- Patient and family satisfaction and employee engagement increased

Building on its innovative trajectory, Children's has recently moved on to the next phase of its quality improvement and transformed its CPI into Seattle Children's Improvement and Innovation (SCII). In their own words:

"Seattle Children's Improvement and Innovation is a guiding philosophy that informs how we approach our work and leadership. It is a commitment to make Seattle Children's better – step by step and day by day – by using continuous improvement and empowering those who do the work to improve and innovate. It challenges us to find new and better ways to do the work that is so vital to those we ultimately serve – our patients and families.

The goal of Seattle Children's Improvement and Innovation is to break down silos and remove obstacles and inefficiencies that prevent us from providing the highest level of service to those

we serve. It empowers our team members to escalate issues and make improvements to their day-to-day work, ultimately allowing us to make advancements in quality, safety, delivery, cost and engagement."

Multiple participants that I interviewed referenced the culture that needs to be present in order to foster an environment where clinicians and staff can openly discuss processes, their deficiencies and improvements, as well as areas for individual growth and improvements through constructive feedback. The benefit of having not only a forum to discuss these ideas and topics, but also the knowledge that one's coworkers and the systems in place are not there to humiliate or penalize, but to facility learning and support, is what helps drive Seattle Children's Improvement and Innovation. Through this, we can expect greater patient outcomes and improved patient safety.

2.2 Team-Based Care

A significant portion of this research study centers around the idea of teams, specifically the code teams at Seattle Children's. Before we dive into how these specific teams interact, communicate, and help each other, let us first take a look at the notion of team-based care at Children's. Seattle Children's self-describes as a teaching hospital, and delivers care to patients from teams with those in training working closely with those further along in their education.

The healthcare team at Children's is composed of many different types of doctors and staff members that each have their own roles. Figure 2.1 outlines these roles and positions.

Figure 2.1

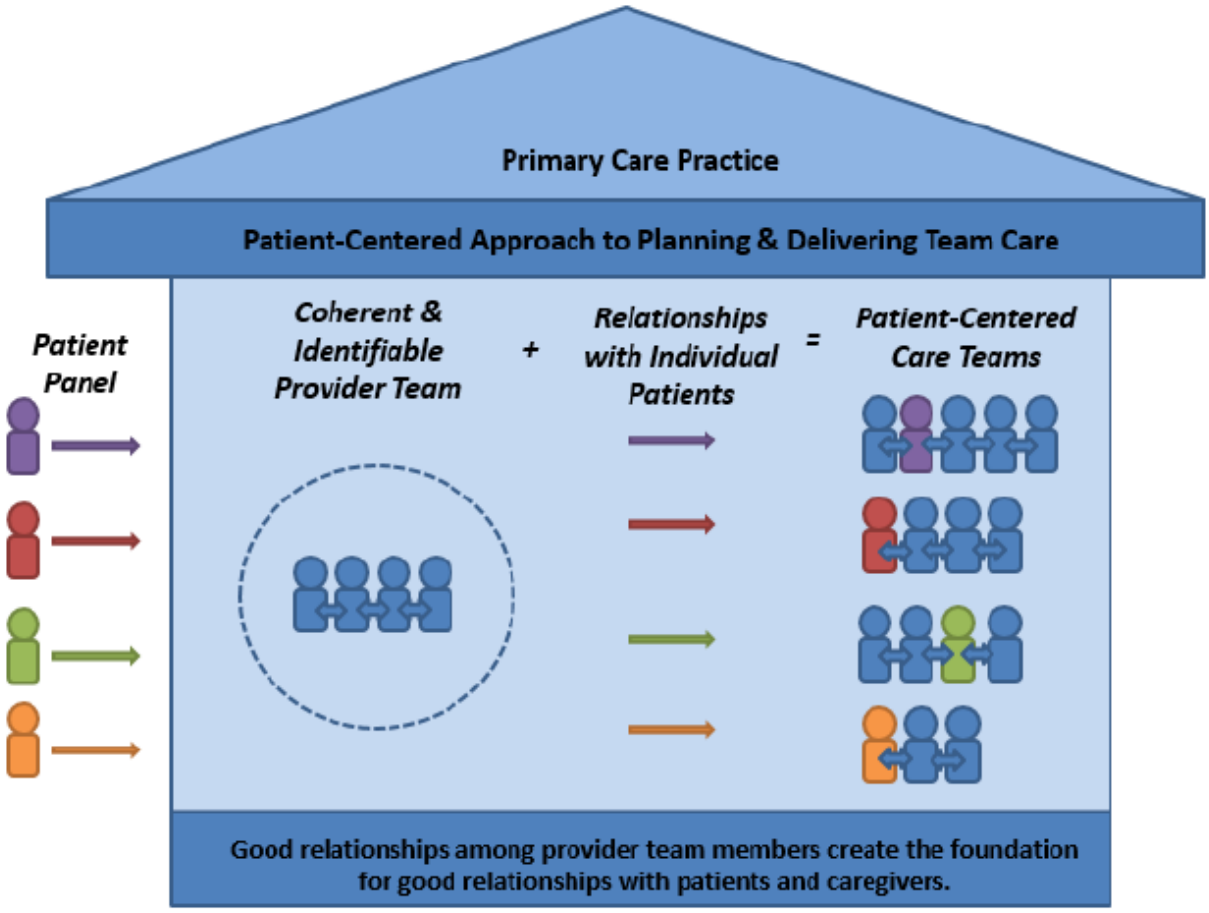
Group	Title	Role
Doctors	Attending Doctor	directs a child's care and supervises the residents and fellows caring for the child.
	Fellow	licensed doctor who has finished residency training and now is training in a specialty field.
	Chief Resident	licensed doctor in their final year of training. The chief resident is in charge of work rounds and oversees the residents.
	Resident	licensed doctor who is in training in a pediatric specialty. They will have the most contact with the child. They give daily orders for care and update the attending doctor about the child's progress.
	Medical Student	studying at the University of Washington to become a doctor. They may be at the child's clinic visit or take part in rounds with residents or the attending doctor.
Nurses	Nurse Practitioner (NP)	registered nurse with advanced education and training. They practice independently and work closely with doctors. They diagnose, treat and teach patients and families about serious and chronic conditions. They also make referrals.
	Clinical Nurse Specialist (CNS)	registered nurse with advanced education and training. They oversee quality, safety and staff education. They are a clinical expert and consult on patients with complex care needs.
	Charge Nurse (CN)	registered nurse who plans, coordinates and delivers care for each shift.
	Registered Nurse (RN)	a licensed nurse who provides and coordinates most of the child's daily care and education. They are the main contact with other members of the healthcare team.
	Nurse Tech (NT)	student nurse who assists and supports the registered nurse.
	Nursing Manager/Director	registered nurse who runs the patient care unit.
	Care Coordinator	registered nurse responsible for coordinating complex inpatient care. They work with families, the healthcare team and community resources to arrange care at home.
Specialists	Neonatologist	pediatrician with special training in newborn and premature infant intensive care.
	Pediatric Surgeon	doctor who have been trained in pediatric surgery.
	Critical Care Physician	doctor specializing in treatment of extreme diseases and illnesses
	Anesthesiologist	medical practitioner trained in anesthesia and perioperative medicine
Therapists	Occupational Therapist (OT)	sees how well the child can do daily activities. Through play and exercise, they will help the child build coordination to complete daily tasks.

	Physical Therapist (PT)	sees how well the child can sit, stand and move. They will help the child build strength, balance and coordination. If needed, they will also teach the child to use equipment like crutches or a wheelchair.
	Respiratory Therapist (RT)	evaluates the child's breathing. They may treat breathing problems with oxygen, medications, techniques to clear the airway, or a ventilator.
	Speech and Language Therapist (SLP)	checks how well the child can speak, understand, read, write and swallow.
Other	Chaplain	provides pastoral, spiritual and emotional support to patients and families from diverse faith traditions and cultures.
	Child Life Specialist	focuses on the child's emotional and developmental needs. They help reduce the stress of a hospital stay. They also provide information about play, child development and adjustment to illness.
	Dietitian	works with the child on a plan for nutritional health, growth and development while in the hospital and at home.
	Pharmacist	prepares medicine prescribed by doctors. They can also explain a medicine's purpose, effectiveness and side effects.
	Social Worker	skilled counselor who works with families to provide emotional support and get the resources they need.
	Unit Coordinator (UC)	make appointments, coordinate procedures, request tests, route phone calls and direct families to resources and staff.

The benefits of team-based care have been well researched and published. When patients are cared for by a variety of providers that draw from their personal expertise, the cumulative effect increases the chance that the patient will get the exact care that they need (17). There are additional benefits that have been outlined including an increase in access to care with greater coverage hours and fewer periods of waiting (18), as well as the potential to improve patient education, behavioral health, self-management support, and care coordination (20,21). These are all essential to the delivery of high-quality care (19). With larger provider teams, the opportunity for data-driven, continuous quality improvement increases (22), which is perfectly congruent with Children's principles of SCII. This necessitates effective communication, problem solving, and support among team members though and these channels are all built on sound relationships. Schottenfeld et. al. summarizes that "good relationships provide the foundation for the development of high-functioning teams and for high-quality patient-centered care. (19)" This means strong relationships both between healthcare providers and patients as well as among the individuals of the healthcare teams.

Figure 2.2 is a conceptual model of team-based care with respect to the patient developed by Schottenfeld et. al.

Figure 2.2


Primary Care Practice
Patient-Centered Approach to Planning & Delivering Team Care
Patient Panel
Coherent & Identifiable Provider Team
+
Relationships with Individual Patients
=
Patient-Centered Care Teams
Good relationships among provider team members create the foundation for good relationships with patients and caregivers.

In conjunction with their team-based and teaching aspects of care, Children's also promotes patient and family-centered care. This means including the child's family as vital components of the healthcare team. Specifically, the family may give input and work with other members of the team to make decisions and develop treatment plans. "Patient and family-centered care in pediatrics is based on the understanding that the family is the child's primary source of strength and support and that the child's and family's perspectives and information are important in clinical decision-making (16)." Children's commitment to this idea of patient and family-centered care is outlined with their stated goals:

- Partner with patients and their families as essential members of the healthcare team.
- Build partnerships based on mutual respect and open communication.
- Respect each family's uniqueness.
- Listen with care and seek to understand the perspectives and needs of families.
- Share information clearly, completely and consistently.
- Ensure privacy and confidentiality.
- Respond flexibly to family needs and negotiate differences of opinion in a timely and respectful manner.
- Promote and value the competency and expertise that everyone brings to the healthcare team.
- Collaborate with families in the development and evaluation of new and existing programs, policies and facilities.
- Work together with providers and services in the family's home community.

