MULTI-LEARNER, MULTI-LEVEL, MULTI-COMPETENCY SIMULATION

A MULTI-LEARNER, MULTI-LEVEL, MULTI-COMPETENCY SIMULATION APPROACH TO COMPETENCY-BASED EDUCATION OF OBSTETRICAL EMERGENCIES

By VALERIE MUELLER, B.SC., M.D., FRCPSC

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Lay Abstract

This study examined a simulation curriculum for obstetrical emergencies using multiple postgraduate learners in various roles, to provide a learning opportunity and assessment opportunity, for a number of skills required by the Royal College of Physicians & Surgeons of Canada.

It was found that involving learners in various roles, including responders; confederates acting as nurses, patients and family members; and assessors, enhanced learning in regards to patient management, communication, collaboration, assessment and health advocacy while reducing financial costs and faculty time requirements.

Abstract

The CanMEDS 2015 Framework outlines many key competencies that must be addressed during residency training. The move towards the "Competency by Design" curriculum will require the use of simulation for assessment of these competencies. However, the use of simulation poses many challenges for residency programs including meeting the learning needs of multiple levels of learners, financial constraints, time constraints etc.

We performed a program evaluation on an obstetrical emergencies simulation curriculum that involved Obstetrics and Gynecology residency trainees (PGY1-PGY5). Different levels of learners participated in various roles including; first responder (PGY2), second responder (PGY5), confederate roles including patient, nurse or family member (PGY1-3) and assessor (PGY4). This permitted assessment of the following CanMEDS competencies: medical expert and communicator (PGY2); communicator and leader (PGY5); communicator, collaborator and health advocate (PGY1-3) and scholar (PGY4).

We were able to determine financial costs, faculty time, and resident time for our existing simulation curriculum and our new simulation curriculum.

Residents were surveyed prior to the simulation regarding the learning environment in our pre-existing simulation curriculum and self-efficacy ratings for the competencies mentioned above. Faculty were also surveyed prior to the simulation regarding the residents' competencies. Station scores were collected for all competencies. Focus groups allowed further exploration of the residents' and faculty perceptions of the new simulation experience. Lastly, post-simulation surveys of both residents and faculty

allowed comparison of pre- and post- learning environment assessment and self-efficacy/performance scores.

We had limited station scores from our pre-existing simulation curriculum to allow direct comparison between the specific scenarios

The program evaluation determined that this method of incorporating multiple levels of learners provided a feasible and acceptable method of assessing multiple CanMEDS competencies while minimizing financial costs and significantly reducing faculty time requirements.

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List of Abbreviations and Symbols

Multi-LLC	Multi-Learner, Multi-Level, Multi-Competency
RCPSC	Royal College of Physicians and Surgeons of Canada
CBD	Competency by Design
CBME	Competency based medical education
CAS	Complex adaptive system
SBME	Simulation based medical education
EPA	Entrustable Professional Activity
CPR	Cardiopulmonary resuscitation
OSAT	Objective Structured Assessment of Technical Skills
ITER	In-training Evaluation Report
CATS	Communication & Teamwork Assessment Tool
CRM	Crisis Resource Management
OSTE	Objective Structured Teaching Examination
OSCE	Ojective Structured Clinical Examination
OB/Gyn	Obstetrics & Gynecology
CIPP	Context-Input-Process-Product program evaluation framework
HIREB	Hamilton Integrated Research Ethics Board
PGY1	Postgraduate training year 1
PGY2	Postgraduate training year 2
PGY3	Postgraduate training year 3
PGY4	Postgraduate training year 4
PGY5	Postgraduate training year 5
PPH	Postpartum hemorrhage
SD	Shoulder dystocia
CP	Cord prolapse

(List of Abbreviations continued)

PET	Preeclampsia/Eclampsia
ANTS	Anesthetist's Non-Technical Skills Assessment Tool

1.0 Introduction

Recent changes to residency education requirements by the Royal College of Physicians and Surgeons of Canada (RCPSC) are forcing residency programs across the country to reconsider their curricula and assessment methods in order to meet these requirements pertaining to the CanMEDS 2015 Framework, and, more specifically, the Competence By Design (CBD) framework, which focuses on outcomes in regards to competence within a learner-centered framework. Importantly, CBD requires a new approach to the provision of training across all of the CanMEDS competencies that increases the focus on assessment and ensuring trainee competence in all relevant areas prior to independent practice. In this regard, simulation has been identified as a particularly important tool for both learning and assessment as it provides programs with a means to ensure competence in the management of increasingly rare emergency situations.

The Department of Obstetrics & Gynecology at McMaster University (Hamilton, Canada) has had an obstetrical emergency simulation program in existence for a number of years. However, acknowledging the requirements of the CBD framework, the department conducted a needs assessment in order to identify strategies to best meet competency assessment requirements specifically within the simulation curriculum. This assessment was performed by the Department's Residency Program Committee and Postgraduate Education Curriculum Committee, and involved an in depth review of the RCPSC requirements for competency in obstetrical emergency management. With consensus across the committees, the needs assessment determined that in order to meet the requirements of CBD and optimize resources within the department, the priorities moving forward would be to:

1. increase the breadth of learning and assessment,
2. maintain and improve resident learning,

3. reduce monetary costs and faculty time commitment,
4. improve resident acceptance of the program's simulation curriculum.

Interestingly, the assessment recognized that the previous simulation curriculum had focused primarily on the competencies of medical expert and collaborator, neglecting the other CanMEDS roles. It therefore did not meet the requirements of the new CBD framework. Thus, the need to increase the breadth of learning and assessment within the simulation curriculum was identified. In making these adjustments, the need to ensure that we maintain the high levels of learning that were present with our previous simulation curriculum was also identified. Furthermore, budgetary constraints and the fee-for-service payment structure for physicians within our department place limitations on the provision of our simulation curriculum such that any changes that are made will need to reduce costs and, potentially, reduce faculty commitment. Lastly, the assessment revealed a perception that the residents' acceptance of simulation curriculum was low. In this regard, the Department desired to improve this acceptance to ensure that residents are engaged fully in this learning opportunity.

1.1 CanMEDS

In considering how to address these priorities, it is important to consider the role of the RCPSC, and how the CanMEDS framework has evolved over time. The Royal College of Physicians and Surgeons of Canada is responsible for the training of physicians and the maintenance of competence extending beyond residency training in Canada. In the 1990s, the first CanMEDS framework was developed with the main purpose of improving patient care through enhanced physician training. Although CanMEDS was developed and fully adopted by the Royal College in 1996, it has now become a framework embraced by many countries around the world. Revisions in 2005, and again in 2015, have contributed to its continued success. The revision in

2005 became the basis for the educational standards in residency training and was incorporated into the accreditation requirements, the examinations, and the standards for specialty training. The revision in 2015 introduced the new theme of patient safety as well as the concept of competency based medical education (CBME) which they named, Competence by Design (CBD).

In summary, this framework identifies seven key roles, which are required for physicians to care for their patients. The *medical expert* role encompasses the competencies related to the development of management plans for patient care. The establishment of therapeutic relationships with both patients and families, including the ability to share information and management plans, is captured within the *communicator* role. The *collaborator* role describes the ability to work effectively with other physicians and members of the health care team. The *leader* role, previously the *manager* role, incorporates the ability to provide leadership in practice and within the health care team to improve health care delivery. The *health advocate* role describes as the ability to respond to the needs of patients and their communities. The skills of teaching and continued learning are encompassed within the *scholar* role. Lastly, the demonstration of the commitment to patients, society, and the profession are related to the physician's *professional* role.

1.2 Competence by Design

CBD is an outcomes-based approach to curriculum design in postgraduate medical education. Although the practice of medicine has changed significantly over the past 100 years, there has been little change to the structure and process of medical education. Despite the increasing skills and knowledge required of our learners, and the growing accountability to society and governing bodies, many residency training programs remain unchanged in the manner by which they educate and determine their learners competent for independent practice. According to Frank and colleagues (Frank,J.R., Snell, L., ten Cate, O., Hombloe, E.S., Carraccio, C., Swing,

S.R., etc., 2010), CBD is an approach to training physicians that focuses on abilities that have been determined by the needs of society and patients. In this framework there is less emphasis placed on modules of time and a greater emphasis on accountability, flexibility, and learner-centeredness. Thus, students assume a greater responsibility for various aspects of their training, including their own learning and assessment. In CBD, the achievement of competence is obtained by identifying the various milestones that progress a learner from a novice to an independent practitioner. Therefore the curriculum must be modified to allow the progression of competence through the various milestones.

While there has been an increasing interest in CBME over the past 15 years, literature discussing outcomes-based education dates back over 60 years. Frank and colleagues (2010) grouped the recent arguments in favour of CBME into four themes. The first referred to a focus on curricular outcomes. Currently, there exists a failure of training programs to ensure that their graduates have demonstrated competence in all domains required of independent practice. Moving forward, there needs to be a focus on expected outcomes in training and assessment. The second theme reflected the current tendency to emphasize knowledge related to an objectives-based approach - to the detriment of skills, attitudes, and higher order aspects of practice – and suggests an increased emphasis on abilities needs to be put in place. The third theme de-emphasized time-based training. The current focus on time spent as a surrogate marker for achievement of competence has been detrimental to learners at the extremes of the continuum; both those that are progressing more slowly or those progressing more quickly than the average learner. The implication is that curriculum design needs to be flexible with respect to time requirements and to focus directly on the acquisition of skills. Lastly, the fourth theme indicates a need to focus on the promotion of learner-centeredness. There has been a failure of training programs to address

educational activities so as to meet the needs of individual learners. As noted previously, CBME encourages learners to take a larger role in regards to their participation in, and responsibility for, their progress through the various milestones on their path towards competence.

In this view, the competencies that drive the curriculum are observable and their acquisition can be measured and assessed (Frank et al, 2010). Indeed Scheele and ten Cate (2008) emphasize that curricular design within the CBD framework should involve frequent formative assessment. They also emphasized the importance of using a variety of assessment tools to match the various competencies in order to ensure progress through the milestones and achievement of competency.

1.2.1 Assessment within CBD

The assessment principles of CBD are in contrast to assessment in medical education throughout the past century. Throughout the 20th century, assessment in postgraduate education has been primarily based on tests of knowledge (Lurie, 2012). It has been weighted heavily on the medical expert role and much of it has been done outside of the working environment (RCPSC, 2014). Rather than being focused on the more complex competencies of practising medicine, formal assessment methods have been focused on the lower levels of Miller's pyramid (i.e., knowledge and theoretical application) (Miller, 1990). However, the recognition that competence is not represented by success on these tests has increased over the past 20 years (Lurie, 2012). The RCPSC has proposed that assessment moving forward should focus on the early identification of learners requiring remediation by more frequent benchmarking of competence (RCPSC, 2014).

In this regard, Hombloe and colleagues (Hombloe, E., Sherbino, J., Long, D.M., Swing, S., and Frank, J.R., 2010) recognized that, by definition, competency-based education would require an assessment system that was robust and multi-faceted. They suggested that assessment in the context of CBME should be viewed as a complex adaptive system (CAS), which is

characterized by the use of multiple assessment tools. They noted that assessment was not only important for trainees but also served the training programs and the public through mechanisms of continuous quality improvement. Hombloe et al (2010) further emphasized the importance of formative assessment in their outline of what they considered to be the essential features for assessment within CBME to be effective. They justified this emphasis on formative assessment because it best aligns with the concept of the development of expertise through the use of deliberate practice (Ericsson, 2008). The remaining features of effective assessment include ensuring that it: is criterion-based with a developmental approach; is robust and work-based; uses tools that meet a minimum standard; incorporates qualitative approaches; and involves active engagement of learners.

This position is reminiscent of McGaghie and colleagues (McGaghie, W., Miller, G., Abdul, W.S., and Telder, T., 1978), who also discussed the need for assessment tools to be rich and varied. Specifically, they highlighted the need to avoid tools that assess random and isolated aspects of knowledge but rather focus on those that assess the more important problem solving and technical skills. They noted that a training program could not be efficient, economical, or effective without the use of formative assessment. In their view, formative assessment serves as a system of non-judgemental guidance that provides information to the student in a personal and private manner regarding the skills that have been acquired and where further learning is required. Thus, in order to be effective, formative assessment must be provided with a frequency that ensures the provision of guidance but that is also not fatiguing to learners or faculty.

Similarly, the RCPSC has supported the prioritization of formative assessment over summative assessment, stating that it needs to be integrated into all aspects of clinical teaching and supervision. Elaborating on the need for effective assessments, the RCPSC has emphasized

the need for timely and constructive feedback within the curriculum to provide early detection of learners having difficulties and the provision of remediation opportunities. They have also recognized that qualitative and narrative data can be a better predictor of overall competence and long-term competence than quantitative data.

1.3.0 The Use of Simulation

As mentioned previously, the implementation of Competence by Design demands the "*selection of activities, experiences and instructional methods that will assist in progressing learners through developmental milestones*" (RCPSC, 2014, p. 101). As well, programs must be careful in their selection of assessment tools in order to ensure that they are capable of documenting progression through the developmental milestones and achievement of competency while providing frequent opportunities for formative feedback. Simulation is a tool that can be used for both learning and assessment and can assist with this implementation. It provides an opportunity for deliberate practice in a safe environment and provides opportunities for formative feedback that promotes effective learning. As the Department of Obstetrics and Gynecology residency program at McMaster University moves forward with its priorities of increasing the breadth of learning and assessment while improving resident learning, it is crucial to consider the various ways in which simulation can be used.

1.3.1 Simulation for Learning

Ericsson (2008) has advised that educators should provide learning opportunities for deliberate practice in order to develop superior performance in their learners, noting that superior performance does not simply develop from experience, but rather from repetitive practice of a given task with well-defined goals, and the provision of feedback. In this regard, improved learner

outcomes were reported in a study by McGaphie and colleagues (McGaghie, W., Issenberg, B., Petrusa, E., and Scalese, R., 2006) that investigated the use of repetitive practice in the context of simulation-based medical education (SBME). Their findings revealed a dose-response relationship that indicated that more practice leads to better results; across a variety of levels of learners and in a variety of specialties. Thus simulation can provide an opportunity for deliberate practice, making it a potentially superior tool than traditional clinical education for achieving clinical skills acquisition (McGaghie, W., Issenberf, B., Cohen, E., Barsuk, J., and Wayne, B., 2011). In fact, Mc Gaphie and colleagues describe the outcomes favouring SBME with deliberate practice as "*powerful, consistent and without exception*" (McGaphie et al, 2011, p. 4).

In considering how simulation can be used for learning, three additional concepts should be reviewed: the use of role play, learning through observation and progression of learning.

1.3.1.1 Role Play

It is well known that a high level of learner engagement is required for active learning. Role play is a teaching strategy that has been used to promote active learning through an experiential learning technique (Joyner & Young, 2006; Pintrich, P. R., Cross, D. R., Kozma, R. B., & McKeachie, W. J., 1986). It has been reported as a highly valuable teaching tool for the development of interpersonal skills, the development of empathy, and the comprehension of the motivations of others (van Ments 1999). The idea is that in providing experience in both perspectives of clinician and patient, role play leads to a "*greater awareness of the needs of both*" (Joyner & Young, 2006, p. 225). Lane and colleagues (Lane,J.L., Slavin, S., and Ziv, A., 2001) have described it as a very effective method for role-players and observers to promote self-discovery and to improve self-understanding. For instance, post-test survey results from students involved in a role play activity to develop patient interviewing skills found that 97% of students

found role play helpful in providing an opportunity to receive feedback and to experience perspectives of patient and interviewer (Nestel & Tierney, 2007).

A variety of learning theories support the use of role play (Nestel & Tierney, 2007). For instance, experiential learning theory, which encompasses learning in thinking, feeling, watching and doing environments, describes skill acquisition with respect to two tasks: *grasping* and *transforming*. Concrete experiences with abstract conceptualization are essential for *grasping*, while reflection and action are required for *transforming*. The use of structured simulation with debriefing allows for the completion of both tasks within in all four environments. Secondly, simulation-based education with postgraduate learners also resonates with the key elements of adult learning theory: *self-directed learning*, *self-motivation*, *use of diverse previous experiences*, *readiness to learn* and *problem-centered learning*. Furthermore, the use of role-play in simulation also invokes aspects of the theory of reflective practice. Specifically, role play demands learners to reflect-in-action, or consider previous experiences when in the midst of trying to manage a patient, and also encourages learners to reflect-on-action, or reflect on their actions following an event, as part of the debriefing process.

In a study amongst nursing students playing the roles of primary nurse, secondary nurse, and family member in the setting of a simulation of a medical emergency, it was found that students in all roles actively participated in the process of reflection: students in nursing roles reflected on procedures and decision making, while the students in the role of family member reflected on how it felt to be in that position and reflected on different behaviours of the nursing team that would have been helpful to them. The majority of learners in this simulation were able to demonstrate contextual perspective, though the students playing the secondary nurse role expressed less than those in other roles (Kubenfeld & Scheffer, 2006). The development of an ability to understand a

different perspective was also demonstrated in a study that pitted simulations that involved standardized patients against ones that engaged trainees in role-play in the assessment of the development of communication skills in medical students (Bosse, H., Schultz, J., Nickel, M., Lutz, T., Moltner, A., Junger, J., Huwendiek, S., and Nikendei, C., 2012). Certainly, the exposure to both led to improvements in communication skills related to the opportunities for practice. However, it was also noted that the students benefited more from being involved in the role-play scenarios. This was specifically related to their understanding of the patient perspective (Bosse et al., 2012). The authors concluded that the development of empathy for the patient's perspective was a significant advantage to the use of role play. The development of perspective was also documented in a study of medical students involved in obstetrics and gynecology teaching. Students played the role of physician, patient, and observer during difficult patient interaction scenarios related specifically to obstetrics and gynecology. As compared to other educational strategies (i.e. rounds, tutorials, reading resources), role play was found to be the optimal medium for developing student awareness of the patient's emotional needs as well as an effective strategy for learning patient management strategies (Coonar, AS, Dooley, M, Daniels, M and Taylor, RW., 1991).

Taken together, the collected work suggest that the use of role play in simulation can indeed be an effective learning tool in regards to the development of alternative perspectives that can potentially lead to improved patient care through improved communication and collaboration skills. It is often difficult for training programs to develop learning and assessment opportunities specifically for these intrinsic roles. Simulation scenarios encompassing role play could therefore be extremely valuable for this purpose.

1.3.1.2 Learning Through Observation

Simulation also provides a forum for learning through observation. The concept of learning through observation was described half a century ago by Bandura (1961). His position was that the environment influenced people's behaviour, that observation was part of this, and that observational learning was mediated through four distinct processes. The first stage is attention. The idea is that learning can only occur when the observer is paying attention to their environment. The second process described the role of retention and memory. That is, attending to the environment is not enough, and observers must also be able to remember the observed behaviour later in time. During the initiation/motor processing the ability of the observer to have the capacity to physically and/or intellectually to perform the behaviour is reflected. Lastly, through processes of motivation, the learner is able to translate what they have observed into competent behaviour (Bandura & Jeffrey, 1973).

