

Exploring Trainees' Needs in order to Develop a Training Program in Neonatal Resuscitation

SHORT TITLE:

Needs assessment survey for neonatal resuscitation skills.

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ABSTRACT

A retrospective review of trainees' performance in neonatal mock codes identified deficiencies in their skills. Initiatives to create a new curriculum to improve training in this area included surveying trainees to assess their attitudes towards neonatal resuscitation training, perceived skill deficit and preferred learning strategies. **Methods:** An online survey was sent to fifty trainees enrolled in the pediatrics program at the University of Ottawa. **Results:** Seventy six percent of trainees responded. All respondents agreed on the importance of the ability to run a real or mock code. Only 11% of trainees were very comfortable performing a real resuscitation by the end of their first year of training; while 23% were very comfortable when running mock codes. From the different learning strategies presented to them, most trainees preferred hands-on experience (i.e. mock codes). **Conclusion:** Most trainees believed they weren't adequately prepared and weren't comfortable running a real or mock neonatal resuscitation. Information gathered from this survey guided us in developing a new training program to enhance trainees' skill level and comfort in both mock code and real neonatal resuscitation.

Key words: Mock codes, Needs Assessment, Neonatal, Resuscitation, Education.

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INTRODUCTION

Nearly 10% of newborns require some form of resuscitation at birth¹ and prompt, appropriate measures are critical to assist the neonate experiencing difficulty in transition to extra-uterine life.² Demonstrating effective and appropriate neonatal resuscitation skills is defined as a key competency for training in Pediatrics, Obstetrics and Gynecology, and Neonatal-Perinatal Medicine (NPM) by the Royal College of Physicians and Surgeons of Canada.

Neonatal resuscitation requires sound cognitive as well as technical and behavioral skills, attained through both training and experience.³ In Canada and the United States, health care providers involved in the resuscitation of newborns must complete a one full-day Neonatal Resuscitation Program (NRP) course. The NRP teaches evidence-based concepts and skills through hands-on task training.⁴

The NRP incorporates mega-code and performance checklists to assess cognitive, behavioral and psychomotor skills; however, successful completion of the NRP does not translate into competence.⁵ The mega-code assessment process nevertheless provides an opportunity for feedback to trainees, in order to facilitate their learning and provide guidance for further education.

At the University of Ottawa (uOttawa), the NRP course is a mandatory part of residents' and fellows' curriculum in Pediatrics, Obstetrics and Gynecology, and Neonatal-Perinatal Medicine (NPM). Trainees also have occasional opportunities to perform a simulated neonatal resuscitation (neonatal mock code). Despite this, nearly half of those trainees, from all Post Graduate Years (PGYs), assessed using the NRP Mega-code Assessment Form (Advanced) demonstrated inadequate resuscitation skills during mock codes.^{4,6} This finding may be due to

poor retention of skills demonstrated during the NRP course, indicating that NRP participants require additional training to maintain their competence level in neonatal resuscitation.⁷⁻¹⁰

Given these deficits in our trainees' skills, we performed a literature search that showed a lack of any studies done to characterize trainees' learning needs in newborn resuscitation, and what they think is required for them to attain and retain skills for newborn resuscitation.

Faced with our program's need to improve trainees' performance in neonatal resuscitation, and a paucity in the literature describing the trainees' specific educational requirement in this area, we conducted a needs assessment survey to better understand what trainees thought they required to help them attain comfort and competencies in this area. This paper discusses the results of the survey and delineates how the information gathered was used to guide the development and implementation of an improved mock code curriculum to meet trainees' educational needs.

METHODS

Survey development

A literature review of models and methods of data collection for needs assessment¹¹⁻¹³ informed the design of the survey (**Appendix A**). A literature search on the advantages and disadvantages of various teaching methods used in neonatal resuscitation identified the well-studied methods while the survey sought the trainees' attitudes and opinions around using those methods in our future curriculum development.

Key domains were identified from our literature search and included: the training program; attitudes towards learning resuscitation skills; opinions regarding methods used to achieve those skills; opinions on the adequacy of the program at the time to make trainees comfortable with real mock codes; actual comfort level in performing real and mock neonatal resuscitation; perceived needs for further training; and opinion on the use of well-recognized and studied educational strategies to acquire and retain neonatal resuscitation skills.

The survey included open-ended questions and statements to be rated using 4-5 point Likert-type scale (“Strongly agree to Strongly disagree”, “Very comfortable to Uncomfortable” or “Very effective to Not effective”). A “Not sure” option was added to question number 4 as it required trainees to have completed their PGY1. The survey was reviewed, edited and amended by four local experts. Consensus was reached among all experts.