This shift towards patient and family-centered care directly follows up on the recommendation made in the IoM's Cross the Quality Chasm report which emphasized the need to better inform patients and their families as well as improve their access to health information (16). Comparable to the research that has been done on team-based care, many studies have been published on patient and family-center care as well. Some examples include the result that patients in the NICU who received more patient and family-centered care received more satisfactory care with the parents displaying greater competence in caregiving (23). Significant reductions in nonurgent emergency department visits were also associated with patient and family-centered care (24).

Finally, case study of a particular patient and family-centered care children's hospital has shown that this particular strategy is related to a reduction in medical errors and a decrease in average length of visit (25). The benefits are present with providers as well with an overall higher staff satisfaction, more accurate information and collaboration leading to better clinical decision making, and improved communication among all healthcare team members (16). In summary, patient and family centered care leads to better health outcomes (16).

Now that we have an idea of how Seattle Children's approaches its delivery of care to its patients through teams (both provider and family), as well as its history and commitment to quality improvement, we can begin to take a look at the code teams at Seattle Children's, the group involved in the focus of this study.

2.3 Background of Code Teams

When examining code teams in the hospital, we must first understand what a code is. Codes in this setting refer to emergency messages that are abbreviated using the hospital's coding system which in most cases are colors (51). This system of coding specific emergencies is utilized to quickly delineate information to hospital staff so the appropriate measures can be taken as soon as possible (51). The exact definitions and systems of coding vary depending on hospital and location, meaning that a Code Yellow for example can potentially mean a missing patient or a combative person - two drastically different things (52). Seattle Children's is a member of the Washington State Hospital Association and thus follows the association's designated emergency code recommendations. There are still some variations in the code recommendations and the code system Children's actually uses, but the specific code team that this study focuses on respond to Code Blues. A Code Blue is called when the emergency situation of cardiac or

respiratory arrest arises. Because Code Blue is generally designated for this specific type of medical emergency, hospitals will often shorten the phrase "Code Blue" to simply "code." So even though there are multiple codes at Seattle Children's, the abbreviation of "code" will be used to refer to this Code Blue situation that requires resuscitation with the code team referring to the medical staff responding to the code.

2.4 Code Team Roles

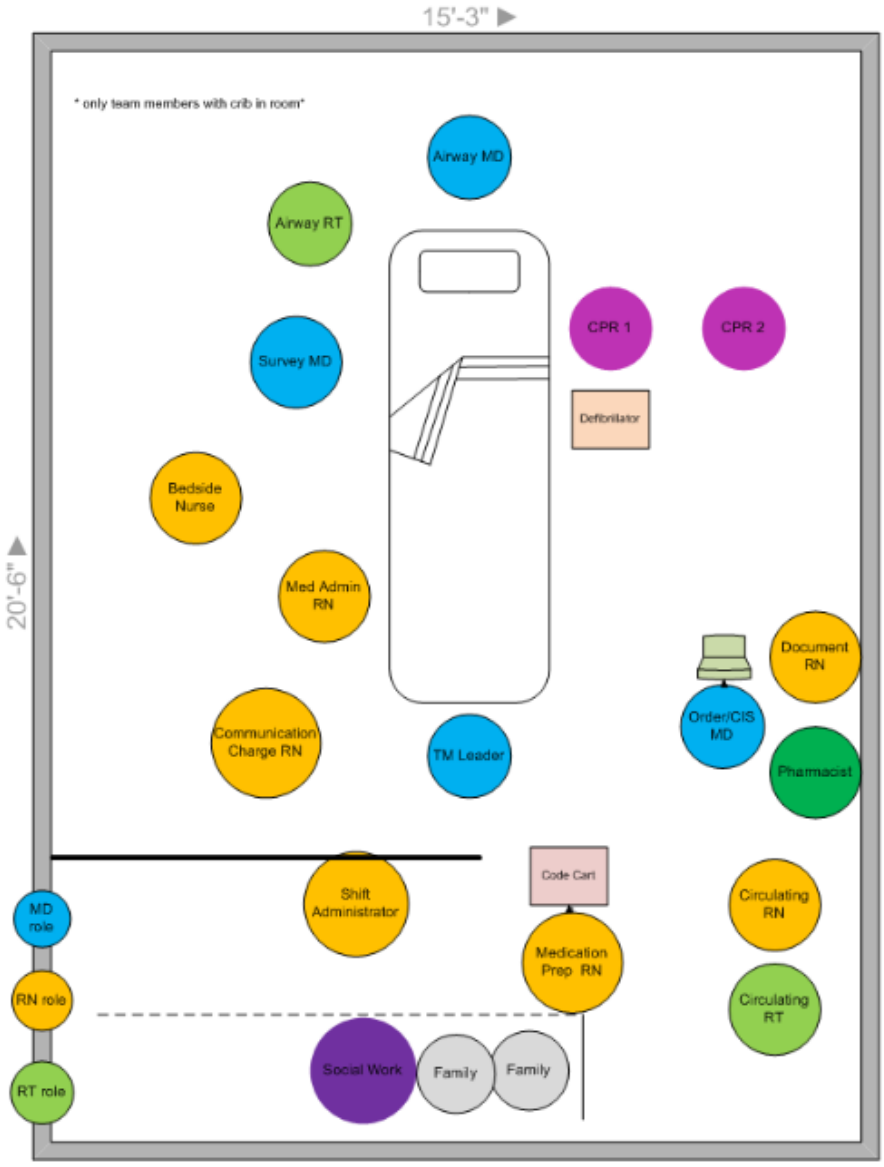
With this understanding of what code teams are, we can look at the way they respond to code events. Code team organization is directly tied to the overall performance and effectiveness of the team (53). In order to provide timely and high-quality care, it is critical that teams should have clearly designated role assignments with proper positionings relative to the patient (53). To achieve this, code team members have visible name tags to delineate their role and will proceed to their optimal position. Every code is slightly different and may have different numbers of code team members responding but each team member has a role and will work with the team accordingly. In a typical code, the key team members include: the attending physician with a fellow or resident, respiratory therapists, a pharmacist, and several nurse roles such as CNs and NPs. Other team members may be present depending on the location, timing, and severity of the code. Figure 2.3 shows an example chart of the potential code team members at a code event along with their roles and responsibilities. Different hospitals will have different positions and required number of roles, but it is still worth showing how hectic code events can be with the sheer number of people present. Figure 2.4 then shows where code team members at Seattle Children's Hospital might position themselves for a code event.

Figure 2.3 (53)

Position / # Needed	Role	Primary Responsibility	Secondary Responsibility
Leader / 1	Fellow or attending in emergency, critical care or anesthesia	To lead team resuscitation; identify reversible causes.	To correct errors and assist team with duties if needed (i.e. procedures).
Survey physician / 1	Resident	Perform repetitive physical exam and report findings.	
CPR / 2	Two staff nurses from 3N and/or 6N and/or intern; located on the right and left of the patient; intern could take on the role of the left side staff nurse	RIGHT SIDE: Evaluate need for CPR and provide uninterrupted high quality CPR, audible counting with metronome. Assure backboard in place. LEFT SIDE: Need for CPR and provide uninterrupted high quality CPR, alternate compressions every 2 minutes with right CPR. Evaluate airway and breathing.	RIGHT SIDE: If CPR not needed, assist with IV/meds as needed.
Airway / 1	Anesthesiology provider	Secures airway.	
Airway/Respiratory / 2	Respiratory therapist	Provide appropriate bag valve mask or advanced airway ventilations as needed.	Assist with patient comfort, supplemental oxygen, suctioning, and positioning.
IV/Meds / 1	ICU nurse	Assess and/or place IVs, IOs immediately, accept med orders and administer medications.	Assist with patient comfort and positioning.
Monitor/Defib / 1	ICU nurse	Hook up patient to defib and monitor, provide defibrillation, cardioversion as needed and at the direction of the leader.	Assist in placement of IV/IO if needed.
Pharmacy / 1	--	Fill and provide ordered medications to the IV/Med nurse promptly and correctly.	Prepare medications that may be needed ahead of time (anticipating patient needs).
Lab / 1	--	Draw lab, Code Blue panel automatically and immediately upon arrival to code. Send to lab stat and	--

		ensure results are returned to leader.	
EKG / 1	--	--	--
Spiritual Services/ Pastor / 1	--	Support present family members, pray for patient, family, and code team members.	Contact family and provide updates related to information on patient condition, end of life decisions, donation, autopsy and funeral home options if indicated.
Recorder / 1	Supervisor	Record all events and give information to leader as requested.	Get medical records from unit primary nurse and communicate with unit nurses, receiving unit and patients' primary service.

Figure 2.4 (53)



Code event organization can be further complicated if different procedures are involved or the patient must be transported to different areas of the hospital. For example, a patient may start outside of the ICU and then end up in the ICU with different team members starting and ending the code. There may also be ancillary services present or perhaps surgery needs to take place so the surgical team is working on the patient. With these types of complicated codes, it is rare that all the same people start and finish the code together in the same place. These are perhaps not as common as the more straightforward code events, but they do occur nonetheless. Debriefing

after such eventful codes is perhaps even more meaningful because there might be more processes to discuss in terms of what went well and what could have gone better. Being able to discuss with everyone who was present and worked on the code is extremely challenging because of the time schedules and tasks that team members need to get back to doing before the emergency. The next chapter discusses what the process for debriefing used to be at Seattle Children's as well as what the process in practice is now.

Chapter 3: Related Work - Debriefing

This research study primarily looks at the debriefing process that occurs at Seattle Children's Hospital following a code event. I first explain what debriefing is and where it came from and then explain how it pertains to Children's and their code teams. There are different types of debriefing and my study focuses on the transition from cold to hot debriefs and members of the code team's reactions to this change. Knowing this, I outline my approach along with my goals of the study and end with a look at some related work that has been done on debriefs.

3.1 Debriefing

Debriefs are generally conversational sessions revolving around the discussion and examination of information regarding a specific event after its occurrence (26). Debriefs allow for participants to learn and reflect on an event and their experience with it. This process was originally used in the military and aviation industries and has been adopted by other high-risk industries as well, including the healthcare sector (26). By reflecting on their experience, debrief participants are able to identify things that went well and things that could be improved upon not just for themselves, but for other participants as well. This type of reflective thinking leads to conceptualization and insight on the event for the application to similar scenarios in the future (27). This practice of debriefing in industries where there is significant risk to human life such as the military or aviation industry are generally highly technical in nature (28). The meetings are conducted professionally and business-like with minimal time for emotional release or the discussion of feelings (26). Contrast this with psychological debriefs after traumatic events which are meant to provide a space for participants to share personal feelings and reactions in a venting but controlled and supportive environment (29). These types of debriefs are generally

used for emergency responders to reduce stress (29). The type of debriefing that I will be studying that is done by Code Teams contains aspects of both of these debrief types and should not be categorized as one or the other.

