

# Preparedness of urban, general emergency department staff for neonatal resuscitation in a Canadian setting

Nicole Kester-Greene, MD; Jacques S. Lee, MD, MSc

## ABSTRACT

**Objectives:** The level of expertise and degree of training in neonatal resuscitation (NNR) of emergency physicians is not standardized and has not been measured. We sought to determine the self-reported comfort with, knowledge of, and experience with NNR of emergency department (ED) staff in a general ED prior to the opening of a new neonatal intensive care unit (NICU) and to explore factors associated with NNR comfort.

**Methods:** Using Dillman methodology, we electronically surveyed full-time emergency physicians and nurses. Participants rated knowledge, comfort, and experience on 5-point Likert scales. We used logistic regression to explore factors associated with NNR comfort.

**Results:** The response rate was 67.3% ( $n = 107$ ). Only 4.2% of staff reported ever participating in a NNR, and only 38.7% reported any previous NNR training. Between 75 and 85% of participants rated their comfort level in caring for neonates, sense of preparedness, and knowledge of managing a sick neonate as poor or very poor. A recent neonatal clinical encounter was the strongest predictor of perceived comfort in NNR (OR = 22.2, 95% CI 5.0–98.7), as was completion of the Neonatal Resuscitation Provider (NRP) course (OR = 3.1, 95% CI 1.4–7.0).

**Conclusions:** Perceived comfort with, knowledge of, and preparedness for NNR were poor in an urban, general ED prior to the opening of an NICU. Recent neonatal clinical encounter and participation in the NRP course were the strongest predictors of improved NNR comfort. In future work, we intend to assess the impact of simulation-based training on comfort with NNR among ED staff who primarily treat adults.

## RÉSUMÉ

**Objectifs:** Le degré de connaissances spécialisées et de formation des urgentologues en réanimation néonatale (RNN) n'est pas uniformisé et il n'a jamais fait l'objet de mesure. L'étude visait donc à déterminer, par autoévaluation,

le degré d'aise et d'expérience du personnel d'un service d'urgence (SU) général en RNN, ainsi que des connaissances en la matière, avant l'ouverture d'un nouveau service de soins néonataux intensifs (SSNI), et à examiner les facteurs associés au degré d'aise en RNN.

**Méthodes:** Nous avons procédé à une enquête électronique, selon la méthode de Dillman, parmi les urgentologues et le personnel infirmier à temps plein. Les participants ont coté leur degré de connaissances, leur degré d'aise, et d'expérience sur une échelle de Likert à 5 points. L'analyse des facteurs associés au degré d'aise en RNN s'est faite à l'aide de la régression logistique.

**Résultats:** Le taux de réponse s'est élevé à 67.3% ( $n = 107$ ). Seulement 4.2% du personnel a fait état d'une participation à une RNN, et seulement 38.7% a déclaré avoir reçu de la formation en RNN. De 75 à 85% des participants considéraient leur degré d'aise en soins néonataux, leur sentiment de préparation et leur degré de connaissance du traitement des nouveau-nés malades comme médiocres ou piètres. Le facteur prévisionnel le plus puissant du degré d'aise perçu en RNN était une intervention clinique récente en néonatalogie (risque relatif approché [RRA] = 22.2; IC à 95%: 5.0–98.7), de même que le fait d'avoir suivi un cours en réanimation néonatale (RRA = 3.1; IC à 95%: 1.4–7.0).

**Conclusions:** Le degré d'aise en RNN, les connaissances en la matière, et le degré de préparation étaient perçus comme médiocres dans un SU général, en milieu urbain, avant l'ouverture d'un SSNI. Les interventions cliniques récentes en néonatalogie et la participation au cours de réanimation néonatale se sont révélées les facteurs prévisionnels les plus puissants d'une amélioration du degré d'aise en RNN. Il est de notre intention d'évaluer, dans le cadre d'un autre travail, l'incidence de la formation axée sur la simulation sur le degré d'aise en RNN du personnel de SU, qui traite principalement des adultes.

**Keywords:** emergency department, neonatal resuscitation, preparedness

From the Department of Emergency Services, Sunnybrook Health Sciences Centre, Toronto, ON.

**Correspondence to:** Dr. Nicole Kester-Greene, Sunnybrook Health Sciences Centre, 2075 Bayview Avenue, Toronto, ON M4N 3M5; Nicole.kester@me.com.

