NEONATAL RESUSCITATION COMPETENCIES IN RESIDENTS AND RECENTLY GRADUATED PEDIATRICIANS

EXPLORING NEONATAL RESUSCITATION COMPETENCIES IN RESIDENTS AND RECENTLY GRADUATED PEDIATRICIANS

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A Thesis Submitted to the School of Graduate Studies in Partial Fulfillment of the

Requirements for the Degree Master of Science

MASTER OF SCIENCE (2019)

(Health Science Education)

McMaster University Hamilton,

ON, CANADA

TITLE:

Exploring neonatal resuscitation competencies in residents and recently graduated pediatricians

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NUMBER OF PAGES:

xi, 88

LAY ABSTRACT

The practice of neonatal resuscitation is challenging because practitioners are dealing with an infant who is critically ill, requiring multiple interventions within a very short duration of time. Despite residency training, literature reports challenges with acquiring and maintaining resuscitation skills. Using qualitative methods, specifically interpretive design, this project sought to explore trainees' perceptions of competency for neonatal resuscitation, as well as potential barriers to this process. The principles of repeated exposure over different times in training, performance under pressure and the confidence in one's abilities required to achieve a specific goal were used to inform data collection and analysis.

The participants identified four attributes for competency in neonatal resuscitation required to ensure successful transition towards readiness for independent practice: (a) medical expertise, (b) leadership, (c) transferability, and (d) self-efficacy. Informed by educational theory, these constructs were then used to describe a conceptual model for competency acquisition in neonatal resuscitation

ABSTRACT

Introduction: The practice of neonatal resuscitation involves superior technical skills, an ability to lead an interdisciplinary team as well as make clinical decisions based on complex dynamic transitional physiology within a narrow timeline. These skills are a mandatory component of pediatric residency training and have been assessed using standardized assessment tools such as certifying board exams, procedure checklists, and in training exams. Recent literature has raised concerns about trainees' competency in the technical skills for neonatal resuscitation. This project sought to explore trainees' perceptions of competency for neonatal resuscitation, as well as potential barriers that challenge this process.

Methods: This project employed an interpretive design qualitative methodology, using an a priori educational theory incorporating the principles of social cognitive theory, deliberate practice, distributive practice, and 'choke phenomenon'. Semi structured focus groups of residents and pediatricians were used for data collection. Interpretive analysis in the style of Crabtree and Miller was employed. Validity criteria as described by Lincoln and Guba were applied. Institutional ethics board approval was obtained.

Results: The participants identified four attributes for competency in neonatal resuscitation required to ensure successful transition towards readiness for independent practice: (a) medical expertise, (b) leadership, (c) transferability, and (d) self-efficacy. The enablers and barriers towards acquisition of these four aspects during residency training and transition to practice were identified and explored.

Conclusions: Through the self-reported experiences of trainees and practitioners and

informed by educational theory, this study describes a "across rocky seas" graduated

conceptual model of a sailing ship for competency acquisition in neonatal resuscitation. An

understanding and application of this model may thus inform the development of new

competency-based curricula.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

NRP   Neonatal resuscitation program

RCPSC   Royal College of the Physicians and Surgeons of Canada

CPR   Cardiopulmonary resuscitation

CPAP   Continuous positive airway pressure

PPV   Positive pressure ventilation

UVC   Umbilical venous catheter

MRSOPA   Mask reposition, suction, open mouth, pressure increase, alternate airway

NICU   Neonatal Intensive Care Unit

OR   Operating room

TN   Transport Nurse

RT   Respiratory Therapist

NP   Nurse Practitioner

ETT   Endotracheal Tube

Chapter 1: Introduction Background: Neonatal Resuscitation

In comparison to other resuscitation practices, the field of neonatal resuscitation is fairly new, with its origins tracing back to the late twentieth century. Today, achieving a "successful" neonatal resuscitation requires a thorough knowledge of neonatal physiology and the skill to transition an imperiled newborn to their extra-uterine existence. It involves the ability to institute intensive care interventions based on transitional neonatal physiology within a timeline calculated in seconds. This ability demands proficiency in technical skills, an ability to lead a multidisciplinary team, and the discernment to manage inconsistent resources. In addition, advances in the field of newborn intensive care and changing perceptions of viable gestational ages continue to challenge ethical decision-making. Finally, the implications of a suboptimal resuscitation have significant consequences for survival, neurodevelopmental impairment, and future health capacity. Given the challenging nature of this practice, efforts to evaluate and determine areas of improvement in neonatal resuscitation training and performance are imperative.

The Challenging Practice of Neonatal Resuscitation: Inconsistencies in Performance

In the literature, Neonatal Resuscitation Program (NRP) performance has been evaluated by means of audits, survey questionnaires, and video recordings. These studies have found marked variability between clinical practice and guideline adherence across centres. In Canada, while comparing clinical performance to the existing NRP guidelines using a prospective clinical audit, Mitchell, Niday, Boulton, Chance, and Dulberg (2002) reported

multiple errors in the sequencing of the NRP algorithm, with a greater prevalence of errors in smaller community centres. They hypothesized that a lack of knowledge, inadequate technical mastery, inappropriate team composition, and limited resources were possible reasons for error. Lindback et al. (2014) found significant deviations from the established guidelines in the use of suction, bag and mask ventilation, and timing of heart-rate assessments using a Dome charge-coupled device camera for resuscitation review. In another study on NRP performances that used video recording as an evaluation tool, deviations from the NRP guidelines were found in more than 50% of the resuscitations reviewed. The "deviations" from the guidelines were predominantly related to lack of mastery of the technical skills as well as clinical decision-making (Carbine, Finer, Knodel, & Rich, 2000). Finally, multiple survey studies from the United States, Canada, and the United Kingdom have reported significant variation in practice despite frequently updated recommendations and opportunities for recertification (Leone, Rich, & Finer, 2006; El-Naggar & McNamara, 2012; Singh & Oddie, 2013).

The preterm infant has added another layer of complexity to the challenges of neonatal resuscitation with a demand for greater skill and an increased need for therapeutic interventions. For example, a recent observational study in Spain videoed resuscitations of preterm infants at less than 32 weeks' gestation and audited them for performance using a predesigned score sheet. The results of this study revealed that only 8 out of 50 resuscitations (16%) were technically correct (Maya-Enero et al., 2018). In a survey that included 91 hospitals in Italy with an 88% response rate, significant heterogeneity in resuscitation practices for extremely low birth weight infants (ELBW) was reported (Trevisanuto et al., 2006). In addition to the technical skills required for a successful neonatal resuscitation, timing of interventions

was another area of deficiency. In a study that evaluated the resuscitations of 189 infants

between the gestational ages of 29 and 34 weeks, the authors found that the median time

required for all interventions was more than the recommended guidelines (McCarthy, Morley,

Davis, Kamlin, & O'Donnell 2013).

It is clear that 30 years after the establishment of NRP guidelines, there is still

considerable concern regarding NRP performance, including gaps in knowledge as well as

technical and behavioral skills. In addition, an unsuccessful resuscitation can have significant

adverse, long-term consequences for both the infants and their families given the risk of

permanent neurological injury. Jay Goldsmith (2011) drew attention to an important aspect of

neonatal resuscitation training in the context of its medicolegal implications in the delivery

room when he wrote in an American Academy of Pediatrics (AAP) news magazine: "Are you NRP

certified? Generally, this is one of the first questions asked by a plaintiff attorney of a

pediatrician involved in the care of a brain damaged infant who required resuscitation in the

delivery room (DR). The appropriate answer is No, the American Academy of Pediatrics does

not certify anyone in neonatal resuscitation, but I have renewed the course every two years to

maintain my status as an NRP provider" (Goldsmith, 2011, p.1). This statement stimulates

reflection on the mandate and responsibility for neonatal resuscitation and highlights gaps in

the perception of training and competency in neonatal resuscitation.

Competency Acquisition and Preparedness for Independent Practice

Recent years have witnessed a paradigm shift in postgraduate medical education as

regulatory bodies have moved away from traditional models towards frameworks built on the

premise that competencies are measurable activities (Frank et al., 2010). In 2005, the Royal

College of Physicians and Surgeons of Canada (RCPSC) adopted and updated the "CanMEDS

competency framework" as the basis for standards of medical education (Frank et al., 2015).

This framework integrates the roles of communicator, collaborator, health advocate, leader,

scholar, and professional within the traditional medical expert role. A competent physician has

been defined as one who seamlessly integrates the competencies of all the seven roles. In 2016,

the RCPSC began the implementation of its "Competence by Design" initiative where emphasis

on timing for training was replaced with a learner-centric model allowing each individual to

follow their own trajectory for milestone achievement. Similar frameworks have been

implemented by regulatory authorities in the United States (Swing, 2007) and the United

Kingdom (Mayer, 2002).

Within these frameworks, competency/competence refers to "the ability to do

something successfully and efficiently" as per the Oxford English dictionary (2012, p.240). In a

systematic review that looked at definitions of competence in health sciences education

literature, the authors reported significant variability in the definitions of competence

(Fernandez et al., 2012). In addition to knowledge and skill, the authors described thirteen other

components of competence based on their literature review. These included "reflection in daily

practice, appropriate values in judgement making, adequacy of qualification, ability, attitudes,

quality or state of being, professional judgement, attitudes and values, character attributes,

professional socialization and judgement as well as attitude and competence as personal

ability" (Fernandez et al., 2012, p. 360).

Competency acquisition and development have been described using various models. Some sentinel models described in the literature include Miller's (1990) three- dimensional pyramid which characterize the different phases of competency as knowing, showing, and doing. Dreyfus (2004) outlined a five-stage model for adult skill acquisition in which he described the individual stages as novice, advanced beginner, competence, proficiency, and expertise. For neonatal resuscitation, the "learn, see, practice, prove, do" model has been adapted for teaching technical skills and competencies as per the 7th edition of the NRP curriculum (Sawyer et al.,2015; Sawyer, Umoren and Grey, 2016). However, despite varying degrees of integration of these models in postgraduate medical education, a "practical gap" in the design, implementation, and assessment of competency-based curricula still appears to exist in postgraduate residency training. Anecdotally, one of the reasons for this gap is that competency in NRP for a practicing physician encompasses more skills, knowledge and attributes than compared to what is reported in the literature, which is predominantly in the context of the NRP algorithm.

Residency Training in Neonatal Resuscitation

With regard to pediatric training for neonatal resuscitation, specialty training requirements outlined by the RCPSC mandate that residents are expected to do "three) to five (5) blocks, or longitudinal equivalent, of newborn care, which must include neonatal resuscitation in the case room, care of the normal newborn, and rotations in level II and level III neonatal units" (Royal College of Physicians and Surgeons,2015). In addition to the required block rotations, some programs allow for additional opportunities for clinical exposure through

a night call schedule. Pediatric residents also undertake certification in NRP through standardized courses with recommended recertification every two years. NRP provider training certification courses are single-day courses that are taught by healthcare professionals from different disciplines such as nursing, midwifery, medicine, respiratory therapy, etc., who have successfully completed the NRP instructor course. Such courses focus on basic concepts and skills of neonatal resuscitation exclusively in the context of the NRP algorithm.

In addition to resuscitation exposure during clinical rotations, postgraduate residency programs have reported the use of NRP simulation as both educational and assessment tools to supplement clinical experience. There exists, however, significant heterogeneity in the methods and exposure provided in different programs. In a systematic review that explored the educational role of simulation training for procedures and resuscitation experiences, the authors described multiple different study designs and assessment tools. Of note, of the eight studies included, only two focused specifically on neonatal resuscitation skills (Mills, Williams, & Dobson, 2013).