One of the purposes of debriefing is for it to act as an educational tool. Another educational tool that hospitals use is the simulation of events. Simulation replaces real patient experiences with guided and controlled ones to replicate what events would look like in the real world (30). This often entails full immersion and interaction with everything except for a live patient. Simulation in pediatrics is a technique that has been rapidly growing in support (31). Pediatric cardiac arrests have seen increased survival rates after the implementation of a "longitudinal simulation mock code program (32)." Just as debriefing can be conducted after actual events, debriefs can be used after simulations as well to provide further learning tools. Debriefs after simulated events can especially be helpful with regards to the training of nontechnical skills such as leadership and communication (26).

While the positive aspects of both debriefs and simulations have been well documented, there is still debate as to the manner and approach of debriefing after simulated or real-life events with no generally accepted standard (33). What can be agreed upon is that regardless of whether the event was simulated or real, the debrief afterwards is important for the evaluation of learning objectives and reflection (34). Reflection is especially critical in pediatrics because of the faster potential decline in health of children - events can transpire much more quickly intensifying the stress of the situation. This makes it more difficult for providers to remember and analyze their actions (35). Studies have been done to test whether different debrief modalities, such as oral or video-assisted, can help healthcare providers with their reflection and review in these tense situations (36). Savoldelli et al found no differences in improvement between the type of debrief

conducted, but did find differences between those that conducted a debrief and those that didn't with those that did demonstrating greater improvement (36). There is tremendous promise in the utilization of debriefs especially after stressful and traumatic events, but there is still a lot to be done with regards to how to improve the debrief process.

3.2 Approach

Now we know that debriefing as a tool for learning has been researched and studied extensively (40, 41, 42). The general process of debriefing is not anything new at Seattle Children's. Physicians and other healthcare members often have impromptu or informal dialogues with each other discussing events they have experienced among their other non-specific conversations. With the code teams in particular, members would often respond to a code event and then discussions might occur relating to the event later on, but these would not be considered debriefs by any formal definition. If a code event was particularly stressful or difficult, any member of the code team that responded might ask for other members to meet up afterwards and talk, but even these meetings were unstructured, informal, and mostly with the intent for team members to decompress and support one another emotionally. There was also no documentation associated with these meetings and full participation was unreliable.

In addition to these informal discussions, Seattle Children's conducted more formal Code Reviews. Every Friday, these reviews would occur with key players such as the attending physicians and other leaders of the code teams. These conferences reviewed code events with the aid of very specific and quantitative data from machines that tracked markers for high quality CPR such as CPR rate and depth among other measurable aspects of a code event. These overall reviews did not include all members of the code team and even though important information

was being analyzed, the complete picture of any single code event could not be accurately portrayed and reviewed because of this.

These review sessions and informal discussions are often termed as cold debriefs because they take place long after the actual code event, days later even. In October 2016, Dr. Joan Roberts, chair of the code teams at Seattle Children's implemented what are known as hot debriefs. These hot debriefs took place immediately after every code event or at most thirty minutes afterwards and included all members that responded to and participated in that code event. These hot debriefs were formal, but quick discussions that took place in order to review information regarding what just happened in a more intimate and qualitative way. This is an opportunity for all members of the responding code team to share and converse about what went well as well as what could have been improved upon.

Out of the related clinical institutions to Seattle Children's in the WWAMI region, 90% of the hot debriefs take place at Children's with the others still utilizing cold debriefing methods. Studies have been published that show the value of debriefing after code events but there has yet to be conclusive evidence providing support that there is a superior method of debriefing between cold and hot debriefs (33, 43). With the recent implementation of the hot debriefs, I wanted to gain insight from those actually participating in the debriefs, how they felt about them, and what their experiences have been. Because I had no expectation of what the participants would deliver this was a perfect opportunity to assess the hot debrief process using qualitative informatics methods so an emergent qualitative methodology was proposed. My plan was to recruit Code Team participants, interview them about the shift to hot debriefs, and then parse through the themes that emerged. I felt that this approach would give me a better understanding of what the participants themselves thought about the hot debriefing process, whether or not they

felt like it was beneficial or necessary, and help guide the subsequent changes and improvements. This exploration with a bottom-up frame of reference was chosen because I did not have at my disposal a plethora of mature knowledge on the subject of hot debriefs to corroborate and explore generality. There were no measures or numbers to rely on because the process was still in its infancy at Seattle Children's so the assessment would be less deductive, and more inductively driven. Other studies related to medical debriefing were characterized with a more qualitative approach as well. The exact methods used may differ, whether they were case studies, sample surveys, questionnaires etc. but the guiding principles of the approach are generally the same. Debriefing involves complex interactivity and feedback systems as well as minimal quantitatively identifiable outcomes so the focus becomes on the internal dynamics - the strengths and weaknesses rather than on the product itself (46). For my study, it is also especially true that the perceptions of the participants differ from outside observers. These aspects of the process I am studying orient me towards a qualitative approach based on individual interviews as the source of data. Specifically, the goals of my project were to:

1. Evaluate the status of hot debriefs from Code Team members at Children's through individual qualitative interviews.
2. Analyze and describe the themes that arise from the interviews
3. Provide recommendations that will address those themes.

Before we look into the detailed methods of my project, let us take an inventory of the studies that have already been done relating debriefs to clinical outcomes.

3.3 Related Work/Citations

Debriefing is not a process that is ubiquitous among all medical processes, but a few specific ones that have seen successful implementation are obstetrics, resuscitation, and critical care (26).

Debriefs facilitate an environment and culture where providers are more willing and open to discuss individual and team performance and learn from their near-misses, errors, and achievements, increasing patient safety (26).

For anesthetic trainees, debriefing was viewed as a useful tool and those that participated felt more supported by their senior colleagues (37).

Findings also suggested that in order to have the best chance of higher quality and safety in their practices, debriefs should be performed after every live patient experience. This will not only provide the best chance for behavioral improvement, but also lead to greater team cohesiveness (37).

The American Heart Association recognizes the importance of debriefing to improve clinical outcomes and has incorporated debriefs into their Pediatric Advanced Life Support courses (38).

There are two types of debriefs depending on the timeframe in which they are completed. Hot debriefs take place immediately after the medical event while cold debriefs occur sometime later. For cold debriefs related to resuscitation events, defibrillator data can be downloaded and analyzed to review CPR quality along with other measures of quality resuscitation. The implementation of cold debriefing with the aid of hard resuscitation data was shown to improve CPR delivery, provider knowledge, and a "14% significant absolute improvement in return of spontaneous circulation (39)." Another study showed that cold debriefs in a pediatric ICU led to

positive effects on confidence, performance, and knowledge of healthcare providers which led to improved CPR quality (40).

Chapter 4: Study Methods

This chapter describes the entire process of my study. I explain each step of the project to elucidate the difficulties and importance of this type of work as well as to show the involvement that I had with Children's and my participants. This also gives a better sense of the type of approach that might be utilized with similar research studies at similar institutions. My interview questions are laid out as well as the overall structure of my codebook. More specifics about the codebook can be seen in Appendix A.

4.1 IRB Approval

Because my study necessitated the interaction with other humans, it had to first gain approval from an Institutional Review Board (IRB). An IRB is a committee that formally reviews, approves, or rejects any research activities in order to protect the rights and welfare of the research participants (44). The IRB at Seattle Children's is composed of a variety of pediatric specialists, non-scientists, and members unaffiliated with Children's (44). In order for a study to be approved, an IRB application must be submitted. This application includes all of the details about the research study that might affect a participant. The Seattle Children's IRB request form specifically asked about the project's: Objectives, Background, Inclusion and Exclusion Criteria, Number of Subjects, Recruitment Methods, Number of Sites, Procedures Involved, Confidentiality Measures, Risks to Subjects, Potential Benefits to Subjects, Setting, Resources, Prior Approvals, Provisions to Protect the Privacy Interests of Subjects, Economic Burden to Subjects, Consent Process, and Good Clinical Practice. Once the IRB form was submitted and approved, I was able to begin the process of gaining access to Seattle Children's campus as a Research Non-Employee which would allow me to contact and then interview participants.

4.2 Onboarding Process

Seattle Children's is a healthcare facility so there are highly specific requirements that must be passed before access can be granted. Additionally, as a children's hospital, the majority of patients that visit Seattle Children's can be considered as vulnerable populations, essentially a "disadvantaged subset of the community requiring utmost care (45)." Because of this, my onboarding was extremely thorough. The tasks that I had to complete included:

- Signing a disclosure and confidentiality agreement
- Undergoing a background check
- Receiving Tetanus, Diphtheria, and Pertussis (TDAP) immunization
- Receiving additional Varicella immunization
- Receiving an influenza vaccination
- Blood testing for Hepatitis B and Tuberculosis
- Filing of financial disclosures
- Orientation
- Non-Employee Action Tracking (NEAT)

Once these were all completed and passed, I received my Seattle Children's badge, e-mail address, and was added to the research project e-mail account which allowed me to contact and meet with my study participants.

4.3 Interview Questions

The primary mode of data collection for my research study was interviewing, the prime qualitative data-collecting tool which serve the purposes of qualitative methods as well as surveys (46). As an emergent qualitative study, several key decisions were made to craft my interviews to be more explorative than hypothesis driven. There were a few important aspects of the hot debriefs that I was highly interested in so those were given specific questions, but the rest

of the interview was open and allowed for organic discussion between the interviewer and the participants. A few of the design choices that were made for the interview are listed below:

- Semi-structured interview guide to provide predetermined questioning structure for the interviewer, as well as allow for unscripted, free-form questioning
- Recording respondents' free responses verbatim as opposed to choosing among predetermined responses or categorizing in predetermined response codes
- True purpose given to the respondents as opposed to concealing motives with false purpose
- Interviews were all set as one on one, not as groups

As for the content of the interview questions, there are six basic types of questions that can be asked of people (46), and out of those six, I focused on four of them. I started off with a background/demographics question to understand their role and position at the hospital and in the code teams and then the rest of the interview consisted of experience/behavior, opinion/belief, and feelings questions. The other two types of questions, knowledge and senses, were not specifically asked. Figure 4.1 shows the semi-structured interview script.

Figure 4.1

Hello, *name*, thank you so much for contacting the hot debrief study.
I will review some basic aspects of the project and, if you agree to participate, we will discuss your hot debrief experience.
Did you have a chance to review the information sheet about the project?
Do you have any questions about the project?
At this point, I would like ask for your verbal consent to participate. After you have verbally consented, I will begin recording our session for future reference.
Remember, you can decide how long your answer is and you can opt out of any question.
We think that your responses will be very helpful and integral to improving the hot debrief process.
First, I would like to ask you a few questions about your work on the Code Team as well as your interactions with the hot debriefs.

- First, can you please describe your role on the Code Team? How long have you been in this role, not just at Seattle Children's, but including any other workplaces?
- What was the process for debriefing and reviewing an event before the implementation of the hot debrief?
- Do you think this old process was effective for information review?
- If yes, in what ways? If no, why not?
- Were there ever times when the team was unsure of certain information, particularly important aspects of care associated with the event?
- If so, how were those uncertainties resolved?
- What aspects of the process did you feel were helpful?
- Any that were detrimental?