Moreover, Billiet (1996) and Brown and colleagues (Brown, J.S., Colling.,A. and Duguid,P., 1989) described the theory of situated learning, which can also assist in understanding the process of learning through observation. This theory suggests that novices learn a key set of explanations and actions through observation of experienced practitioners. Through this process learners discover what to focus on in their observations, how to link their interpretations to what is being observed, and, lastly, the words and actions that will be present in their performance of the action/behaviour. In this way, learners can develop skills such as clinical decision making in relevant contexts.

While there exists literature around the learning of technical skills in medicine through the process of observation, there seems to be a paucity of literature examining how observation can be used to learn non-motor behaviours related to the medical expert role, such as clinical decision

making. Park and colleagues (Park, J., Woodrow, S., Reznick, R., Beales, J., and MacRae, H., 2010) did perform a study looking at how faculty and residents learn professionalism. The results of their qualitative analysis demonstrated that one of the key methods of learning professionalism was felt to be through observation. This was substantiated by comments such as

"*…working with someone who has a high degree of professionalism, seeing how they interact with people and how they carry on their daily activities, I think you can learn a lot from a person that way…*" (Park et al, 2010, p. 136)

and,

"*…you learn from….watching your colleagues, watching other residents, your senior residents. When you watch them you think, this is how I'd like to be and then you try to model yourself after that…*". (Park et al, 2010, p. 136)

Thus it appears that there is certainly the potential that learners can develop competency with the intrinsic roles through the process of observation, and simulation could be the means through which opportunities for observation are provided. This literature suggests that it may be possible for learners to benefit even if not directly participating, which allows for the accommodation of an increased number of learners. Thus, learning through observation also purports to assist with the financial challenges and faculty time limitations of providing simulation opportunities to a large group of trainees.

1.3.1.3 Progression of Learning

Simulation may also provide an opportunity for progression of learning. A significant component of CanMEDS 2015 is the incorporation of "milestones". Previously the objectives of training considered only the competencies required at the completion of training rather than

considering the way certain skills and knowledge would be obtained along the way. In the most recent CanMEDS framework, milestones refer to "*observable markers of someone's ability along a developmental continuum*" (CanMEDS 2015 Physician Competency Framework). They are a guide for curriculum development. This framework also refers to the "entrustable professional activity" (EPA) which refers to a task in the clinical setting that is assessed to demonstrate competence. Often this competence is accomplished by meeting several milestones.

As residency training programs move towards developing their CBD curricula, it will be important to consider how progression of learning occurs in order to develop a curricular plan and assessment strategies that best guides their learners through these developmental milestones to achieve the related EPAs. Harden (2007) describes four methods by which there can be progression of learning leading to the achievement of the end outcome: increased breadth, increased difficulty, increased utility and application to practice, and, lastly, increased proficiency. Increased breadth of a learning outcome refers to the extension of competence to new areas or contexts. Increased difficulty in regards to progression of learning refers to an increase in the depth of understanding as progression towards the achievement of the learning outcome occurs. The move from knowledge in the classroom to the ability to apply this knowledge in the clinical setting is reflected under the heading of "*increased utility and application to practice*." Taking less time to perform a task while committing fewer errors exemplifies the increased proficiency required for progression. It is recognized that this progression of learning will occur in different rates in different learners and this, as noted previously, is one of the fundamental concepts of CBD. As the move to CBD is made, these concepts will need to be incorporated into curriculum and assessment planning. Carefully developed simulation scenarios could allow for the use of these four methods

of learning progression that will lead postgraduate learners through the required milestones towards achievement of their exit learning outcomes or EPAs.

Guadagnoli and colleagues (Guadagnoli, M., Morin, M.P., and Dubrowski, A., 2012) have also described a progression of learning strategies in regards to technical skills. They suggested that there are three components to consider: practice schedule (random or block), feedback frequency, and learning environment. Learners practising new or complex task require a blocked practice schedule with frequent feedback. Those trying to refine a skill or learning a new simple task, have improved retention with random practice and less frequent feedback. In regards to the learning environment, there should be change as the learner progresses in their skill development; changing from an environment which provides little distraction to the learner's focus on the task at hand, to a more dynamic environment which best simulates the clinical setting.

1.3.2 Simulation for Assessment

As mentioned previously, simulation can not only be used as a learning tool but also as an assessment tool. In considering the components of effective assessment in the context of CBD, Lurie (2012) emphasized the need for reliability. The achievement of reliability in assessment requires large amounts of testing time and resources as reliable clinical performance assessments are reliant on multiple samples from multiple faculty assessors (Lurie, 2012). This challenge, in regards to time and resources, may prohibit the ability to reliably measure performance and meet the demands of assessment posed by CBD for many skills.

Over the past decade there has been an increasing use of simulation for assessment in postgraduate medical education due to limited patient availability for learning opportunities, increased attention to patient safety, and the move towards more outcomes-based education

(Scalese, R., Obeso, V., and Issenberg, S.B., 2008). The fact that simulation can be available readily and simulate a wide array of clinical scenarios, while allowing all levels of learners to participate without patient harm, make it a plausible solution to the challenges mentioned above. With its ability to provide a variety of scenarios in a standardized fashion, it provides a mechanism for reliable assessment across a variety of domains. Issenberg and colleagues (Issenberg, B., McCaghie, W., Petrusa, E., Gordon, D., and Scalese, R., 2000) suggest that the use of simulation-based medical education (SBME) leads to the most effective learning because it is able to provide educational feedback, repetitive practice, a range of task difficulty for various levels of learners, adaptability to a variety of learning strategies, a controlled environment for standardized learning opportunities, and tangible outcome measures. Especially important in their view is the idea that learner self-confidence and perseverance is enhanced by skill acquisition, practice, and feedback in the SBME context. Indeed, simulation can be used to assess many of the CanMEDS competencies: cardiac arrest in a full-body simulator to assess the medical expert role, using a simulated patient to assess the communicator role, or a nursing confederate to assess the communicator and collaborator role. It quickly becomes apparent with this list that in one simulation there is the potential to assess more than one competency as well.

1.4.0 Simulation for CBD

In order for simulation to be effective within the context of CBD, it must be able to be used as a learning and assessment tool for the multiple competencies within the CanMEDS framework; specifically, those most related to effective patient care: medical expert, communicator, collaborator, leader, scholar, and health advocate. In considering how to increase our breadth of assessment, it is important to consider the role of simulation in each of these competencies.

1.4.1 SBME and the Medical Expert Role

As noted, SBME has been used across a wide variety of specialties to provide learning and assessment opportunities for a number of clinical skills, from simple and isolated technical skills to complex patient management skills. As an assessment tool for the competencies related to the medical expert role, simulation has also been found to have the ability to discern different levels of learners as well as proficiency with specific skills. This was demonstrated in a study by Dong and colleagues (Dong, Y., Suri, H.S., Cook, D.A., Kashani, K.B., Mullon, J.J., Enders, F.T., Rubin, O., Ziv, A., and Dunn, W.F., 2010) who explored the use of cadavers and part-task trainers to assess competence at central venous catheter placement by medicine residents. They involved multiple levels of learners who practiced the skill of central venous catheter placement on both cadavers and part-task trainers. Following the workshop learners were then assessed on their ability to place a central venous catheter on a part-task trainer. Results showed that not only could this simulation effectively assess proficiency with the skill but it was also able to discern different levels of learners

Interestingly, it has been reported that residents are experiencing decreased exposure to critically ill patients during their training, specifically pediatric patients (Weinberg et al, 2009). Simulation can be used to ensure that residents receive opportunities for resuscitation practice. Learners that have had this type of practice on a simulator perform better on mock resuscitation drills and display higher adherence to resuscitation guidelines (Weinberg, E., Auerbach, M., and Shah, N., 2009). Similarly, Tubbs and colleagues (Tubbs, R.J., Murphy, B., Mainiero, M.B., Shapiro, M., Kobayashi, L., Lindquist, D., etc., 2009) explored the use of simulation to assess learners' ability to manage potentially life-threatening contrast reactions. Using a scenario for second- and third-year radiology residents, they found that simulation provided a "*valuable means*

of assessing residents' skills and comfort levels in managing severe contrast reactions." (Tubbs et al, 2009, p. 582). Simulation was also used to assess residents' abilities to manage another type of emergency: failed intubation in an obstetrical patient (Goodwin & French, 2001). When combined with practice and formal teaching, simulation has been shown to be a useful tool for assessment of performance in this life-threatening situation.

Of particular interest, simulation in the field of obstetrical emergencies, as a means to assess competencies within the medical expert role and to promote skill retention, has been described by Maslovitz and colleagues (Maslovitz, S., Barkai, G., Lessing, J., Ziv, A., and Many, A., 2007) and Crofts and colleagues (Crofts, J., Bartlett, C., Ellis, D., Hunt, L., Fox, R., and Draycott, T., 2007). Maslovitz and colleagues developed a curriculum of obstetrical emergency simulation scenarios for teams of residents and midwives. They assessed participants using standard checklists and were able to identify and provide feedback regarding the most common errors in management (e.g., unfamiliarity with medical management of postpartum hemorrhage, poor CPR (cardiopulmonary resuscitation) technique, and inappropriate use of episiotomy). Following feedback, those performing sub-optimally were asked to repeat the curriculum six months later. All learners displayed significantly improved performance scores. Crofts' team evaluated skills related specifically to the management of shoulder dystocia. Obstetrical caregivers underwent a workshop regarding shoulder dystocia and then were assessed via a simulation scenario at three weeks, six months, and twelve months following the workshop. The investigators found that skill retention was high. As well, they were able to identify those who required additional training to improve their competency.

Assessment of surgical skills has also presented a challenge to educators. Often learners' surgical skills are practised and assessed in the clinical setting, creating a potentially unsafe

situation for both learners and patients. Ahlberg and colleagues (Ahlberg, G., Enochsson, L., Gallagher, A., Hedman, L., Hogman, C., McClucksy, D., etc., 2007) noted the challenges related to laparoscopic surgery; specifically, loss of 3D visualization, loss of tactile feedback, and counterintuitive instrument movement. Their study involved the use of a virtual reality laparoscopic simulator to practise the skill of laparoscopic cholecystectomy. They were able to show that residents trained with the virtual simulator were able to perform significantly better in ten procedures as compared to the control group. Specifically, the control group demonstrated three times more errors and required 58% more surgical time to complete the procedures.

In regards to assessment of surgical skill, Goff and colleagues (Goff, B., Lentz, G., Lee, D., Houmard, B., and Mandel, L., 2000) developed an objective structured assessment of technical skills (OSATS) for obstetrical and gynecological residents based upon simulation scenarios. Residents were assessed on specific surgical skills, both laparoscopic and open surgery skills using anesthetized pigs. They found their tool to have high validity and reliability, as well as being able to identify learners requiring additional training. OSATS have been used with a variety of simulation tools to assess a breadth of technical skills beyond surgical skills. Antomarchi and colleagues (Antomarchi, J., Delotte, J., Jordan, A., Tran, A., and Bongain, A., 2014) used an OSATS tool with a birthing simulator to assess their learners' skills in performing vaginal delivery. They found their tool with a birthing simulator to be a reliable means to assess medical students on this competency.

The value of objective assessment in the simulation lab has been found to provide utility above and beyond the traditional in-training evaluation reports (ITERs) for surgical skills, which are often based upon subjective observations. In a study by Feldman and his team (Feldman, L., Hagarty, S.E., Ghitulescu, G., Stanbridge, D., and Fried, G.M., 2004), it was found that while

residents who performed well on a simulation-based assessment of surgical skills also tended to perform very well on their ITER, residents who performed poorly on the simulated assessment, frequently received "satisfactory" on their ITER. Thus, the simulated assessment was able to better detect residents having difficulties than the traditional subjective ITER.

1.4.2 SBME and the Communicator Role

Communication skills are fundamental to patient-centered care (Levinson, W., Lesser, C., and Epstein, R., 2010). However, much education around these skills has primarily been provided by didactic lectures. Just as surgical skills cannot be learned by practising on patients due to patient safety concerns, communications skills cannot be solely learned, practised, or assessed in the clinical environment. Simulation provides a safe learning environment for the deliberate practice of these skills and allows the opportunity for provision of constructive feedback. An advantage of practising these skills with a simulated patient is the ability to take a "time out" when the learner runs into difficulties; thus allowing the facilitator to provide guidance. Continuing in the face of a poor interview could otherwise lead to a loss of confidence in the learner and repetition of poor skills (Maguire & Pitceathly, 2002).

The implementation of a patient communication skills curriculum across three medical schools which incorporated the use of simulation by means of simulated patient encounters resulted in significantly improved communication skills performance; including, skills of relationship building, organization and time management, negotiation, and shared-decision making (Yedidia, M., Gillespie, C., Kachur, E., Schwartz, M., Ockene, J., Chepaitis, A., etc., 2003). Similar findings resulted from the work by Sijsterman and colleagues (Sijsterman, R., Jaspers, M., Bloemendaal, P.M., and Schoonderwaldt., E., 2007) in which 134 medical students

participated in two simulated patient encounters. Investigators found improvements in constructing lists of patient finding, patient problems, differential diagnosis, and action plans.

There is also evidence that simulation based communication skills training can be helpful in providing learning opportunities for difficult patient conversations. Marken and team (Marken, P., Zimmerman, C., Kennedy, C., Schremmer, R., and Smith, K., 2010) used adult simulated patients with a child simulator to expose pharmacy students and residents, nursing students, and medical residents to challenging situations regarding infant health issues, partner violence, and suicidal ideation. They provided a formal debriefing following each session. Students felt the feedback allowed them to consider alternate approaches to patient communication and they felt more comfortable with approaching such difficult conversations. Performance scores on the Inter-Professional Teams in Difficult Conversations Survey showed improvement for all items. Further to this, Rosenzweig and colleagues (Rosenzweig, M., Hravnak, M., Magdic, K., Brach, M., Clifton, M., and Arnold, R., 2008) explored the use of simulation for difficult conversations with acute care nurse practitioners and found similar results including improved confidence and perceived skills with difficult patient conversations.

1.4.3 SBME and the Collaborator Role

While simulation was initially used primarily as a tool for developing and assessing skills within the medical expert competencies, it has emerged as a valuable tool for the development of some of the intrinsic roles, including inter-professional communication or collaborator role. This is incredibly valuable as collaboration failures are the leading cause of medical errors and negative health outcomes (Brock, D., Abu-Rish, E., Chiu, C., Hammer, D., Wilson, S., Vorcick, L., 2013). A prospective study involving medical and nursing students in a traditional learning versus simulation-based inter-professional communication curriculum noted that students found the

simulation-based curriculum to be more helpful in regards to their development of inter-professional skills, and a vast majority reported that the simulation opportunity provided them with a better understanding of their role within the team. It was clear from the qualitative analysis, that learners developed a better appreciation of each other's skills and abilities regarding patient management and, from this, developed valuable skills regarding inter-professional communication (Reising, D., Carr, D., Shea, R., and King, J., 2000).

Similar findings resulted from a study involving inter-professional teams of faculty and students participating in three acute adult, three pediatric, and three obstetrical emergency simulation scenarios. Results showed that this training increased positive attitudes towards working in teams and that participants felt better able to implement the skills they had learned in regards to collaboration. Using an attitude questionnaire, the investigators were also able to determine improvement in communication and mutual support scores (Brock et al, 2014). Similar improvements in self-confidence in inter-professional communication skills were noted in Liaw and colleagues' (Liaw, S., Zho, W.T., Lau, T.C., Siau, C., and Chan, S.W.E., 2014) evaluation of a simulation-based inter-professional communication education program designed to improve inter-professional communication skills in medical and nursing students. Small inter-professional group learning was used to manage deteriorating patients in several simulated scenarios.

Although much of the assessment in the studies around inter-professional communication skills and simulation has been based on self-efficacy scores, a limited number of studies have used formal assessment tools for communication and teamwork competencies. Smithburger and team (Smithburger, P., Kane-Gill, S., Kloet, M., Lohr, B., and Seybert, A., 2013) used a simulation with medical, nursing, pharmacy, physician assistant and social work students to solve complex medical and social patient issues. The participants participated in weekly simulation scenarios over a period

of 4 weeks. They were assessed using a communication and teamwork assessment tool (CATS). The CATS scores improved significantly over the four-week curriculum. As well, student perceptions of their inter-professional skills, and their confidence in inter-professional teamwork improved. Further to this, Garber and colleagues (Garber, D., Paige, J.T., Bonnano, L.S. Runak, U.V., Barrier, K.M., Kozmenko, L.S., 2013) were able to note similar improvements in team-based competencies including inter-professional communication following a simulation curriculum provided to medical, nursing and physical therapy students. However, they were also able to demonstrate retention of these skills over a six-month time period.

1.4.4 SBME and the Leader Role

Team leadership skills are recognized as critical to the overall functioning of the health care team in a crisis situation and have been shown to improve patient care (Gilfoyle, E., Gottesman, R., and Razack, S., 2007). There is limited literature evaluating the use of simulation for learning and/or assessing leadership skills specifically. The majority of literature exploring these skills is incorporated within the concepts of teamwork and team functioning. Gilfoyle and colleagues (2007) did explore the development of a simulation based curriculum to develop leadership skills in resuscitation in pediatric residents. The residents participated in two simulation scenarios with their team performance assessed by checklist scores. Performance was also re-assessed six months following the initial session. Results showed an improvement in team performance, including leadership skills as well as improvement on self-reported survey results. The assessment at six months also demonstrated retention of skills. Residents in emergency medicine also felt they benefited from simulation training in Crisis Resource Management (CRM) skills which included leadership training practice (Reznik, M., Smith-Coggins, R., Howard, S.,

Kiran, K., Hater, P., Sowb, Y., etc., 2003). This practice in simulation based CRM was felt to benefit their skills in team based management of acute situations.

The benefits of team training extend beyond medical residents to other health care professionals as well. In a study introducing simulation scenarios of medical crises to multi-professional teams to assess both technical and teamwork skills (collaborator and leadership), a significant improvement in team functioning, simulated patient survival, and task completion occurred over the three training sessions. One of the unfortunately surprising results was the poor survival (0%) of the simulator at the time of the first scenario thus demonstrating that knowledge of resuscitation does not correlate with successful performance of a resuscitation, which involved performance of technical, collaboration and leadership skills.

Team training in obstetric crises with teams of residents (anesthesia and obstetrics) and nurses was explored in regards to its ability to practise teamwork skills with managing these rare events. These sessions found the obstetrical residents to be hesitant to assume the leadership role and it was their perception that these sessions provided an opportunity to develop these very important leadership skills (Daniels, K., Lipman, S., Harney, K., Arafeh, J., and Druzin, M., 2008).

1.4.5 SBME and the Scholar Role

Senior medical students report that 20-60% of their teaching is done by residents. Residents report that 20-25% of their time is spent teaching and evaluating junior learners (Cullimore, A., Dalrymple, J., Dugoff, L., Hueppchen, N., Casey, P., Chuang, A., 2010). There are two main aspects to the scholar role as it pertains to simulation: the value of the learning opportunity from the deliberate practice of providing instruction and feedback, and the use of simulation for assessment of these skills. Accordingly, various approaches to providing education around

"residents as teachers" have been developed. The majority focus on didactic sessions or e-learning modules to provide postgraduate learners with the basic concepts of teaching and assessment. There is a paucity of literature regarding the mechanisms by which residents practice and develop these skills.