Similar heterogeneity in use and implementation exists in subspecialty fellowship training programs as well. Kumar et al. (2019) described the integration of simulation encounters in neonatal-perinatal medicine fellowship programs as boot camps and/or longitudinal training experiences. In a survey of Canadian neonatal-perinatal medicine programs, program directors and fellows described their different experiences with simulation for neonatal resuscitation. Varying degrees of fidelity, ranging from the use of advanced technology mannequins and standardized patients to the use of fruits and meat as task trainers,

for teaching the technical skills of neonatal resuscitation were reported. Five out of the eight programs used simulation for formative assessments (Wong et al, 2017).

Although studies on the use on simulation in neonatal resuscitation have reported improved immediate simulation performance, the literature does not describe improved clinical outcomes (Cavaleiro, Guimaraes, & Caleiros, 2009; Curran, Aziz, O'Young, & Bessell, 2004; Surcouf, Chauvin, Ferry, Yang, & Barkmeyer, 2012). Researchers have sought to enhance knowledge transfer in simulation sessions using educational constructs such as deliberate practice—a structured and reflective activity designed to improve a critical level of performance (Cordero et al., 2013). However, in neonatal resuscitation, these interventions have shown only transient improvement in technical skills and failed to show sustained skill retention (Finan et al., 2012). Limitations in study design, methodology, and lack of standardization of outcomes are some of the   additional challenges encountered that may contribute to the outcomes described (Mills, Williams, & Dobson, 2013; Rakshasbhuvankar & Patole, 2014).

Adequate clinical exposure to resuscitation situations during training continues to be a concern to both residents and educators designing competency curricula. In light of current training schedules respecting work hour guidelines and competing learning demands, the question remains whether graduating pediatricians achieve true competency and are adequately prepared for independent practice in neonatal resuscitation. In a survey measuring preparedness for independent community practice administered to 435 pediatricians certified by the RCPSC, pediatricians felt less than adequately prepared for 25% (23/92) of the RCPSC objectives for training competencies. Areas identified as needing improvement included crisis

resource management skills (leadership, problem-solving, situational awareness, communication), technical skills (obtaining IV access, endotracheal intubation, performing cardiopulmonary resuscitation), knowledge (chest x-ray interpretation), and applying ethical principles to provision of or withholding of clinical care (Amin, Singhal, & Cole, 2011). In another study analyzing self-reported proficiency in procedural skills amongst Canadian pediatric senior residents, the participants did not believe they were proficient in the RCPSC- required procedures. Three out of the four key technical skills required for successful neonatal resuscitation—cardiopulmonary resuscitation (CPR), umbilical vascular access (UVC), and tracheal intubation—were included in these (Levy, Dubrowski, Amin, & Bismilla, 2014). Specific to neonatal resuscitation, Cormier, Chan, Yaskina, and van Manen (2019) described the self-reported proficiency of Canadian pediatric residents and reported that only 17% of their survey participants met their study criteria for proficiency in resuscitation skills. They defined their resuscitation skill criteria as a score of 3 or greater in bag and mask or T–piece ventilation, intubation of an infant >28 weeks in the case room or NICU, and umbilical venous catheterization. In practice, measured success rates of resuscitation skills are equally concerning; for neonatal intubation, success rates for pediatric trainees have been reported between 20% and 26% (Haubner et al., 2013; Foglia et al., 2015). In a retrospective review of resuscitation attempts of junior and senior neonatal trainees over an 8-year period, the authors reported a failure rate of 40%. Failure was defined as algorithm failure, technical skills failure, or both (Cusack & Fawke, 2012). Currently, the successful completion of a postgraduate program and multiple stages of national licensing exams certify graduating trainees to engage in independent practice in the Canadian healthcare system, thereby becoming the default

indicator of "competency." However, the dilemma clearly exists that licensed pediatricians report being unprepared for independent practice in neonatal resuscitation.

If achieving competency in neonatal resuscitation is more than the successful completion of a checklist or a licensing exam, then educators are left with a number of unanswered questions. What does competency in neonatal resuscitation truly entail and how is it achieved? How do current residency training models ensure that residents acquire these competencies and are prepared for independent practice? While training, what challenges do trainees face in competency acquisition? Finally, why are residents not "ready"? The present thesis aims to answer these questions through a qualitative study using interpretive description as its methodology to explore residents' and recently graduated pediatricians' perceptions of competency, and the challenges encountered during training as well as the barriers within the system that limit successful acquisition of competency.

Chapter 2: Research Methods

This chapter details the thesis objectives and research design by first exploring the

educational theory informing the methodology and next, reviewing the sequence of participant

recruitment, data collection, and analysis. Finally, the attention paid to rigor and researcher

bias will be reported.

Study Goals and Objectives

The overall goal of this work was to understand trainees' perceptions on competency

acquisition and preparedness for practice in neonatal resuscitation. Additionally, barriers to

successful competency acquisition and the reasons these barriers exist were explored.

The specific research questions were:

1) How are residents prepared for independent practice in Neonatal resuscitation?

2) What are the perceived gaps in training?

3) Why, in their view, do these gaps exist?

To address these questions, the objectives of this work were:

1) To describe the participants' perceptions of competency in neonatal resuscitation,

training, and assessment experiences, as well as barriers that challenge successful

competency acquisition and independent practice.

2) To develop a conceptual model of competency acquisition in neonatal

resuscitation that could inform future curriculum development in postgraduate

medical education.

Study Design

The qualitative study was designed using the analytic framework of interpretive

description as described by Thorne (Thorne, Reimer Kirkham, & MacDonald-Emes, 1997).

Interpretive description was chosen as the study design since it allowed us to build on existing

educational constructs through an iterative and interpretive process to develop a conceptual

competency model that has "application implications" (Thorne, 2004, p. 3). In order to inform

the design of our study (including participant recruitment, sensitization of the focus group

interview guide, and framework for iterative analysis), the investigators integrated constructs of

deliberate practice, distributive practice, social cognitive theory, and "choke" phenomenon to

create a "foundational fore-structure" (Thorne, Reimer Kirkham, & MacDonald-Emes, 1997, p.

173) which encompasses "conceptualizing the analytic process" and , finding the knowable"

(Thorne, 2004, p. 8) from both available literature as well as clinical experiences of the

researchers. This foundational fore-structure is depicted in Figure 1.
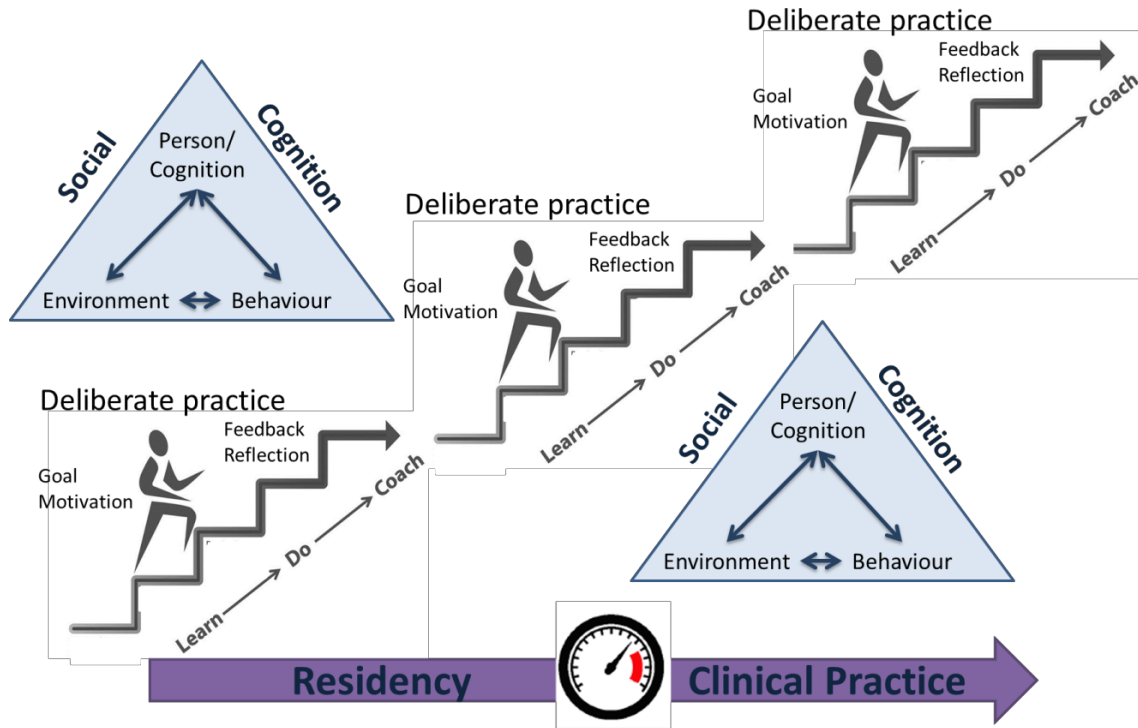
Figure 1. Integrated foundational forestructure informing study design. Adapted from: "Developing people: the bane of training" by Martin, 2013, https://tkmg.com/developing-people-the-bane-of-training/

This figure is made up of educational constructs that would facilitate competency acquisition in neonatal resuscitation allowing for a successful transition to independent practice. The key aspect of this foundational fore-structure is the interaction and interdependence of its constructs creating a framework for competency training in neonatal resuscitation over time. The four constructs and their individual roles in facilitating competency acquisition based on the literature are described below.

Deliberate practice. Deliberate practice is defined as a structured and reflective activity designed to improve a critical level of performance (Ericsson, 1993). Based on a review of skill

acquisition, Ericsson described significant improvement in performance when individuals were set goal-oriented tasks, were motivated to improve, and were provided with feedback and opportunities for repetition resulting in improvement in their performance (Ericsson, 2008). Issenberg et al. (1999), in their systematic review, identified repetition as one of the most important features of a successful simulation- based training program. The use of deliberate practice in simulation training for neonatal resuscitation has demonstrated short-term improvement in technical skills (Cordero, Hart, Hardin, Mahan, & Nankervis, 2013), NRP teamwork, and leadership behaviours (Sawyer et al., 2011).

Distributed practice. Distributed practice is defined as "practice interspersed with rest" (Murray & Udderman, 2003, p. 19). Distributed practice lends itself to optimal skill retention, building on a foundation of deliberate practice. An important determinant of skill retention is an amount of "overlearning" or additional training beyond that required for initial proficiency (Benjamin & Tullis, 2010). The utilization of this principle in postgraduate medical training has been described in skill acquisition in the surgical literature (Moulton et al., 2008) and more recently as an intervention amongst medical residents to improve knowledge retention (Matos, Petri, Mukamal & Vanka, 2017).

Social cognitive theory. At the very core of social cognitive theory is self-efficacy, which relates to a person's own judgement regarding her/his performance (Bandura & Schunk, 1981). In educational studies, self-motivation has been linked to self-efficacy as an effective way to cultivate competencies. In addition, enhanced self-efficacy has been shown to correlate with better performance (Bandura & Schunck, 1981). In addition to its influences on cognitive

function and human adaptation, self -efficacy was reported to have positive influences on learning (Schunk, 1986) and skill acquisition (Schunk & Gunn, 1986).