- How open was communication from all team members during this process?
- Please describe any emotional effects or feelings associated with this process. For example, did you feel safe sharing your opinion?
- How effective was this process for improving the quality of future events?

Now we are going to switch gears and speak about the hot debriefs.

- Please describe the hot debrief and your experience with it.
- Do you think this process is effective for information review?
- If yes, in what ways? If no, why not?
- In what ways has information review changed in effectiveness?
- Would you say there are more or less uncertainties in information with the hot debrief?
- Can you explain why that is?
- Has the process of resolving uncertainties changed?
- How open was communication from all team members during the hot debrief?
- Please describe any emotional effects or feelings associated with the hot debrief. Did you feel safe sharing your opinion?
- How effective was this process for improving the quality of future events?
- Do you have any comments or criticisms about the "Resuscitation Quality Improvement Review" form?
- Can you describe the learnings that occurred during the hot debrief?
- In what ways are these learnings different from before?
- Please describe what you think would make the hot debrief better.
- (Do you think technology could be used to improve the hot debrief?)
    - In what ways (given no restraints)?

Thank you so much for taking the time out of your busy schedule to meet with me. Your answers have been incredibly helpful and useful. Are there any last comments you wish to make about this whole process or hot debriefs?

4.4 Conduction of Interviews

The recruitment of participants was done through fliers posted around the Seattle Children's main campus as well as requests by Dr. Roberts to staff who had participated in code events and hot debriefs. Participation was completely voluntary with no incentives given other than the described potential benefits to subjects: "The main benefit to participants in this study lies in the potential improvements to the debrief process that are made possible from the information derived from the interviews. Another potential benefit lies in the opportunity to share reflections on a highly emotional event, such that processing the information is beneficial to the participant." If they chose to volunteer, the participants would declare their interest through a secure Seattle Children's e-mail account (hotdebriefs@seattlechildrens.org). Once they sent this

notification in, I would contact back and work to find an agreeable and convenient time, location, and mode for the interview.

Twelve total volunteers contacted and agreed to participate in the study, but I was only able to reach ten of them back to coordinate interviews. Of those ten, nine were phone interviews and one was in-person. The phone interviews were recorded using a call recording app (TapeACall) and the in-person interview was recorded using a handheld audio recorder. The interview data is given in Figure 4.2. Directly after each interview, field notes were taken that summarized the interviews as well as detailed general impressions or thoughts about the interview. This was a way to write down important aspects of the interview that might be lost after the fact.

Figure 4.2

n	min (time)	max	avg	med
10	16:56:00	46:14:00	28:24:30	25:38:00

Once the recordings were transcribed by hand into Dedoose, a secure web-application built for qualitative and mixed methods research, the audio recordings were deleted. All of the subsequent data analysis was done in Dedoose on the transcripts hosted there.

The transcription of all of the recorded interviews were done following the "Qualitative Data Preparation and Transcription Protocol (47)." This included general formatting, labeling, and documenting. All of the audio recordings were transcribed verbatim including repeated or hesitated words. If parts of the recordings were inaudible, that fact was noted [inaudible]. The transcripts were not cleaned up through the removal of slang, grammatical errors, or mispronounced words except through the exclusion of filler sounds such as "*hm, huh, mm, mhm,*

uh huh…" If the participant and I happened to speak at the same time to cause overlapping speech, [crosstalk: *overlapping words*] was noted and transcription carried on with the ability to pick up the next audible speaker. If words or phrases were distinguishable but there was doubt in the accuracy of it (medical lingo for example), a "?" was placed used to note the uncertainty. If the participants provided other people's real names, an equal sign was placed immediately before and after the named information to identify sensitive information that may or may not require substitution. All transcriptions were reviewed against the audio recordings for accuracy and then saved for coding and analysis in Dedoose.

4.5 Excerpting and Coding

Because my research project was built to be an emergent study, I developed my codebook after all of the interview recordings had been completely transcribed. The act of conducting the interviews as well as all of the playbacks required to transcribe gave me a great idea of what general themes were emerging. The codebook was broken down into four main codes that excerpts could be categorized under:

- Cold Debriefs
- Hot Debriefs
- Paper Form
- Technology

These codes were chosen so that excerpts could be analyzed with general frameworks in mind. I also flagged particular good quotes so that exemplary excerpts that highlighted specific ideas or elicited deep insights could be used and found with ease.

Once I had my developed codebook, I went through each transcript and coded key excerpts. Not every response from the participants were excerpted because sometimes ancillary responses were

given, but for the most part, interview questions were related to the themes of the available codes. This way, most responses were excerpted and given a code. Most excerpts were given more than one code if multiple ideas were present. During the excerpting and coding process, the idea of translational validity was kept in mind. This form of data validity requires that the "terms used for constructs or concepts match well the data excerpts intended to illustrate them (46)." The parent-child coding format made my excerpting and coding process amenable to such validity. For example, if a response was given that contained ideas worthy of inclusion for analysis but did not quite fit any of the child codes, instead of forcing the excerpt under a specific code, more general parent codes could be given. This allows for the ability to go back and review these excerpts for discussion without compromising my results.

To illustrate this validity and give a sense of what types of excerpts are being used for what code, Appendix A lists examples of excerpts for each code.

Chapter 5: Results

I describe my methods of analysis here as well as the themes that emerged from my interviews. Four key themes developed from my analysis of the data. They are also supplemented with key excerpts picked to highlight the ideas surrounding these themes. I then give explanations about the themes and why they were particularly relevant or important for my participants.

5.1 Analysis

Once I formalized my codebook and coded all my excerpts, I could look at the themes that emerged and the patterns that those themes came in. Those patterns would then lead to my conclusions with the primary criterion being that any conclusion and analysis I made must be grounded in my interview excerpts. Through the process of interviewing, making transcripts, and generally becoming more familiar with the material, I started coming up with a few working hypotheses about repeating patterns. This allowed me to observe the consistency or lack thereof of these hypotheses as I worked my way through the rest of the interviews.

With all the data at hand once excerpting and coding was completed, I was able to test the patterns and hypotheses I saw and formulated to see whether my proposed explanations fit well enough to be satisfactory. Due to the nature of this type of emergent qualitative study, I am unable to provide statistically significant results, and instead deliver generalizations, that is, generalities and general perceptions or perspectives from the data.

For some similar emergent qualitative studies, results stem from the analysis of code frequency or weight matched against descriptors of the participants (46). Descriptors here represent information that distinguish between participants such as demographics, or any other categories

relevant to the research study. The only relevant descriptor I had for my participants was their role on the code team. Other descriptors were not apparently important before the study nor were they found to be important as the study progressed. The "Position/Role" descriptor had six different fields:

- Attending Physician
- Charge Nurse
- Fellow
- Nurse Practitioner
- Resident
- Respiratory Therapist

Descriptions of these roles can be found in Figure 1.1. There are other potential fields that would have been included had participants that matched those fields volunteered and participated in the research study. With ten total participants, three were attending physicians, three were respiratory therapists, and one of each of the other fields was represented. With just one descriptor for my data, there remained the potential to conduct code by descriptor analysis. For example, I could analyze the percentage of excerpts that were coded as "Dissemination of Information" by role to see if any particular role such as Attending Physician represented a disproportionate amount. Doing so gave me several charts that displayed normalized code frequency percentages against the six different fields of my descriptor. This analysis process did not lead to any substantive results nor did it seem to contribute positively or negatively to any of my working hypotheses.

This is most likely due to the fact that I only had ten participants for six types of roles. With a larger sample size, patterns may be extrapolated more easily as particular codes may have greater correlated with the role of the participant. There was also the issue that my interview questions and the responses and excerpts that they led to, as well as my system of coding, was not

conducive for this type of analysis. My codes and excerpts rely heavily on context so while the excerpts are given codes that categorize them into themes, the codes alone cannot fully explain any feelings or deeper thoughts. Their frequency is due to specific respondents mentioning certain coded themes particularly more or less, but for my purposes, the lack of context means those numbers hold incredibly little weight. For example, "Communication" is an important code for one of my generalities which I think depends heavily on the descriptor of "Position/Role." However, when looking at the frequencies of that particular code against my descriptor fields, there are no significant discrepancies. But if I look deeper into the context of those excerpts, a pattern based on this descriptor seems to emerge. The next section explains this and the other general results I demonstrated.

5.2 Themes

5.2.1 Quality Improvement & Effectiveness

The most significant theme that emerged from my research study was how overwhelmingly positive my respondents felt about the transition to hot debriefs. Again, the importance and impact of debriefing after Code Events has been thoroughly corroborated (26,29,33,36,39,40), yet the question of debrief modality had yet to be definitively answered (33). Seattle Children's moved from cold to hot debriefs in the fall of 2016 and though hot debriefs cannot be considered a panacea, the positive impact that this transition had cannot seem to be overstated. All of the respondents affirmed the importance of hot debriefing and how constructive it has been. Especially compared with cold debriefing, hot debriefing has contributed to improvements in information review effectiveness, communication, learning, and overall quality improvement. Here are some excerpts that demonstrate these values concerning hot debriefs:

P9: So I think the hot debriefing works because it increases one's appreciation and understanding of another team member, and it also increases my awareness of the entire process, everyone's, of what everyone is doing specifically I understand that entire process but specifics is a different thing and it's, it's good to good to know. It kind of like adds to the flow, the hot debriefing adds to the mental flow of what's going on.

P8: I think they're valuable because especially when they're performed immediately and everybody, the participants are all still there it's fresh in their mind. And it helps people process a stressful event where you know even a small thing that they they might forget you know even a few hours later in that moment was very real to them, ... so I think an immediate debrief with everybody involved and not just talking about you know the big things, is more likely to identify those smaller systems things that can be easily addressed

These are just a couple of excerpts that attest to the value and effectiveness of hot debriefing. Debriefing is helpful for these Code Event situations because there is the potential for a great deal of activity and processes mixed with the fact that human lives are at stake. During an actual event, the nature of the emergency necessitates complete attention to the matter at hand. There is no built in time for reflection or discussion. Introducing the debriefs has allowed for these Code Team members to evaluate, and more importantly, learn and understand.

P4: I mean, I gain a lot of appreciation and perspective on like what other people's thought process is and what they were seeing and thinking and like how they benefit from like a shared mental model and things that I find very beneficial at least to be reminded or reinforced or like gain a new perspective. I feel like I share those things in a debrief and they seem to be well received and there's concrete things that we can do better, you know, why did like finding concrete process places to improve things like to have a piece of equipment in the code cart or to have a piece of equipment brought to a place sooner or faster.

Before with the implementation of the hot debriefs, members of the team might attempt to have a debrief, but those efforts were inconsistent and participation was low. So, while the potential for understanding and learning through debrief discussions existed, in practice, it failed to achieve the successes of debriefing as reliably as hot debriefing does.