Survey distribution

The survey was distributed on-line through SurveyMonkey®, a questionnaire creation and distribution website. All trainees received email invitations, including a cover letter explaining the purpose of the survey, and a link to complete it. A follow-up email was sent as a reminder two weeks following the initial invitation.

Study population

All participants were postgraduate trainees at the uOttawa during the 2010-2011 academic year (July 2010 to June 2011). All participants had completed at least one rotation of 4 consecutive weeks in the Neonatal Intensive Care Unit (NICU) at the Ottawa Hospital – General Campus (TOH-GC) before taking part in this survey. Invited participants included: all (PGY-1 to PGY-4) Pediatrics residents, PGY-1 Obstetrics and Gynecology (Obs/Gyn) residents, and first and second year NPM subspecialty trainees.

Current University of Ottawa neonatal resuscitation training

Trainees included in the survey rotate through either one or both of the two university hospital NICU sites: TOH-GC and the Children’s Hospital of Eastern Ontario (CHEO) in Ottawa, Canada. These are referral centers for newborns from Eastern and South-Eastern Ontario, Western Quebec and the Baffin region of Nunavut. Each rotation is 4 weeks in duration. Rotations at CHEO NICU provide the trainees with experience managing infants with a variety of complex surgical, cardiac, respiratory and other disorders. During rotations at TOH-GC NICU, trainees attend high risk deliveries, neonatal emergencies and manage problems associated with transition and prematurity including providing neonatal resuscitation as needed.

Pediatric residents enrolled in the uOttawa program have two 4-week NICU rotations during PGY-1 training at TOH-GC, one rotation in PGY-2 at CHEO and one rotation in PGY-3 at one of the two sites. Pediatrics residents are expected to attain the basic knowledge as well as the skills necessary to perform neonatal resuscitation during their PGY-1. This acquisition of skills ensures that they can be on-call in the NICU without additional in-house senior supervision in PGY-2. Obs/Gyn residents have one rotation in the NICU at TOH-GC during their PGY-1, and by the end of this rotation they are expected to be comfortable initiating neonatal resuscitation. NPM subspecialty trainees have 6 rotations per year in the NICU, with 3 rotations at each site. They are expected to be able to competently perform resuscitation measures in a compromised baby at the start of their training program.

All trainees complete a full day NRP course early in their first year of training and every two years thereafter. At the time of the survey, some neonatologists would occasionally conduct mock codes as part of the informal teaching in the NICU, to refresh skills learned from the NRP.

E. Ethics

The two participating institutions' local ethic boards approved the study. Completion of the questionnaire indicated implied consent. The collected data was kept confidential and stored on a password-protected website. Training status and/or educational experience was not affected by participation or lack thereof.

F. Data Collection and Analysis

A mixed methodology design was used. Questionnaire responses were tabulated and analyzed using SPSS 20.0. Data exploration and descriptive statistics were performed. 4-5point Likert-style questions were analyzed by calculating average responses, as well as by combining responses at the extremes as positive responses (e.g., useful/very useful) and negative responses (e.g., slightly useful/not useful). Rating averages of the Likert-type responses were also calculated.

The relationship between comfort with resuscitation and year of residency training was tested using Spearman correlation test. While maintaining the confidentiality of responses, the year of residency training for each respondent was determined post-survey completion based on their email addresses. Responses to open-ended questions were evaluated using qualitative content thematic analysis methodology for coding and identifying principal themes.

RESULTS

Between January 2011 and May 2011, 39 of 50 trainees (76%) completed questionnaires. Respondents included all Obs/Gyn residents (n=6 of 6), all NPM subspecialty trainees (n=4 of 4) and the majority of Pediatric residents (n=29 of 40). The distribution of the responding pediatric residents according to the year of training was: 8 PGY-1, 12 PGY-2, 4 PGY-3 and 5 PGY-4. Of note, most of the NPM fellows in 2010-2011 were international graduates (3 of 4), with varying levels of experience in neonatal resuscitation.

1-Attitudes and past experience

All respondents agreed strongly that they should acquire neonatal resuscitation skills early during their training. To enable skills attainment, trainees rated their own observation and/or participation in a real neonatal resuscitation as most effective, followed by NRP courses and then their experience observing and/or participating in neonatal mock codes (**Figure 1**). The open-ended question yielded two additional suggestions to improve training; interactive teaching and feedback sessions after both simulated and real neonatal resuscitations.