One study by Dunnington and DaRosa (1998) prospectively randomized general surgery residents to either a control group or an experimental group to participate in a "residents as teachers" curriculum, which used role-play and simulation with standardized "students". Both groups were evaluated by means of an Objective Structured Teaching Examination (OSTE) five months later. The results were mixed – while there was some improvement in performance in some areas of assessment skills, there was no improvement in others.

Learning how to provide feedback was explored in a study amongst medical and nursing students. The students received workshops on communication skills in the 1st year which were composed of didactic sessions once weekly as well as practice via role play with simulated students. Their skills were evaluated by means of a three-station OSCE (Objective Structured Clinical Examination) in the fall and spring. During the OSCE they participated in each of three roles: candidate, examiner, and observer. The students enjoyed the opportunity to both learn and practice communication skills but also to practice the delivery of feedback to peers. Ninety-one percent reported that they learned new things participating in the role of examiner. While 27% reported that it was difficult to provide feedback to peers, 94% agreed that they were able to provide useful and honest feedback despite the difficulty.

Specific to obstetrics & gynecology, Hammoud and colleagues (Hammoud, M.M., Haefner, H.K., Schigelone, A., and Gruppen, L.D., 2004) developed a one-day workshop that included both interactive small group sessions and learner practice via role play. The workshop

explored the qualities of a good teacher, reviewed students' objectives and assessment tools and reviewed the practise of giving feedback. Residents evaluated this workshop positively and believed it increased their commitment to teaching. Improvements in the quality of their teaching were noted however they were not statistically significant. Morrison and colleagues (Morrison, E., Rucker, L., Boker, J., Holingshead , J., Hitchcock, M., Prislin, M., and Hubbell, A., 2004) trialed a 13-hour curriculum to improve residents teaching skills. This curriculum made use of didactic sessions but also a large component of practice via role playing with the provision of feedback on their performance. An OSTE was used as the assessment tool for the acquisition of skills. The experimental group's overall post-test scores showed significant improvements over their pre-test scores while the control group showed no improvement.

Many strategies have been used to assess the teaching and provision of feedback skills of residents: direct observation, student assessment, self-assessment, video recordings, and, as previously mentioned, OSTEs. Typically, OSTEs make use of simulated students to evaluate learners' ability to teach or provide feedback, in a station format similar to OSCEs. An OSTE for family medicine residents using 4th year medical students as the standardized (simulated) students and raters was found to be both a valid and reliable assessment tool for this purpose (Julian, K., Appelle, N., O'Sullivan, P., Morrison, E.H., and Wamsley, M., 2012). Further studies have continued to use the OSTE to document acquisition of skills in their learners. Zabar and team (Zabar, S., Hanley, K., Stevens, D.L., Kalet, E.K., and Lipkin, M., 2004) used a ten station OSCE which incorporated 2 OSTE stations using simulated students to evaluate internal medicine residents. They were able to discern a difference between junior and senior learners and found it to be a valuable, feasible and acceptable method of assessment. As noted above, Morrison and

colleagues (2004) also used the OSTE as an effective assessment tool in demonstrating improved skills following their "residents as teachers" curriculum.

1.4.6 Simulation and the Health Advocate Role

Poulton and Rose (2015) completed a systematic review of the literature surrounding health advocacy training in Canadian postgraduate training programs. They found that both educators and learners consider this role to be the least relevant to their clinical practice. It is also a challenging topic to both teach and assess. Currently the majority of postgraduate learners feel that their training needs in this CanMEDS role are not being met. The lack of clarity with the role, lack of published literature on the topic, lack of appropriate role modeling, and the lack of a gold standard for assessment, provide the barriers for meeting learners' needs. The review also found that the most common teaching method used in regards to this knowledge and skillset was role modeling. Assessment is most often provided by oral examination, OSCEs and short answer tools.

Flynn and Verma (2008) explored the concepts related to the health advocacy role and determined six attributes that are required for an effective health advocate: knowledge, altruism, honesty, assertiveness, resourcefulness, and being up-to-date. They further listed a number of behaviours related to each of the attributes. They proposed a curriculum for learning and assessment of the health advocacy competencies which made use of role modeling, small group learning, didactic sessions, and simulation using standardized patients. A survey of Obstetrics & Gynecology residents in Canada regarding their training experiences with the health advocacy competencies, found that the most common teaching methods employed were teaching session, clinical teaching and role modeling. It is obvious that the lack of literature in regards to training and assessment of the health advocacy competencies provides a significant challenge to postgraduate training programs in regards to development of health advocacy curricula. Although

there is no literature evaluating the most effective strategies for teaching or assessment of these competencies, simulation with standardized patients has been one method proposed to be a key component of any training program.

1.4.7 SBME and CanMEDS roles: Summary

There is no lack of literature supporting the use of simulation for learning and assessment of the medical expert role. As well, there exists convincing literature that simulation can be used effectively in regards to the communicator and collaborator competencies. As noted, the majority of literature considering leadership skills is in regards to management of emergencies by teams. This literature suggests that leadership skills can be both learned and assessed in the simulation setting. There is not a significant body of literature around the scholar or health advocate competencies in the context of simulation. However, the literature suggests this setting as a potential source of valuable learning and assessment opportunities. Thus it is possible that our goal of increasing our breath of learning and assessment can be met through the use of simulation

1.5.0 Summary

As discussed, the CBME curricula demands the selection of the appropriate learning tools that will allow learners to progress through the pre-determined developmental milestones (RCPSC, 2014) required of their specialty training. It also requires the selection of the appropriate assessment tools to identify learners not achieving these milestones in a timely fashion and to determine competency for independent practice. Medical educators are challenged in residency training by the fact that they must ensure that our learners are competent in all required skills, including those related to emergency situations. However, these are rare and, as noted by Weinberg

and colleagues (2009), residents are being exposed to even fewer of them in recent years. Residency programs are also challenged by limited funding and limited faculty time to provide training and assessment.

From the literature described above, it is clear that simulation can be used for a variety of purposes, including learning and assessment. As well, it can be used effectively across a wide variety of competencies. It can provide a safe learning environment to practice a variety of skills, even those related to management of rare emergencies. Simulation allows for deliberate practice which enhances learning and also provides an opportunity for formative feedback, which is a requirement of effective learning. It is even clear that participants in simulation can experience learning opportunities across a wide variety of roles which may be undertaken in a simulation scenario.

However, some of the challenges of the use of simulation include limitations in regards to equipment and space as well as financial costs associated with the use of resources and faculty time. Frequently, simulation occurs with one learner participating in the simulation with one faculty assessing and providing feedback regarding the resident's performance. The competencies being assessed are often limited to those related to the medical expert role. The combination of these limitations makes the traditional simulation sessions less efficient and less effective. The ideal simulation would thus minimize financial cost and faculty time commitment while providing learning opportunities/assessment across a wide breadth of competencies and maintaining a positive learning environment.

It is hypothesized that an obstetrical emergency simulation curriculum that involves multiple learners, at multiple training levels, could be developed to provide learning and assessment opportunities across a number of CanMEDs competencies in a feasible, acceptable and

effective manner. This hypothesis is tested via the evaluation of a new curriculum that involves four obstetrical emergency simulation scenarios, with various levels of learners participating in various roles with different objectives that represent a wide breadth of CanMEDS competencies (ie a Multi-learner, multi-level, multi-competency approach, or Multi-LLC). Specifically, junior and senior residents will participate as the first and second responders, respectively, with objectives related to medical expert, communicator, and leader. Other residents will participate as confederates in the roles of the patient, nurse, and family member; allowing them the opportunity for learning through role-play in the areas of communication, collaboration, and health advocacy. With these residents participating in these roles, costs could be reduced significantly by avoiding the hire of standardized patient confederates to play these roles. Lastly, some residents will participate as evaluators, exploring the scholar competencies. Having multiple learners participating in each scenario at one time, with multiple competencies learned/assessed, should allow faculty time to be optimized and used most efficiently.

A program evaluation using Stufflebaum's (1971) Context-Input-Process-Product framework will be used to evaluate this new simulation curriculum. The context evaluation reviews the information about the strengths and weaknesses of the current system, which will aid in defining potential improvements. This component asks the question: "*what should we do*?" The input evaluation reviews the strengths and weaknesses of the alternative strategy or strategies, and asks the question: "*how should we do it*?" Strengths and weaknesses are again reviewed under the heading of "process" as they relate to the implementation of the chosen strategy. The process evaluation asks: "*are we doing it correctly*?" Finally, the product evaluation determines whether the required objectives have been met. That is: "*did it work*?".

2.0 METHODS

Our needs assessment identified key priorities in regards to our simulation curriculum: increasing the breadth of learning and assessment, maintaining or improving resident learning, reducing monetary costs and faculty time commitment and improving resident acceptance. It was hypothesized that we could do this by developing a simulation curriculum that involved multiple learners at multiple levels of training, learning and being assessed across a number of competencies (ie Multi-LLC simulation). Therefore a set of obstetrical emergency simulations were created, in which multiple levels of learners participated. This was done with the objective of creating a simulation activity that would allow for the teaching and assessment of multiple CanMEDS competencies; including, medical expert, communicator, collaborator, health advocate, leader and scholar. We then used a program evaluation framework to evaluate the simulation activity with respect to its feasibility, acceptability and effectiveness.

2.1 Participants

2.1.1 The Committees

The members of the OBGYN Residency Program Committee and Postgraduate Education Curriculum Committee participated in the needs assessment portion of this evaluation. The Residency Program Committee includes the Department's Residency Program Director, Site Faculty Leads (n = 5), Chair, Associate Chair of Education, Undergraduate Program Director, a medical education consultant, and a resident representative from each year of training (n = 5). The Curriculum Committee is composed of 5 faculty members including the Residency Program Director, Associate Chair of Education, and 3 resident representatives. In total, given the overlap in membership between the two committees, 13 Faculty members and 8 resident representatives participated in the Needs Assessment portion of the evaluation.

2.1.2 The Residents

Thirty-one of a total of 36 residents enrolled in post-graduate medical education studies with the Department of Obstetrics and Gynecology (OBGYN) at McMaster University participated in the simulations (3 Post-Graduate Year (PGY) 1 residents, 9 PGY2 residents, 7 PGY3 residents, 8 PGY4 residents, 4 PGY5 residents). Their average age was 30 years (SD 4.6). There were 29 females and 2 males. Their participation occurred as part of their mandatory obstetrical emergency simulation training curriculum therefore they were expected to participate in the simulation scenarios however, participation in the program evaluation was voluntary with informed consent being obtained prior to participation as per the guidelines set forth by the Hamilton Integrated Research Ethics Board (HIREB).

2.1.3 The Faculty Assessors

A faculty assessor was assigned to each of the simulation scenarios. Over the two days of simulation, a total of five faculty members participated as assessors, including the Residency Program Director (VM, the author of this dissertation) and the Department Simulation Lead. Four of these faculty members have had five or more years of experience in simulation-based obstetrical learning and debriefing. One faculty member was a junior faculty member new to the simulation assessor role. All faculty participants received training in simulation assessment and debriefing prior to the simulation days as part of McMaster University's commitment to professional faculty development. In addition to the participants involved directly in the simulations, the generalist and sub-specialist faculty in the Department of OBGYN also participated as survey respondents (N = 30).

All participants provided informed consent prior to participating according to the guidelines set out by the Hamilton Integrated Research Ethics Board (HIREB) and the Declaration of Helsinki (1954).

2.1.4 The Program Evaluation Team

The program evaluation team was composed of the following members:

- 5 trained research assistants facilitated the focus group interviews
- A transcriptionist transcribed the focus group recordings
- The department simulation director was an active contributor to the development and delivery of the scenarios. This individual's perceptions of the Process of implementing the curriculum are captured as one of the reflective essays
- An expert in qualitative methodology collaborated on the analysis of the focus groups to satisfy the methodological need for confirmation of themes
- The program evaluation and associated analyses were carried out by the primary investigator, V.M., who also, as noted, held the role of Residency Program Director at the time of the study.

2.2 The Simulations

In order to cover a reasonable breadth of obstetrical emergencies we developed four obstetrical emergency simulation scenarios: postpartum hemorrhage, shoulder dystocia, eclampsia, and cord prolapse. Depending upon their training level, the residents participated in various roles within the simulation scenarios (first responder (PGY2), second responder (PGY5),

confederates (PGY1-3) and evaluators (PGY4)). The majority of PGY2 residents participated in the role of first responder for one of the simulation days and participated in the confederate role on the other day. These participants were scheduled such that these residents did not act as a confederate for a scenario that they were later to engage in as a first responder. Residents who participated in confederate roles were provided with a written outline of the relevant scenario and their specific role one week prior to the simulation days. The residents that participated as assessors received a written brief outline of the key concepts of debriefing, an outline of the relevant scenario, and the relevant assessment tools one week prior to the simulation days. All were required to review these materials prior to the simulation days.

The formal simulation training curriculum was carried out over 8 hours spread evenly across 2 days (i.e., 4hours/day). The four scenarios ran simultaneously twice a day in order to accommodate the full cohort of student participants. Each student was assigned a schedule of participation that dictated the order in which s/he engaged with each of the 4 scenarios. Each scenario involved a period of pre-briefing, live simulation, and debriefing, which occurred over roughly 1.5 hours. Participants in the first and second responder roles, participated in each simulation only once. Participants in the confederate or assessor roles did so for the same simulation, twice (i.e., they participated in the same scenario for each instance the simulation was run on a given day). In light of the fact that the residents know that our obstetrical simulation scenarios involve the management of obstetrical emergencies and that there truly are a limited number of obstetrical emergencies to practice, no formal restriction of communication between the residents in between scenarios was levied.

The scenarios, student activities, and assessed competencies are described in the following section.

2.2.1 Simulation 1

Title: Postpartum Hemorrhage (PPH)

Description: In this scenario, a patient develops a postpartum hemorrhage shortly after a precipitous delivery. The patient has delivered an over 10-pound baby girl. The placenta has delivered and the perineum is intact. After the medical staff leaves the room, the patient calls for assistance because she is feeling unwell. Her partner is with her in the room. The nurse attends to her call and then calls for assistance. The first responder assesses the situation and determines that the patient is having a postpartum hemorrhage. The first responder is required to initiate management of the postpartum hemorrhage and call for assistance from staff when appropriate. The staff provides assistance in management and obtains informed consent for any operative procedures that are considered. The scenario ends when the decision is made to move the patient to the operating room.

Modality: Hybrid model involving a standardized patient and obstetrical pelvic model (Delivery patient simulator; Gaumard; Florida, USA).

Roles & Competencies:

PGY2 - First Responder: This resident entered the scenario first and was expected to identify the emergency situation and begin management of the postpartum hemorrhage while communicating clearly with the nurse, patient, and family member. S/he was expected to ensure assessment of vitals, initiation of fluid resuscitation, and to work through the most common cause of postpartum hemorrhage (i.e., atony) by way of bimanual massage and various uterotonics. Thus, s/he was assessed on the medical expert and communicator roles. This resident was assessed on his/her knowledge of management of postpartum hemorrhage and communication skills using a validated

global rating scale (see Appendix 1) (Dore, K.L., Kreuger, S., Ladhani, M., Rolfson, D., Kurtz, D., Kulasegaram, K., etc., 2010). The assessment tool includes a checklist to provide guidance to the assessor regarding the critical expectations of the performance but score on the checklist was not collated as part of the overall assessment.

PGY1- PGY3 - Confederates: PGY1 residents participated in the role of the partner while the PGY2 and PGY3 residents participated as the patient or nurse. In this scenario, both the patient and partner were instructed to be concerned but not distracting. The nurse was instructed to be cooperative but to identify when requests were unreasonable. These residents were not formally assessed on the skills related to their roles; however, each was asked to complete a reflective exercise (see Appendix 2) regarding what they had learned in their role in regards to collaboration and/or patient communication and advocacy as per their assigned roles. Accordingly, the simulation was designed to provide education to these residents around the Communicator, Collaborator and Advocate competencies.

PGY4 – Assessor: This resident was responsible for generating an assessment for the first and second responders, and providing feedback in the debrief. This role was designed to provide education to the resident around the Scholar competency. This resident was assessed in the role of scholar in two ways: his/her scores for each of the residents s/he assessed were compared with the faculty member's scores for the same residents, and s/he was assessed on his/her ability to effectively provide some feedback in the debrief. The assessment tool for their performance in the debrief was developed internally based upon Pendleton's rules for debriefing (Pendelton, D., Schofield, T., Tate, P., and Havelock, P., 1984.) (see Appendix 3).

PGY5 - Second Responder: This resident was responsible for acting as the staff member in providing assistance to the First Responder in the management of the situation. S/he was expected

to assume the role of team lead and to communicate effectively both inter-professionally and with the patient and family member. S/he was assessed on the competencies of Leader, Communicator and Collaborator using the Ottawa Global Rating Scale (Kim, J., Neilipovitz, D, Cardinal, P., and Chiu, M., 2009) (see Appendix 4), which was modified slightly so as to incorporate the Segue framework for assessing patient and inter-professional communication (Makoul, G., 2001). Specifically, the resident was required to obtain consent for operative management in this scenario.

2.2.2 Simulation 2

Title: Shoulder Dystocia (SD)

Description: In this scenario, a primiparous patient is undergoing a post-term induction of labour. Her partner is present. She progresses and reaches full dilatation. The nurse in attendance calls the physician for delivery. With delivery of the head, the turtle sign is noted followed by inability to deliver the baby's shoulders. The resident recognizes and diagnoses the shoulder dystocia, calls for help, and initiates the usual maneuvers for resolution of the shoulder dystocia. Upon arrival, the staff person supports the resident and assists as needed. Following delivery, the partner displays a significant amount of agitation demanding an explanation of what happened. The scenario ends once the baby has been delivered and the staff has debriefed the patient and partner.

Modality: Hybrid model with simulated patient and obstetrical pelvis (Delivery patient simulator; Gaumard; Florida, USA)

Roles & Competencies:

PGY2 - First Responder: This resident was summoned to the room by the nurse for the delivery of the baby. S/he was expected to identify the shoulder dystocia and then work through the Society of Obstetricians & Gynecologists of Canada (SOGC) mnemonic ALARMER to manage the shoulder dystocia, while communicating directions to the nurse and communicating appropriately with the patient and partner. This resident was assessed in the medical expert and communicator roles using a validated global rating scale (see Appendix 5) (Dore, K.L., Kreuger, S., Ladhani, M., Rolfson, D., Kurtz, D., Kulasegaram, K., etc., 2010). The assessment tool did have a checklist to provide guidance to the assessor regarding the critical expectations of the performance but score on the checklist was not part of the assessment score.