Before hot debriefs:
P6: There could be members of the code team who would grumble to each other but would never call for a debrief. So since it was informal, it relied on somebody actually speaking up rather than being given an opportunity

P8: Not, not successful at getting everyone together no. It was usually just a subset of participants.

P3: Not really, again since it categorically left out issues although it it did when they came up, it did identify problems but but there wasn't a clear mechanism then to to do anything with that information.

After hot debriefs:
P5: I think because it involves more players so it involves everyone who was in the code instead of just you know the few people that are still around after the code … so you capture more information and more opinion or data depending on how you want to look at it as far as feedback and what could've been done better and what went really well.

P6: It's it's since it's a formalized process, I think it gives people more opportunity to be vocal. It gives you more confidence to express your concerns than than having to to get the ball rolling yourself when it's when it's the process that's that's run by somebody else, once people are more inclined to share I think.

P7: I think it was effective because I mean I think kind of doing it right after while it's still fresh in your mind is is definitely better than doing it you know sometime later when kind of maybe you would've forgotten what all had happened … it's most effective I think for information review and things right after.

For Seattle Children's, the transition to hot debriefs facilitated better participation after an event had occurred. With higher participation and a more formal process, team members were more willing and able to share their thoughts and opinions. This increased dialogue generated deeper thought and perspective which directly led to quality improvements. When having discussions about "what things went well" or "what things could be made better," the goal is to improve the process and increase the quality of the next Code Event. The hot debriefs made it more apparent to more people the types of work and behaviors that led to successful codes which should be continued. They also raised awareness to deficiencies in the process which more team members could reflect upon, generate suggestions, and continue to work on.

P7: It was helpful to talk about you know what happened and you know where the deficiencies were

P5: I mean certainly yes, some of the more abstract kinds of things like better closed loop communication, being quieter in the room when there's a code like things like that that I I think we've learned from and gotten better at doing yea for sure. You know not pausing, you know not pausing chest compressions and doing effective chest compressions and not bagging too fast, all those things.

P3: They all reinforce the important good, important aspects of good quality CPR and I think that piece of it is I think what, I think of as the important educational part that helps everyone remember the next time of where's our priorities need to be in performing high quality CPR.

The hot debriefs and the ideas being generated because of them are directly leading to specific and tangible improvements to the quality of Code Events. As hot debriefs continue to push forward such events on an upward trajectory, better patient outcomes and patient safety will result. Sometimes results will be immediately apparent, while at other times, the hot debriefs will lead to incremental and more abstract improvements.

P4: Yea, specific things that have come up have shown like things, there are now things on code carts that didn't used to be there that came out of hot debriefs where somebody said I think this might help things faster

P10: So I think there's, there's some pretty concrete things that we've, we discuss at some of them that we then try to take moving forward.

P5: I think because it calls out deficiencies as well as things that are done well … it pushes people along the improvement pathway. I think calling things out that are good helps people to, helps to reaffirm people's skills in the room and make them feel a little bit more confident in what they're doing.

5.2.2 Process Formalization

One of the greatest benefits of transitioning to the hot debriefs was a greater formalization in the debrief process. Before the hot debriefs, meetings were haphazard, long after the event, highly circumstantial, and unreliable. There was no documentation to help guide quality improvement, and in most cases, discussions were more for emotional release than for review of process information. The benefits of a formalized process were well recounted by participants. Along with those were also warnings of finding the right balance of formalization. There was the idea that too much formalization, documentation, and strictness might counteract the purposes of the hot debriefs. Team members might be less inclined to share if they knew that every last detail was being recorded or that the debrief was simply the team going down a pre-determined list of points to hit for the sake of completion. The right balance of structure and organic discussion needs to be maintained in order to continue the positive feelings towards hot debriefs which will encourage rather than dissuade eager participation.

For formalization:
P10: The goal is certainly to have all the at least many of the people who were involved in the code, have a quick check in right after the code to see if there were things we did well, things we could improve upon and to be pretty specific about it. Like, since it's all called down on the paper, we can talk about airway and access and medications and leadership and those kind of things right in the moment. And it's a pretty clear list that we can follow so I think it it keeps us on track and helps us stuff on the things that we've seen and codes can be a challenge.

P6: I think it works well, I think triggers things that people might not think about and I also think that people have other things to get onto so keeping it keeping it moving forward with a checklist is effective.

Against Formalization:
P2: I think recording what people are saying or something along those lines I think would might, runs the risk of making people feel uncomfortable and not feeling open to saying their opinions about things

P9: But for the purpose of hot debriefing and having more of a spontaneous and open conversation and dialogue, no I would not formalize it.

Participants voiced mixed opinions on having the hot debriefs be formalized with six excerpts describing the benefits of formalization and eight excerpts saying how increased formalization could be detrimental. But the positive aspects of formalized hot debriefs can outweigh some of the potential drawbacks and even be strengthened by being cognizant of essential elements of good hot debriefing. Dreifuerst has published concept analysis work describing the different types of debriefs that can be utilized in medical settings for learning and the characteristics that define them (42). Many of the different types depend on the formality and structure of the debriefs. This study builds upon that work by recommending the combination of different types of debriefs to design the best possible fit for Seattle Children's and the Code Teams that use them.

In terms of formality, a large part of what characterizes a hot debrief is the way leaders conduct the debriefs. The perceived skills of the debriefer have the highest independent correlation with the perceived overall quality of the experience (26). Hot debriefs currently being done at Children's are generally led by the fellow or attending who ran the code. To help facilitate the debrief, a form titled the "Resuscitation Quality Improvement Review" is used. The form includes places for the Code Team leader and the unit charge nurse to fill out event data such as Time, Date, Location etc. as well as providing checkboxes for specific Code Event quality data such as documentation, systems or leadership issues. The form also contains information to be covered with the whole team during the post-event debrief. In its current state, the information that is asked for during the debrief includes things that went well, things that could be improved, as well as a table of resuscitation quality. This table requests for the team to review specific variables of CPR, what the gold standard for those variables are, and what the actual corresponding event data was. There is then room to discuss the positive aspects and barriers for

each of those variables. The goal of the debrief leader is to help others analyze and synthesize issues and to apply those learnings to future events (48). This can best be achieved through "open-ended questions, positive reinforcement, cognitive aids, and audiovisual capabilities (48)." The Resuscitation Quality Improvement Review form is a great start that leaders can build off of. There are open-ended questions provided, but discussion does not need to stop there. As team members continue to dialogue and understand one another, further questioning will often be raised. This is a great opportunity for anybody, but especially the leader of the debrief to expand and provoke even deeper thinking. The challenge is maintaining an environment where discussion is encouraged, while still being respectful of people's time. Code Events are often emergencies where once the event is over, team members have to get back to their original jobs. The debrief cannot go on forever. One respondent particularly noted the benefit of quick debriefing. When asked what the best part about hot debriefs were:

P8: That it's supposed to be immediate and fast. But yea, it's it's very fast, it's immediately afterwards it's usually when people are still there. And it's pretty efficient.

Another respondent recognized the obstacle that hot debriefs face when trying to balance the timing aspect while still achieving its intended goals:

P4: I don't know that you can accommodate people who are busy and need to get back to work and also people who need it not to happen now, and people who want it to happen now because their shift ends soon or whatever. So I think at a certain point like, you can't make everybody happy with a hot debrief.

No two Code Events are exactly identical in process or complexity, and the debriefs that follow should be tailored accordingly. Sometimes codes are incredibly straightforward and relatively simple. Such events most likely will not require in depth analysis or review. On the other end of the spectrum, some codes can be emotional and physically taxing, complicated, and extremely difficult. These are events which may warrant more discussion and longer debriefs. The leader of the event and subsequent debrief needs to recognize the severity of the situation, make

judgments based on the events that happened while incorporating the different needs and feelings of the room. This is a tall order further multiplied by the stressful nature of the situation. Loss of life is a potential and real outcome, and talking about it is not easy. With so many variables to handle, debrief leaders are aided by the structure and guidance of the hot debrief. While the hot debrief may not need to be formalized to the point where it and the facilitator feel robotic, the protocols set in place are a great way for debriefs to maintain purpose and efficiency. There is also room for code leaders to make adjustments and guide discussions depending on the situation. In the theme of quality improvement, code leaders after the event and debrief should be willing to ask for and be receptive to feedback about the debrief itself. The process of facilitating a debrief can be a challenging one and taking suggestions and learning from experience will lead to better debriefs in the future. Leading debriefs is a skill that can be refined with the aid of assessment from peers as well as self-evaluation. The facilitator's influence on debriefs is not limited just to its structure or formality, but extends into another important aspect - communication.

P7: And I think and I think that is fine like I don't think she necessarily needed a script … giving facilitators like a framework in their mind of what they should include and if they need a script like they can't remember it or don't do it frequently enough to remember, having it available I guess wouldn't be a bad thing. But I don't think it would need to be so detailed that they should need a script.

5.2.3 Openness of Communication/Safe Environment

Debriefs after events such as codes gives the opportunity for members of the code to think through and discuss aspects of the event. There is a growing recognition of the value of debrief participants being able to articulate, explore, and learn from such experiences together, rather than being told or taught directly (26). In order to maximize the benefits of debriefs, the participants need to be willing to share and discuss; code members should feel safe and be open about sharing their thoughts even on difficult matters such as feedback on deficiencies. The

propensity to share one's thoughts or feelings depends heavily on the individual's personality. In a debrief, some providers might speak or contribute to the discussion less because they have comparatively less talkative personalities. Even though this is not a necessarily a detriment in character, there has been evidence that doctors with better communication and interpersonal skills deliver higher quality healthcare (50). This finding, along with the fact that debriefs are inherently verbal in nature and require discussion and contributions from multiple perspectives to be successful, demonstrates that code members should be encouraged to share and dialogue with one another. The ability to share one's viewpoints and listen to other people's as well is a large contributor to why my study's participants found hot debriefs to be so effective and meaningful.

P10: I think everybody has valuable, you know everybody's perspective is a little bit different about what's going on and so there are there are perspectives about what happened and what was good and what was challenging I think it would be really helpful for us to do better going forward.

Because good communication is such a vital component of successful debriefing, the question of whether or not team members feel safe sharing their opinions because important. When asked about their thoughts on the openness of communication in hot debriefs, eight out of the ten participants felt that the hot debriefs were highly open with the other two expressing some doubts.

P5: I felt it was very open, I don't yea, I don't feel like anyone held back anything. People seem genuinely involved and accountable for for everything

P2: I felt like all the members of the team were totally comfortable talking.

P9: I think it's been, I think it's been remarkably open. I think and that starts at the top because since we're a full disclosure hospital, I think that, I think that sets the culture also in this hospital we practice what's called just culture which is looking to the system as to the individual … those are two really good foundations on which to build trust and honesty and everyone and also the trust that they're not going to be unfairly treated or singled out for talking about something that maybe they did wrong, or that they could've done better.