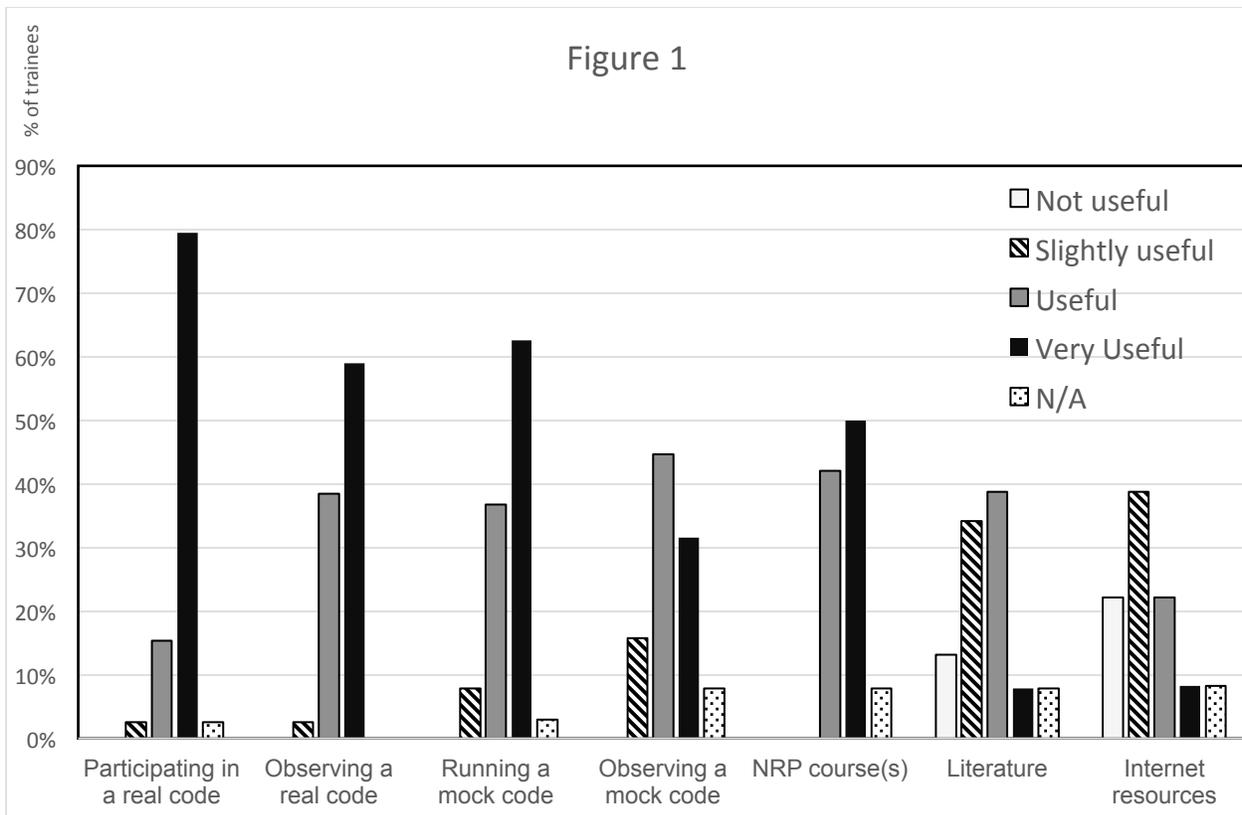


Figure 1. Percentage of trainees ranking of the helpfulness of currently available educational activities and resources, in learning neonatal resuscitation

2- Perceived comfort level

We explored participants' comfort levels with their ability to lead a real neonatal resuscitation by the end of PGY1: four (11%) trainees felt they were very comfortable (**Figure 2**).

When the NPM trainees were excluded from the analysis, only three (8%) trainees felt they were very comfortable.

Looking at their comfort level in running real or mock neonatal code in the NICU, irrespective of their level of training, nine (23%) trainees felt they were "very comfortable" (**Figure 3**). When NPM trainees were excluded from the analysis, only six (15%) felt very comfortable.