"Choke phenomena." Breakdown of skills is often noted in an acute emergency situation despite seemingly adequate preparedness. "Performance pressure is defined as an anxious desire to perform at a higher level" (Beilock & Carr, 2001, p. 701). Despite an innate desire for superior performance, stressful environments have been associated with skill and knowledge breakdown, potentially resulting in undesirable consequences. This is described as "choking under pressure" (Beilock & Carr, 2001). In psychology literature, evidence for this phenomenon is presented through the fields of sport and mathematics (Beilock & Carr, 2005). Implications of this phenomenon on working memory, intelligence, and attention have been described (Beilock, 2001). The "choke phenomenon" has not been previously described in the context of competency in neonatal resuscitation. However, given the high-stakes environment and an extremely rapid timelines, neonatal resuscitation situations classify as "pressure" situations and the ability to perform successfully in a stressful environment was considered an important aspect of competence for this study.

These four educational constructs were considered key aspects for competency acquisition in neonatal resuscitation and informed the development of the focus group interview guide which is described in further sections.

Data Collection

Informed by the research objectives and educational theory described above, the study methods are illustrated in Figure 2 and explored in detail below.

Educational Theory
Social Cognitive
Deliberate practice
Distributed practice
'Choke phenomenon'

Informs

Focus Groups (2x2)
Participants ↔ Interview guide
N= 5 Residents; 5 Pediatricians

Describing

Representing

Organizing

Triangulation
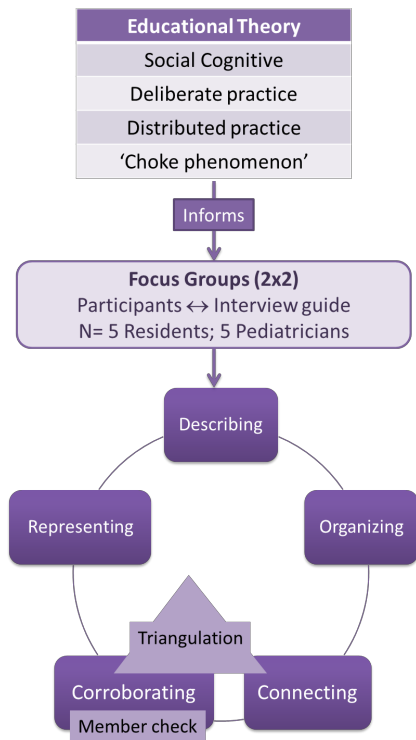
Corroborating

Connecting

Member check

Figure 2. Study methods

Focus groups. Historically, qualitative methods have provided links between concepts and behaviours and have helped to answer the "why" question (Bradley, Curry, & Devers, 2007). Kreuger described focus groups as follows: "The focus group interview … taps into human tendencies. Attitudes and perceptions related to concepts, products, services and programs are developed in part by interaction with other people. We are the product of our environment and are influenced by people around us." (Kreuger, 1994, p. 10–11). The key elements of synergy, snowballing, stimulation, and spontaneity that a group dynamic can generate make focus groups an effective tool (Catterall & Maclaran, 1997). In addition, focus groups reveal shared vulnerabilities, personal interactions, and experiences faced by similar participants (Hyde, Howlett, Brady, & Drennan, 2005). Iterative focus groups allow the opportunity for triangulation and clarification of ideas, while minimizing the bias of pleasing the interviewer or transference effects.

In medical education, focus groups have been used to evaluate undergraduate medical courses, continuing medical education programs, and postgraduate medical education (Asher & Lane, 1993; Wernstein et al., 1997; Perez & Patel, 1995; Woodhouse et al., 1997; Fein et al., 1993; Tipping & Tenenbaum, 1997). Focus groups have also been used to provide insight into learner perspectives.

For this work, focus groups were the chosen method of data collection versus in- depth interviews due to their ability to (a) facilitate an understanding of the learner's perspective—the focus group dynamics provide insight into the learner's perspective on the training received towards competency acquisition in neonatal resuscitation, such as the strengths, weaknesses,

and challenges; and (b) identify barriers towards competency acquisition through the shared experiences of participants.

Study sampling and participant recruitment. Using purposeful sampling, two participant groups were recruited. Purposeful sampling seeks to "select information rich cases from which one can learn a great deal about issues of central importance to the purpose of inquiry" (Patton, 2004, p. 230). These two groups included senior pediatric residents in year 3 or 4 of their training at McMaster and recently graduated pediatricians from the same program who had been in practice for three years or less. The cohort of recently graduated pediatricians was chosen since, given their recent transition, they would be able to link their training experiences with transition into practice. In addition, given that they were now practicing independently, they would have lived experiences of performance under pressure as well as insights into their own self efficacy for the practice of neonatal resuscitation.

PGY-3/ PGY4 residents were chosen specifically, as given their situation of the training continuum, they would be able to provide their training experiences on repeated exposure over time, performance under pressure and describe their own perceptions of competency as they near the end of their postgraduate training.

The pediatric residency program at McMaster University is a 4-year program. The participants in this focus group were both third- and fourth-year trainees who had already completed their mandated NICU rotations both in tertiary and community centres. The pediatricians were recent graduates who had completed the program within the last three years. Four out of the five participants were pediatricians; the fifth participant was pursuing

additional adolescent medicine training. The overarching training program structure and curriculum for both the residents and the pediatricians was similar.

The number of participants recruited into each focus group was informed by sample size literature, which describes an optimal focus group size between 4 and 12 participants (Tang & Davies, 1995). This number allows for adequate exploration of themes and ideas without "overcrowding." For this study, homogenous focus groups were used to ensure participant compatibility and avoidance of power imbalances, while still allowing for diversity in data collected (Crabtree & Miller, 1999). Hence. each focus group comprised of five residents and five pediatricians. The participants were not strangers to each other and there was the potential that "dynamics are quite different and more complex when participants have prior established relationships" (Patton, 2004, p. 387). However, given the nature of this research question, participants with previous relationships were chosen to ensure that the groups were comfortable discussing sensitive information and to accelerate the group dynamic.

Ethics approval was sought by the Hamilton Integrated Research Ethics Board. For recruiting purposes, study details and information were distributed by the pediatric chief residents as well as by the office of the Chief, Department of Pediatrics, McMaster University. Interested participants contacted the primary investigator (MW) directly. The focus groups were subsequently scheduled based on participant availability.

Five residents and five pediatricians comprised the two study groups. Both of the study groups were interviewed separately at two different times (Interview 1 for initial data collection and Interview 2 for member check and triangulation of themes).

The focus group interview guide. In each of the groups, Interview 1 was conducted using an interview guide, consisting of open-ended questions that reflected the research questions and the constructs of the "foundation forestructure" (Thorne, Reimer Kirkham, & MacDonald-Emes, 1997, p. 173) described in Section 2.2. The questions were designed to reflect different aspects of the "foundation forestructure",i.e. distribution of training over time, types of learning and assessment methods and specific questions around palliative care that would elucidate aspects of performance under pressure The interview guide was refined by the committee members who included two physician researchers and a qualitative medical education researcher (refer to Appendix 1 for the interview guide).

Data Analysis

Focus group interviews were tape recorded, transcribed, and all identifiers removed. Data analysis was conducted using an iterative process as outlined by Crabtree and Miller (1999)—describing, organizing, connecting, corroborating/legitimizing, and representing the account. Two independent examiners coded the data and organized them into categories that represented aspects and features of the clinical phenomenon (competency) being studied. Some examples of the categories used in coding included "competency enablers," "competency assessments," and "competency barriers." Coding was performed independently by both the primary investigator and the thesis supervisor, who met periodically to identify and resolve differences and address potential biases. Triangulation of codes was performed across investigators. Analysis was done as soon as the focus group interviews were conducted, allowing for a constant comparison process between data collection and analysis (Thorne,

2004). Documents, codes, and categories were stored and managed using the Atlas ti software (Version 1.5.4).

During Interview 2, for each group, the student investigator provided participants with a written summary from Interview 1 for member check and enhancing data validity. In addition, participants could provide further insights and reflections that would contribute to data "breadth" (Thorne, 2004, p. 11) during analysis. Next, triangulation of themes across groups was performed, where the anonymized Interview 1 summaries of contrasting groups were provided for review and feedback (i.e., the residents reviewed their own and the pediatricians' focus group summaries and vice versa).

Multiple stages of data analysis were conducted after initial coding that sought to organize the data into answers to questions such as: "What makes competency acquisition in neonatal resuscitation different?"; "What does competency acquisition in neonatal resuscitation actually mean?"; "Does simulation truly enable competency development? If yes, how?" Finally, following member check and triangulation across groups, the data was then organized into a conceptual framework for competency acquisition using the analogy of the sailing vessel to propose key attributes of competency and explain its enablers and barriers. A final product seeking to create a "sense-making structure for the eccentricities and variations that inevitably occur in the real world of healthcare application" (Thorne, 2004, p. 7) is core to the interpretive design methodology. As such, each element of the metaphor was analysed to ensure that they were "critical elements" in the model (Thorne, 2004, p. 6) and provided valid grounds for application.

Rigor

Congruent with qualitative methodology, Lincoln and Guba's (1985) four criteria of data rigor were applied to this project: credibility, transferability, dependability, and conformability. Credibility of the data was ensured through peer debriefing via feedback from the dissertation committee, in depth observations of the data as well as triangulation across investigators. Additionally, analyzed summaries of the transcripts were presented to the participants for member check, in keeping with the rigorous research design (Sandelowski, 1993; Thorne, Reimer Kirkham, & MacDonald-Emes, 1997). The use of a purposeful sampling strategy and detailed description of the employed methodology satisfied the transferability requirements. Dependability of data was ensured through the investigator's audit trail recording timelines of process interventions and stages of data analysis as well as using a code- recode strategy during data analysis. Reflective notes acknowledging biases as a researcher were kept by the primary investigator accounted for data conformability. Finally, the end result of the study—the conceptual competency model—was put through the "thoughtful clinician test" (Thorne, 2004, p. 8) through five poster and three oral presentations at various local and national conferences where it was reviewed by multiple experts in the fields of both neonatal-perinatal medicine and medical education.

Role of the Primary Investigator

The primary investigator was a third-year fellow in the Division of Neonatology, Department of Pediatrics, McMaster University. Though not in a formal supervisory role, she worked with some of the participants during their clinical service. This relationship may have

facilitated trust and rapport with the participants as they spoke about   sensitive issues,

challenging circumstances, fears, and vulnerabilities, adding richness to collected information. It

may also have had other, unintended influences; participants were therefore expressly told that

in keeping with the ethical principles of this study, the focus group interviews were completely

confidential and would be anonymized. There were no implications on evaluation and

performance.

Chapter 3: Results

The study population was comprised of five pediatric residents in postgraduate year 3 or 4 of training at McMaster University and five recently graduated pediatricians who had been in practice for less than three years. One of the pediatricians was pursuing subspecialty training in adolescent medicine. As described, the study objectives explored how residents are prepared for competent independent practice in neonatal resuscitation, their perceived gaps in training, and why, in their view, these gaps exist.

The participants identified four attributes for competency in neonatal resuscitation required to ensure successful transition towards readiness for independent practice. These four aspects of competency included (a) medical expertise, (b) leadership, (c) transferability, and (d) self-efficacy. The first part of this chapter details the participants' perceptions of medical expertise, leadership, transferability, and self- efficacy in neonatal resuscitation. The second part of this chapter describes their postgraduate training experiences related to these different aspects of competency, with the third part highlighting the perceived barriers that challenge successful competency acquisition. Finally, the chapter concludes by exploring participants' experiences with the most challenging exercise in neonatal competency—the unsuccessful resuscitation of a newborn—and experiences with redirection of care, highlighting competencies and consequences of performance under pressure.