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There were 376,683 newborns discharged from hospital in Canada in 2009–2010.<sup>1</sup> In Ontario, approximately 25% of newborns are discharged within 24 hours and 60% are discharged within 24 to 48 hours.<sup>2</sup> The practice of early discharge has the potential to interrupt monitoring newborns during the early stages of life, possibly leading to delay in the identification and treatment of neonatal illness.<sup>2</sup> The Canadian Paediatric Society has stated that timely access to care and services, including early intervention, is critical to promote health and prevent problems in all pediatric patients. In neonates, signs and symptoms of serious problems may be subtle and develop quickly.<sup>3</sup>

Emergency department (ED) staff are responsible for assessing and providing timely treatment to any neonates presenting to their facility. Neonatal emergencies require specialized skills, knowledge, equipment, and preparedness. The sudden onset of a potentially life-threatening condition in the newborn period may trigger an ED visit. Thus, ED personnel should be trained and prepared for neonatal emergencies.

No publications currently exist on the state of preparedness for neonatal emergencies in Canadian urban centres. We became particularly interested in our own state of preparedness when Sunnybrook Health Sciences Centre (SHSC) opened its first neonatal intensive care unit (NICU) in September 2010.<sup>4</sup> Historically, SHSC had served a population consisting of 95% adults, in contrast to the average pediatric census at all hospitals in Ontario of 14.8%.<sup>5</sup> The objectives of this study were to determine self-reported comfort with, knowledge of, and experience with neonatal resuscitation of ED staff at SHSC prior to the opening of the new NICU and explore factors associated with neonatal resuscitation comfort.

## **METHODS**

We conducted a cross-sectional cohort study using a structured survey. The research ethics board at SHSC approved the study, and informed consent was obtained from all participants.

### **Setting**

SHSC is a tertiary, university-affiliated teaching hospital with a focus on adult trauma and critical care.

The annual ED census was 49,809 patients in 2010, of which 2,199 (4.4%) were pediatric visits. There were 77 full-time emergency nurses and 30 emergency physicians at SHSC at the time of the study.

### **Data collection**

The survey instrument was developed and reviewed by experts in academic emergency medicine practice, medical education, and survey methodology prior to distribution (the survey instrument is available as an appendix at <http://www.surveymonkey.com/s/preparednessurbanED>). Surveys were distributed using a modified Dillman methodology.<sup>6,7</sup> All eligible ED staff at SHSC were asked to participate in the study through an email invitation. A link in the email allowed access to an anonymous Web-based survey. Four reminder notices spaced at 2- to 3-week intervals followed the initial invitation. Online access to the survey was allowed between August 2010 and October 2010 through a commercially available site.

### **Survey tool and measurements**

The survey instrument asked questions about the amount of experience with neonates and previous continuing education endeavours. Self-reported preparedness of staff regarding their knowledge, comfort with neonates, and perceived impact of the NICU opening were assessed using a 5-point Likert scale.<sup>8</sup>

### **Outcome measures**

Our primary outcomes were the number of neonatal resuscitations reported by staff, the number of neonates they had managed, and the temporal proximity to these experiences. For secondary purposes, we also examined factors associated with increased staff comfort with neonatal emergencies.

### **Data analysis and sample size**

Descriptive statistics with 95% confidence intervals (CIs) were generated where appropriate. We used multivariable regression modeling to assess the association between comfort and the following predefined covariates: working in another ED; years of experience; recent experience caring for a neonatal patient; and completion of the following courses: Advanced Paediatric Life Support

(APLS), Paediatric Advanced Life Support (PALS), Neonatal Resuscitation Provider (NRP), or Emergency Nursing Pediatric Course (ENPC). Statistics were performed using SAS 9.2 (SAS Institute, Cary, NC).

Our goal was to survey all 107 full-time ED staff. To estimate the anticipated precision of our primary outcomes, we assumed a response rate of 70% ( $n = 75$ ). Given an estimate of 5% previous neonatal resuscitation experience, the anticipated width of our 95% CI would be acceptable at  $\leq 10\%$  using the two-tailed exact binomial distribution.<sup>9</sup>