PGY1 – PGY3 – Confederates: PGY1 residents participated in the role of the partner, and PGY2 and PGY3 residents participated as the patient or nurse. In this scenario, both the patient and partner were instructed to be concerned but not distracting during the delivery. However, following the delivery the partner was instructed to become agitated and demand an explanation for what happened. The nurse was instructed to be cooperative but to identify when requests were unreasonable. These residents were not formally assessed on the skills related to their roles; however, each was asked to complete a reflective exercise (see Appendix 2) regarding what they had learned in their role in regards to collaboration and/or patient communication and advocacy as per their assigned roles. Accordingly, the simulation was designed to provide education to these residents around the Communicator, Collaborator and Advocate competencies.

PGY4 – Assessor: This resident was responsible for generating an assessment for the first and second responders and providing feedback in the debrief. As mentioned above, they received a very brief outline of the key aspects of debriefing one week prior to the simulation days. This

resident was assessed in their role of scholar in two ways: the scores for each of the residents he/she assessed were compared with the faculty member's scores for the same residents and he/she was then assessed on their ability to effectively provide some feedback in the debrief. The assessment tool for their performance in the debrief was developed internally based upon Pendleton's rules for debriefing (Pendelton, D., Schofield, T., Tate, P., and Havelock, P., 1984). (see Appendix 3).

PGY5 - Second Responder: This resident was responsible for acting as the staff member in providing assistance to the First Responder in the management of the situation. S/he was expected to assume the role of team lead and to communicate effectively both inter-professionally and with the patient and family member. S/he was assessed on the competencies of Leader, Communicator and Collaborator using the Ottawa Global Rating Scale (Kim, J., Neilipovitz, D, Cardinal, P., and Chiu, M., 2009) (see Appendix 4). It was slightly modified to incorporate the Segue framework to include patient communication and inter-professional communication (Makoul, G., 2001). Specifically, the resident was required to debrief the patient and partner effectively dealing with the partner's agitation.

2.2.3 Simulation 3

Title: Cord prolapse (CP)

Description: A multiparous patient, having had a previous Caesarean section, presents to the hospital in labour. Her partner has gone to park the car while the nurse does an initial assessment of the patient. After her assessment, the nurse calls the physician to further assess the patient. During the physician's history taking the patient reports a gush of fluid, after which a fetal bradycardia is noted on the external fetal monitor. Examination by the physician finds a cord

prolapse. The first responder calls for assistance and provides initial management. The patient refuses Caesarean section due to her negative experience with her previous Caesarean section. Upon their arrival, the staff provides support to the resident while working with the patient to get her on board with the management plan. Once the partner arrives, the partner is able to convince the patient to follow the management plan thus ending the scenario.

Modality: Hybrid model with simulated patient and obstetrical pelvic model (Delivery patient simulator; Gaumard; Florida, USA).

Roles & Competencies:

PGY2 - First Responder: This resident entered the simulation first. S/he began the scenario by taking a general history and during the history-taking a fetal bradycardia occurs. S/he was then expected to call for assistance and initiate intrauterine resuscitation. In this process, s/he was expected to examine the patient and identify the cord prolapse. The resident was assessed in the medical expert and communicator roles. This resident was assessed on their knowledge of management of fetal bradycardia and cord prolapse, and their communication skills using a validated global rating scale (see Appendix 6) (Dore, K.L., Kreuger, S., Ladhani, M., Rolfson, D., Kurtz, D., Kulasegaram, K., etc., 2010). The assessment tool did have a checklist to provide guidance to the assessor regarding the critical expectations of the performance but score on the checklist was not part of the assessment score.

PGY1 – PGY3 – Confederates: PGY1 residents participated in the role of the partner while the PGY2 and PGY3 residents participated as the patient or nurse. In this scenario, the patient was instructed to be insistent in her refusal for Caesarean section until her partner returned from parking the car. The nurse was instructed to be cooperative but to identify when requests were

unreasonable. These residents were not formally assessed on the skills related to their roles; however, each was asked to complete a reflective exercise (see Appendix 2) regarding what they had learned in their role in regards to collaboration and/or patient communication and advocacy as per their assigned roles. Accordingly, the simulation is designed to provide education to these residents around the Communicator, Collaborator and Advocate competencies.

PGY4 – Assessor: This resident was responsible for generating an assessment for the first and second responders and providing feedback in the debrief. As mentioned above, s/he received a very brief outline of the key aspects of debriefing one week prior to the simulation days. This role was designed to provide education to the resident around the Scholar competency. This resident is assessed in their role of scholar in two ways: their scores for each of the residents they assessed were compared with the faculty member's scores for the same residents and they were assessed on their ability to effectively provide some feedback in the debrief. The assessment tool for their performance in the debrief was developed internally based upon Pendleton's rules for debriefing (Pendelton, D., Schofield, T., Tate, P., and Havelock, P., 1984) (see appendix3).

PGY5 - Second Responder: This resident was responsible for acting as the staff member in providing assistance to the First Responder in the management of the situation. S/he was expected to assume the role of team lead and to communicate effectively both inter-professionally and with the patient and family member. S/he was assessed on the competencies of Leader, Communicator and Collaborator using the Ottawa Global Rating Scale (Kim, J., Neilipovitz, D, Cardinal, P., and Chiu, M., 2009) (see Appendix 4). It was slightly modified to incorporate the Segue framework to include patient communication and inter-professional communication (Makoul, G., 2001). Specifically, the resident was required to communicate with the patient and partner effectively in order to convince them to follow the appropriate management plan for the emergency situation.

2.2.4 Simulation 4

Title: Eclampsia

Description: A young primiparous patient with no antenatal care presents in labour with hypertension and proteinuria. She has a spontaneous vaginal delivery and is transferred to the postpartum ward in the company of her mother. On the ward she develops a severe headache with a markedly elevated blood pressure. The nurse calls the resident to assess the patient. The resident performs an initial assessment and begins management of the hypertension and symptoms. The blood pressure is not responsive to initial medications. The patient then begins seizing. The resident calls for assistance. The patient's mother becomes extremely distraught at the sight of her daughter seizing, and requires management by the staff. The scenario ends once the seizure is managed and family member is calmed and debriefed.

Modality: Simulated patient

Roles & Competencies:

PGY2 - First Responder: This resident entered the room first after being summoned by the nurse and is instructed that they are responding to a patient feeling unwell on the ward. While taking the patient's history, the patient began seizing. The PGY2 was then required to call for assistance and initiate management of the seizure and hypertension. This resident was assessed in their role as medical expert and communicator. This resident was assessed on their knowledge of management of preeclampsia and eclampsia and their communication skills using a validated global rating scale (see Appendix 7) (Dore, K.L., Kreuger, S., Ladhani, M., Rolfson, D., Kurtz, D., Kulasegaram, K., etc., 2010). The assessment tool did have a checklist to provide guidance to the assessor regarding

the critical expectations of the performance but score on the checklist was not point of the assessment score.

PGY1 – PGY3 - Confederates: PGY1 residents participated in the role of the mother while the PGY2 and PGY3 residents participated as the patient or nurse. The patient was cooperative but scared and obviously feeling unwell. The mother was instructed to be cooperative and supportive until her daughter begins seizing. She then became agitated and disruptive. The nurse was instructed to be cooperative but to identify when requests were unreasonable. These residents were not formally assessed on the skills related to their roles; however, each was asked to complete a reflective exercise (see Appendix 2) regarding what they had learned in their role in regards to collaboration and/or patient communication and advocacy as per their assigned roles. Accordingly, the simulation is designed to provide education to these residents around the Communicator, Collaborator and Advocate competencies.

PGY4 – Assessor*:* This resident was responsible for generating an assessment for the first and second responders and providing feedback in the debrief. As mentioned above, s/he received a very brief outline of the key aspects of debriefing one week prior to the simulation days. This role was designed to provide education to the resident around the Scholar competency. This resident was assessed in their role of scholar in two ways: their scores for each of the residents they assessed were compared with the faculty member's scores for the same residents and s/he was assessed on their ability to effectively provide some feedback in the debrief. The assessment tool for their performance in the debrief was developed internally based upon Pendleton's rules for debriefing (Pendelton, D., Schofield, T., Tate, P., and Havelock, P., 1984) (see Appendix 3).

PGY5 - Second Responder: This resident was responsible for acting as the staff member in providing assistance to the First Responder in the management of the situation. S/he was expected

to assume the role of team lead and to communicate effectively both inter-professionally and with the patient and family member. S/he was assessed on the competencies of Leader, Communicator and Collaborator using the Ottawa Global Rating Scale (Kim, J., Neilipovitz, D, Cardinal, P., and Chiu, M., 2009) (see Appendix 4). It was slightly modified to incorporate the Segue framework to include patient communication and inter-professional communication (Makoul, G., 2001). Specifically, the resident was required to de-escalate the mother and debrief the patient and mother following the seizure.

2.3 The Program Evaluation

Medical education residency programs have the dual responsibility of ensuring the quality of their training program and determining whether the trainees have acquired the required competencies (During, S.J., Hemmer, P., and Pangaro, L.N., 2007). There are various program evaluation tools available for use. For this project we opted to use the CIPP (Context – Input – Process – Product) model outlined by Stufflebaum (Stufflebaum, 1971), which facilitates improvement in educational programs by providing "timely evaluative information". This model was chosen because it is a holistic program evaluation method, which allows for examination and exploration above and beyond a perspective that focuses solely on outcomes. Furthermore, the CIPP's features of inputs and products aligns naturally with the assessed needs of reduced costs and increased breadth of assessment and maintenance/ of learning respectively. In particular, Stufflebaum describes this framework as a means to provide proactive evaluation, which serves decision making, and retroactive evaluation, meeting accountability requirements. He describes the evaluation process as having three steps: delineation of the questions to be answered,

obtainment of the relevant information, and the provision of information to those who can use it effectively to make decisions.

The framework works to blend the evaluative process with four key types of evaluation: context, input, process and product. The context evaluation reviews the information about the strengths and weaknesses of the current system which will aid in defining potential improvements. This component asks the question: "*what should we do*?" The input evaluation reviews the strengths and weaknesses of the alternative strategy or strategies, and asks the question: "*how should we do it*?" Strengths and weaknesses are again reviewed under the heading of "process" as they relate to the implementation of the chosen strategy. The process evaluation asks: "*are we doing it correctly*?" Finally, the product evaluation determines whether the required objectives have been met. That is: "*did it work*?" (Stufflebaum, 1971).

2.3.1 The Context Evaluation

As noted previously, the purpose of the context evaluation is to identify the strengths and weaknesses of what is currently in place, (i.e., the previous simulation curriculum). This involved determining resident perceptions of the current simulation learning environment and determining their perceived competency at the various CanMEDS roles. We also wanted to collect information from the faculty in regards to their opinion of resident competency in the various roles. These two sources of information would allow us to determine if indeed, the residents required further skill development. Lastly, in order to ensure that we had developed a comparative assessment method within our Multi-LLC curriculum, we obtained scores from previous simulation scenarios.

The context evaluation included:

1. Resident Survey: We were interested in understanding resident perceptions about the McMaster OBGYN Post-Graduate obstetrical emergency simulation learning environment and its residents' emergency management, collaboration, communication, educator (i.e., assessing and feedback delivery) and leadership skills as they pertain to the Department's requirements to meet the required RCPSC accreditation standards. To do this, we developed and administered an independent survey to the Department residents (N=31, Appendix 8). The survey first asked a question concerned with the residents' perceptions of the previous (i.e., prior to the described simulation) learning environment. Residents provided answers to this question using a five-point scale, which ranged from "poor" to "excellent". The answer to this question is reported as a function of the entire resident cohort. They were then queried regarding their perceived skill level in the key competencies of Medical Expert (specifically related to the management of postpartum hemorrhage, shoulder dystocia, cord prolapse, and eclampsia), Communicator, Collaborator, Leader, and Scholar. These questions were also answered using a 5-point scale, which ranged from "not competent" to "expert". This survey was developed on the basis of surveys created by Pliego and colleagues (Pliego, J., Wehbe-Janek, H., Rajab, H., Browing, J., and Fothergill, R., 2008) and refined to reflect the specific needs of the Department. The surveys were developed and reviewed for accreditation relevance in conjunction with the members of the Department's Residency Program Committee and Curriculum Committee. In this way, the developed surveys demonstrate face validity. Survey data is reported as a function of assigned role in the Multi-LLC.

2. Faculty Survey: We were also interested in the faculty perceptions regarding the residents' skills. As such, a survey was developed and administered to both generalist and sub-specialist faculty within our department (N=30, Appendix 9). Faculty were asked to rate the residents in regards to the same key competencies described in the resident survey. Specifically, they were asked to rate the skill level of the PGY2 residents (i.e., as a cohort and not as individuals) in regards to their ability to manage postpartum hemorrhage, shoulder dystocia, cord prolapse, and eclampsia; the PGY5 residents in regards to collaboration and leadership, the skill level of all residents in regards to patient communication; and the PGY4 residents' abilities to assess and provide feedback. All questions were answered using a five-point scale that ranged from "not-competent" to "expert".

3. Resident Obstetrical Emergency Simulation Performance: We obtained 9 PGY2 and 4 PGY5 resident scores from previous Postpartum Hemorrhage Emergency simulations. These scores provided a descriptive indicator of resident simulation performance before the development of the new simulation modality and provide a comparison metric for resident performances in the new simulation strategy. These performances were measured via a modified version of the Anaesthetist's Non-Technical Skills (ANTS) assessment tool (Fletcher, G., Flin, R., McGeorge, P., Glavin, R., Maran, N., and Patey, R., 2003), which categorizes the related "non-technical skills" or intrinsic roles into four main categories (team working, task management, situational awareness, and decision making), each of which is further defined by 3-5 "elements" and superseded by an overall performance score (see Appendix 10). Each of the elements is scored on a four-point scale ranging from poor to good. Previous applications of

the ANTs have demonstrated the tool to be valid and reliable (Fletcher et al, 2003). Of particular relevance to this evaluation are the resident overall scores.

2.3.2 The Input Evaluation

This component of the evaluation was key in providing a comparator for our Multi-LLC in determining whether or not this new simulation curriculum met the priorities of increasing breadth of learning and assessment and reducing financial costs and faculty time commitment. The input evaluation involved a gathering of information regarding the previous simulation curriculum. This was done with reference to the total number of residents that would have participated in the previous simulation curriculum. This pertains to only the number of PGY2 (n=9) and PGY5 (n=4) residents. This information will provide a comparison to the same indicators with our new curriculum.

1. Monetary costs: The only financial costs to the department of our previous simulation curriculum was the cost of the confederates (i.e., standardized patients) used for the scenarios. The department is not invoiced for use of the simulation center or equipment. These costs were calculated based upon our current method of simulation training which involves one resident per scenario and calculated over number of simulations required to run each of our PGY2 and PGY5 (first and second responders) through each of the four scenarios multiplied by the hourly rate for confederates.

2. Faculty time (total): Faculty time was calculated based on the number of simulations required to run each of our PGY2 and PGY5 residents through each of the scenarios, as noted above, given a per-scenario time requirement of 1.5 hours.

3. Resident time (per resident): Calculated based upon the time each resident would require to run through each of the four scenarios with each requiring 1.5 hours of time.

4. Competencies assessed: This was the number of CanMEDS competencies assessed in our previous simulation curriculum.

2.3.3 The Process Evaluation

The process evaluation allows us to consider if the issues relating to the implementation of the new simulation curriculum. To explore this, we surveyed the faculty involved directly with the simulation regarding the simulation process, gathered specific feedback regarding process from the simulation developers, and, lastly, gathered information from residents and faculty participants regarding the process via focus group interviews. The process evaluation included several components:

1. Faculty Survey: The process evaluation survey was given to the 5 faculty that participated in our simulations as assessors. This post-simulation survey asked the Faculty to consider the scenario realism and their opinions about the way the scenarios and associated debriefs facilitated the assessment of resident technical, communication, collaboration and assessment and feedback-provision skills. The survey questions were answered by way of a five-point scale, which ranged from “poor” to “excellent”. The survey also explored the Faculty’s

perceptions of residents' performance with specific respect to the key competencies explored (medical expert, leader, communicator, scholar). These questions were also answered using a five-point scale that ranged from "not competent" to "expert". This survey was developed on the basis of the surveys created by Pliego and colleagues (Pliego et al, 2008) and Daniels and colleagues (Daniels, K., Lipman, S., Harney, K., Arafeh, J., and Druzin, M., 2008) (see Appendix 11).

2. Developer Reflections: The process evaluation also included a collation of specific written reflections of the two organizers of the simulation curriculum, which includes the author of this thesis (V.M.). These two investigators had been involved in the development of both the previous and new simulation curricula, and therefore had a unique insight into the difficulties and challenges of the development of each. These reflections were guided by prompts that reflected each of the program goals as identified in then needs assessment.

3. Resident and Faculty Focus Groups: Focus groups explored the residents' impressions of the simulations. These focus groups were run at the conclusion of each of the two simulation afternoons. Semi-structured interviews (see Appendix 12) were conducted in groups defined by the residents' roles within the simulations (i.e., first responders, confederates, assessors, second responders). Specifically, the interviews focused on the impressions of acceptability of this new curriculum and explored participants' perceptions of various aspects of the simulations; such as, junior residents providing assessments and feedback to senior residents, learning by observation, and the influence of role playing on skill development. The participating faculty members also participated in a semi-structured focus group interview that

explored the same ideas (see Appendix 13). Participants were welcomed to provide comments freely on any related topic during the focus groups. The interviews were run by trained external facilitators and audio-recordings of the discussions were taken and transcribed. The transcriptions were augmented by summary notes recorded by the interview facilitators. The analysis of the focus group data was performed using general grounded theory techniques. Two of the researchers (BMD and VM) performed a thematic analysis which involved coding the dating, categorizing these codes and then distilling these categories into a minimum number of themes.

2.3.4 The Product Evaluation

The purpose of the product evaluation is to determine if the Multi-LLC simulation achieved its priority goals. In order to determine if it increased the breadth of learning and assessment, we compared the number of competencies learned/assessed in the previous simulation with the number in the new simulation curriculum. To ensure that resident learning was maintained/improved, we compared scores on the previous simulation scenarios to the new curriculum. We also looked at station scores for each role and scenario. As well, reflection exercises were completed by all residents playing confederate roles. Pre- and post- Multi-LLC self-efficacy scores were compared as a surrogate marker for learning. A comparison of financial costs and faculty time commitments was done to determine if we were able to reduce of these. Lastly we compared resident perceptions of the learning environment in our previous simulation to our Multi-LLC curriculum. The product evaluation similarly involved a gathering of information regarding our new simulation curriculum. This pertains to only the number of PGY2 (n=9) and PGY5 (n=4) residents.

1. <u>Residents involved:</u> The number of residents involved in the new simulation curriculum.

2. Monetary costs: This determination included any costs related to the running of the new simulation curriculum. However, the only costs of running the simulation activity, as noted previously, was the financial remuneration of the confederates. The new curriculum did not employ external confederates. The value determined in the Product Evaluation was compared to that in the Context Evaluation in order to provide an appraisal of the difference in costs between the two simulation curricula.