Aspects of Competency Acquisition in Neonatal Resuscitation

Medical expertise. Medical expertise in neonatal resuscitation was described by the

participants as an attribute that incorporates knowledge, technical skill, clinical decision-making, judgement, and insight.

   Knowledge. The pediatricians identified knowledge as the first step in the competency continuum for neonatal resuscitation. Both groups of participants acknowledged the traditional aspects of knowledge around neonatal resuscitation that included the NRP algorithm, the equipment used, and the ability to trouble shoot equipment malfunction. Both the residents and pediatricians also described a need for specific knowledge around ventilation strategies, modes, and equipment used beyond the initial resuscitation of the neonate, as this resident highlighted:

> …. especially after the resuscitation and now the baby is intubated and doing PPV, okay now the next hurdle is CPAP {continuous positive airway pressure}. How do I set this up, where is my RT {respiratory therapist}? How do I get my CPAP started? And so, being what {are} appropriate settings? What is my tidal volume? What will be my rate? So, all those things are for me still a bit intimidating. So, you have acutely stabilized, now what and how am I going to generate an appropriate differential working my way through. (Resident 4)

Being in practice, the pediatricians also highlighted the importance of knowledge in the context of their abilities to manage common neonatal pathologies (such as hypoglycemia), determine appropriate investigations, prioritize referrals, and initiate subspecialty consults based on the infant's physiology. In addition, they described the requirement of being up-to-date with the latest evidence around management strategies for commonly encountered clinical

conditions.

Technical skill. Both residents and pediatricians emphasized the importance of having

proficiency in the technical skills required for neonatal resuscitation. They highlighted the

importance of being able to manage the airway of a neonate in an acute situation and spoke

fearfully about a perceived lack of competency in this particular skill set as described by these

residents:

> I think the technical skills probably come to the forefront of a lot of our minds
>
> because those are the ones that are more unique to that environment. Especially
>
> with other competencies that we have to learn about during a resus, like team
>
> dynamics and communication and knowing how to talk to the referring centre if
>
> you need to get help from somebody. They are all important skills to develop.
>
> But I think we get a chance to practice a lot of those in other areas as well.
>
> Whereas the neo-specific skills are the ones that we feel least comfortable with I
>
> believe. (Resident 1)

> For me it is totally isolated to intubating. I feel like when I make these
>
> comparisons, I should clarify that really, I should be saying intubate. That is the
>
> thing that it all comes down to. (Resident 4)

The participants further described successful airway management as being able to trouble shoot clinical challenges such as obstructed views from secretions or blood, inherent floppy tone of a depressed neonate, or anatomical airway abnormalities with limited resources/available equipment. Finally, they acknowledged that successful neonatal resuscitation involves a timeline that runs in seconds which applies to both successful performance of technical skills as well as clinical decision-making.

Clinical decision-making and judgement. Integration and application of acquired knowledge and technical skill expertise to intensive care clinical situations was described by the residents as a feature of medical expertise, as this resident highlighted: "…the hardest being how to apply the knowledge. So, applying it and the experience for me. So maybe having the theoretical knowledge but I don't feel like I could apply it effectively and competently" (Resident 1). Additionally, this also included the ability to provide ongoing assessment, stabilization, and reassessments following initial stabilization. Managing high patient volumes and acuity, ensuring appropriate triage, and patient safety were additional aspects of clinical decision-making. Decision-making around initiating tertiary care support for advice/transport as well as determining infant disposition were features of clinical judgement. The capability to independently troubleshoot and anticipate next steps when things were not going well in an acute, stressful resuscitation situation was another feature of judgement, as this pediatrician narrated:

> And so, I could see that the RT was trying to intubate so I assumed they had
>
> already done PPV {positive pressure ventilation} and the baby had not responded.

And then they were starting chest compressions, so I assumed that this baby was a few minutes old at least. And from that I was like, let's stop trying to intubate and do PPV. And then the equipment fell apart and so the PPV was not connected properly. So, the manometer was not connected, so then of course the flow inflating bag would not inflate, and the RT totally panicked in that situation. So, a few different things were going on in that situation and being able to rein it in and ask people to leave if they were not helping in that chaos was the main challenge. At the end of it all I found out this was a flat meconium baby and the baby was about five or six minutes old, had no PPV, and only had multiple intubation attempts prior to my arrival. And they had not been able to intubate. When I arrived the heart, rate was below 60 and they said before, when they listened, the heart rate was well above 100. So clearly things had been deteriorating and they had not done PPV at all. And of course, then the PPV broke down. (Pediatrician 2)

Finally, they spoke to the nuanced roles that their own insight played in clinical decision-making in neonatal resuscitation especially in "grey" clinical circumstances requiring transition from intensive care to palliative care plans.

Insight. Both groups of participants had excellent insight into their individual competencies and expressed fear and insecurity around their practices of neonatal resuscitation. In describing situations where there was need for redirection of care, participants universally described an acute intensive care scenario—the clinical and procedural challenges of

which add an additional layer of complexity. They also reported personal experiences of conflict between guideline adherence and clinical practice, as this pediatrician narrated:

> We needed to resus the child and then understandably the child was not coming back. We brought the parents in … continued to resus more for the parents. We brought them in and then we withdrew care. But we were almost at 20 to 30 minutes at that point of resuscitation and obviously we should not have been that long. So that is one case where we have done that. (Pediatrician 1)

The residents described insight in the context of their roles and responsibilities in relation to other members of the multidisciplinary team in the NICU as this resident reflected: "…and you quickly recognize that you are by far the weakest link of this team and that you are leaning on them for support" (Resident 3). Insight as a component of medical expertise helped the participants on an individual level to solidify/refute their own clinical decisions, allowing for self-directed learning.

In summary, the medical expertise aspect of competency in neonatal resuscitation involved a thorough core foundation of knowledge and technical skill expertise as well as understanding and recognizing the nuances of insight and judgement in clinical decision-making, allowing for effective leadership of the multidisciplinary team.

Leadership. The ability to provide effective leadership of the multidisciplinary team was described as another aspect of competency in neonatal resuscitation. In describing leadership, the participants highlighted the characteristics of this role as being able to navigate

heterogeneous team dynamics, communicate effectively, provide education, and conduct

meaningful debriefing sessions as well as advocate for resources.

General characteristics. Both sets of participants described the ability to assume control

of a resuscitation situation as a mandatory requirement for this role. The pediatricians

described additional challenges of having to assume responsibility of the situation midway since

community practice is usually set up such that the physician is not the first responder and may

only be available 20 minutes after the resuscitation situation has commenced. Often, these

circumstances have an underlying panic and chaos component that needs to be addressed

simultaneously to allow for optimal outcomes, as highlighted by this pediatrician:

> It was very hard for me to really understand what was going on because no one
>
> would give any information even though it was announced that I was there ...
>
> there were chest compressions happening on the baby and the baby was
>
> receiving PPV and they were trying to coordinate with the chest compressions.
>
> So, it is a little tricky to get all the information right off the bat in a situation
>
> where there is so much chaos. (Pediatrician 2)

Additionally, it includes the ability to institute corrective measures as well as anticipate and

prevent potential harm that a delay in appropriate steps/incorrect steps could cause. Marked

heterogeneity in first responder skill and composition adds to the challenge, as this physician

narrated:

> The anesthetist was bagging the baby with an oral airway which meant that there

was no real good chest rise … You took the oral airway out, you bagged the baby,

did PPV … intubated to secure the airway because there was not a good way to

transport the baby from the operating room (OR) to the nursery. So, it was chaos

and you didn't find anything out. (Pediatrician 5)

As highlighted above, "chaos" challenged effective resuscitation and the pediatricians

acknowledged the ability to practice closed loop communication and successfully navigate team

dynamics as an integral part of the team leader's role.

Team dynamics and communication. Insight and understanding of the level of skill and

expertise of the multidisciplinary team was a key feature of leadership, as highlighted by this

physician:

I think in the first two {resuscitations} my first shortcoming was assuming that

everybody works as I would work, and I didn't necessarily need to prepare them

or educate them on the basics of NRP (resuscitation). And then only to find out

during the actual NRP that the things we took for granted at McMaster, such as

priming an umbilical venous catheter line or just asking for a UVC line, was kind

of a foreign concept for them. (Pediatrician 4)

A leader must be proficient in all the team roles required in a neonatal resuscitation.

She/he must also be able to transition seamlessly through the different roles based on the

situation. Role assignment and closed loop communication were important skills described. The

ability to gently assert authority for "crowd control" in an acute resuscitation scenario was

another skill that was identified. Finally, the ability to identify and address team-member conflict in a resuscitation scenario was described by this pediatrician: "The nurse felt like the RT was a team leader but had not received directions from the RT. And the RT was a newer RT and she felt like she could not really leave" (Pediatrician 3). The pediatricians, while acknowledging the challenges of navigating team dynamics in an acute resuscitation, also described their responsibility as educators of and advocates for the multidisciplinary team.

Education, debriefing, and advocacy. The pediatricians described their responsibilities as educators of the team as teaching concepts of neonatal resuscitation using learning tools such as mock codes, ensuring appropriate certification procedures were implemented, and being able to effectively debrief and initiate self-reflection in the team members following a resuscitation, as this pediatrician narrated:

> … so, then we implemented mock code pink every month and kept a log of who had been exposed to it. So, from a leadership perspective we were failing. As well as updating nurses on MRSOPA {Mask, reposition, suction, open mouth, pressure increase, alternate airway}. There were NRP nurses and special care nursery nurses who didn't even know about that until we started asking questions about NRP. (Pediatrician 4)

From an advocacy standpoint, it involved ensuring adequate staff allocation based on clinical workload. It also involved ensuring that financial resources were available to cover education sessions and certification requirements. As highlighted by the pediatricians above, leadership in neonatal resuscitation is a complex process with roles and responsibilities that are

different in training and clinical practice environments.

Transferability. Both sets of participants described the ability to be able to practice neonatal resuscitation across different environments and circumstances, ensuring safe tangible outcomes as an aspect of competency in neonatal resuscitation. As described by the pediatricians above, there exists a significant difference in resource, skill, and personnel availability in tertiary care centres (where training occurs) and community centres (where independent pediatric clinical practice occurs), as these residents described:

> Everything is all set to go, so then when you go out into the community and you don't have the RT there, you are like, oh I have to actually get my mask, get suction on, oxygen and feel comfortable. So being comfortable in the space is a huge piece. (Resident 3)

> Just being comfortable in the environment too, going into the community, everyone's set-up will be different then our L&D. Orillia had this archaic warmer that I was like, what is this thing? (Resident 5)

> And I think there is a time space and difference between getting a skill under your belt and then not doing it for months and not doing it again. And then also with having the ability to do it legitimately by yourself and in multiple actual different environments. So, to change the environment that you have the skill in and knowing that you will be able to still practice the skill. You are not only going to practice it if the RT is standing over the shoulder and they have preselected the

tubes and the drugs and the ideal environment. So, removing all the crutches that

you have. (Resident 1)

Additionally, maintenance of knowledge and technical skill expertise over time was

described as a salient feature of this competency, as this resident detailed:

… where I have started fourth year. And I am not comfortable intubating a baby.