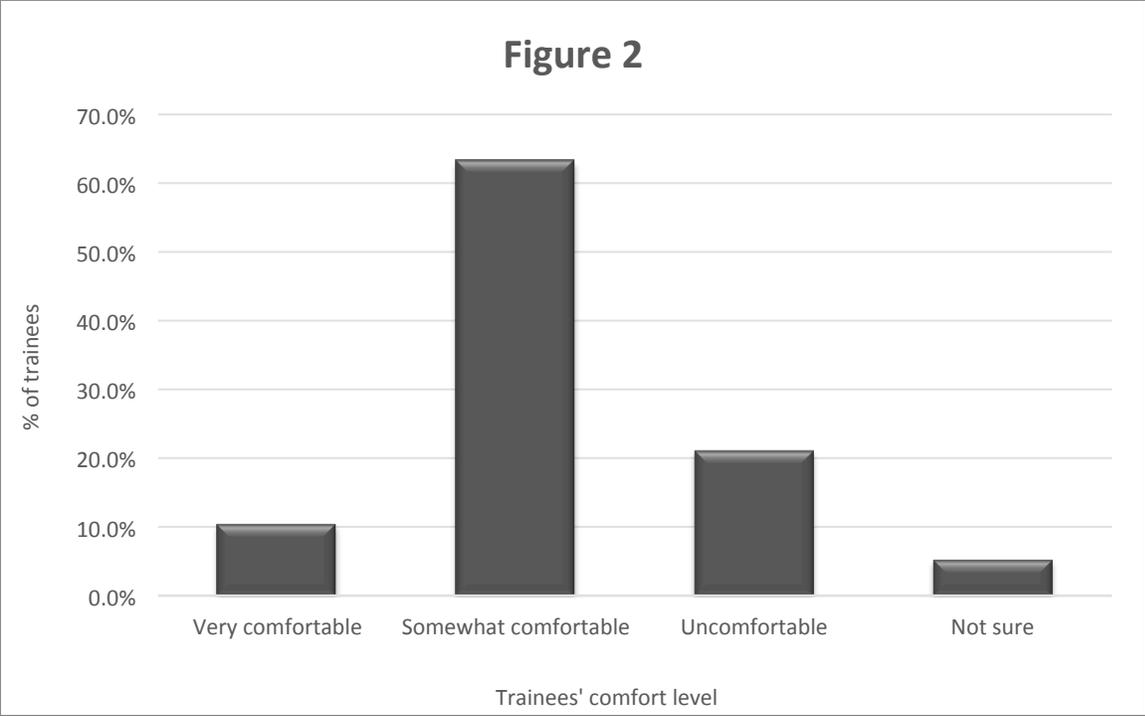


Figure 2. Comfort level to run a real neonatal resuscitation among trainees following their first year of post-graduate training



Figure 3. Comfort level of all trainees, irrespective of their level of training, to run a real or a mock code in the NICU

A statistically significant association was found between year of training and comfort level, suggesting improved comfort with increased experience ($p= 0.014$).

3- Educational needs and expectation

Three previously studied educational strategies.^{5, 16, 17} were proposed for future curriculum development including hands on experience, interactive teaching and video demonstration of mock code. All respondents agreed that hands-on experience is a convenient and effective strategy that could enhance their skills. 90% indicated the effectiveness of interactive teaching and 59% indicated that digital video would be an effective or very effective way to learn to run a neonatal code. The average rating of effectiveness using 4-point Likert scale was calculated to be 3.8 for hands-on experience; 3.2 for interactive teaching and 2.4 for digital video demonstration of a mock code concluding that the average sentiment among respondents is that those methods are fairly effective in providing training on how to run a neonatal code.

Trainees expressed the need for frequent mock code sessions, with 49% wishing to observe a mock code led by someone else four times per rotation (i.e. weekly) and 53% wishing to lead a mock code themselves twice per rotation (bi-weekly).

In response to the question asking for suggestions for other strategies to help trainees learn and feel comfortable in the resuscitation of the newborn, fourteen open-ended text answers were received (**Table 1**). Overall, mock codes conducted to teach neonatal resuscitation were highly appreciated. From the thematic analysis, we determined that trainees made suggestions in the following three main domains to improve the overall teaching; (1) mock codes should be frequent and should occur at designated times; (2) debriefing and didactic teaching were considered to be very helpful, to better understand decision-making in real life neonatal emergencies; and, (3) a multidisciplinary approach with inclusion of other health care

professionals such as respiratory therapists and nurses would enhance the teaching of resuscitation skills.