3. Faculty time (total): This value was calculated based on the requirement of 4 faculty assessors to be present for each of the two, 4-hour simulation sessions. This value was compared against the Faculty time metric calculated in the Context Evaluation. This comparison provides an appraisal of the relative Faculty commitment for the 2 simulation curricula.

4. Resident time (per resident): This value was calculated based on the time required for each resident to complete the four scenarios and compared to the time for each resident to participate in the previous simulation curriculum.

5. Competencies assessed: This reflects the number of CanMEDS competencies assessed in the current simulation curriculum and is compared to the competencies in the previous curriculum

6. Resident Simulation Assessments: The resident assessments delivered by faculty from each of the various simulation scenarios were gathered to provide an actual assessment of the ability to meet the objectives of comprehensive competency-based education. As noted previously, the PGY2s, or first responders, received independent assessments for each scenario, on the competencies of Medical Expert and Communicator, as well as an overall score for the relevant performance. Each of these assessments was delivered in the form of a score on a nine-point global rating scale, which ranged from "unacceptable" to "superior". The PGY5s (second responders) were assessed on the following: overall performance, leadership skills, problem solving skills, situational awareness, resource utilization, inter-professional communication, and patient communication, each on a seven-point scale, which ranged from fulfilling criteria rarely to fulfilling criteria always for competency in that domain. Mean scores for each of the assessment categories, for each scenario, were calculated for both the first responders and second responders. We reviewed these scores with respect to the expected performance levels for residents at their level of training (i.e., we expect that PGY5s will perform at or near the level of ready for independent practice). The Assessor (PGY4) performances were reviewed in two ways. First, the resident assessors' performances during the debrief were rated by way of a simple checklist. The second method was a comparative assessment mentioned below.

7. Reflection Exercise: The residents participating in the confederate role were required to complete a reflection exercise (see Appendix 13) which required them to reflect upon their role, and feelings, attitudes and knowledge around how health care providers in the clinical setting, relate to their role. At this stage, assessment of the reflection did not involve review of the content of what was written, but rather encompassed a tabulation that the exercise had been

completed. In future iterations of this work, the idea that the written reflection can serve as a catalyst for debriefing those individuals in the confederate role around the advocacy competency will be explored.

8. Comparative assessment:

Furthermore, for the PPH scenario, we were able to compare resident scores from previous postpartum hemorrhage simulations to the scores obtained with this new curriculum. To do so, 13 resident scores from independent PGY2 and PGY5 simulation sessions conducted in the Department of OBGYN at McMaster University in the year, 2014-2015 were collected. For both the PGY2 and PGY5 performances these assessments were provided by a modified ANTS tool which included an overall score and a number of subdomains that reflected the Medical Expert and Communicator competencies. Each of which was assessed by way of a 4-point scale, ranging from poor to good. Importantly this assessment tool was slightly different than those used in the current simulations. In order to compare these scores to the new simulation curriculum scores, we limited our comparison to the overall performance scores from both tools. This required that we convert the relevant 4-point, 9-point and 7-point raw assessments for all residents into a proportion of the total possible score (i.e., a percentage correct). These converted values were then compared by independent t-tests. The t-test is a mathematical method of comparing the variance between normally distributed data sets as a means of determining whether the two sets are significantly different in relation to each other.

The assessors were also assessed by comparing the mean resident assessments of the first and second responders with the scores provided by the faculty assessor for the same residents by way of Pearson's correlation methodology.

9. Resident Survey: A post-simulation survey of the residents was administered. This survey asked the resident participants to consider their perceptions of the scenarios, both in terms of realism, and also with respect to the way they facilitated the education and assessment of technical, communication, collaboration and evaluation and feedback skills. The survey also explored residents' perceptions of their performances with specific respect to the relevant competencies (medical expert, leader, communicator, collaboration and scholar) following the simulation activity. Scales for this survey were as that described in the Faculty Process Survey above. As in the context evaluation, this survey was based on previous surveys (Pliego et al, 2008; Daniels et al, 2008) (see Appendix 14). The self-efficacy ratings for each of the competencies as determined in the Context Evaluation – Resident Survey, were compared to the self-efficacy ratings determined in the Product Evaluation –Resident Survey by way of two-tailed t-test analyses across each of the resident roles (i.e., first responder, second responder, confederate, and assessor). The results of these surveys also allowed for comparison of the learning environment in our new curriculum to the previous simulation curriculum. This was done by way of two-tailed t-tests on the mean learning environment item scores.

3.0 Results

3.1 The Context Evaluation

1. Resident Survey: We had an excellent response rate to the resident survey with thirty out of thirty-one residents involved in the simulation having completed the survey (97%). The residents rated the learning environment in our previous simulation curriculum as adequate – good (mean score (SD) = 3.6 (0.93), where 3 is adequate and 4 is good).

   The residents also rated their perceptions of their skill level across the various competencies (Table 1). There is a noticeable trend in the ratings by the more junior residents to rate their medical expert skills lower than their skills in regards to the intrinsic roles (collaboration, communication, leadership and evaluator/ability to provide feedback). This suggests that junior residents recognize the skill development they require in the medical expert competencies but perhaps not in the intrinsic roles. All scores suggest that our residents feel that they have not reached the level of competency required of an expert therefore suggesting that there remains a need for further learning across all of the competencies.

Table 1: Mean (SD) self-efficacy scores for each of the assessed competencies.

	PPH	Medical SD	Expert PET	CP	Collaborator	Communicator	Leader	Scholar
First responder	3.0 (0.50)	2.3 (0.65)	2.6 (0.46)	2.9 (0.60)	3.6 (0.50)	3.9 (0.60)	3.1 (0.60)	3.0 (0)
Second responder	3.8 (0.35)	3.3 (0.44)	3.5 (0.46)	3.8 (0.35)	3.7 (0.69)	3.8 (0.83)	3.3 (0.43)	3.5 (0.70)
Confederate	2.8 (0.83)	2.5 (0.66)	2.6 (0.64)	2.9 (0.79)	3.8 (0.83)	3.8 (0.39)	3.5 (0.66)	3.1 (0.51)
Evaluator	3.8 (0.37)	3.5 (0.76)	3.5 (0.50)	3.7 (0.75)	4.2 (0.37)	4.3 (0.47)	3.8 (0.37)	3.5 (0.50)

2. Faculty Survey: We also had a good response rate to the faculty survey with twenty-four out of thirty faculty having completed the faculty survey for a response rate of 80%. The mean (SD) faculty ratings of medical expert of the PGY2 residents across the scenario content were between minimally competent – adequately competent for each of the obstetrical emergencies (PPH = 2.5 (0.70), SD = 2.2 (0.55), PET = 2.6 (0.69) and CP = 3.0 (0.91)). The ratings across the intrinsic roles for the PGY5 residents were higher with average scores between adequately competent and very competent (Collaboration = 3.6 (0.70), Leader = 4.0 (0.20)). The average

rating for the senior residents in the Scholar role was 3.5 (1.0), between adequately competent and very competent. The average rating for Communication skills for all residents was very competent (4.0 (0.41)). These results are consistent with what would be expected. We would expect the junior residents to be just beginning their progress in developing competency with the medical expert role while we expect our most senior learners to be approaching expert competence. What is important from these results is that the faculty appreciate that learners at all levels still require some learning to reach competence.

3. Previous Postpartum Hemorrhage scenario scores: We collected data from our previous simulation curriculum, specifically scores from previous postpartum hemorrhage simulations. Thirteen of our residents (9 PGY2s and 4 PGY5s) had completed the previous postpartum hemorrhage scenario. The mean (SD) overall performance score was 3.0 (0.5), "acceptable" for the PGY2s and 3.75 (0.5), "acceptable-good" for the PGY5s.

3.2 The Input Evaluation

In collecting information as a basis for comparison between our previous simulation curriculum and out Multi-LLC curriculum, the following was obtained:

1. Monetary costs: The confederate costs ($40 per hour X 2 confederates in the previous simulations) to provide the same four scenarios (1.5 hr per scenario X 4 scenarios) to our PGY2 (9) and PGY5 (4) residents in our previous obstetrical emergency simulation curriculum adds up to $6240 (CDN).

2. Faculty time (total): The total faculty time required to provide assessment and debriefing for the four scenarios (1.5 hr X4) for each of the PGY2 (9) and PGY5 (4) residents is equivalent to 78 hours.
3. Resident time (per resident): The resident time required to participate in the four scenarios and their debrief is 6 hours (1.5 hr X 4).
4. Competencies assessed: In our previous simulation curriculum the following competencies were assessed: medical expert and inter-professional communication/collaboration.

3.3 The Process Evaluation

In considering whether we were using the correct process in developing our new simulation curriculum, we gathered feedback from both residents and faculty by means of the following:

1. Faculty Survey: We collected information regarding the acceptability of the simulation scenarios including realism, ability to assess and ability to debrief. The mean (SD) for the elements of "realism" (PPH= 4.0 (0). SD = 4 (0), PET = 4 (0) CP = 4 (0)), "ability to assess" (technical skills = 4.63 (0.74), crisis resource management skills = 4.88 (0.35), communication skills = 4.88 (0.35), scholar role = 4.0 (0.76)) and "ability to debrief" (technical skills = 4.63 (0.52), crisis resource management skills = 4.75 (0.46), communication skills = 4.75 (0.46)) ranged from good to excellent. Thus faculty felt the new curriculum provided a realistic simulation that had a good-to-excellent ability to assess and debrief the range of skills including technical skills and intrinsic roles suggesting that we are providing a very good learning opportunity through use of our Multi-LLC simulation curriculum.

2. Developer Reflections: The two main developers of the simulation curriculum reported that there were several key elements to the successful implementation of this simulation curriculum. It was felt to be important to select appropriate simulation scenarios to ensure that they are relevant and have a relatively standard approach to management. Appropriate selection of equipment for each of the scenarios was important as well. For example, there was much thought and discussion around the use of hybrid models versus standard simulation mannequins. In the end, it was felt that hybrid models would allow the patient communication element that was felt to be key to our scenarios. A practice run of the simulation scenarios with the simulation staff prior to the simulation days was critical in terms of ensuring the appropriate equipment had been selected for each scenario and ensuring that the equipment would work as expected. Along this line, simulation staff who are experienced, flexible and adaptive was essential.

   "*The key to success with this new simulation was really the preparation beforehand: the careful selection of the scenarios and equipment, and running through the scenarios the day before. Without this, it would not have been as successful as it was.*"

   It was also important to have administrative staff to develop the schedule that allowed appropriate time for all components of the simulation (pre-brief, running of the scenario and debrief) and biologic breaks. Lastly, it would not have been as successful without faculty that were engaged and willing to participate.

3. Resident and Faculty Focus Groups: We gathered feedback from faculty and residents through the use of focus groups. The described qualitative approach resulted in a distillation of the

transcribed interviews into three main themes: 1) meeting CanMEDS competencies, 2) learning through simulation and, 3) feedback: giving and receiving (Table 2).

Table 2: Main themes with their components, from the resident and faculty focus groups

Meeting CanMEDS Competencies	**Learning through Simulation**	**Feedback: giving and receiving**
Management benefit	Realism	Personalized feedback
Teamwork/collaboration	Safety	Confederate feedback
Communication	Preparation	Hierarchal feedback
Learning through observation		Group feedback
Scholar		Value of debriefing
		Benefits of peer feedback

The first theme "*Meeting CanMEDS Competencies*" reflected the various ways in which this simulation curriculum attributed to the ability of the residents to learn and achieve the various competencies outlined in the RCPSC's CanMEDS curriculum. Participants expressed how the various components of the simulation experience benefited learners in regards to their ability to manage patients. This is best reflected in comments from our junior learners (PGY2) and senior learners (PGY5), respectively, as they highlight the different objectives for the two very different level of learners:

"*It think all of the stations were trying to handle, not just the medical management but foundations that we should have walking into a room, getting vitals, determining stable, unstable, when we should call for staff.……regardless of what the scenario is, it is kind of similar in all emergencies.*" (PGY2 #1)

"*I think for me it was trying to figure out how to medically manage while talking to the patient and the family in the room, and the nurses, like trying to balance that was definitely eye opening*". (PGY5 #1)

Participants also recognized how the simulation contributed to their development of 'collaborator' competencies and to working in teams. When asked about the value of having the paired PGY2 and PGY5 response teams, residents across all levels found this to be beneficial:

"*I very much liked that we were paired with a senior...it made it more realistic*." (PGY2 #2)

"*I liked that we had split levels so senior and junior working together…it is nice to learn from our seniors and see how we will develop in time.*" (PGY2 #3)

"*I think it was really a great experience for both of us, because they (PGY2) could ask questions, but we could also teach our juniors and maybe learn from things they did well. It was great!*" (PGY5 #2)

Residents acting as confederates commented on the learning experience with respect to collaboration with other health professionals, specifically nursing,

"*It gives you a little insight too, into what it must be like to be a nurse with doctors yelling orders at you – this was a good learning experience for me*" (PGY2 #2).

Similarly, the simulation was seen as a valuable opportunity to practice patient/family communication skills. For example, one of our PGY5s commented that:

"*I think it is helpful for us, in these last few months of residency to have someone observe and critique even simple things like debriefing family because quite often we are left to our own devices*." (PGY5 #1)

The ability to learn various competencies (medical expert, communicator etc.) from observing others was highlighted by several participants:

"*I think that whether you are a confederate or participating or evaluating, everyone's learning something…oh that person did this….I am going to try to do that next time or now I'm going to try to remember not to do that*." (PGY4 #1)

"*The best part was being able to for once, sit back and watch a simulation unravel because usually you're in it and you feel overwhelmed. Being able to watch others work through it helps you organize things in your own head*." (PGY4 #2)

The residents also reflected on the ability to develop competency in the scholar role by participating as the evaluator in the simulation curriculum.

"*We don't get a lot of opportunity to be evaluators and then there's a sudden transition to the staff role and you're expected to all of sudden be an evaluator*." (PGY4 #3)

The second theme, "*Learning through Simulation*", reflected both the positive and negative aspects of learning using this tool. Maintaining realism is a challenge in any simulation experience. In this simulation, comments reflected three key aspects of realism in simulation: technical, time, and confederate realism. Concerns about technical realism are reflected in the following quote:

> *"I just think with shoulders (dystocia) you need the immediate feedback from the actual baby, you need the actual time*" (PGY5 #3).

Time realism was described by another resident:

> "*How long was it? And I remember that I looked at the clock, at what time we got that (medication) and what time it went in…and now it's been four minutes and I don't know if it was supposed to be four minutes real time or four minutes in scenario time.*" (PGY2 #4)

Finally, there was some concern that having a colleague play a role in the simulation would impact the "confederate realism":

> *"I think it's harder to make it as realistic when it's your colleague."* (PGY5 #4)

Residents and faculty commented on the use of the simulation in regards to various types of safety: learning while protecting patient safety and safety for the learners as well. This was reflected in comments from our PGY2s:

> *"I just wanted to say that it is a low stress environment so you have the space to learn without actually worrying about patient outcomes"* (PGY2 #5)

> *"I think also having the opportunity to step out of your comfort zone but knowing that it's safe like no one would be harmed"* (PGY2 #6).

Lastly, an example from one of our PGY5s:

"I think it is just a safe place to be." (PGY5 #1)

It was also noted that the simulation needed to be extremely well prepared to ensure a valuable learning experience for all learners involved. This was of course, most appreciated by the faculty involved in the development and running of the simulation curriculum:

"It clearly went very well… we were ahead of time….that comes back to a lot of preplanning, and troubleshooting." (Faculty #1)

The third theme, "*Giving and Receiving Feedback*" reflected the learning that occurred through the opportunities for providing and receiving feedback at the various stages of the simulation experience and in the various roles within the simulation experience. The value of personalized feedback was commented upon by many of the residents:

"*I think there was a nice amount of time for feedback for every individual person whereas in real life we might debrief about an emergency but you won't necessarily know how you could have done better*." (PGY2 #7)

However, it was clearly expressed that even though feedback was received in the debrief that at least one resident was desiring of more concrete feedback as noted in the comment

"*I would have liked to go home with something physical that says…this is how you did overall…this is one thing to work on and this is one thing you are good at*." (PGY2 #8)

One PGY2 described the specific value of having another resident play the confederate role in respect to the very specific feedback that they could provide:

> *"I think the benefit of them being your colleagues is that they are able to give constructive criticism because they do have that similar understanding"* (PGY2 #5).

Another PGY2 expressed the value of feedback provided from the view of a nurse or patient/family member,

> *"There is something useful in being a nurse or the family member because you can provide good feedback from that perspective as well."* (PGY2 #2)

Concerns were raised about how hierarchy and power between the different levels of learners may impact the experience of giving and receiving feedback. The issue of "Hierarchal Feedback" included a variety of opinions from the various players in the simulation. Several of the PGY4 evaluators made comments reflecting their feeling that is was inappropriate and/or uncomfortable to provide feedback to residents who were their seniors. For example,

> *"I think it's fine to give feedback to the PGY2s but almost inappropriate to give feedback to the PGY5s in front of the juniors."* (PGY4 #3)

This was reiterated by another resident who stated,

> *"When I was giving feedback to the PGY5s I found myself trying to be very careful with the way I said things… I found myself leaving things out"* (PGY5 #4).

Interestingly, however, these sentiments were not expressed by the PGY5s, in fact, a comment was made that

"I think that I feel open to receiving feedback from whomever… even the junior in my scenario." (PGY5 #1)

Similarly, there were comments related to the challenges of providing individual feedback in a group setting. One of the PGY4 evaluators stated:

"I also think it is stressful for the juniors because they haven't done a lot of sims and giving them feedback in front of the staff, in front of their seniors, in front of juniors… it's embarrassing. It actually goes against the principles of feedback … you are not supposed to give feedback in front of other learners." (PGY4 #2)

While another stated

"Maybe that is the point of it…maybe we need to get more comfortable with this." (PGY4 #1)

Despite these challenges in providing feedback, many of the residents expressed the value of the debriefing process. One of our PGY5s expressed that,

"It was an experience in that I learned a bit more of what I did right, what I did not do so well. The debriefing at the end was very important." (PGY5 #3)

The faculty assessors also noted the value of the debrief:

"The debrief afterwards was where it seemed the learning happened like they were able to process in a deeper way what they had done and what they should have done."(Faculty #2)

Lastly the value of peer feedback was commented upon by faculty and residents who expressed that feedback from peers might have more of an effect than feedback from faculty. One of the faculty assessors commented,

> *"I think what worked very well in the debrief was that the feedback came from their peer… I could see that it was sinking in differently."* (Faculty #3)

3.4 The Product Evaluation

In reviewing the specific financial and faculty time requirements of our new simulation curriculum, compared to our previous curriculum, we found the following (Table 3):

1. Residents (#): Thirty-one residents were involved in our Multi-LLC simulation.
2. Monetary Costs: Our multi-level simulation used residents as the confederates and therefore there were no actual monetary costs to our department of the simulation as costs for use of the simulation lab and equipment falls within the education budget of the Faculty of Health Sciences, McMaster University.
3. Faculty time (total): We were also able to reduce total faculty time from 78 hours, to less than half of that, 32 hours (4 faculty for 4 hours each for two sessions).
4. Resident time (per resident): The time for residents was slightly increased from 6 hours to 8 hours (4h X 2 sessions), for the responders in the scenarios. There was also the addition of the simulation time for the non-responders, specifically the confederates and the resident evaluators.
5. Competencies assessed: In our current simulation scenarios, the following competencies were assessed: medical expert, communicator, collaborator, leader and scholar. Although not

formally assessed, the competency of health advocate was explored in the reflection exercise completed by the residents in the confederate role.