But let's say that I was, competency that translates into practice for me would be

stopping now and not attempting for another eight months and then feel like I

could do it then. That I feel would translate into practice. (Resident 2)

Finally, there is a greater onus on individual performance with no backup, as this

pediatrician described: "For me the biggest jump going from residency where I am supported

and have backup to being staff is that is it. It is me and no one else. There is no back up"

(Pediatrician 3). Both sets of participants acknowledged that while tertiary centre supports

(advice/transport) are available in community practice, an individual sense of confidence and

being able to perform under pressure is inherent to feeling competent in neonatal resuscitation.

Self-efficacy. The residents expressed having confidence in their own ability and skills to

meet best practice standards as an important aspect of competency, as this resident explained:

… or if it looks like that will not be happening, knowing that if you have to call a

code or neonatal death, feeling comfortable that you ran an appropriate

resuscitation and that everything that could have been done was done and was

done appropriately when reviewed. (Resident 1)

They also described the need for feeling ready, from a knowledge, skills, and emotional standpoint, for an acute resuscitation, acknowledging that the outcomes may not be as optimal, as this resident highlighted:

> … knowing and feeling ready on any shift to have a flat baby be born or baby that needs any kind of resus and know that I can ... that if a baby, say, passes away, that it is not because of a skill that I was not good at, so outstanding circumstances aside. (Resident 1)

Successfully confronting their fears of a difficult airway, having insight and self-reflection into their knowledge and abilities, and recognising gaps and subsequently developing strategies to address specific areas of improvement were described as features of self- efficacy, as this pediatrician described: "…one of the other challenges is the knowledge. So, when is enough? And what more do I need to do? What number of things do I need to do for them to be sufficient?" (Pediatrician 2). Having identified and defined the different aspects of competency in neonatal resuscitation in the focus groups, the participants moved on to describe their experiences with postgraduate training related to competency acquisition in neonatal resuscitation and readiness for practice.

Training in Neonatal Resuscitation

The training experiences of participants related to neonatal resuscitation are organized into four categories: (a) residency clinical rotations, (b) simulation experiences, (c) coaching encounters, and (d) competency assessments and evaluations. These are each discussed in detail below.

Residency clinical rotations. As described by the participants, the clinical rotations facilitated exposure for the aspects of medical expertise and transferability. The curriculum structure allowed for clinical exposure to neonatal resuscitation encounters that focused on the NRP algorithm as well as procedural skill opportunities. The curriculum had a built-in flexibility that allowed the learner to focus on their individual learning goals at appropriate times in their training, as this pediatrician recounted:

> … as I was getting closer to finishing my fourth year I felt like I had not intubated a
> baby for quite some time. And I needed that kind of exposure, so I did an elective
> in the neonatal intensive care unit (NICU) for a month in level 3. So, giving that
> flexibility there helps us to go where you feel like you are lacking in skill sets and
> you can fill those gaps. (Pediatrician 4)

Having community rotations built into the curriculum provided for exposure in environments that are differently resourced as compared to traditional tertiary training environments. It also provided them with the opportunity for autonomy in resuscitation scenarios, as these participants described:

But then in the community I feel that the best part of it is that you are the person

who runs everything and people working around you might not know most of the

things. (Resident 1)

You get a lot of support that way in a tertiary centre where the RT knows exactly

what to do. So, all that big support you do not get in the community, so you are

the one-man team almost. (Pediatrician 1)

While the existing clinical rotation structures laid the foundation for postgraduate

training, the participants also described the role of simulated experiences as opportunities to

enhance competency acquisition.

Simulation in neonatal resuscitation. Both sets of participants described simulation as a

useful training modality for neonatal resuscitation. Simulation training was found to help

facilitate acquisition of expertise primarily in the domains of medical expertise and leadership.

Some of the pitfalls in simulation training were described in the context of the constructs of

transferability and self-efficacy.

Benefits of simulation. The residents described the usefulness of simulation in

facilitating knowledge of the NRP algorithm and developing an understanding and familiarity

with the equipment used in a neonatal resuscitation. Simulation encounters helped to facilitate

clinical decision-making processes, such as problem solving and generation of a differential

diagnosis by repeated iterations of common and uncommon scenarios. It also provided

opportunity for unlimited practice of technical skills, as this resident described:

But for earlier learners there is a comfort in knowing that you know how to hold

the laryngoscope and you have touched 100 ETT tubes. And that bit gets you a bit

more comfortable. So, when you are at the head of the bed with that pressure, it

is better. (Resident 2)

The participants reported increased benefit of simulation training sessions when peers

played different roles. This facilitated sharing of ideas and practices among a similar cohort of

trainees, allowing for better learning and knowledge translation. These training situations also

helped develop closed loop communication skills. Finally, the simulation experience was felt to

have contributed to success in licensing exams. In addition to recognizing the benefits of

simulation, the participants also described key aspects that challenged knowledge translation in

simulation.

Challenges of simulation. The biggest criticism of simulation for competency acquisition

in neonatal resuscitation was its limitations for transferability—truly mimicking a real-life

scenario, as this pediatrician commented:

I feel like simulations are just so contrived that no matter how high fidelity it is and

no matter how much real life they try to make it, it is just a contrived and fake

situation. So, my powers of pretend are just not that good that I can be like, this is

real life. (Pediatrician 3)

They spoke to a "disconnect" in the procedural environment available during a simulation

situation versus a real-life resuscitation. While a high-fidelity simulated situation may have

complications built in, it lacks implications and the challenges that occur in real life, as this resident recounted:

> We have all intubated those NEO mannequins a million times. And then where you have a baby in real life, they are so floppy and so wet … you can't actually put them in the right position … But those true technical skills I need to do in real life a thousand times. (Resident 3)

While simulation has been designated a safe space to practice, it was also felt to perpetuate a false sense of expertise and forgive inattention to detail given the predictable evolution of the situation, as this pediatrician reflected:

> So, I think that was the kind of dangerous part of it for me or walking through the motions of a simulation when I knew in my heart that sometimes logistically my eye/hand coordination was not stellar. And if I had just come off a neonatal resuscitation, then sure, I could do beautiful ventilation. But I found that for myself that if I was not using my skills all the time, they would be quite weak. (Pediatrician 4)

The pediatricians criticized simulation scenarios utilized for examinations for predictability wherein the trainee could achieve success without actually demonstrating skill. Additional differences between simulation and real-life included differences in timing (real life emergencies occur any time of the day or night) and differences in team skill and availability (simulation encounters are usually planned encounters where roles are predetermined, played

by familiar people with similar skills in an environment that is adequately resourced).

Both sets of participants highlighted a perceived lack of competency in neonatal resuscitation following simulation training, identifying that success in a simulation situation does not translate into competency in real life. One specific reason for this was the lack of accountability and consequences that are associated with an unsuccessful resuscitation in simulation as compared to a real-life scenario, as this resident and pediatrician reflected:

> I am sure we all think the same thing, that SIM baby is never going to die. I feel like I am so comfortable in SIMs now and I am someone who was terrified in first year and almost entirely terrified in second year overall. But that same person feels very confident in SIMs with babies right now. I picked up all this extra NICU time and now I can go apply for jobs and say, I am so comfortable with babies who are fake. (Resident 1)

> Even if I knew the algorithms and knew what to do and could tell you with expertise and confidence, if they asked me to demonstrate some of these skills, I would have had problems with demonstrating confidence. (Pediatrician 5)

A second reason was the lack of stress, anxiety and panic associated with a simulation encounter as compared to real life. The pediatricians narrated their own experiences where they acknowledged that the stress of the situation affected their performance, as this pediatrician described:

In a real case you don't know what the outcome is and what will happen to the

baby. Are they going to survive or not? What will happen? How do you manage?

How do you monitor the baby in a code pink? There are a lot of uncertainties

there and it creates a lot of stress. And that is the biggest factor I feel that affects

the performance more so than the simulation. (Pediatrician 4)

Finally, both groups of participants described what they perceived an ideal simulation scenario for neonatal resuscitation would look like. They acknowledged that while there will always be a disconnect between real life and simulation scenarios, finding ways to bring the element of fear/unknown into training encounters would help build better accountability as a training modality. The encounters should incorporate the elements of unfamiliarity by having people with varying expertise play the roles of team members. Additionally, designating these encounters as high-stake examination events may help achieve better stakeholder credibility.

Coaching in neonatal resuscitation. As they navigated through their clinical and simulated learning experiences, the participants strongly endorsed coaching as an important aspect of training for ensuring competency in neonatal resuscitation, specifically for leadership and self-efficacy, when available and skillfully done. The participants described the characteristics of a good coach as one who had insight into the level of the learner and was able to facilitate relevant learning opportunities. The coach was a content expert and role model who could "guide hands and thoughts" through procedures and clinical decision-making. This allowed for direct observation with opportunities for individualized feedback tailored to the level of the learner, as these participants described:

Coaching is important. Someone telling you what went well and what didn't … You

hyper-flexed and that is why the intubation did not go well. So those pieces are

really helpful. (Pediatrician 2)

I had one guy who would take your hand and put it on the thing and move it with

his hand until you did it right—pressure and all … and then I have had experiences

too where I am not even touching the baby. (Resident 4)

The participants described the coaching relationship as one in which the trainee was

encouraged to be a "hands-on leader." He/she provided a safe space for identification of areas

of weakness, thereby enabling the development of strategies for improvement, as this

pediatrician described: "…versus coaching and self-refection where you are consciously

thinking, how can I improve this so that in the future some patient lives because of my skill?

(Pediatrician 5). A close relationship protected the vulnerability of the learner, built trust, and

enhanced the ability of the coach to influence behaviour in a meaningful way and individualize

training.

The participants described differences between tertiary and community centres with

regard to their coaching experiences. They described their coaching experiences in the

community centres as more individualized—"one-on-one" (Resident 4). In comparison, tertiary

centre experiences were structured group encounters supported by interprofessional teams

with opportunities for team simulation and debriefing. Having described their spectrum of

clinical experiences in neonatal resuscitation, the participants critically reviewed their formal

training assessments with regard to competency acquisition in neonatal resuscitation.

Competency assessments. Both residents and pediatricians described in-training evaluation reports (ITER), procedure log books, and certification in neonatal resuscitation programs as the three evaluation tools for assessment of competency in neonatal resuscitation during their residency. They commented on the disconnect between a successful evaluation on the ITER and procedure logs and their own perceptions of competency. It was felt that ITERs had an unknown benchmark and, while they were useful for summative evaluations, they did not measure competency, as this resident highlighted:

> If you ask the majority of residents, half of us don't even know what the end
>
> points are on the ITERs that we are getting evaluated on. You don't know. You
>
> don't know what the 1 is or the 5 is. You will not really know what you are going
>
> towards. I think the ITER is a non-factor. (Resident 1)

One resident felt that the ITER was more reflective of CanMEDS roles rather than an assessment tool for clinical skills and performance. The pediatricians reported additional factors—not completed in real time, and often, not by immediate supervisors—that challenged the validity of this assessment.

The benefits of the log books were that they were an objective evaluation of exposure and initiated self-reflection around competency and acquired expertise. With respect to self-reflection as an evaluation strategy, there were differing experiences. The residents and one pediatrician reported using self-reflection strategies as personal evaluations and described

being able to initiate self-directed learning strategies, as this pediatrician described:

> So, without telling other people, what did I think my weaknesses were and what
> should I improve on and how do I get that? I think that if you sit down and write
> and try to recollect what you did or did not do, then it provides more impact for
> you and for a little bit longer. I think you can take that and use it for the future.
> (Pediatrician 2)

Other pediatricians reported either no experience with self-reflection strategies or did not identify benefit from self-reflection exercises mandated by the program.