This notion of communication being incredibly open in the hot debriefs was shared by most of the participants. However, there were two participants who voiced concerns about the openness of communication raised two important issues with these type of debriefs. The first concern

relates to the idea of giving critical feedback to fellow team members. Code events can be incredibly emotional experiences and with the potential for mistakes, deficiencies, and unwanted outcomes. Being able to give and receive feedback about the processes involved with a code event can be challenging as well. In relation to the openness of communication, some members might be hesitant to deliver comments or thoughts that are critical in nature, even if they are meant to be constructive and non-accusatory. This hinders the benefits of hot debriefing and prevents substantive dialogue about how to improve certain aspects of the code.

P4: it's kind of been a hard to elicit like critical feedback from through the hot debriefing like it's often a really good way for people to be like, great job everybody or like, sometimes it's easy to find like one concrete like process step that could've been done better, but it's sometimes hard to figure out or elicit like big picture feedback on things that could've gone better or things that people got confused about.

P4: nobody wants to necessarily criticize … they tend to be quite reticent to like say what they think someone else could've done better.

P4: I just think lots of people are hesitant or don't want to be seen as criticizing like other team members in a really stressful and like really provocative type of situation and so I think a lot of people kind of hold back on what they think could go better … it could be helpful to get like more raw opinions from people or something.

P4: the more fruitful thing as far as like outcomes is probably in what didn't go well and so sometimes that can just be hard to elicit.

These excerpts all come from one respondent so these feelings may not be widely prevalent, but it does bring to light an important factor that affects the quality of hot debriefs that should be addressed. There are many potential reasons to explain why code team members might be holding back more critical feedback, but there was one idea that all ten respondents brought up that might help assuage such reservation - the idea of the hot debrief being a safe environment. By explicitly stating that hot debriefs are a forum for communication and reflection without blame or shame, participants might feel more inclined to have the tougher conversations and dig deeper into how specific processes could be improved. One of my study respondent's noted how because some code team members work closely together all the time, it can be difficult to point out problems with the code without negatively affecting future discussions or interactions.

Framing the hot debrief as a non-threatening and non-critical approach to figure out what could have gone better will not only help make team members more receptive and accepting of feedback, but also help participants deliver the feedback that needs to be addressed. By glossing over key points of the code that could be improved, the code team is preventing itself from learning and improving quickly. Calling to attention the things that went well in a code is important to a debrief's success and maintenance of those accomplishments in the future, so the same is true for the things that could be improved so they can be prevented in the future. This requires that team members feel safe in sharing and that communication is as open as possible.

The second concern that was brought up relating to the openness of communication has similar overtones to the first in that it also has to do with team members holding back their thoughts and feelings. This time, it specifically deals with the different groups of code team members. In a code event, the attending physician and/or fellow run the code and deliver instructions to the other team members who subordinately carry out those instructions. This dynamic can flow over to the debrief as well causing these groups lower down in the chain of command to be more reluctant to give feedback to those above them such as the attendings or fellows. A directionality of feedback can potentially arise where leaders of the code are giving more feedback than they receive. This is an issue because when certain perspectives are not being raised, the picture of how a code transpired can become distorted. There is a specific section of the quality review form that asks about leadership issues and if those issues are held back, repetition of those same issues is much more likely to occur. The assumption should be that everybody wants to improve and make the code better, and leadership can improve much more effectively with the perspectives of all members of the code team being brought up.

P10: Nursing tends to have a hard time giving feedback to leadership if there are issues with code leadership like with there are too many doctors giving orders, or if it's unclear what's supposed to happen. I have not seen very many nurses be willing to speak up in the hot debrief and say that but then afterwards when we talk about it ourselves we'll say it was very, something was very unclear, something was really hard for us, but we won't say that in the hot debrief.

P10: I know nursing is holding back.

P10: I don't believe people feel safe sharing their opinion and I sense that often times the doctors are annoyed that I have stopped them from walking away so that we can do the hot debrief.

P10: I would love for people to be more frank about concerns or issues that they have so that we could really work on improving how we do all parts of a code.

Even if these are not widespread patterns among all code teams, it is important to recognize these as potential issues and to be aware of their principles. The issue of code team members holding back or not entirely feeling safe sharing their opinion is crucial and even if not everyone feels this way, preventative measures should be taken so that they do not become problems in the future. Openness of communication is tied directly to whether debrief participants feel like they are in a safe environment.

P3: Well I think the, the most important thing is that it's a safe and blame free environment where people are free to speak their concerns.

5.2.4 Dissemination of Information

The last main theme that was discussed by all ten participants was about the idea of disseminating information gleaned in the hot debriefs. There were mixed feelings about this subject as well with some being incredibly supportive of such dissemination while others were hesitant and even recommending against so. The premise behind this idea is that debriefs are where important ideas are raised about improvements that could be made as well as things that went well and should be continued. Important learnings are being made in these hot debriefs but only a subsection of the entire pool of code event responders is at any given debrief. The rest of the potential code members are then not exposed to these discussions and learnings and are not improving alongside the ones who were. For example, a deficiency might arise in one code event

and the subsequent debrief discusses ways to prevent the same from happening again so those that were in that debrief successfully handle that situation the next time. The same deficiency could occur somewhere down the line but involve different people who were not a part of the discussion to remedy it and must go through the process of identifying the problem and figuring out ways to fix it all over again. By disseminating the learnings gathered the first time, such repetitions could be eliminated and overall learning by the entire code team can be increased.

P10: I think it would be super helpful to see that information cuz we go to these over and over again and we might have the same things happen at our own codes but we might not necessarily know what's happening at all the other codes, and people were having an issue then there's things we could fix from a nursing standpoint that if we knew it was consistently an issue, we could go ahead and try to implement something to make it different

P5: if something worked really well in the code and they wanted to integrate it into you know how we always do things, because it went so well, then it would be pertinent to share with everyone

P6: I think that's the whole point of having the debriefs is to learn from our mistakes and be able to implement that in code policy, policy and practice so that I mean just you know that specific example, I mean if every time we have a code and we wind up with the same mistakes, then we're reinventing the wheel and it's it's all about using you know learning from our mistakes and and putting that into practice and policies. Which is getting the information out to the other people.

There are issues with widespread dissemination though. Because each code event is slightly different, some of the learnings associated with one event might not be amenable to another. Providers need to be able to adapt to the situation at hand which may mean disregarding information about another event. There is also the fact that because each code event is different, the learnings could potentially be difficult to understand and internalize if a code team member was not present to witness the context of the situation. The background situation of each code is important to the learnings and processes associated with them so even if other code teams wanted to apply them, it might be difficult. There is also the manner in which these learnings would be sent out. If code team members continually received emails that they viewed as irrelevant, even if they had to do with process and quality improvements, they may become increasingly disinterested in them, a form of alert fatigue. This would defeat the entire purpose of sending out such learnings in the first place.

P5: each code is the same but different, it's different patient, different things, and different people in the room … not being present in the code makes it hard to follow the hot debrief.

P7: I don't necessarily think it would be helpful to have the learning points be sent out to everyone partially because I think it's like, if people weren't there, it'd may be hard to understand some of the learning points unless it was something big

Because there are valid points to both sides of whether or not to disseminate information regarding hot debriefs, it is a topic that deserves further attention and study. Perhaps a compromise would be to only send out information that was agreed to be of significant importance and is relevant to all code events and team members. This way, not only would such notifications be infrequent and weighted more heavily, they could also be more pertinent and relatable. Such learnings would be less tied to the particular situation, and more globally scoped. Alongside this would be a system to track trends and spot points that are showing up repeatedly. Even with this situation, if you were to disseminate any information regarding a debrief, it is critical that team members know the information being delivered is quality improvement information for the purposes of learning only. If people feel as though information is being sent out that has to do with mistakes or errors made in the event, they may be less inclined to share and open up. Such feelings would erode trust and prevent effective debriefs so names must be excluded from anything being sent out to other people. There may not be a singular perfect solution to this idea of information dissemination in hot debriefs, but regardless, anything related to the hot debrief or code event that is to be discussed somewhere down the line, the details matter. By being completely honest about what types of information may get relayed or sent out and making sure people feel comfortable and safe with that form of sharing, better debriefs will result. And like the other themes, better debriefs mean better code events, and better health outcomes for the patient.

Chapter 6: Summary and Discussion

Being able to have meaningful discussions with support from team members makes debriefing an invaluable process for code team members. Evaluating, comparing, and sharing ideas drive improvement, a necessity in this field. The opportunity to be a part of and contribute to this process helps push these code team members to become better health care providers, and deliver higher quality care to their patients. Improvement in any part of this chain, from emergency event to the debrief about it works to increase patient safety, reduce deficiencies in the process, and result in better health outcomes.

Because hot debriefs in particular have not been widely studied nor are they in widespread practice in the region, Seattle Children's transition to these hot debriefs created room for me to analyze the efficacy of this process through the lens of the code team members themselves. I wanted to figure out what was working about the hot debriefs, as well as what could be improved. I also wanted insight just on what the code team members felt about them with their thoughts and opinions. I conducted a qualitative assessment of the hot debriefs by interviewing ten code team members of varying roles and responsibilities. After transcribing the resulting interviews, coding them based on emergent themes, and analyzing the resultant data, four major ideas arose.

These four ideas that resulted from my study showed the impact that this process of hot debriefing has had on my participants. They all attested to the effectiveness of the process when it came to quality improvement and information review. Almost all of them could give specific learnings that they have discussed in a hot debrief and have seen be implemented at a later code event. A remarkable finding considering that hot debriefs were only introduced in October of

2016. The next major idea revolved around the openness of communication and whether or not they felt safe while participating in the hot debriefs. Eight out of my ten participants spoke to the openness that they felt while the other two asserted that certain code team members were holding back during the debrief. Specifically, these participants were holding back giving critical feedback to other team members. In one specific case, my respondent mentioned how the nursing group particularly had a difficult time speaking up and giving feedback to leadership. The other two ideas were a bit more controversial and were accompanied with more evenly split opinions. My respondents were divided on whether or not process formalization and the dissemination of learnings from the debrief were beneficial to the overall process. There were supporting thoughts from both sides with no clear consensus or best practice introduced. Because the three themes of openness of communication/safe environment, process formalization, and dissemination of learnings are deeply connected to the first theme of the effectiveness that hot debriefs actually have, my findings should be incorporated in and help guide decisions made revolving debriefing with code teams moving forward. Hot debriefing as it is at Children's is effective according to participants, but in the spirit of quality improvement, it can always be made better.