Table 1: Suggestions to improve overall teaching in Neonatal Resuscitation

1) Frequent and designated times for mock codes

- Trainees perceive mock codes as an important learning experience.
“Mock codes are a great idea to learn neonatal resuscitation.”
- Trainees would like more frequent simulated neonatal resuscitation sessions. This tells us that they believe mock codes are a real need.
“Mock codes are a great idea to learn neonatal resuscitation; it is not enough to only have training during the one block of NICU. In order to be able to use it continuously, we as residents need to be exposed to it frequently”
- Cancellation of sessions is described as a major problem and needs to be addressed in order to improve learning.
“Making sure the mock codes actually happen once a week, as they are often forgotten about or not taken seriously.”
“They were often cancelled because the unit was too busy.”
“Frequent mock code[s] are] all [t]hat is wanted, [but] sometimes [they] get cancelled because of [being] short staff[ed], I hope this get fixed.”
- Designated time for and more frequent mock code opportunities have been identified as important strategies to maximize benefit.
“I only had the opportunity to run one mock code and observe one code during my NICU rotations over a 4 year residency ...It is important to have designated time for mock codes.”

2) Debriefing and didactic teaching session

- Trainees appreciated having debriefing sessions as they found them very helpful. They also recognize the benefits of having didactic sessions.
- *“Debriefing sessions with seniors and staff after real resuscitation situations [were] very helpful in order to talk about what[, when, and why] decisions were made during codes in order to better understand how decisions are made in real life situations.”*
- *“Didactic teaching sessions covering examples of some of the pitfalls/unexpected occurrences during resuscitations [would be helpful]”*

3) Multidisciplinary approach to mock codes

- *“Mock codes should be done with the actual team members (respiratory therapists, nurses, and [physician]s) not just residents”*

Discussion

This paper summarizes the results of a needs assessment survey to assess post-graduate physician trainees' comfort in neonatal resuscitation, and to explore their preferred training methods in this area. Our results showed that only a small minority of respondents felt comfortable performing either mock or real neonatal resuscitation, indicating a shortcoming in current neonatal resuscitation training. This is consistent with our finding of poor resuscitation skills on a retrospective review of performance in mock codes done in our center.⁶ The survey identified frequent hands-on experience as the most important training method, and found that trainees considered debriefing to review and reinforce best practices to be another valuable strategy.

Research studies have demonstrated increased skill retention with repetitive practice using regularly scheduled neonatal mock codes^{2,5} as they allow trainees to develop advanced cognitive, technical, and behavioral skills such as effective communication, teamwork, and leadership, in an environment that is realistic and relevant to them.¹⁹ Implementation of mock codes incorporates the principles that support adult learning¹⁹ and can be a very effective strategy for retention and subsequent improvement of trainees' skills.⁵

At the time of this study, NRP used videos to demonstrate well-run neonatal resuscitations with interactive discussion to foster cognitive integration and emphasize knowledge gained from NRP courses. The NRP steering committee now highly encourages learners to make use of these resources.²¹

As Kern explained, when designing a curriculum it is imperative to use multiple educational techniques to maximize learning for all participants.²⁰ Adult learners learn and process information in multiple ways; some prefer to hear information; others to see it; and some to experience it. Hence, for the new curriculum, we propose the use of different learning strategies,

including a demonstration video, interactive discussions, and debriefing to improve and maximize the benefit of hands-on experiences.

Needs assessment is the foundation for creating an effective training program.¹² As Laidlaw and Hesketh stated^{11,12} “with recognizing the gaps between current practice and desired practice and analyzing the steps to be taken to close these gaps, it is possible to be confident that the aims and design of the educational program are appropriate”. Our survey results will help us to create educational goals for a new curriculum that is well aligned with trainees' needs, and realistically achievable with the resources available in our institution.¹⁸

Limitations

The main limitation of this study is that it reports on a small sample size at a single institution. Nevertheless, the high response rate makes this survey very useful and although it was local and restricted to one training program, the results are highly applicable to all teaching institutions.

A second weakness was asking the senior trainees to remember their comfort level performing neonatal resuscitation by the end of their first year. This introduces the risk of recall bias as trainees must remember their comfort level in the past. Their memory may be imperfect and thereby unreliable.²⁴ However, the finding of low comfort level was supported by the findings regarding their current comfort level.

Future directions

Based on the combined results of trainee performance on previous mock codes (observed needs)⁶ and the results of this questionnaire (perceived needs), we are designing a new curriculum to improve their skills with the goal that they will feel confident and able to initiate and lead a neonatal resuscitation by the end of their first year of training.