The biggest criticism for competency assessments was the lack of observation and meaningful evaluations that would serve as stepping stones to build on. There was no endpoint in training that certified competence. This lack of observed encounters or goal posts significantly challenged competency acquisition, as this resident described: "I also think that as much as we hate evaluations ... I don't know if anybody actually knows if I am competent at anything and I don't even know if I am competent with anything because we don't actually measure it" (Resident 3). Having reflected on their own perceptions of competency in neonatal resuscitation and their training experiences, the participants next described the barriers to competency acquisition that they encountered during training and in early practice.

Barriers to Competency Acquisition in Neonatal Resuscitation

In this section, the perceived barriers to competency acquisition in neonatal

resuscitation are organized using the four aspects of competency described by participants in

section 1 above: medical expertise, leadership, transferability, and self- efficacy.

Medical expertise. The biggest barrier to the development of medical expertise was the

lack of exposure to neonatal resuscitation scenarios and skill practice during clinical training.

Tables 1 & 2 summarize the clinical experiences of participants related to exposure of neonatal

resuscitation skills.

Table 1

Clinical NRP exposure in training and practice —Pediatricians

	Pediatrician 1	Pediatrician 2	Pediatrician 3	Pediatrician 4	Pediatrician 5
NRP frequency*	Never	5-10/year	5-10/year	>10/year	5-10/year
Level III weeks**	12	16	14	14	16
Level II weeks**	12	8	8	18	16
NRP (member)***	15-20	5	6-10	10-15	15-20
NRP (sim member) ***	5-10	8	4	7-10	5-10
NRP (leader)***	4	1	4-6	5-7	5-10
NRP (sim leader) ***	4	2	2-3	5	1-5
WLST****	3	3	0	0	0

*NRP frequency in practice

** Weeks in residency training

*** Residency and practice

****WLST: Withdrawal of life-sustaining treatment during practice

Table 2

Clinical NRP exposure during training—Residents

	Resident 1	Resident 2	Resident 3	Resident 4	Resident 5
Year of training	4	4	4	3	3
Level III weeks	10	10	10	8	8
Level II weeks	8	8	12	6	6
NRP (team member) **	12	5-10	5	<10	5-10
NRP (sim team member) **	5	3	5	<5	5
NRP (leader)**	7	1	4	0	0
NRP sim (leader)**	3	3	6	1	1-2

** Frequency in residency

The participants described their clinical rotations over time in residency as truncated

learning experiences with isolated encounters as opposed to a continuum of consolidated

graduated learning with encounters solidifying experience. Changes in curriculum structure,

including changes in the call schedule with reduced working hours, also contributed to this lack

of exposure. Within their current rotation schedule, the residents felt that there was an

inadequate emphasis on neonatal skills and competencies needed for a general pediatrician,

given that a large portion of their clinical time is spent in subspecialty rotations, as this resident

detailed:

> Because whatever is sexy to say about it and whatever I think I should say about
> needing the four weeks of rheumatology to be a good pediatrician ... the outcome
> is that it will not make a lick of difference to me when I am out practicing. I will
> recognize a malar rash and I will recognize when I don't know what I am seeing
> and I will eventually consult a rheumatologist down the line, acutely or not. And
> part of that ... what I have been hearing from general pediatricians where they
> say, you can consult, all you need to do when you come up here is art stabs and
> baby resus. You are like, oh darn. (Resident 5)

In addition, workload stress, competing interests, exams, and social commitments further limit the ability to acquire additional clinical exposure. A lack of exposure to complex transitional physiology in real time (as opposed to simulation encounters) affected clinical decision-making abilities, as this resident described:

> It is a little bit crazy to me that it is like, no, no, we will not practice. We will just
> give you the dead baby and we will see how it goes. It is like, what? How is that
> (a) even safe for families and also how is that part of the ... so wait until you are
> in the real scenario of the flat baby and hope that once-every-3-year NRP course
> has kind of got your back! (Resident 4)

Multiple learners across different interprofessional groups (residents, fellows, nurse practitioners [NP], respiratory therapists [RT], transport nurses [TN]) seeking to develop

technical expertise limit the number of opportunities available per person.

The NICU environment, with its high acuity and busy workload, often resulted in what was a perceived imbalance of service and education requirements. The environment was described as so different by participants compared to other rotations in residency that a significant proportion of time was often spent "acclimatizing" versus actually "learning." In addition, skilled interprofessional teams, though supportive in providing patient care, were seen to take away some opportunity for learners to problem solve (particularly as they became more senior in their rotations, and were seeking more autonomy). Finally, some current residents described challenging interactions with the interdisciplinary healthcare team. At times, a perceived lack of collegiality and support created a difficult learning environment. This sentiment was not echoed by the pediatricians who found the team interactions supportive.

Leadership. A lack of opportunity to transition from the novice to senior role and a lack of coaching were described as barriers to acquiring leadership competency in neonatal resuscitation. The greatest barriers to effective coaching were the coach's skill and lack of time, given competing service demands. They identified a lack of insight in their coaches regarding an understanding of the learner's competencies, as this resident described: "By the time you have coached the coaches to coach you, you have done the rotation" (Resident 4). Trainees also reported a lack of insight and self- reflection in their faculty who were challenged in balancing and addressing the learning needs of multiple learners at different levels. Residents echoed the need for ongoing faculty development to improve bedside teaching as well as to develop skills in balancing patient safety, learner autonomy, and ideal observation/supervision. Finding

innovative, creative methods of teaching and being able to provide constructive feedback and meaningful evaluations were suggestions made by participants to facilitate better competency acquisition. They strongly reiterated the need for coaches to adapt their styles to align with the current training environment as opposed to modelling their coaching behaviours based on their own training experiences, which were very different from what exists currently.

Transferability. As described by the participants, transferability as a measure of competency entailed being able to practice neonatal resuscitation successfully in different environments with different resources and personnel as well as being able to maintain their competency over time. Tertiary care training environments with subspecialty focus are not always representative of clinical practice. This "disconnect"—lack of communication and congruence of curriculum between community and tertiary training environments for neonatal resuscitation—was reported as a significant barrier to acquisition of competency. Inherent challenges in the community included the variable skills and experience of the interdisciplinary team, availability of resources, and a lack of confidence in their own leadership. In addition, gaps in preceptor knowledge and communication were identified. Strengths of the community setting included: more autonomy for the learner; a high volume of clinical cases with particular emphasis on the "normal"; and the opportunity for observed feedback with preceptors. In comparison, tertiary centre experiences were perceived to be "overwhelming" with a demanding workload and limited opportunity for direct observation and feedback from faculty.

Strengths of the tertiary centre experience included variety and a high volume of acute clinical cases facilitating technical skill expertise and self-confidence as well as a strong

academic focus on physiology and knowledge translation.   In addition, existing competency

assessments are designed almost exclusively for tertiary care centre practice. This exposes a

significant gap in the competency continuum and is a barrier to the acquisition of competency,

as this resident described: "You look at my particular skills, I have gotten the check boxes but

yet there is still a huge gap between what the program has laid out for me and actually feeling

like I would provide a good service to the community" (Resident 4).

Self-efficacy. Similar to barriers related to graduated responsibility and readiness for

practice, the residents also described a lack of initiative, perspective, and self- directed learning

on their own parts during their clinical rotations. They described being overwhelmed during

their initial rotations where they just wanted to "get through" (Resident 1) meeting program

requirements versus actually working towards developing competency. The acuity and team

dynamics of the NICU were described as being challenging from a role identification standpoint,

as illustrated by this resident who described her experience in the NICU as "walking into a

dysfunctional family event and not wanting to bother anybody" (Resident 5). They identified a

lack of willingness and drive to put themselves in difficult and unfamiliar situations, even in

simulation scenarios. As a result of this, both residents and pediatricians described a sense of

anxiety and inadequacy with regard to overall competency in neonatal resuscitation. They

related this lack of self-confidence to their perceived lack of competence at the end of training

and worried about implications for future job opportunities and patient care, as this resident

described:

Whereas I feel that I stand a chance now at being comfortable intubating by the

last day of my residency, but I would not feel that translates into practice because

two weeks later I think, oh man can I still do it? I don't know? And that would

affect where I would be comfortable working for sure. (Resident 5)

In addition, the challenges of dealing with adverse events, guilt, and second-guessing one's own

performance based on lack of confidence, were additional barriers to self- efficacy given the

enormity of the implications of a missed/delayed step. This is highlighted by this resident:

I think that is what will really eat at you afterwards ... knowing that after you

head home for the day you will run through the case a million times. And so, for

peace of mind, you have to know that even though there was not a good

outcome that we really tried our best and there was ... we could not have done

one more step or we missed this step. (Resident 1)

Compounding the issue, some residents described a hesitation to ask questions, to

request clarification or assistance in procedures for fear of "looking dumb." Others also

identified challenges with advocating for specific learning opportunities or closer supervision.

They described self-advocacy as a personality trait and felt that some colleagues may lose out

on learning opportunities given the constraints of the environment. They felt conflicted by an

inherent need to do more call or build exposure with other competing interests of work/life

balance. The residents overall did not feel that seniority conferred a degree of competency.

Finally, even now in practice, the pediatricians described being "terrified" (Pediatrician 3) of a

baby needing intensive care support. They described a fear of being unable to perform a skill

given prolonged lack of exposure. In retrospect, they described a lack of perspective at the time

of graduation, being unsure of what they did not know as well as challenges with the responsibility that independent practice involved, as described by this pediatrician:

> Everyone is looking at you…. Even for simple things that is how the response is. Even though it is nice to hear that they look up to you for things. But then when you are in a situation where things are not going well then you feel like you are the only responsible person, and everyone is backing off a bit. So that is the biggest challenge. (Pediatrician 3)

This burden of responsibility is further illustrated in the context of an unsuccessful neonatal resuscitation.

Performance under Pressure: Unsuccessful Resuscitation and Redirection of Care

In this section, the participants' perspectives on their own competencies in neonatal resuscitation are explored through the lens of a neonatal resuscitation where there was a need to transition from acute resuscitation to end-of-life care. Both residents and pediatricians could relate to a situation in which one has to redirect care in a neonatal resuscitation. They described in all instances an acutely ill infant needing a high degree of intensive care support, for example, a 33-weeker with diaphragmatic hernia, a 25-week infant with perinatal depression, and a term infant with hypoxic ischemic encephalopathy. The pediatricians described situations that demanded a thorough knowledge of complex transitional neonatal physiology and an expertise in technical skills as well as rapid clinical decision-making. They described a conflict with established guidelines that recommend stopping care after 10 minutes

of resuscitation, given that, in practice, recommended timelines are extremely difficult to implement and adhere to. From a leadership perspective, the pediatricians described situations that involved navigating challenging team dynamics, demonstrating situational awareness, and appropriate resource utilization.