6.1 Implications

The results of my study begin to show the impact that hot debriefs are having on code team members at Seattle Children's. Here I am going to take a look at the implications that each of the four major themes of my study have on hot debriefs moving forward. The fact that there was unanimous agreement on the effectiveness of hot debriefs shows right away that the transition Children's made has been a positive one (See Section 5.2.1). Even though I only had ten participants, each one of them recognized the value that hot debriefs were having and commented on their appreciation for them. Because I have seen positive feedback for this type of

hot debriefing for the code teams, I might see similar results for other response teams. As one participant noted, "the process could be beneficial around something that requires a team effort." Because Children's is a learning hospital that emphasizes team-based care, other processes and situations that multiple team members work on would be amenable to adopting hot debriefs. Hot debriefs provide a forum and opportunity for healthcare providers to share their thoughts and feelings on events in order to improve the quality of health care they deliver. It would potentially be beneficial to have similar opportunities for other teams as well. Improving quality and increasing patient safety should be on the forefront of all providers and the process of hot debriefing can facilitate that. Research would need to be done to see if other teams and events would actually benefit from hot debriefs, but my work with code teams shows that it could at least be a possibility.

More research can also be done to determine the exact factors of hot debriefs that caused such an overwhelmingly positive review. That is, the change from cold debriefs to hot debriefs made debriefing a requirement after the appropriate code events and it also changed the time factor. Debriefs occurred immediately after the code event whereas for cold debriefs, they would happen at a much later time. Studies in psychology have shown that feedback should be given closely after performance of an event (55). This way, memories are still fresh and links between behavior and outcomes can develop (55). People are also more likely to apply behavior changes to future events when feedback and debriefs occur with minimal time delay (56). The change that made debriefing a requirement also improved debriefs because of the increased participation rate. With more relevant participants interacting in the debrief, greater levels of discussion and perspectives can emerge, making the entire debrief process more impactful. While my study did

not delineate between reasons that helped improve the quality of debriefing, I can point to these two factors as important contributors.

For the theme of hot debrief formalization, the result I found that some participants value the process being more formal while others display aversion towards it is fascinating (See Section 5.2.2). The reason being that people interpreted formalization differently and viewed it through varying scopes. Those in favor of more formalization would compare hot debriefs to cold debriefs which were very much informal since they were not required. These participants saw that by increasing the formality of the event through requiring it after code events, introducing the Resuscitation Quality Improvement Review form, and documenting code team member's thoughts, the effectiveness of the debrief increased. Participation rate increased as well and people seemed to view the process of debriefing as more real and important. On the other side, some feared that increased formalization would make the debriefing process too robotic and stringent. By listing all of the key event points to discuss and clearly defining topics for discussion, more organic dialogue and interaction might be stifled. People might view the debriefs as just another thing to check off and get through, rather than appreciate it for what it was meant to be and participate accordingly. The concern that increased formalization might result in increased documentation was also mentioned. When people are writing down every single word spoken and documenting it for report, people may be less inclined to share their honest thoughts and opinions, especially when they concern mistakes or critical feedback. We can see that there is a delicate balance here for just how formal or informal this hot debriefing process should be. By taking into consideration all of these differing viewpoints and concerns, hot debriefs can be tailored to maximize effectiveness for the participants as well as overall quality improvement on a higher level. Any extreme here would be detrimental to this and

discourage team members from actively participating so careful thought and attention should be invested when making any changes for the future or newly applying the process elsewhere.

This consideration of a careful balance between two options extends to another major theme of my study which is dissemination of information (See section 5.2.4). In this context, dissemination of information is the propagation of learnings and discussions had during the hot debriefs. Because such valuable information is discussed during these hot debriefs such as potential solutions to process problems or recommendations on how to improve quality, there could be value in sharing that information to code team members that could not be a part of that particular debrief. My participants recognized the value of such dissemination and agreed that it could be useful, but there were many concerns and considerations that they had in regards to the particular manner of dissemination. This is fair because these healthcare providers already receive a litany of e-mails and information and piling onto that may not necessarily be beneficial. This also depends on the severity or applicability of the learnings being sent out. If incredibly minor and uncommon details are being sent out, it becomes easy to pass that off and not think about it, defeating the purpose of that information being shared in the first place. When a code team member is not present at a specific code event, they are unaware of the specific situation or context and information sent out regarding that event is lacking this additional meaning. This makes it tougher for these code team members to internalize the message for future use. The phrase "you just had to be there" can be pertinent to this situation. The balance for this situation could be to only send out information that is widely applicable and critically important. Information such as changes in particular protocols or processes that need to be implemented or important trends that need to be brought to everyone's attention. This form of dissemination would achieve the goals of spreading the discussion and learning to people who were unable to

participate, while also being conscientious of people's time and energy. There can also be varying levels of dissemination that may be useful. Sometimes a code team member cannot participate in a hot debrief for whatever reason and can still benefit greatly from the discussions that occurred. Because they were present in the event being discussed, they can still appreciate that information and carry it forward. Adjusting the level of dissemination based on the healthcare team's needs and requests would greatly benefit everyone involved.

The final theme that I discovered in my study concerned the openness of communication in these hot debriefs and how safe of environment they were (See Section 5.2.3). The majority of my participants remarked that communication seemed genuinely open with team members participating readily and not withholding thoughts. This is an extremely positive finding because the entire purpose of the hot debriefs is to allow for people to speak their mind and have meaningful discussions with one another about the event that just transpired. If people are being bashful or suppressing their thoughts and feelings, debriefs become ineffective. The priority would be to create as safe of an environment as possible in the debriefs to allow for free and open communication from all team members. This is a prerequisite for consequential debriefing and actually improving quality and outcomes. A couple of significant factors play into how safe of environment the debriefs are. One of them is founded on the culture of the institution. If the particular health care institution is especially strict with mistakes or errors and heavily punishes offending providers, people would be inclined to be more reticent with their information. If the institution emphasized the importance of sharing and created a blame-free and guilt-free environment, there is a greater capacity to recognize flaws in processes rather than flaws in people. Work can therefore be invested into fixing the process as opposed to the providers. Participants commented on how Children's does a great job of creating such an open

environment where people are not shamed or scared into acknowledging their mistakes. Similar considerations must be taken by the code team leaders. These leaders have important roles because they facilitate the code event and carry not only the weight of running a stressful medical emergency smoothly and safely, but also carry the gravity of being in a leadership role. These facilitators hold great power when it comes to the debrief afterwards because they can influence how open communication is.

Along the lines of groups in the hot debriefs interacting with leadership, this theme of openness of communication includes an issue that warrants further study. One participant described how the nursing staff was incredibly reserved when it came to providing feedback towards leadership. This can slowly but surely be remedied by constant reinforcement into how team members are not going to be punished in any way and that meaningful discussion and quality improvement necessitates being open and truthful even on tough subjects. Such team dynamics are not always seen or heard readily so extra attention should be paid here. Even though only one participant described this issue of groups of nurses feeling unsafe or holding back feedback, this is an extremely important result. More research needs to be done to look at the significance of roles and whether those roles affect levels or perceptions of openness and safety. If even a single person is being reticent because he or she feels unsafe and especially if that person is in a subordinate role to leadership, attention would need to be brought to this issue and change necessarily needs to occur. The importance of having a safe environment to debrief cannot be overstated. More work can be done to figure out additional aspects that can be included into the hot debrief to facilitate more open communication. It is important to reinforce positive aspects of the code as well as address any deficiencies, we need to have both be discussed openly and freely to achieve successful debriefs and quality improvement.

Before the hot debrief begins, statements should be made regarding the shame-free nature of the debrief. Any information that is recorded will be anonymized and discussions will be non-judgmental even if they are about mistakes or deficiencies. Participants described how some code leaders would start off the debrief with a sentence or two with this primer. This instantly sets the stage for how open participants are willing to be. This also affects how different subordinate groups may choose to interact with such leadership. Leadership needs to make it clear that team members will not be punished by raising concerns about leadership performance and instead encourage such behavior. Everyone's perspective is important so making the debriefs an environment where everyone's thoughts and opinions are valued by each other creates a culture of openness and honesty. Communication will improve as a result which will in turn improve the quality of the debrief and future code events. The Resuscitation Quality Improvement Review form currently does not have any statements of openness, being non-judgmental, or shame-free so those can be included to prompt the code leaders to delineate that message to the whole team before every debrief. There can also be reinforcement during the weekly code review meetings to make sure code leaders are continually relaying that message to their team and making sure that people feel comfortable discussing difficult topics with each other. If for time's sake, team members are unable to express their thoughts, a system could be set up so that those engaged in the code could share feedback or anything they would like to share that was missed at the time. Code members should be encouraged to share and have meaningful discussions, but time constraints are still real and other people's time should be respected. Having a platform to continue open discussions after the fact will generate deeper conversations and prevent things from being missed entirely. The goal again is to improve quality of communication so that the quality of patient outcomes can improve as well.

6.2 Limitations

This study was conducted in a manner thoughtful to its methodology and scope, but even so, there are a few limiting factors that need to be considered when looking at the results. One of the biggest limitations my study encountered had to do with my method of data collection and analysis. The population I was recruiting my participants from were incredibly busy with many time constraints so one approach to work around this was to conduct interviews over the phone. Out of my ten participants, nine were interviewed in this manner with one being interviewed in person. While the advantages of phone interviews were significant especially with my participants, there are significant drawbacks. A lot of information is conveyed through nonverbal signals such as facial expression, hand gesticulation, and body position. All of these works to add layers of meaning to the words that are being spoken - layers that are being neglected when speaking over the phone. Even with the interview conducted in person, analysis and transcription was done through an audio recording device, so those subtle nonverbal cues were lost in the tape. This is important because when trying to parse through people's thoughts and feelings, the words being spoken are just a subsection of their meaning. Without the ability to interpret those feelings in its entirety, we necessarily lose critical information pertaining to it. This limits the capacity to truly interpret my participants.

Along the same line, my methodology further shed layers of meaning through the process of transcription. Transcription was used to put into writing what my participants were saying. I already mentioned how communication is highly nonverbal so ridding that communication of any intonation, rhythm, emphasis, or inflection continues to erode meaning. Transcripts change the medium of the data and makes it less transparent. The same words being spoken in different ways can force different meanings. When looking back over a transcript, the precise way in

which the participant spoke those words cannot be perfectly recreated so their intention is left up to interpretation. Also, when looking at the transcripts and excerpting, I am necessarily decontextualizing the information. The process of excerpting and coding is important when parsing out themes and general trends, but by doing so, I lose sight of the larger narrative - isolating bits and pieces of a much bigger arch of thought. To help with this problem, I jot down field notes immediately after each interview session. These notes would help capture the thoughts and feelings about the interview while the conversation was still fresh. This helped interpretation of more difficult passages at times and worked to add a bit more context to the transcripts.

Another limitation of my study resulted from the participation rate I encountered. I was only able to recruit ten participants for my study with important code team member roles only being singly represented. With so few participants, some of their thoughts and feelings can be highly individualized and anecdotal. This is especially true for those who have participated in only a few code events and debriefs. Personal experience is the main driver of my study and results, but without greater corroboration from a wider variety of participants, those results should be viewed within this limited context and not be generalized to all code team members. There is still validity in the general consensus of hot debriefs being more effective than cold debriefs, but more work needs to be done to solidify that claim among my other results as well.