The new mock code curriculum will include:

- A one hour interactive scenario-based teaching session during the first week of each 4 week TOH-GC NICU rotation. This session will reinforce the knowledge needed to apply the skills of resuscitation.²¹ Trainees will be expected to review the NRP textbook prior to this first session.
- A 20 minute video demonstration of a well performed mock code that translates knowledge and skills into performance. This will be viewed by trainees during the first week of their inaugural TOH-GC NICU rotation, and as needed thereafter.
- Weekly mock code sessions during TOH-GC NICU rotations, where trainees can practice neonatal resuscitation based on situations commonly encountered in the NICU. Each session will include two different scenarios. Based on the available resources, we anticipate that each trainee will have the chance to lead 2 mock codes and observe 4 codes in one rotation. Trainees' performances will be assessed using a modified version of the previously validated NRP assessment tool (**Appendix B**).
- Facilitated debriefing session after each mock code. This is a critical component of effective learning in simulation-based education.^{22,23} Facilitated debriefing encourages trainees to reflect on the experience and to reinforce performance-enhancing strategies.

Conclusion:

The majority of trainees rotating through NICUs affiliated with University of Ottawa are not comfortable enough with their neonatal resuscitation skills. The information gathered from this survey provides the basis to design a new curriculum to enable trainees to increase their confidence and ability to initiate and lead a neonatal resuscitation early in their training.

Main Messages

- Most trainees rotating through NICUs affiliated with University of Ottawa are not comfortable enough with their neonatal resuscitation skills regardless of their level of training.
- Designated time and frequent mock code opportunities as well as debriefing to review and reinforce best practices, have been identified as important strategies to help trainees acquire and retain neonatal resuscitation skills.
- Assessing trainees' needs in neonatal resuscitation is a very important step when planning for educational program improvement based on previous trainees' performance.
- A multi-faceted approach to learning the neonatal resuscitation skills including the appropriate mixture of didactics, interactive teaching, and hands on experience would be most effective, and the process needs to be repetitive so that it becomes second nature to perform in these emergency situations.

Current research questions

- Evaluating trainees' performance during neonatal resuscitation after the new curriculum was implemented.
- Evaluating facilitative debriefing and self-reflection as an educational method to improve leadership skills and confidence in trainees to lead real neonatal resuscitations.
- Investigating patient outcomes after implementing a sound evidence-based curriculum in neonatal resuscitation training.

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Competing interests

The authors declare that they have no financial competing interests

Needs Assessment Questionnaire

1) Training program:

- Pediatrics resident
- Neonatal-Perinatal fellow
- Obstetrics and Gynecology resident

2) “Running a real or a mock code is an important skill that Obstetricians, Pediatricians and Neonatologists should acquire during their training. Having this skill will help me make appropriate clinical decision when caring for sick newborns.” Please select your opinion in regard to the quote.

- Strongly agree Agree Unsure Disagree Strongly disagree
-

3) Please rate the following resources based on their usefulness in helping you learn and understand the sequence of running a neonatal code.

Resources	Not useful	Slightly useful	Useful	Very useful	N/A
Your own clinical experience participating in a real codes					
Your own clinical experience observing a mock code					
Mock codes you run during the NICU rotations					
Mock codes you observed during the NICU rotations					
NRP courses					
Literature (text books, medical journals)					
Using internet resources.					
Other sources					

if you used other resources (please specify):

.....

.....

4) There are mock codes run during your perinatal rotation. In your opinion, were/are these sessions enough to make you feel comfortable with the basic skills to run a real code by the end of your PGY1 Year?

- Very comfortable Somewhat comfortable Uncomfortable Not sure
-

5) How comfortable are you with your ability to run a real code or a mock code in the Neonatal Intensive Care Unit?

- Very comfortable.
- Somewhat comfortable.
- Somewhat uncomfortable
- Uncomfortable.

6) The following educational strategies are a convenient and effective way to enhance learning in neonatal resuscitation:

	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
Digital video demonstrating a mock code					
Interactive teaching Session					
Hands –on experience (Mock codes)					

7) Please rate the following educational strategies in terms of their effectiveness in providing a good training on how to run a neonatal code:

	Not effective	Slightly effective	Effective	Very effective
Digital video demonstrating a mock code				
Interactive teaching Session				
Hands –on experience (Mock codes)				

8) To make the mock code teaching useful, how often should a mock code be run or observed by each respective trainee during the four weeks rotation (one block) of neonatal-perinatal medicine at the Ottawa Hospital-General Campus?

Once a block Twice a block 4 times a block 8 Times a block

- Observe a mock code
- Run a mock code

9) Besides mock codes, would you suggest any other strategies to help you learn and feel comfortable in the resuscitation of the newborn?

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