Thus we were able to reduce our costs by $6240 and half our faculty time, meeting two of the most challenging priorities identified for the program (see comparison Table 3).

Table 3: Comparison of costs and time for the previous and new curricula.

	Previous	New	Difference
Residents (#)	16	31	+15
Monetary costs	$6240	0	-$6240
Faculty time (total)	78 hours	32 hours	-64hours
Resident time (per resident)	6 hours	8 hours	+2 hours
Competencies assessed	2	5	+3

6. Resident Simulation Assessments (Table 4)

In reviewing the average scores for the assessment of the PGY2s in the Medical Expert and Communicator competencies to be in the good-excellent range although the scores for shoulder dystocia were slightly lower. This would be in keeping with the lower frequency of this emergency. The average scores for the PGY5s in regards to Collaborator, Leader, and Communicator skills were in the competent to superior range which would be expected for residents in their final year of training. The evaluators (PGY4) were assessed during the debrief by simple checklist. The

assessors average score was 7.4 (1.1) out of a possible score of 10. Certainly the most challenging area for the assessors was discussing the "negatives" of their peers' performances while ensuring they focused on behavior only, providing examples and alternatives. The other challenging areas appeared to be the ability to lay out a potential plan for improvement for their colleagues and encouraging their colleagues to reflect upon their performance during the simulation.

Table 4: Resident simulation assessments (station scores) for the various resident roles

	Medical Expert (SD)	Collaborator (SD)	Leader (SD)	Communicator (SD)	Scholar (SD)
First responder					
PPH	6.75 (0.43)			6.75 (0.43)	
SD	5.00 (1.00)			4.50 (1.10)	
PET	6.25 (0.83)			6.50 (0.87)	
CP	5.50 (0.50)			5.75 (0.43)	
Second responder					
PPH		5.75 (0.43)	5.50 (0.50)	6.00 (0.70)	
SD		5.50 (0.87)	5.25 (0.43)	6.00 (0)	
PET		6.00 (1.00)	6.00 (1.00)	6.50 (0.50)	
CP		5.75 (0.43)	5.25 (0.83)	5.50 (0.50)	
Assessors					7.4 (1.1)

9. Reflection Exercise: The reflection exercises completed by the confederates were collected to ensure that they were completed. They were completed by all of the residents in the confederate roles. As noted previously they were not assessed for content in regards to reflection of the advocate, communicator or collaborator roles, but simply for their completion.

10. Comparative Assessment:

a) Average overall scores (SD) from our previous simulation scenario of PPH were compared to scores on the PPH scenario of our new simulation curriculum for both the PGY2 (81.25 (12.5) vs 83.50 (11); t(0.27)=6, p=0.80) and for PGY5 (93.75(12.5) vs 83.25 (3.5); t(1.6)=6, p=0.16). There was no significant difference between the scores on the two scenarios suggesting that our previous simulation and Multi-LLC simulation were assessing similar competencies.

b) As noted, the evaluators were assessed by comparing the scores they gave to residents that they were assessing, to the scores provided by faculty on the same resident performances. There was a higher correlation for the PGY2 scores as compared to the PGY5 scores. (Table 5)

Table 5 Resident Evaluator Scores as compared to Faculty Evaluator Scores

	Average Score	P value	Pearson correlation coefficient
First responders (PGY2)			
Resident score	5.78	0.69	0.65
Faculty score	5.67		
Second responders (PGY5)			
Resident score	5.86	0.04	0.37
Faculty score	5.64		
PGY2 & PGY5 combined			
Resident score	5.82	0.08	0.51
Faculty score	5.65		

10. Resident Survey:

The final component of the "product" evaluation was review of the resident survey. One of the program requirements for this project, was the development of a simulation curriculum that provided a positive learning environment for the learners. Thus the learning environment was addressed in both the Context Evaluation – Resident Survey and Product Evaluation – Resident Survey and served to provide a comparison of the learning environment score of the previous simulation curriculum to the score for this new simulation curriculum. The comparison shows a significant improvement in the learning environment from a score between adequate – good (mean score 3.63 (0.96)), to a score between good-excellent (mean score 4.73(0.50)) ($t(6.1)=62$, $p<0.0001$).

We also examined self-efficacy scores on the main CanMEDS competencies being assessed (medical expert, collaboration, communication, leadership and scholar/evaluator) by means of both the Context Evaluation – Resident Survey and Product Evaluation – Resident Survey (Tables 6-9). For the PGY2 or first responders, only the scores on the skill of managing shoulder dystocia showed a significant improvement despite the fact that all scores were higher in the post-simulation survey (2.29(0.70) vs 3.75(1.26), $t(2.45)=9$, $p=0.04$). For the second responders, there were no significant differences between the pre- and post-simulation survey scores, and in fact, when looking at the individual scores, some of the scores were lower post-simulation than pre-simulation. The confederate group (PGY1-3) showed significant improvements in their self-efficacy scores relating to medical expert competency for all of the simulation scenarios but not for the other competencies (collaboration, communication, leader and evaluator/scholar). Lastly the evaluator group (PGY4) showed no significant improvement in their scores.

Table 6 Self-efficacy scores: Comparison of pre-simulation versus post-simulation scores for First responders (PGY2)

First responder (PGY2)	Pre-simulation average score (sd)	Post-simulation average score (sd)	P value
Medical expert			
PPH	3 (0.53)	3.25 (0.66)	0.46
Shoulder dystocia	2.29 (0.70)	3.75 (1.26)	0.04
Preeclampsia	2.57 (0.49)	3.25 (0.66)	0.06
Cord prolapse	2.86 (0.64)	3.13 (0.60)	0.45
IP communication	3.57 (0.49)	3.75 (0.83)	0.64
Leadership	3.14 (0.64)	3.38 (0.86)	0.59
Patient Communication	3.86 (0.64)	3.88 (0.60)	0.96
Evaluator Role	3.00 (0)	3.38 (0.86)	0.28

Table 7 Self-efficacy scores: Comparision of pre-simulation versus post-simulation scores for Second Responders (PGY5)

Second Responder (PGY5)	Pre-simulation average score (sd)	Post-simulation average score (sd)	P value
Medical expert			
PPH	3.83 (0.37)	3.50 (0.50)	0.21
Shoulder dystocia	3.33 (0.47)	3.38 (0.48)	0.88
Preeclampsia	3.50 (0.50)	3.38 (0.48)	0.67
Cord prolapse	3.83 (0.37)	3.63 (0.48)	0.42
IP communication	3.67 (0.75)	3.25 (0.43)	0.29
Leadership	3.33 (0.47)	3.50 (0.50)	0.57
Patient communication	3.83 (0.90)	3.50 (0.70)	0.51
Evaluator role	3.50 (0.76)	3.25 (0.43)	0.53

Table 8 Self-efficacy scores: Comparison of pre-simulation versus post-simulation scores for Confederates (PGY1-3)

Confederates (PGY1-3)	Pre-simulation average score (sd)	Post-simulation average score (sd)	P value
Medical expert			
PPH	2.81 (0.83)	3.68 (0.55)	0.001
Shoulder dystocia	2.55 (0.66)	3.59 (0.65)	<0.001
Preeclampsia	2.63	3.55 (0.66)	0.002
Cord prolapse	2.90 (0.79)	3.63 (0.64)	0.02
IP communication	3.82 (0.83)	3.86 (0.62)	0.88
Leadership	3.45 (0.66)	3.50 (0.58)	0.85
Patient communication	3.81 (0.30)	3.91 (0.51)	0.59
Evaluator role	3.10 (0.51)	3.41 (0.14)	0.14

Table 9 Self-efficacy scores: Comparison of pre-simulation versus post-simulation scores for Evaluators (PYG

Evaluators (PGY4)	Pre-simulation average score (sd)	Post-simulation average score (sd)	P value
Medical expert			
PPH	3.83 (0.37)	4.00 (0)	0.36
Shoulder dystocia	3.50 (0.76)	4.00 (0)	0.20
Preeclampsia	3.50 (0.50)	4.00 (0)	0.08
Cord prolapse	3.67 (0.75)	4.00 (0)	0.36
IP communication	4.17 (0.37)	4.00(0)	0.36
Leadership	3.83 (0.37)	4.00 (0)	0.36
Patient communication	4.30 (0.47)	4.14 (0.35)	0.47
Evaluator role	3.50 (0.50)	3.86 (0.35)	0.21

Lastly, we viewed the resident and faculty scores, in regards to assessment of realism of the various simulations, the ability of the simulations to test various competencies and the ability to debrief a variety of skills (Table 10). In general, both the resident and faculty group rated the realism, ability to test and ability to debrief better than adequate. There were challenges to realism with the shoulder dystocia and eclampsia stations. Also the residents felt that there were some difficulties in being able to assess technical skills and again, this was most obvious with the shoulder dystocia scenario.

Table 10: Comparison of post-simulation scores: residents versus faculty

	Resident average score	Faculty average score
Realism:		
PPH	3.70	4.0
SD	3.6	4.0
PET	3.7	4.0
CP	4.1	4.0
Ability to test:		
Technical skills	3.4	4.4
Leadership	4.2	4.8
Communication skills	4.6	4.8
Evaluator role	4.9	3.9
Ability to debrief:		
Technical skills	3.8	4.5
Leadership	4.2	4.6
Communication skills	4.5	4.6

4.0 Discussion

4.1 Summary of Findings

The implementation of Competence By Design will force a number of changes within residency training. One of the most challenging will be the need for increased breadth of learning and assessment. In obstetrics and gynecology this poses many challenges. Fortunately for patients, obstetrical emergencies are rare. However, this poses a challenge for residency programs in terms of ensuring competence of their trainees in managing these rare events. Obstetrics and gynecology training programs are also challenged by the ratio of number of residents to the number of obstetrical emergencies. Ensuring each and every resident is capable of managing each emergency is near impossible. Further to that, within the management of each rare emergency there are a number of competencies that need to be assessed. In addition to these challenges, the funding to residency training programs continues to be lacking, and time, both resident and faculty, is limited. In a fee-for-service payment system, having faculty available and willing to teach can be challenging. Lastly, resident engagement is also difficult as learning and assessment in the presence of peers can be intimidating for learners.

The Department of Obstetrics and Gynecology at McMaster University performed a needs assessment identifying their specific needs in terms of meeting the Competence By Design requirements of the RCPSC. Five key “needs” were identified: increased breadth of learning and assessment, maintenance and improvement of resident learning, reduction of monetary costs, reduction in faculty time commitment and improved resident acceptance of the simulation curricula. With this in mind, the Multi-LLC simulation curriculum was developed and evaluated

to determine if it would indeed meet the Department needs. Our findings support that the Multi-LLC has great potential.

4.1.1 Increasing breadth of learning and assessment

It is clear from the literature review that simulation can be used to teach and assess a variety of competencies. In this study, the number of competencies assessed in the simulation communication was increased to 6 (medical expert, communicator, collaborator, health advocate, scholar and leader), from 2 in the previous curriculum (medical expert and collaborator) (Table 3). The surveys of the faculty assessors involved in the simulations and the participating residents, questioned the simulation scenario's ability to assess the main competencies assessed in the stations (medical expert, leadership, communication skills and scholar). Results showed (Table 6) that the majority of resident and faculty scores were in the good-excellent range, suggesting that the specific simulation scenarios were indeed a very good tool for assessment of these competencies.

As well, the focus group analysis revealed that both residents and faculty felt that learning occurred across a wide variety of competencies. All residents, including those who were in "non-responder" roles (i.e., confederates and evaluators), all commented that they were able to improve competency in the medical expert role by participating in the simulations. Those who were not actively participating as responders felt they learned by observing others and reflecting upon what actions they would take in a similar situation. There was also convincing evidence that significant learning occurred in regards to collaboration, communication, and health advocacy; specifically, for those in the confederate role. The active role play facilitated the development of insight into the perspectives of the nurse, patient, and family member, which residents felt would lead to improved collaboration and communication within their healthcare teams, improved

communication with their patients, and a better appreciation of issues related to patient advocacy. The reflection exercise completed by the residents in confederate roles, provided another opportunity to assess the learning that occurred in this group. Similar themes to those already mentioned were revealed in the analysis of the reflection exercises.

Specifically, the resident evaluators commented on the value of the time to practice and be given feedback on their assessment and feedback skills. Many commented that the scholar role comprises a significant component of their daily activities, however, they are rarely provided with feedback. The PGY5 residents or second responders, commented on the value of practice within the leader role, and feedback regarding their leadership skills. They felt it was something that they rarely received feedback on in the clinical setting. They appreciated the opportunity to act as "staff" in a safe learning environment as they prepare for independent practice. As well, they specifically noted the value of practice of the "difficult conversation" with provision of feedback as they noted that at their level, they are rarely observed when counselling patients.

The success of this first iteration of the Multi-LLC simulation, raises interesting questions about how broadly competencies can be assessed within a single scenario. The first of these questions may consider whether there is a maximal and/or optimal number of competencies that can be incorporated into a single session. From an assessment efficiency standpoint, one may reason that the more competencies integrated, the better. However, we must be cautious to ensure that the volume of assessment does not compromise the robustness of the assessment. For example, one may imagine that a hastily added competency assessment could have *a final straw* effect in that it splits the assessment providers' focus across too many aspects of performance such none receive adequate attention for a refined determination of ability. While the evidence from the present evaluation suggests that assessments were levied from faculty and students without

interference, future studies would do well to consider aspects of assessment reliability and validity as a function of the number of concurrent assessments. Similar work should also consider the way in which the number of learners participating simultaneously impacts the assessments' psychometric properties.

On the other side, a larger volume of assessments may have a positive influence on the learning experience. In particular, it is well known that assessment drives learning (Epstein, 2007; Van Der Vleuten, 1996; Wass, Van Der Vleuten, Shatzer, & Jones, 2001). Given this, it is possible that combining multiple assessments together refocuses trainees' efforts more towards a holistic conceptualization of medical practice; one that values the intrinsic competencies more acutely, considers how they may augment or diminish the efforts around medical expertise, and that ultimately promote well-rounded professional growth. Again, however, it is important to recognize that too many areas of focus for trainees at an early stage may be maladaptive. In this regard, future development of Multi-LLC simulations should consider the formative impact that degrees of multiple competency assessment may have on learners. One idea is that complexity of the simulation may be managed via integration of more competencies, which in turn reflects more holistic practice expectations. This may be an innovative way to leverage appropriately designed progressions for learners at different levels of ability (Brydges, Carnahan, Rose, Rose & Dubrowski, 2010; Guadagnoli, Morin & Dubrowski, 2011).

4.1.2 Maintain and improve resident learning

The focus group analysis revealed that the residents felt strongly that simulation was a superior learning tool to didactic sessions. They felt that actually practising their skills led to better retention of these skills. They also noted that a wider range of competencies were addressed when using simulation and hence it provided a better learning opportunity. Residents commented that

the safe learning environment provided an opportunity to "*push your limits*", which enhanced their learning. Another advantage of simulation was reported to be the ability to consider the entire management of a problem, which was felt to be something that is not obtained from other learning opportunities.

Certainly there were challenges to the simulation curriculum. The residents noted challenges to realism in regards to their colleagues playing confederate roles and some challenges in regards to time realism. In the analysis of the entire focus group feedback, however, it appears that these challenges to realism were overcome and the overall report was that simulation provided an exceptional learning opportunity. Considering that the best test of realism is the ability of the learner to transfer their experience into the clinical setting, future work with the Multi-LLC will explore how this transfer is occurring.

While the analysis of the resident focus groups was convincing that this simulation curriculum served to improve resident learning, the comparison of our pre-simulation and post-simulation self-efficacy scores were less convincing in this regard. Comparisons of these scores for each of the roles within the scenarios demonstrated that it was only the confederate role that demonstrated an improvement in medical expert scores for each of the scenarios. This perhaps reflects the learners actually adjusting their self-efficacy scores to match their performance in the simulation when they realized that perhaps they did not perform as well as expected.

While we made use of self-efficacy scores as a surrogate marker for actual ability, the literature certainly suggests that self-efficacy scores are not very accurate and their value is perhaps not in their accuracy but rather, their impact on future performance (Eva & Regehr, 2005). Self-efficacy ratings appear to affect performance by means of a self-fulfilling prophecy phenomena. Thus over-estimation of one's abilities may indeed be helpful in improving performance to a

certain degree (Shapiro, Schwartz and Austin, 1996). In regards to self-assessment of performance, in their review of the literature, Eva and Regehr (2005) discuss the need for the incorporation of various sources of input in order to achieve an accurate assessment of one's performance (i.e., the need for incorporating input from peers and others improves accuracy as their assessment is more predictable of actual performance). This helps to explain the lower self-efficacy scores following performance in the scenarios, as these scores were collected following the debriefing period therefore, these self- assessments would have likely incorporated peer and faculty feedback as well as the learner's own reflections on their performance, thus making them a more accurate assessment of ability.

4.1.3 Reduction of monetary costs and faculty time commitment

The previous simulation curriculum required the use of paid confederates to play the roles of nurse, patient, and/or family member. The monetary costs were primarily related to these fees as other fees associated with simulation fall outside of our department budget. In the new simulation, with the residents playing the confederate roles, costs were reduced to zero dollars, a savings of over $6000. Furthermore, the previous simulation curriculum involved one faculty assessor paired to one resident for a 1.5 hour simulation session. With our new simulation, we were able to reduce the faculty time commitment by over half. Thus there were considerable reductions in monetary and faculty time commitments for our department, meeting two further priorities determined by the needs assessment. Importantly, we recognize the tremendous impact that the context of development played in this particular outcome. Programs across Canada and the world will all be differentially funded and resourced, such that it is reasonable to expect the costs and savings described in this report to be different in different locales. Furthermore, it may also be prudent to consider how standardized patient programs may be impacted by curricular

developments that promote student participation in simulation-based role play in lieu of professional actors, and what financial impacts this may have on existing relationships within a medical school.

4.1.4 Improved resident acceptance

Comparison of the results from the resident pre-simulation and post-simulation survey demonstrated a significant improvement in scores assessing the learning environment with scores increasing from average-good to good-excellent. Certainly there were some resident comments that challenged this – several of the resident evaluators felt that it was very difficult to provide constructive feedback to their senior residents and one resident commented that principles of providing feedback were contradicted in that feedback was provided in front of others during the debrief - however, other residents quickly refuted these comments and pointed out the learning that was achieved through this process. Overall the resident feedback obtained through the focus group interviews reflected mostly positive impressions of this learning opportunity.