The biggest challenge that the participants described was the ability to make the decision to redirect care. The pediatricians narrated their clinical experiences when they struggled to determine the steps of decision-making. They described feelings of intense fear associated with this irrefutable decision—fear that incompetence might have led to a situation that now required redirection of care and of the potential medicolegal actions that may be associated. The pediatricians also narrated the difficulties they encountered in facing the parents during their time of grief. They discussed the burden of the tremendous sense of responsibility involved in ascertaining the endpoint. In addition, they described fear, a lack of knowledge, and feelings of self-doubt and guilt with respect to this decision, as these participants reflected:

> As a treating physician you always feel like I have not completed or done what I should have done. What would happen if I resuscitate for five more minutes and the baby might turn around? That is always in the back of your mind. You feel like you are responsible for this child and you have to answer to the parents.
>
> (Pediatrician 3)

The residents described very limited experience with the clinical situation of withdrawal of life-sustaining treatment in neonatal resuscitation. When asked about their individual

comfort around decision-making with regard to redirection of care, the residents rated their

comfort level as between 0 and 2 on a scale of 1 to 10. The reason they gave the scores of 0 to 2

were related to a lack of confidence in their own competency to successfully manage a dying

neonate, as this resident reflected:

> How do I know when we are done? How do I know that it is okay to say to the
>
> family, based on what we know about the baby ... we probably should not pursue
>
> further medical stuff and we are going to go more palliative? So, to make sure that
>
> I know myself that we have done enough. I am not sure how I will know that.
>
> (Resident 2)

The emotional burden of this decision was another aspect discussed by the

pediatricians. They described a strong need for their decision to be justified and ratified by

others as being the right thing in the given circumstances. The pediatricians narrated

experiences where they witnessed their colleagues' anguish and suffering in the event of an

unsuccessful resuscitation, where perceived incompetency may have contributed to the

outcome, as detailed below:

> …even seeing pediatricians with 20 years of experience and it haunts them, and it
>
> haunts them. I know in my heart they did everything they could but being haunted
>
> by it. They are talking to every single friend they have in the department and
>
> asking them if they would have done that. (Pediatrician 3)

They acknowledged the personal trauma associated with these situations and its implications

on career choices. The residents also described anecdotal encounters of community hospitals struggling to find physician coverage, given the fear of an unsuccessful neonatal resuscitation. They also identified the challenge of balancing their own emotions while supporting the bereaved family through their loss. They described practical challenges related to the death of the baby—what to do with the baby who has passed, navigating the family's reactions to the dying process, eliciting their goals and values, and eventually supporting memory-making. The emotional burden of the encounter is highlighted by this pediatrician's narrative:

> Honestly, they were just screaming, there were no words really. We had to close down the Emerge to visitors so that people would not be witnessing this. And we took the parents to a calmer area where they could have their grief privately. But the mom was ... there were no words. (Pediatrician 3)

From a communication standpoint, the pediatricians felt that this news was best communicated through multiple encounters versus an abrupt declaration as it allowed for better preparation. They acknowledged the need for prioritizing the family's needs above everything else.

The pediatricians compared experiences in tertiary and community centres and spoke to the isolation experienced as the physician making the call even in circumstances when they knew that the situation was irreversible (e.g., 45 minutes of vital signs being absent). They expressed the need for having their decisions ratified by the tertiary centre, especially as a recent graduate, as this pediatrician recounted:

...if for your own individual peace of mind and to reassure you that you have done

everything. But also, it is for the medicolegal purposes. So, if someone comes back

and says, okay you made this decision. So, I think it is important that it is a team

decision and not like an individual physician's decision. (Pediatrician 5)

The pediatricians also described additional challenges unique to the community setting; these included a lack of individual and team expertise as well as a lack of allied health resources (e.g., social work). Residents and pediatricians identified both the need for and the challenge of involving the entire team in the decision-making process. Finally, the pediatricians acknowledged a general feeling of lack of readiness amongst their cohort for this very difficult situation in neonatal resuscitation:

So, I think that everybody seems to be in the same boat. So not having the

expertise of a skill set. So, what do you do and how do you disclose that kind of

information to the family? That is what I feel is the biggest drawback. We are all

not having so much experience and no one feels quite comfortable dealing with a

situation like that. (Pediatrician 3)

Both groups of participants expressed strong sentiments about their individual journeys towards competency acquisition. They expressed a certain degree of frustration and disappointment at their own perceived incompetency in neonatal resuscitation despite having completed requisite training, as this pediatrician reflected: "Even at this point with four months out of residency. I don't feel comfortable putting {in} a UVC. I would have thought that at completion of my residency that I could confidently intubate without me worrying about it"

(Pediatrician 1). This resident summarized well the expectations of training and their own

individual performances of all the participants when he said:

> Not everything will be perfect, and you can't prevent that. but I think the hope is
> that coming out of training you will at least have some sense of knowing that you
> could look at the parents in the eye and say, I am so devastated that this
> happened to you, but we have tried everything that we could for your baby.
> (Resident 4)

The experiences and emotions expressed by the participants when dealing with an

unsuccessful resuscitation that required redirection of care illustrate the different competency

attributes in neonatal resuscitations as well as highlight the gaps in current training and

assessments. They also delineate the importance of the individual journeys of competency

acquisition within the existing curriculum.

Chapter 4: Discussion

This study examined the perspectives of residents and recently graduated pediatricians regarding the characterization of neonatal resuscitation competencies and the barriers that challenge the process of competency acquisition and assessment. From the experiences and perspectives of participants, competencies were characterized into four themes: medical expertise, leadership, transferability, and self-efficacy. In order to achieve readiness for practice, however, the "sum" of these four aspects of competency needed to be greater than the individual parts. Informed by this work, this chapter first proposes and discusses a dynamic conceptual model of evolving competency acquisition in neonatal resuscitation. Next, the enablers of and challenges to this process are analyzed in the context of this conceptual model and the current literature. Finally, the limitations of this study and considerations for future research are described.

Exploring a Graduated Model of Competency Acquisition in Neonatal Resuscitation

Based on the experiences of participants and grounded in the educational theory informing this methodology, we describe a conceptual competency model for neonatal resuscitation that is analogous to the smooth sailing of a constructed vessel across potentially rocky seas (as depicted in Figure 3).
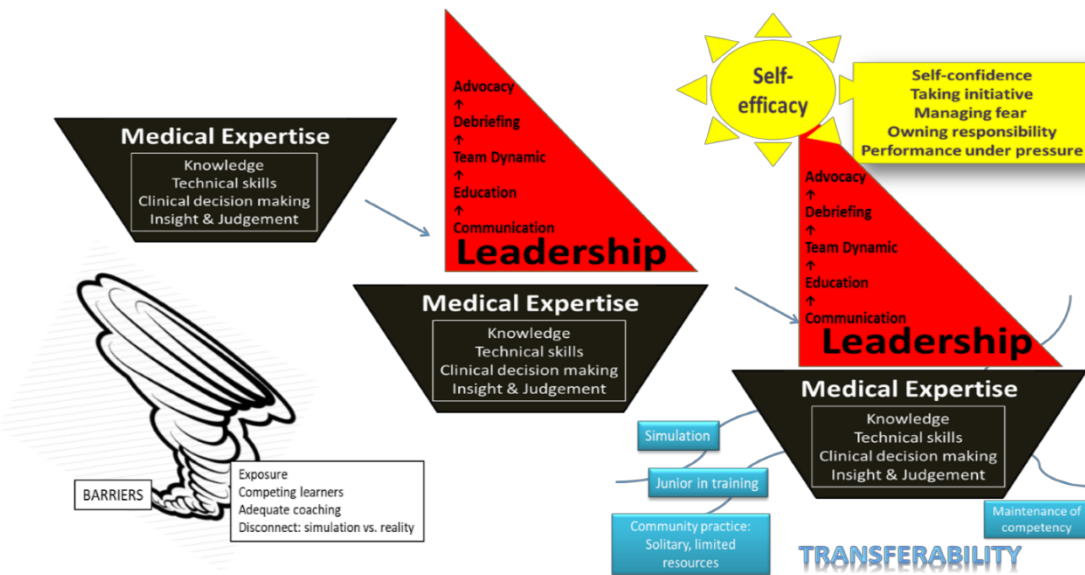
Figure 3. An evolving model of competency acquisition in neonatal resuscitation. The conceptual parts of this model include:

1. Establishment of a solid foundation (i.e., the hull) = medical expertise

2. A strong sail to effectively harness navigational forces = leadership

3. The ability to sail across uncharted waters = transferability

4. Mastery over the elements = self-efficacy

Key to the effective and successful functioning of this model is both the graded acquisition of expertise in all the individual attributes as well as their interdependence allowing for eventual competency. The interrelated roles of the four aspects of competency in the conceptual model are discussed below.

Medical expertise. Medical expertise was described as the cornerstone of competency

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in neonatal resuscitation. It represents the hull of the ship and serves as its foundation. It must

be robustly constructed, or it will not survive its maiden voyage. In addition, over time it may be

prone to wear and tear without regular upkeep. In neonatal resuscitation, robust construction

includes expertise in transitional neonatal physiology and the acquisition of technical skills.

Equally important, the wear and tear over time represents the lack of knowledge and skill

retention, as well as the increasing challenge of clinical decision-making.

Current literature focusses on technical skills and aspects of transitional physiology as

key concepts of knowledge in neonatal resuscitation (Manley et al., 2017). The limited

proficiency in neonatal intubation reported in our study population was concurrent with the

literature (Bismilla et al., 2010; DeMeo et al., 2015). Studies measuring knowledge retention in

neonatal resuscitation have predominantly focused on improving knowledge of the NRP

algorithm, with limited success (Chan et al., 2019; Cutumisu et al., 2019). Even deliberate

practice and mastery learning simulation interventions were unable to prevent decay in NRP

skills beyond a 4-month period. (Matterson et al., 2018). In our study, aspects of medical

expertise described by the participants included not only algorithm knowledge and technical

skill proficiency, but also a superior level of clinical decision-making, judgement, and insight.

Participants highlighted clinical rotations and simulation training as enablers of certain aspects

of medical expertise; however, these fell short of achieving "competency."

The two main barriers to achieving "competency" related to medical expertise were

described lack of exposure by participants (despite having mandatory clinical rotations and

simulation training in RCPSC programs) and the lack of development within that exposure of

reflective clinical judgement and insight. Minimum block rotations challenge ongoing exposure, as do reduced working hours and yearly night float systems. During their clinical rotations, there was also competition for exposure to technical skills and procedures across learners in disciplines with overlapping scopes of practice. The increasing use of non-invasive ventilation has also affected acquisition of technical skill expertise with an overall decrease in frequency of procedures. Finally, the majority of infants now requiring intubation in tertiary centres are "high risk, extremely low birth weight infants" and thereby unsuitable "procedures" for junior learners. Therefore, the ability for learners to progress in this environment from a "junior" to a "senior" role is challenged by exposure, and additionally, this challenges the development of higher-order competencies related to decision-making, judgement, and insight.

In this context, distributed practice strategies could address barriers related to inadequate exposure by revisiting neonatal experiences longitudinally throughout their training at varying levels of seniority and experience. In addition, the application of deliberate practice during their clinical rotations could help enhance development of critical thinking and judgement skills. For junior trainees, this would involve developing reliable assessments of what is "normal" versus "abnormal" in history and physical examinations. Clinical encounters with a focus on initiation of intensive care interventions—such as determining and performing intubation, initiating vascular access and volume resuscitation, and choice of inotropes—would be appropriate for senior residents. Finally, for trainees transitioning to independent practice, decisions for transport (to/from the community) and evaluations for disposition and readiness for discharge would be congruent with their level of training. Deliberate practice interventions provide for ongoing strengthening of the hull structure, recognition of areas of wear and tear,

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and implementation of strategies to address them. For the competency of medical expertise in

neonatal resuscitation, it helps to develop mastery in knowledge and clinical decision-making as

well as ensure ongoing skill retention.