Credibility in my study was difficult to achieve when viewed as the combination of translational validity and elimination of rival explanations. Translation validity requires that "terms used for constructs or concepts match well the data excerpts intended to illustrate them (46)." While the coding system used for my data worked well with the excerpts I used, this was not validated externally. Any particular construct can change throughout the course of the study, so my

codebook was built after every interview was conducted and transcribed. This helped to make my coding more consistent but did not factor in inconsistencies of any individual coder over time. While my codes were looked over by a colleague familiar with qualitative research, my codes were not developed with high inter-coder reliability. Edits were made to my codes with some external aid but the actual excerpts were coded individually.

My study was unable to fully achieve the elimination of rival explanations to improve the credibility of my results. This is due in part to the difficulty of collecting evidence for rival explanation elimination while still in the field, or in this case, still in the interview. Rival explanations should be anticipated when drawing consensus around proposed interpretations but my study did not focus on these and rather looked at the themes that were emerging. My analysis was dedicated to these themes and my interpretation of them rather than eliminating any rival explanations. Future work can be done to bolster these results through this method of increasing credibility.

Finally, credibility for my study could have been reinforced through member checking. Member checking is a method of authenticating data by bringing the data and transcripts to my original participants (46). If they agree with my interpretation of their views on the situation, I can display my results more definitively. This would also enable me to recreate some of the lost meaning through my method of recording and transcribing. By addressing and knowing these limitations, I can more accurately frame my results and work to build on them with future studies.

6.3 Transferability/Application as Future Work

Because most of the healthcare institutions in Seattle Children's network do not utilize hot debriefs, but still practice the process of cold debriefing, this work can potentially pave the way for these other institutions to transition from cold to hot debriefs. When compared to cold debriefing, hot debriefing was by far more effective in terms of quality improvement and information review according to my participants. This is due in part to the adoption of hot debriefs as a requirement after code events. This increased participation rate made review of information and discussion of ideas more accurate because a greater percentage of perspectives were included. Before, many providers that worked in the code event would not participate in the cold debriefs which were sporadic and highly dependent on the willingness of team members to organize it. There are benefits to cold debriefing though. Being able to incorporate quantitative CPR data with concrete trends and results is a valuable resource when determining where in the process quality improvement can take place. But my participants emphasized that there is much more to these code events than just raw data. Elements at play such as teamwork, communication, and intuition can all be heightened through meaningful discussions involving as many code team members as possible.

Just as one of my participants keenly noted about debriefing, "you can't make everyone happy." There are many aspects to debriefing that may be highly applicable for one institution and set of code team members, but may differ drastically with another. Culture plays a large part in what these healthcare providers value and place importance on. The ideal level of formalization of debriefing is not necessarily the same for all hospitals because of the differences in culture and protocol. The same can be said for levels of dissemination for debrief learnings as well as the openness of communication, the themes that stood out with my participants at Children's. There

are lots of other different factors that may come into play when determining the best practice for debriefing at a specific hospital such as timing, location, tracking, and implementation of changes. With so many variables and research that has yet to show the ideal method for debriefing (33), there is tremendous room for further research. There is still work to be done on the hot debriefing at Children's as well. The process is still very much in its early stages and more research can be done tracking trends in quality improvement as well as personal thoughts from the code team members themselves. Even with so many variables, I nonetheless recommend the adoption of hot debriefing because of the overwhelming support for required hot debriefs that I saw from my participants. Every provider I interviewed attested to the positive impact that hot debriefs had on information review and quality improvement.

Future work at Children's and at other institutions regarding the process of hot debriefs necessitates the inclusion of code team members' thoughts and feelings when making judgments on effectiveness and quality. While it is important to widen the scope of this type of work, the key results stem from the individual providers. With this in mind, research done on the process of debriefing and figuring out best practices for specific institutions can be incredibly beneficial to the overall quality improvement track of healthcare.

I am incredibly pleased to have done this work on hot debriefing with the code teams at Seattle Children's Hospital. My results were deeply meaningful and highly impactful for the future of code teams there as well as contributed to the general knowledge about debriefing in clinical institutions. The ideas about process formalization, openness of communication, and dissemination of information that I found are key components of successful debriefing and need to be taken into consideration when potentially implementing and transitioning to hot debriefs, a change that can have amazing benefits as my study participants unanimously agreed upon.

Benefits that not only improve the quality of healthcare provided, but also increase patient safety and patient outcomes.

Appendix A: Code Book

Here are the four top level codes used to describe my excerpts:

- Cold Debriefs
- Hot Debriefs
- Paper Form
- Technology

More specific codes were added under the headers of Hot and Cold Debriefs. These included:

- Aspects - Delta
- Aspects - Positive
- Communication
- Dissemination of Information
- Emotional Effects/Feelings
- Feedback
- Information Review & Effectiveness
- Quality Improvement
- Types of Learning

These codes were child codes under Hot and Cold Debriefs because every excerpt that contained one of these codes would be about Hot or Cold Debriefs (or both). Also note that these are the final versions of my codes after I adjusted their titles for better fit. That is, I started with my initial codes - a list of categories from raw data, then checked their consistency by relating each code title to the actual coded material, and then finally settled with codes with titles that had the best fit.

Examples of the excerpts used for each of my codes:

Code	**Excerpt**
Cold Debriefs	It was usually just by preference if you wanted to get the code group together and review things then you could do that but it was optional depending on who the team leader was.
Aspects – Delta	Not, not successful at getting everyone together no. It was usually just a subset of participants.
Aspects – Positive	I mean if we optionally took the team aside and debriefed, it gave us good points, you know good things to learn from and key points of areas of improvement. And then of course, M and M is always helpful just to be able to look at all the data retrospectively and take some sort of learning point out of that.
Communication	Once again it's it's personality dependent but I'd feel that the, that people were able to speak their mind. I don't feel like it was ever a feeling of retribution or, that you'd get in trouble for for calling somebody out on poor poor behavior during a code.

Emotional Effects/Feelings	Yea I think so, I think the more emotional the code, the more likely there was to be a debrief, cuz people recognized that they needed to talk about it.
Feedback	But I think in most of the debriefs, you know, pre pre the hot debrief, there's usually, it's usually a forum for feedback to be given if there needs to be.
Information Review & Effectiveness	The previous one you mean where it was just done ad hoc? Well it was completely dependent, right. If I think when there was an issue that someone felt like they needed or wanted to discuss then that was pursued, but I think it necessarily left out categorical aspects of the resuscitation that may have gone well or not well but could've easily been overlooked.
Quality Improvement	Yes, yea I think it probably it was it was helpful still just to talk about it. So that any of us who were there then had that information to carry into the next experience to make sure we try to do things better.
Hot Debriefs	Yea it usually takes place shortly after the code and it usually involves the charge nurse, the team leader, the bedside nurse and then any other key team members of the code and we kind of go over things that went well, things that didn't go well and then there are some specific questions that we go through and answer on the sheet.
Aspects – Delta	Nine times out of ten at the hot debrief it is just the charge nurse and sometimes the bedside nurse is able to participate often their patient is still so sick that they can't step out even for five minutes, and then the, usually a fellow and an attending. It's usually a very small group who participates in a hot debrief. Usually anesthesia's long gone any other ancillary services are long gone and the shift administrator's typically gone by the time we get around to doing it, it's usually a very small quorum of people that are left.
Aspects – Positive	So I think, you know in the same way that there's any version of a rolling refresher or as we go through these events I think identifying the things that go well and the things that could be better always help each of us kinda have a better sense of what to do in the future so yea I think to me that kind of immediate feedback is always important for self directed or you know team directed improvements.
Communication	I think it's more related to the general atmosphere of multiple people sitting around and nobody wants to necessarily criticize or people are often pretty willing to like volunteer what they think they could've done better but they tend to be quite reticent to like say what they think someone else could've done better.
Dissemination of Information	Oh if it were like an e-mail that just went out to people and said these are the learnings, maybe, maybe. I was picturing like trying to bring people down to participate in the hot debrief. Yea no I think that could be, I think probably the learnings will stick more when you're involved in it but I don't think it would be harmful to have the learnings e-mailed.
Emotional Effects/Feelings	Absolutely, I mean you'll see many people you know, crying, holding on to one another and it it really, while it's a tragic situation, you'll see staff really pulling themselves together, to one another and holding on to one another and really clinging to one another cuz it's very sad. It's a very safe environment. I've never had an unsafe environment in that, with the debrief ever.

Feedback	I would say in my experience, the feedback has generally come from the code team leaders.
Information Review & Effectiveness	I think because it involves more players so it involves everyone who was in the code instead of just you know the few people that are still around after the code during the post, you know, post arrest care. I think that's, and so you capture more information and more opinion or data depending on how you want to look at it as far as feedback and what could've been done better and what went really well.
Quality Improvement	I think because it calls out deficiencies as well as things that are done well, personally for me, I focus more on something called out that's a deficiency and want to make it better so that it, you know, it forces you to recognize a deficiency and then also consider things to do to make it better as well as receiving the feedback from people and ideas of how to make it better but I think in that sense, it pushes people along the improvement pathway. I think calling things out that are good helps people to, helps to reaffirm people's skills in the room and make them feel a little bit more confident in what they're doing.
Types of Learning	We usually talk about quality of chest compressions, you know, time of no chest compressions, time from the beginning of the code till they're cannulated onto ECMO, you know, closed loop communication, you know down to specific drugs that were used, things like that.
Paper Form	I mean a lot of the time, not really, I mean a lot of the time a lot of the information on it is kind of like not particularly relevant like especially the shock question I think, we end up shocking remarkably few patients because they're not in shockable rhythms but you know, as a marker for prompt quality care like if they were in that, it would be important to recognize that, I don't know.
Technology	Yea I mean, given no restrains I could envision like a tablet you know, I don't know if it would be like on the code cart or, I don't think we probably have real estate for it on the code cart. I think if the shift administrator kept a tablet and brought it to the codes and that was like a way to track you know that we performed it and you know, identify like a way for things electronically to be shunted to the right people if there were issues identified, yea that'd be easy enough

As for why there are “Aspects - Delta” and “Aspects - Positive” codes in my code book, we have to turn to some of the terminology commonly used for debriefing. Debriefing can be boiled down to a discussion of what went well, and what could be improved. In the field of aviation, the plus delta debriefing model is used to account for this approach (26). Positives therefore represent the things that went well while deltas represent the things that can be improved upon. Applying this to my study and system of coding excerpts then, “Aspects - Delta” was used to code any excerpt that spoke of things that they disliked or could be made better about the debriefing process. This could be applied to either cold or hot debriefs, not the change between the two. “Aspects - Positive” was coded for excerpts that described the benefits or things that they liked about the debriefs, again either cold or hot.

Appendix B: Participant Roles

P1: Respiratory Therapist
P2: Attending Physician
P3: Attending Physician
P4: Fellow
P5: Nurse Practitioner
P6: Respiratory Therapist
P7: Resident
P8: Attending Physician
P9: Respiratory Therapist
P10: Charge Nurse

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