4.1.5 Summary

As outlined, we were able to meet all of the priorities determined by the needs assessment. The Multi-LLC significantly increased the number of competencies for which we were able to provide both learning and assessment at a level at least consistent with the previous simulation curriculum. Despite increasing the number of competencies, the change in structure of the simulation process lead to a significant reduction in monetary costs and faculty time commitments. Lastly, but importantly, the Multi-LLC demonstrated improved resident acceptance of the

simulation curriculum which we expect to translate into increased engagement as they move forward with the new simulation curriculum.

4.2 Learning within the Multi-LLC Simulation

The implementation of "Competence by Design" demands the "*selection of activities, experiences and instructional methods that will assist in progressing learners through developmental milestones*" (RCPSC, 2014). Programs must be careful in their selection of assessment tools in order to ensure that they are capable of documenting progression through the developmental milestones and achievement of competency. Clearly simulation is a tool that can be used for both learning and assessment and can assist with this implementation. It provides an opportunity for deliberate practice in a safe environment. As well, it incorporates formative feedback allowing for the most effective learning. As discussed above, we were able to show that our Multi-LLC simulation curriculum was able to meet our program needs as they pertain to meeting the requirements of the RCPSC. It is also worthwhile reflecting back on some of the key features of the simulation strategy and how the use of these tools enhanced the learning provided by the simulation curriculum.

4.2.1 Role Play

One concern with the development of the new simulation curriculum was centered on whether the residents in the confederate roles would have a positive learning experience. Specifically, would there be learning around the communicator, collaborator, and health advocacy competencies through role play, and would there be learning of the medical expert competencies through observation. There is little literature around the use of role-play in complex patient

management simulations and the learning that can occur through this tool; although, evidence in support of experiential learning theory, adult learning theory, and theories of reflective practice (Nestel & Tierney, 2007), all resonate in this context. In considering our simulation curriculum, our debriefing sessions and focus group discussion, it was found that the simulation experience optimized exposure to all four learning environments considered in experiential learning theory, while also invoking reflective practice in several ways. For instance, the residents in confederate roles were actively involved in the scenarios, allowing them opportunity to draw on previous experience. In keeping with both theories of adult learning and reflective practice, the debrief and reflective exercise all permitted opportunities for reflection-on-action. Thus it is reasonable to assume that the resultant learning occurred via role-play. This is particularly reflected in the positive results that emerged within the confederate group.

This is an incredibly useful finding in regards to future simulation curriculum development. Historically, the learning acquired through the use of simulation was felt to be primarily related to medical expert competencies for learners performing in the role of responder, often as the sole learner involved in a scenario. The knowledge that learners can attain knowledge/skill pertaining to a variety of competencies through role play, means that simulation scenarios can be used more effectively in regards to both learning across a breadth of competencies and be used more effectively in regards to budgetary issues. Consideration can also be made to further explore the learning occurring through role play by adjusting the scenarios so that this learning is more intentionally directed to more specific aspects of the various competencies. While we gained most of our knowledge regarding our participants reflections on their learning through role play via the focus group discussions, in future, assessment of the content within the reflective exercises (ie

rather than simply completion) would also be useful in terms of better understanding the learning around the communicator, collaborator and health advocate roles.

The findings supportive of the use of role-play as a learning tool in regards to communication and collaboration suggest that there may be potential for its use outside of the simulation laboratory. The ability of the use of role play to be used for improved understanding of the perspectives of others in the clinical setting is an area for future research. If role play is effective in gaining insight into the roles of others, could it be used in the clinical setting to improve team functioning? Or could this gain of insight be helpful in conflict resolution in the workplace?

4.2.2 Learning through Observation

With the development of this simulation curriculum, we also wondered if those resident participants who were not "responders" would derive some learning of the medical expert competencies purely by observation (Bandura, 1961). Our focus group analysis revealed that many residents felt they were able to learn some of the medical expert competencies purely through observation. As noted previously, residents playing the evaluator role felt that they were able to learn more in regards to overall management of emergencies from the opportunity to observe others working through an entire case. Others reported that through the process of observation of their peers they were able to consider certain aspects of their provision of care that they would change in the future. They also expressed that they felt that the advantage of the evaluator role was that they could see the whole case unravel and reflect upon it more easily than those directly participating in the scenario.

Confederates felt similarly; that learning of clinical management occurred despite being in an observer role in regards to this competency. Their comments in the focus groups regarding this

concept were almost identical to the evaluator group. In reflecting on Bandura's (1961) processes of observation, and how these might explain the learning that occurred in this simulation curriculum for our "non-responders", one might surmise that the issues of attention and motivation would have been high in this setting. The residents would have had a high degree of attention as some were participating in the scenarios (confederates) and some were evaluating and thus would have needed to attend to what was occurring. While both groups required a significant amount of attention to the unfolding simulation scenarios, it is difficult to determine the similarity of what the two groups learned through observation. The confederate group, certainly had the opportunity for reflection on the communicator, collaborator, and health advocate roles, but also, as noted, believed they had learned about the medical expert role. Would this learning in the medical role be any different for the evaluator group? While the latter group focused more on the procedural aspects of the medical expert role as guided by the assessment tool, we are not able to determine if the aspects of the medical expert role they felt they learned were different from the confederate group. The evaluator group was also assessing communicator, collaborator, and leadership skills, thus it is likely that similar to the confederate group, there was some additional learning in regards to these intrinsic roles. The specifics of what aspects of the observed roles was learned could be further explored in future studies by the use of some specifically directed questioning in focus groups to develop a better understanding of the potential differences. In addition to the significant degree of attention provided to the scenarios, the combination of several factors such as the rarity of obstetrical emergencies, the knowledge that they all must be deemed "competent" in managing these rare clinical situations along with the general desire to provide good care in these emergency situations would have led to a high degree of motivation.

Thus the keys to enhancing learning through observation in the simulation environment may indeed be related to having the learners actively engaged in the simulation in order to maximize their attention and to choose scenarios that would be deemed to be high priorities for the leaners. These key concepts are not specific to the context of our simulation scenarios but rather, they are generalizable. Thus it is not unreasonable to suggest that learning through observation could occur in simulation curricula in any number of areas of medicine and health care to potentially benefit learners at any level (for e.g., undergraduate, postgraduate, and faculty). Areas of future research could include exploring this in other specialty programs within postgraduate education but also, within the undergraduate programs of medicine, nursing or other healthcare disciplines.

4.2.3 Progression of Learning

A significant component of CanMEDS 2015 is the incorporation of "milestones". Previously the objectives of training considered only the competencies required at the completion of training rather than considering at what points along the way, certain skills/knowledge would/should be obtained. In the most recent CanMEDS framework, milestones refer to "observable markers of someone's ability along a developmental continuum" (CanMEDS 2015 Physician Competency Framework). In this way, they are a guide for curriculum development. This framework also refers to "entrustable professional activity" (EPA) which refers to tasks in the clinical setting that are assessed to demonstrate competence. Often this competence is accomplished by meeting several milestones.

Although the milestones and EPAs have not been developed for Obstetrics & Gynecology as of yet, the simulation curriculum was developed using various concepts of progression of learning. Harden (2007) describes four methods by which there can be progression of learning that leads to the achievement of the "exit learning outcome". The Multi-LLC curriculum has made use of all of them: increased breadth, increased difficulty, increased utility and application to practice, and, lastly, increased proficiency. It increased "application to practice" simply by making use of simulation of potentially real clinical experiences. The simulation scenarios allowed all of the learners to apply their learned knowledge to the simulated emergencies providing them an opportunity to practice these skills in a safe environment in preparation for dealing with them in the clinical setting. The Multi-LLC allowed for progression of learning through "increased breadth" by developing objectives that were specific to the year of training. Our most junior learners' objectives were targeted to the medical expert role of management of the emergency itself with performance of the related medical expert skills. Their objectives also encompassed collaboration skills. The objectives for our PGY3 learners were further development of collaboration skills, as well as patient communication skills and health advocacy skills. Although they were not formally assessed in regards to these skills, they completed refection exercises to further develop an awareness of the importance of their role as a physician as it pertains to these skills. The PGY4's objectives were specifically related to the scholar role and their ability to both assess and provide feedback to their colleagues. We specifically tasked our PGY4s with these objectives as we felt their own skill development would be far enough along for them to have some understanding of the expectations for performance. It also seemed appropriate for them to be practicing these skills just prior to entering their final year of training when they would be expected to be assessing and providing feedback to junior learners with whom they would be working.

Lastly, the objectives for the PGY5s included communication and collaboration skills, plus the added skill of providing leadership. The Multi-LLC also made use of increased difficulty by having the PGY5s challenged by difficult patient communication scenarios (for e.g., patient refusing care, informed consent in an emergency situation, difficult family member) rather than simple communication scenarios. Lastly, the Multi-LLC made use of "increased proficiency" as a means of progression of learning through the increased expectations of our PGY5 learners in regards to the performance of collaboration and communication skills. Thus the Multi-LLC simulation curriculum optimized the progression of our learners from the knowledge and basic management skills stage, to meeting the expectations of independent practice with exceptional management skills while demonstrating competence with communication and collaboration skills even with difficult situations and providing leadership to the health care team.

Moving forward we hope to further explore these concepts of progression of learning as we continue with our Multi-LLC simulation curriculum. It will be interesting to determine if those residents who have participated in the Multi-LLC simulation previously will show improved performance on the various competencies than residents who have not participated previously. Future studies will involve a comparison of performance between residents who have previously participated in the simulation curriculum versus those that have not. We would expect that those who participated previously in the confederate role, for example, would demonstrate superior performance in the areas of communication, collaboration, and advocacy due to the previous learning through role playing. It would also be expected that they would perform more strongly in the medical expert competencies because of the previous learning through observation. While these studies will provide information regarding progression of learning and milestones, one challenge in regards to the CBD framework is that the current Multi-LLC simulation is structured

based on year of training. To be truly congruent with the framework, we will need to incorporate a structure to the simulation curriculum that incorporates progression based on achievement of competency rather than training year.

Again the development of a simulation curriculum that allows for the progression of learning to meet CBD requirements is generalizable beyond the field of obstetrics and gynecology. The methods of developing a curriculum that encompasses progressive learning can potentially be used in simulation curriculum development in a wide variety of fields by using these strategies used in the development of the Multi-LLC. Lastly, the progressions used within the Multi-LLC could form the basis for the development of developmental milestones for the obstetrical emergency EPAs for obstetrics & gynecology programs within the context of CBD.

4.3 Assessment within the Multi-LLC Simulation

In considering assessment within the context of CBD, McGaghie (1978) discussed the need to use tools that would allow assessment of both problem solving and technical skills rather than the traditional sole focus on knowledge. He also emphasized the need for frequent formative assessment with timely and constructive feedback. The Multi-LLC simulation provided a tool that was able to assess problem-solving skills in regards to the management of complex obstetrical emergencies both in regards to patient management but also in regard to problem solving around the other challenges that are encompassed within the provision of patient care; including, collaboration and patient communication within difficult situations. Our Multi-LCC simulation also specifically assessed medical expert skills for our PGY2 learners, patient communication and leadership skills for our PGY5s, and evaluation and feedback skills for our PGY4 learners.

As discussed, there is a paucity of literature regarding assessment of some of the CanMEDS competencies. The Multi-LLC simulation provided an opportunity to assess the scholar role. As noted, there is little description in the literature regarding assessment of competency within this role. The OSTE has been used to provide assessment of some aspects of the scholar role. The Multi-LCC provided the opportunity to assess our residents' abilities to assess other learners and also assess their ability to provide feedback in an effective manner. The focus group feedback revealed that the residents valued this practice opportunity and feedback from the assessment of their skills on these two tasks. They acknowledged that although they are expected to be performing these tasks on a daily basis, they are seldom observed performing these skills and rarely received specific feedback regarding their performance.

The simulation also provided the opportunity for assessment of the Leader competencies. The majority of literature examining the assessment of these skills exists in the workplace simulation environment in the context of team functioning. The Multi-LLC simulation provided a safe environment for assessment of these skills using a previously validated tool. Focus group feedback confirmed the value of this learning opportunity and the feedback provided in assessment of these skills. Residents felt that they seldom received feedback regarding their performance of these skills and therefore feedback within the context of the debrief was incredibly valuable.

The senior residents also found particular value of the assessment of their patient communication skills. It was commented that by the time residents are at the senior level, they are rarely observed in their communication with patients. This observation of their skills and provision of feedback regarding their ability to communicate in difficult patient situations was found to be incredibly valuable as they quickly approach independent practice. Overall the debrief was regarded to be a valuable learning tool by the residents and also by the faculty. It certainly met the

needs as outlined by McGaghie (1978) in that it provided timely and constructive feedback. Although there were some concerns regarding the process of debriefing, mostly concerns around providing feedback in front of others and the difficulties associated with providing constructive feedback to more senior learners, overall the resident group noted the feedback to be very important to the learning. Faculty also noted that it was within the process of the debrief where a significant degree of learning occurred as the larger context of the clinical scenario was realized. Faculty and residents also noted the value of feedback received from peers with faculty noting that they observed realizations coming from peer feedback that were not occurring with the provision of feedback from faculty.

Lastly, as described previously, residents are currently facing a challenge in having exposure to emergency situations and thus the opportunity to assess residents in emergency situations makes ensuring competency prior to independent practice challenging. The Multi-LCC simulation provided the opportunity to assess residents in four different emergency situations across a breadth of competencies related to the management of obstetrical emergencies. In summary, our Multi-LLC provided the opportunity for learning and assessment for several competencies for which learning opportunities and assessment have been challenging historically. These challenges are present across postgraduate education and not specific to obstetrics and gynecology. With the demands of CBD, the Multi-LLC could potentially provide a tool to meet these challenges and benefit other specialty or non-specialty programs.

4.4 Limitations

In this evaluation, we did not assess learning in the clinical setting. Moving forward we could make use of a procedure logging and assessment tool, to both track and evaluate performance with obstetrical emergencies to ensure that the simulation curriculum is indeed leading to improved

performance in the clinical setting. There exists a web-based program, ("T-Res") primarily for surgical postgraduate trainees that allows for logging of procedures (obstetrical procedures, gynecological procedures, emergency situations, etc.) and also, provides an evaluation tool. Based upon the residents' tracking of procedures, a request for completion of a standardized surgical assessment tool is emailed to faculty. These completed evaluations can then be reviewed to ensure appropriate progression of learning and competence with the required skills. The Department of Ob/Gyn at McMaster University subscribes to this program and thus there is the ability to capture this assessment information.

Fortunately, at McMaster University, there exists an educational budget that supports the Centre for Simulation-Based Learning. Much of the costs related to the use of simulation within undergraduate and postgraduate medical education are not encompassed within the individual medical departments' budgets. As mentioned previously, for the obstetrics and gynecology program, the only costs associated with the simulation lab are those associated with the use of confederates. For other residency training programs outside of McMaster University, where other funding structures exist, the costs for the simulation may be different and may include the costs of rental of the space and equipment, as well as costs associated with disposable equipment (for e.g., sponges, simulated blood, etc.).

4.5 Future Steps

Moving forward the plan is to continue the Multi-LLC simulation annually to allow all residents to participate in simulation scenarios in the various roles. It is hoped that this will lead to improved performance in all skills over time. The evaluation of the simulation will continue as the learners progress through the various roles. Specifically, as noted previously, there is interest in determining if learners who have progressed through the various roles have superior performance

to those who did not have the opportunity, if there is an optimal number of assessments for effective Mulit-LLC education, and whether competency assessments may be incorporated progressively as a means of managing complexity for learners at various milestone stages. As well, we plan to explore the use of this type of simulation model in the context of other specialties. It is expected that this model will work in the context of other emergency simulation scenarios irrespective of specialty, and potentially also in inter-professional education contexts. Other areas of future investigation, as noted, include exploring how this learning experience transfers to the clinical setting and if indeed it enhances performance in the management of real-life obstetrical emergencies. Lastly, we plan to further explore the differences in learning that occurs through observation amongst the learners in various roles.

4.6 Conclusion

The Multi-LLC simulation curriculum was able to meet the needs outlined by the Obstetrics & Gynecology program at McMaster University. It increased the breadth of learning and assessment within the simulation curriculum, maintained resident learning within this curriculum, decreased monetary costs and faculty time commitment, and improved resident acceptance. Moving forward and facing the challenges associated with the CBD framework, the Department certainly finds itself on good footing in terms of providing the Multi-LLC simulation curriculum. CBD provides challenges in regards to ensuring competence via progression through numerous milestones. This Multi-LLC has shown itself to be a tool that can allow assessment of this progress. While we developed this simulation curriculum to address obstetrical emergency training and assessment, there is potential that this simulation curriculum can be used within other specialty or general medicine training programs to address outcomes specific to those programs. We look forward to exploring this simulation framework within these other contexts.

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APPENDIX

APPENDIX 1: FIRST RESPONDER (PGY2) ASSESSMENT TOOL FOR PPH

OBSTETRICAL EMERGENCY SIMULATION

PPH

Date_____

Resident _____Evaluator's Name_____

Critical Tasks:

- Recognition
- Call for help
- CABs
  - Talk to and observe patient
  - Monitor vitals
  - Commence at least one large bore IV
  - Run crystalloid wide open
  - Obtain baseline BW (CBC, Cross match, coags, consider extended lytes and crea)
- Assess fundus
- Bimanual massage
- Foley catheter placement
- Utertonics
  - Oxytocin
  - Hemabate
  - Ergot
  - Misoprostol
- Bakri balloon
- Call for blood
- Communicate effectively with health care team

Please rate the following aspects of this applicant's performance on this station relative to all residents you are rating. **Please place marks inside the boxes** and not on the dividing lines.

Please score the resident's **communication skill** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the **strength of their knowledge and skills** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the applicant's **overall performance** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

1. Please indicate areas where you feel the resident did well:

_____
_____
_____

2. Please indicate areas where you feel the resident could improve:

_____
_____
_____
_____

APPENDIX 2: CONFEDERATE REFELCTION EXERCISE

Confederate Reflection Exercise

Describe the role you played in the recent Obstetrical Emergency Simulation. Describe your response to playing this role considering your feelings, attitudes and knowledge around how health care providers, including yourself, relate to this "role" within the clinical setting. Did playing this role lead to any new understandings? How will having played this role impact your future behaviour?