Potential challenges that may be encountered in the application of these deliberate and

distributed practice interventions include limited faculty education and skill. In addition, these

interventions require time commitments that may be difficult to integrate alongside a busy

clinical service and multiple competing learners.

Leadership. In the literature, leadership as a competency is described exclusively in the

context of a behavioural skill in a resuscitation scenario with a focus on teamwork,

communication, and immediate resource allocation (Salas et al., 2009; Kattwinkel et al., 2016).

From an assessment standpoint, tools designed to assess competence in neonatal resuscitation

have been limited from a construct validity standpoint, as the question that tested leadership

was, "Did this resident lead the resuscitation?" with yes or no as the answer options (Kane &

Laurent, 2018). There is a paucity of literature around the dimensions of the leadership role in

the context of "competent physician."

In our study, leadership was described as an important step in the graded evolution of

competency. Leadership represents the sail of the boat that harnesses the wind, creating

propulsion and allowing for effective navigation. It is dynamic, able to adapt, to unfurl or tie

down, or to pick up or lose wind as needed. This study describes the leadership competency in

neonatal resuscitation beyond the immediate resuscitation encounters. These responsibilities of

a leader can only be carried out successfully once there was establishment of "competency" in

medical expertise. The participants described the characteristics of leadership in neonatal

resuscitation as the ability to: navigate challenging and heterogeneous team dynamics;

communicate effectively with the team, families, and consulting physicians; and conduct

meaningful debriefings following resuscitation. They also described roles that involved

providing education and advocating for personnel and resources at different hierarchical

organizational levels.

Barriers that affected acquisition of leadership attributes in neonatal resuscitation

included lack of opportunity, lack of role modelling, and inconsistent coaching. In the specific

role of a leader in a neonatal resuscitation, the participants reported a total of one to seven

experiences throughout training. The pediatricians described first-time experiences in the

expanded construct of leadership occurring only after they had transitioned to independent

practice.

Simulation encounters during training provided some exposure to the leadership role in

a resuscitation scenario with opportunities to develop communication strategies. Coaching

incorporated within the training curriculum may be a strategy to address these challenges. In

health care, coaching has been described anecdotally as a means of knowledge transfer,

predominantly in surgical specialities. Highlighting the role of the coach, Atul Gawande (for the

New Yorker) wrote, "No matter how well-trained people are, few can sustain their best

performance on their own. That's where the role of coaching comes in" (Gawande, 2011, p.1).

The role of the coach in training for neonatal resuscitation needs further exploration,

understanding, and redefining. Coaching provides the opportunity for direct observation,

allowing for knowledge building and constructive feedback in the moment. However, this is

entirely dependent on the coach's skill. This study's results challenge the assumption that

clinical preceptors automatically function as good coaches. A lack of skill and insight in the

coach inhibits development of competency, highlighting the need for ongoing faculty

development and training.

Transferability. Through deliberate clinical encounters, distributed across time with

guided opportunities to develop leadership skills, practitioners may achieve the next important

competency illustrated in our model, that of transferability. Transferability as an attribute of

competency is the ability to successfully transition across environments: from simulation to

senior learner to transition to practice; in tertiary or community settings; with heterogeneous

resources; or with new interdisciplinary teams. In addition, it involves the maintenance of

competency across environments and over time. In this way, transferability as a competency in

neonatal resuscitation has not been described before. It is, for individual practitioners, the

ability to successfully sail across unknown waters.

Newborn care in Canada is regionalized along levels of specialization related to acuity

and complexity of care requirements. These different levels of health care are heterogeneous

in terms of available equipment, personnel, and training experiences. In addition to the

different geographical environments, a challenge with the transference of procedural skills

learned during simulation to the clinical learning environment has also been reported (Finan et

al., 2012). In our study, the participants described siloed learning experiences in regard to

training during simulation, in community rotations and within the tertiary care centre. Though

each environment possessed its own strengths and challenges, a bigger challenge was the lack of linkage or consolidation of training across these encounters.

Transferability strives for successful application of knowledge, skills, and behaviours across environments. Inherent to this competency is the learner's ability to adapt to different clinical situations. It is about having the flexibility and openness to continue to build on a robust collection of skills. Recognizing this future aspiration of readiness for practice, transferability needs to be integrated conceptually across the residency curriculum. In part, distributed practice may ensure a longitudinal exposure across environments (simulation, community, tertiary) and coaching, when optimized, could develop skills of adaptability in learners. However, the bigger picture—"curriculum integration"—would need to be organized at a program level.

Self-efficacy. Expertise in technical skills, clinical judgement, leadership qualities, and adaptability across environments were all aspects required in the development of self-efficacy in neonatal resuscitation. Lacking self-efficacy was what worried participants most when facing the challenging scenario of a full neonatal resuscitation. In our study, self-efficacy represented the spectrum of taking initiative, owning responsibility for one's decisions, managing fear and doubt, and being able to perform instantaneously under pressure. It was mastery over the environment, whatever the conditions. The practice of neonatal resuscitation involves dealing with critical situations, sometimes involving life and death decisions, or ones with long-term sequela. Self-efficacy in neonatal resuscitation is therefore the aspect of competency that allows an individual to successfully combat "choke" and perform under pressure. Suboptimal

performance in neonatal resuscitation has impact—on infants, on families, and on

communities. It is not surprising, therefore, that participants were deeply concerned about their

own perceived lack of self-efficacy. This was most evident in their accounts of failed

resuscitation efforts and scenarios resulting in redirection of intensive care. This experience

raised issues of self-doubt, guilt, and lack of preparedness through their training. Perceived 'lack

of competence' and self-efficacy of the participants was self-reported and not compared to

objective methods of assessment as this was not the purpose of this study. The literature reports

challenges with physician's ability to perform self-assessments. In a systematic review that

compared self-reported assessments with objective measures of competence, the authors

reported low accuracies for self-assessment (Davis et al.,2006). In this context, Kruger & Dunning

(1999) make the argument that "the skills that engender competence in a domain are often the

very same skills necessary to evaluate competence in that domain" (p.1121), with incompetence

leading to overestimated and inaccurate self-assessments. In our study however, the

participants rated their skills lower given a perceived lack of self-efficacy. There is a paucity of

literature exploring the implications of evolving self- efficacy in neonatal resuscitation and none

addressing how training can improve self- efficacy.

While Surcouf et al. (2013) reported an increase in residents' self-confidence after an

unannounced simulation, participants in our study did not report improvement in self-

confidence through simulation. Self – confidence refers to strength of belief and was an

important component of self-efficacy in our study. Related to this, participants were unable to

translate confidence from training or simulation experiences towards perceptions of readiness

for practice. In addition to a solid foundation of knowledge, skills, judgement, and adaptability,

the integration of an individualized preceptorship or coaching model to enable the development of self-efficacy in this model needs further study.

Limitations. The limitations of this study are described in the context of Lincoln and Guba's validity criteria of transferability. Given that this a single center study, some of themes expressed could be biased by the center's training practices and resources. However, the transferability across centres was not a focus of this study, which focused on the development of a conceptual model for competency acquisition in neonatal resuscitation using an existing theoretical framework. The constructs described in this model could be transferable to other disciplines. The potential for investigator bias must be acknowledged given the investigator's professional affiliations. This is, however understood to exist within the methodology of interpretive design. Every attempt was made to ensure the data collection and analysis was trustworthy through audit trails, reflexive journaling, code recode strategy, peer debriefing, member check and triangulation across investigators.

Informing Future Training in Neonatal Resuscitation: What to Do in the Shipyard

Through the self-reported experiences of trainees and practitioners and informed by educational theory, this study describes a "sailing ship" conceptual model for competency acquisition in neonatal resuscitation. This model incorporates a graduated and interdependent acquisition of four key components. Postgraduate residency training is meant to provide the blueprints, the materials, and the labour involved in building this model. It also enables the acquisition of skill to successfully navigate the seas, in both smooth and rough conditions. This study integrates educational theories of distributive and deliberate practice, with new

understandings of adaptability and self-efficacy as well as strategies to address the "choke"

phenomenon in neonatal resuscitation training. Beyond traditional clinical rotations and

simulation encounters, further educational strategies, such as coaching, may close the gap

between competency checklists and true competency acquisition. An understanding and

application of this model may thus inform the development of new competency-based

curricula. From an assessment standpoint, the integration of innovative self-assessment

methods along with existing objective assessments needs further exploration.

Appendix 1: Focus Group Outlines

Focus Group Interview Script I

Good morning everyone and welcome to today's focus group session. Thank you for taking the time to join us today. I (Mary Woodward) will be conducting today's focus group session. The goal of this focus group is to understand challenges around competency acquisition in the knowledge, technical and behavioral skills required for successful resuscitation of the newborn. We would also explore how current training programs equip trainees for independent community practice. The results from this study will be used to design a simulation-based curriculum that will aim to address potential barriers towards competency acquisition as well as incorporate self - reflection, coaching and feedback. We will be tape recording this session. Data collected will be completely confidential. Transcripts of the sessions will be available for participant review. Please feel free to express your thoughts, experiences, insights and perceptions as results from this study will help towards ensuring optimal knowledge translation and competency acquisition that will also ensure patient safety and best quality of care.

Thank you once again for joining us. We will now begin this session.

Focus group questions:

1. What does competency acquisition in neonatal resuscitation mean to you? What does preparedness for independent practice?

2. Can you describe a neonatal resuscitation where you felt there was a breakdown of skill/ performance?

3. What are your thoughts on performance in a training simulation versus real life resuscitation**?**

4. Can you describe your experience of a resuscitation scenario where there was redirection of care towards a palliative care plan? What do you think are the challenges of such a clinical scenario?
   How comfortable are you with the decision making around redirection of care?

5. a) How does current residency training ensure competency acquisition and preparedness?

   b) What do you think are the challenges/ barriers towards successful competency acquisition and preparedness for independent practice? Why do you think these barriers/ challenges exist?

6. a) Describe how competencies in neonatal resuscitation were assessed during your training.

   b) In your opinion, what role do

      i) formal assessment (ITER/Observation),

      ii) self-reflection, and

iii) coaching (a process that allows learning and development to occur facilitating improved performance) play in competency acquisition?

Summary and closing question:

After a brief oral summary, the investigators will ask the participants," Is this reasonable summary? Is there anything else you would like to add? Thank you for your time today? Would you be interested in receiving a summary of today's discussion?

If there are any additional thoughts, you would like to share after today please feel free to contact me at woodwm@mcmaster.ca.

Telephone number: 289.680.2584; Pager number: 6570

Focus Group Interview Script II

1. Brief introduction for transcription purposes {check recording}

2. Outline goals for this focus group- presentation of themes for validation, some additional questions for clarification.

3. Clarification of question 6: What is the role of debriefing and coaching in an acute situation? In a level 3 environment? In the community?
   What barriers have you encountered to 'good coaching' or 'effective debriefing? (20 minutes)

4. Clarification of question 5: How do you measure competency? What do you see are

the barriers to acquiring competency?

5. Clarification question: What does preparedness for practice mean? How is it different from competency acquisition?

6. Here is what a group of Pediatricians / residents who took part in one the focus groups said about training and evaluation related to readiness for practice / competency acquisition. Would you have anything to add to their experiences?

Present summary statements questions 2,3,4, ask participants if any questions/clarifications, anything they would like to add.

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