APPENDIX 3: ASSESSOR'S DEBRIEF CHECKLIST

Feedback Evaluation Tool

Resident_____ Evaluator_____

Date_____ Simulation_____

The resident ensured the learner was ready to receive feedback Y N

The resident provided the learner the opportunity to describe what went well Y N

The resident provided the learner the opportunity to describe what did not go well Y N

The resident described what went well Y N

The resident described what could be improved:

- Providing alternatives Y N
- Considering behaviours only Y N
- Using specific examples Y N

The resident described a plan for improvement Y N

The resident appeared to be sensitive to the impact of their message Y N

The resident encouraged reflection Y N

APPENDIX 4: SECOND RESPONDER (PGY5) ASSESSMENT TOOL

OBSTETRICAL EMERGENCY SIMULATION CRM EVALUATION TOOL

Resident: _____
Date:_____
Staff: _____
Scenario:_____

LEADERSHIP SKILLS
stays calm and in control during crisis
prompt and firm decision-making
Maintain global perspective ("Big picture")

PROBLEM SOLVING
Organized and efficient problem solving approach(ABC's)
Quick in implementation (Concurrent management)
Considers alternatives during crisis

SITUATIONAL AWARENESS
Avoids fixation error
Reassesses and re-evaluates situation constantly
anticipates likely events

RESOURCE UTILIZATION
Calls for help appropriately
utilizes resources at hand appropriately
Prioritizes tasks appropriately

INTERPROFESSIONAL COMMUNICATION SKILLS
Communicates clearly and concisely
listens to team input

OVERALL

OVERALL PREFORMANCE

1	2	3	4	5	6	7
Novice; All CRM Skills require significant improvement		Advanced novice; many CRM skills require moderate improvement		Competent; most CRM skills require minor improvement		Clearly superior; few, if any CRM skills that require minor Improvement

LEADERSHIP SKILLS

1	2	3	4	5	6	7
Loses calm and control for for entire crisis: most of crisis: unable to make decisions without delay; make firm decisions: cannot maintain global perspective		Loses calm and control frequently during crisis: delays in making firm decisions (or with cueing): rarely maintains global perspective		Stays calm and in control for most of crisis: makes firm decisions with little delay; usually maintains global perspective		Remains calm and in control makes prompt and firm always maintains global perspective

PROBLEM SOLVING SKILLS

1	2	3	4	5	6	7
Cannot implement ABC's without cues; always uses assessment without direct cues; uses sequential management despite cues: fails to consider any alternatives		Incomplete or slow ABC assessment; mostly uses sequential management approach unless cued; gives little consideration to alternatives		Satisfactory ABC assessment without cues; mostly uses concurrent management approach with only minimal cueing; considers some alternatives		Thorough yet quick ABC concurrent management most likely alternatives in

SITUATIONAL AWARENESS SKILLS

1	2	3	4	5	6	7
Becomes fixated easily despite without cues; constantly repeated cues: fails to re-assess situation without and re-evaluate situation despite likely events repeated cues; fails to anticipate likely events		Avoids fixation error only with cueing; rarely reassesses and re-evaluates situation without cues; rarely anticipates likely events		Usually avoids fixation error with minimal cueing; reassesses & re-evaluates situation frequently with minimal cues; usually anticipates likely events		Avoids any fixation error reassesses and re-evaluates cues; constantly anticipates

RESOURCE UTILIZATION SKILLS

1	2	3	4	5	6	7
Unable to use resources & staff effectively; does not prioritize tasks or ask for help when required despite cues		Able to use resources with minimal effectiveness; only prioritize tasks or asks for help when required with cues		Able to use resources with moderate effectiveness; able to prioritize task and/or for help with minimal cues		Clearly able to utilize resources to maximal effectiveness; sets clear task priority and asks for help early with no cues

INTERPROFESSIONAL COMMUNICATION SKILLS

1	2	3	4	5	6	7
Does not communicate with team; concisely at all times; does not acknowledge team to team feedback; communication, never uses directed verbal/nonverbal verbal/non-verbal communication		Communicates occasionally with team but, unclear and vague; occasionally listens to but rarely interacts with team; rarely uses directed verbal/non-verbal communication		Communicates with team clearly and concisely most of the time; listens to team feedback; usually uses verbal/nonverbal communication		Communicates clearly and encourages input and listens consistently uses directed communication

PATIENT COMMUNICATION SKILLS

1	2	3	4	5	6	7
Does not listen to patient/family; does not allow patient/family to express their feelings; does not show empathy		Occasionally actively listens to patients/ family; rarely allows patient/family to express their feelings; rarely shows empathy		Usually listens to patient/family; allows patient /family to express their feelings most of the time; is empathetic most of the time		Always listens to patient/family to express empathy

APPENDIX 5: FIRST RESPONDER (PGY2) ASSESSMENT TOOL FOR SHOULDER DYSTOCIA

OBSTETRICAL EMERGENCY SIMULATION

SHOULDER DYSTOCIA

Date_____

Resident _____Evaluator's Name_____

Critical Tasks:

- Recognition
- Call for help
- Call for Pediatrics
- M^{c} Roberts
- Anterior disimpaction
- Rotation
- Manual removal of the posterior arm
- Position on all fours
- Active management of the third stage (oxytocin) prepare for PPH
- Inspect for maternal and newborn trauma
- Communicate effectively with health care professionals (use SBAR effectively)

Please rate the following aspects of this applicant's performance on this station relative to all residents you are rating. **Please place marks inside the boxes** and not on the dividing lines.

Please score the resident's **communication skill** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the **strength of their knowledge and skills** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the applicant's **overall performance** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

1. Please indicate areas where you feel the resident did well:

_____
_____
_____
_____

2. Please indicate areas where you feel the resident could improve:

_____
_____
_____
_____

APPENDIX 6: FIRST RESPONDER (PGY2) ASSESSMENT TOOL FOR CORD PROLAPSE

OBSTETRICAL EMERGENCY SIMULATION

CORD PROLAPSE/FETAL BRADYCARDIA

Date_____

Resident _____Evaluator's Name_____

Critical Tasks:

- Change position
- Assess maternal vitals/confirm FH
- Call for help
- Establish IV access
- IV fluid bolus
- Consider O2
- Perform vaginal exam
- Diagnose cord prolapse
- Call for peds and anaesthesia
- Elevate presenting part
- Trendelenburg or knee chest
- Continuous monitor of FH
- Communicate with patient
- Make decision to expedite delivery
- Communicate effectively with other health care team members

Please rate the following aspects of this applicant's performance on this station relative to all residents you are rating. **Please place marks inside the boxes** and not on the dividing lines.

Please score the resident's **communication skill** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the **strength of their knowledge and skills** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the applicant's **overall performance** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|

unacceptable **marginal** **good** **excellent** **superior**

1. Please indicate areas where you feel the resident did well:

_____
_____
_____
_____

2. Please indicate areas where you feel the resident could improve:

_____
_____
_____
_____

APPENDIX 7: FIRST RESPONDER (PGY2) ASSESSMENT TOOL FOR ECLAMPSIA

OBSTETRICAL EMERGENCY SIMULATION

ECLAMPSIA

Date_____

Resident _____Evaluator's Name_____

Critical Tasks:

- Recognize PET
- Call for help
- Obtain history and physical exam
- Repeat vitals
- Treat BP and headache
- Antihypertensive medication to control blood pressure
-
- Venous access
- Baseline BW – CBC, BUN, Cr, AST, ALT, Consider coagulation studies
-
- Post Seizure:
    - Recovery position, clear airway
    - O2
    - Cycle vitals
    - Magnesium load and maintenance
    - Consider Foley
- Communicate effectively with the patient
- Communicate effectively with other members of the health care team

Please rate the following aspects of this applicant's performance on this station relative to all residents you are rating. **Please place marks inside the boxes** and not on the dividing lines.

Please score the resident's **communication skill** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the **strength of their knowledge and skills** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

Please score the applicant's **overall performance** on this station:

|_____|_____|_____|_____|_____|_____|_____|_____|_____|
unacceptable **marginal** **good** **excellent** **superior**

1. Please indicate areas where you feel the resident did well:

_____
_____
_____
_____

2. Please indicate areas where you feel the resident could improve:

_____
_____
_____
_____

APPENDIX 8: RESIDENT PRE-SIMULATION (CONTEXT) SURVEY

OBSTETRICAL EMERGENCY PRE- SIMULATION BOOTCAMP SURVEY

How would you describe the learning environment of the current Obstetrical simulations?(please circle)

1 Poor 2 Suboptimal 3 Adequate 4 Good 5 Excellent 0 N/A

Please answer the following questions using the following scale:

1 Not competent 2 Minimally competent 3 Adequately competent 4 Very competent 5 Expert

How would you assess your competence in managing: (please circle)

PPH:	1	2	3	4	5
Shoulder dystocia:	1	2	3	4	5
Preeclampsia:	1	2	3	4	5
Fetal bradycardia:	1	2	3	4	5

How would you asses your ability to communicate with other health care professionals? (please circle)

1 2 3 4 5

How would you asses your leadership skills? (please circle)

1 2 3 4 5

How would you asses your ability to communicate with patients/ families? (please circle)

1 2 3 4 5

How would you asses your ability to evaluate and provide feedback to other learners? (please circle)

1 2 3 4 5

APPENDIX 9: FACULTY PRE-SIMULATION (CONTEXT) SURVEY

OBSTETRICAL EMERGENCY PRE-SIMULATION BOOTCAMP FACULTY SURVEY

Please answer the following questions using the following scale:

1 Not competent 2 Minimally competent 3 Adequately competent 4 Very competent 5 Expert

In general, how would you assess PGY2 residents in regards to their ability to manage: (please circle)

PPH:	1	2	3	4	5
Shoulder dystocia:	1	2	3	4	5
Preeclampsia:	1	2	3	4	5
Fetal bradycardia:	1	2	3	4	5

In general, how would you asses resident communication with other health care professionals? (please circle)

1 2 3 4 5

In general, how would you assess PGY5 resident leadership skills? (please circle)

1 2 3 4 5

In general, how would you asses PGY5 resident communication with patients/ families? (please circle)

1 2 3 4 5

In general, how would you assess senior resident ability to evaluate and provide feedback to other learners? (please circle)

1 2 3 4 5

APPENDIX 10: SIMULATION ASSESSMENT FROM PREVIOUS SIMULATION CURRICULUM

Simulation Evaluation **Scenario:**

_____ Live Review: ☐ Video Review: ☐

Faculty: _____ Trainee: _____ PGY Level: _____ Date: _____

Categories	*Elements*	*Element Rating*	*Debriefing notes and category rating*
Task Management	Planning & preparing	1 2 3 4	
	Prioritising	1 2 3 4	
	Providing & maintaining standards	1 2 3 4	
	Identifying and utilising resources	1 2 3 4	
Team Working	Co-ordinating activities with team	1 2 3 4	
	Exchanging information	1 2 3 4	
	Using authority & assertiveness	1 2 3 4	
	Assessing capabilities	1 2 3 4	
	Supporting others	1 2 3 4	

Situation Awareness	Gathering information	1 2 3 4	
	Recognising & understanding	1 2 3 4	
	Anticipating	1 2 3 4	
Decision Making	Identifying options	1 2 3 4	
	Balancing risks & selecting options	1 2 3 4	
	Re-evaluating	1 2 3 4	

Add'l CanMEDS	*Elements*	*Element Rating*	*Debriefing notes and category rating*
Medical Expert	Knowledge of topic	1 2 3 4	
	Performance of Technical skills	1 2 3 4	Overall: 1 2 3 4
Professional	Appropriate interaction with others	1 2 3 4	
	Respects others	1 2 3 4	

	Elements	*Element Rating*	*Debriefing notes and category rating*
Safety	Patient	1 2 3 4	
	Self	1 2 3 4	
	Co-worker	1 2 3 4	

	Descriptor
Rating Options	
4 – Good	Performance was of a consistently high standard, enhancing patient safety; it could be used as a positive example for others
3 – Acceptable	Performance was of a satisfactory standard but could be improved
2 – Marginal	Performance indicated cause for concern, considerable improvement is needed
1 – Poor	Performance endangered or potentially endangered patient safety, serious remediation is required
Not observed	Skill could not be observed in this scenario

APPENDIX 11: FACULTY POST-SIMULATION (PRODUCT) SURVEY

OB Emergency Simulation Evaluation (Faculty)

Date: _____

Please reflect upon the simulation experience and answer the questions below with the following scale in mind:

1= Poor 2=Suboptimal 3= Adequate 4= Good 5= Excellent 0 = NA

Scenarios

Realism of the SIMS:	PPH:	1	2	3	4	5	0
	Shoulder Dystocia:	1	2	3	4	5	0
	Preeclampsia:	1	2	3	4	5	0
	Fetal Bradycardia:	1	2	3	4	5	0
Ability of the simulations to test technical skills:		1	2	3	4	5	0
Ability to test CRM skills:		1	2	3	4	5	0
Ability to test communication skills:		1	2	3	4	5	0
Ability to test ability to evaluate/provide feedback:		1	2	3	4	5	0

Debriefing

Ability of the debrief to address technical skills:	1	2	3	4	5	0
Ability of the debrief to address CRM skills:	1	2	3	4	5	0
Ability of the debrief to address communication skills:	1	2	3	4	5	0

Learning

Please answer the questions below using the following scale:

1 Not competent 2 Minimally competent 3 Adequately competent 4 Very competent 5 Expert

Following the simulation, how would you assess the PYG2 residents competence in managing: (please circle)

PPH:	1	2	3	4	5
Shoulder dystocia:	1	2	3	4	5
Preeclampsia:	1	2	3	4	5
Fetal bradycardia:	1	2	3	4	5

Following the simulation, how would you describe the residents' competence in regards to communication with other health care professionals? (please circle)

1 2 3 4 5

Following the simulation, how would you describe the PGY5 residents' competence in regards to leadership skills? (please circle)

1 2 3 4 5

Following the simulation, how would you describe the PGY5 residents' competence in regards to communication with patients/ families? (please circle)

1 2 3 4 5

Following the simulation, how would you describe the senior residents' competence in regards to evaluating and providing feedback to other learners? (please circle)

1 2 3 4 5

What part of the Obstetrical Emergency Simulations did you like the best?

_____
_____
_____
_____

What part did you like the least?

_____
_____
_____
_____

What could make it better?

_____
_____
_____

Other comments

_____
_____
_____

APPENDIX 12: RESIDENT FOCUS GROUP QUESTIONS (1-4)

1) FIRST RESPONDER FOCUS GROUP

OBSTETRICAL EMERGENCY SIMULATION

FIRST RESPONDER (PGY2) FOCUS GROUP

What was the best part of the Simulation?

_____
_____
_____
_____

What was the worst part?

_____
_____
_____
_____

How did you feel about working in a team with another resident?

_____
_____
_____
_____

Did having other residents play roles within the simulation make it seem less real?

_____
_____
_____
_____

How did you feel about being evaluated by other residents?

_____
_____
_____
_____

These topics are often covered in academic half day sessions. Do you feel that this simulation was a better way of learning these topics?

_____
_____
_____

Traditional simulations focus on the role of medical expert only. Do you think this simulation was more beneficial to your learning?

_____
_____
_____

2) CONFEDERATE FOCUS GROUP

OBSTETRICAL EMERGENCY SIMULATION

CONFEDERATE FOCUS GROUP

What was the best part of the Simulation?

_____
_____
_____
_____

What was the worst part?

_____
_____
_____
_____

Consider the role(s) that you played in the simulation:

Did playing the role of "nurse" give you any new insight regarding interprofessional communication?

_____
_____
_____
_____

Did playing the role of "patient" or "family member" give you any new insight in regards to how you communicate with patients and/or family members?

_____
_____
_____
_____

These topics are often covered in academic half day sessions. Do you feel that this simulation was a better way of learning these topics?

_____
_____
_____

Traditional simulations focus on the role of medical expert only. Do you think this simulation was more beneficial to your learning?

_____
_____
_____

3) EVALUATOR (PGY4) FOCUS GROUP

OBSTETRICAL EMERGENCY SIMULATION

EVALUATOR FOCUS GROUP

What was the best part of the Simulation?

_____
_____
_____
_____

What was the worst part?

_____
_____
_____
_____

How did it feel to evaluate and give other residents feedback:

- Junior to you_____
  _____
  _____
  _____
- Senior to you
  _____
  _____
  _____
  _____

These topics are often covered in academic half day sessions. Do you feel that this simulation was a better way of learning these topics?

_____
_____
_____

Traditional simulations focus on the role of medical expert only. Do you think this simulation was more beneficial to your learning?

4) SECOND RESPONDER (PGY5) FOCUS GROUP

OBSTETRICAL EMERGENCY SIMULATION

SECOND RESONDER (PGY5) FOCUS GROUP

What was the best part of the Simulation?

_____
_____
_____
_____

What was the worst part?

_____
_____
_____
_____

How did you feel about working in a team with another resident?

_____
_____
_____
_____

Did having other residents play roles within the simulation make it seem less real?

_____
_____
_____
_____

How did you feel about being evaluated by other residents?

_____
_____
_____
_____

These topics are often covered in academic half day sessions. Do you feel that this simulation was a better way of learning these topics?

_____
_____
_____

Traditional simulations focus on the role of medical expert only. Do you think this simulation was more beneficial to your learning?

_____
_____
_____

APPENDIX 13: FACULTY FOCUS GROUP QUESTIONS

Faculty Focus Group

Tell me a bit about your impressions of this learning simulation

_____
_____
_____

What was the best part of the Simulation?

_____
_____
_____
_____

What was the worst part?

_____
_____
_____
_____

How do you think learning about these topics through simulation compare to learning them through traditional half day sessions?

_____
_____
_____

How do you think this simulation impacted the resident's learning?

_____
_____
_____

APPENDIX 14: RESIDENT POST-SIMULATION (PRODUCT) SURVEY

OB Emergency Post- Simulation Evaluation (Resident)

Role played in the simulation (please circle):

First responder Second responder Nurse/Patient/Partner Evaluator

Please reflect upon the simulation experience and answer the questions below with the following scale in mind:

1= Poor 2=Suboptimal 3= Adequate 4= Good 5= Excellent 0 = NA

Scenarios

Realism of the SIMS:	PPH:	1	2	3	4	5	0
	Shoulder Dystocia:	1	2	3	4	5	0
	Preeclampsia:	1	2	3	4	5	0
	Fetal Bradycardia:	1	2	3	4	5	0
Ability of the simulations to test technical skills:		1	2	3	4	5	0
Ability to test CRM skills:		1	2	3	4	5	0
Ability to test communication skills:		1	2	3	4	5	0
Ability to test ability to evaluate/provide feedback:		1	2	3	4	5	0

Debriefing

Ability of the debrief to address technical skills:	1	2	3	4	5	0
Ability of the debrief to address CRM skills:	1	2	3	4	5	0
Ability of the debrief to address communication skills:	1	2	3	4	5	0

Faculty

Ability of faculty to create a positive learning environment: 1 2 3 4 5 0

Ability of faculty to facilitate an effective debrief: 1 2 3 4 5 0

Learning

Please answer the questions below using the following scale:

1 Not competent 2 Minimally competent 3 Adequately competent 4 Very competent 5 Expert

Following the simulation, how would you assess your competence in managing: (please circle)

PPH:	1	2	3	4	5
Shoulder dystocia:	1	2	3	4	5
Preeclampsia:	1	2	3	4	5
Fetal bradycardia:	1	2	3	4	5

Following the simulation, how would you describe your competence in regards to communication with other health care professionals? (please circle)

1 2 3 4 5

Following the simulation, how would you describe your competence in regards to your leadership skills? (please circle)

1 2 3 4 5

Following the simulation, how would you describe your competence in regards to communication with patients/ families? (please circle)

1 2 3 4 5

Following the simulation, how would you describe your competence in regards to evaluating and providing feedback to other learners? (please circle)

1 2 3 4 5