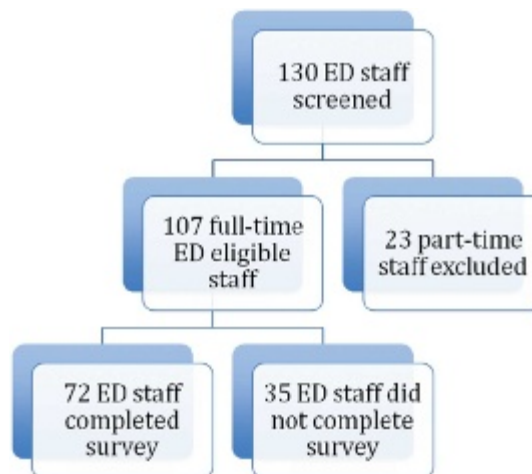
**RESULTS**

Table 1 provides the characteristics of the study population. There were 130 ED staff screened from August 2010 until October 2010, of whom 107 were eligible and invited to participate: 52 of 77 nurses (67.5%) and 20 of 30 (66.7%) physicians completed the survey, for a response rate of 67.3%. Figure 1 provides a graphic illustration of this information.

Whereas 61.1% (44 of 72) of staff had been practicing for more than 5 years, 25.0% (18 of 72) had been practicing for more than 15 years; 84.7% (61 of 72) reported practicing solely at SHSC.

**Neonatal experience**

Table 2 provides information on the number of neonatal resuscitations SHSC ED staff reported involvement with and their temporal proximity. There was limited neonatal resuscitation experience: 95.8% (95% CI 88.3–99.1) reported never having been involved in a neonatal resuscitation at SHSC, whereas 72.2% (95% CI 46.5–90.3) reported never having been involved in a



**Figure 1.** Emergency department (ED) staff who completed the survey.

	<i>n</i> (%)
Profession ( <i>n</i> = 72)	
Staff physician	20 (27.4)
Registered nurse	53 (72.6)
Number of years in practice ( <i>n</i> = 72)	
0–5	28 (38.9)
5–10	19 (26.4)
10–15	8 (11.1)
> 15	18 (25)
Current work environment ( <i>n</i> = 72)	
Sunnybrook Health Sciences Centre solely	61 (84.7)
Other additional site	11 (15.2)

	<i>n</i> (%)
Neonatal resuscitations at SHSC in past year ( <i>n</i> = 72)	
0–1	69 (95.8)
2	1 (1.4)
3	1 (1.4)
4	0
≥ 5	1 (1.4)
Last time treated a neonate ( <i>n</i> = 72)	
< 1 wk	3 (4.2)
< 1 mo	1 (1.4)
< 6 mo	10 (13.9)
< 1 yr	12 (16.7)
< 5 yr	13 (18.1)
Never	33 (45.8)
Estimated number of neonates managed at SHSC in the average month ( <i>n</i> = 71)	
0	57 (80.3)
1	9 (12.7)
2	3 (4.2)
3	1 (1.4)
4	0
≥ 5	1 (1.4)
Neonatal resuscitation course experience ( <i>n</i> = 29)	
Yes	29 (38.7)
No	46 (61.3)
Certifications obtained in past 2 years ( <i>n</i> = 34)	
PALS	10 (29.4)
APLS	4 (11.8)
NRP	5 (14.7)
ENPC	23 (67.6)

APLS = Advanced Paediatric Life Support; ENPC = Emergency Nursing Pediatric Course; NRP = Neonatal Resuscitation Provider; PALS = Paediatric Advanced Life Support; SHSC = Sunnybrook Health Sciences Centre.

neonatal resuscitation at any other facility. Similarly, there was limited reported experience managing neonates in general. In total, 45.8% of staff (95% CI 34–58) reported never managing a neonate at SHSC or any other facility and 18.1% (95% CI 10–29) stated that it had been less than 5 years since they managed a neonate. Only 1.4% (95% CI 0.03–7.5) of SHSC staff indicated that they had managed a neonate in the past month.

### **Continuing education qualifications**

Previous certification in neonatal resuscitation among staff was moderate. The number of staff who reported ever having participated in a neonatal resuscitation course was 38.7% (29 of 75), of whom 45.3% had taken a course within the past 2 years. The majority (67.6%) had participated in the ENPC. PALS was the next most frequent course (29.4%) followed by NRP (14.7%).

### **Perception of preparedness**

Table 3 provides information on self-reported preparedness and knowledge of the participants. A total of 74.9% rated their comfort level as poor or very poor, and 83.3% (60 of 72) rated their sense of preparedness as poor or very poor. Similarly, 76.3% (55 of 72) rated their knowledge of managing a sick neonate as poor or very poor, and 28.1% (20 of 72) gauged their knowledge of neonatal resuscitation as average. Figure 2 provides a graphic illustration of this information.

### **Factors associated with comfort**

Our multivariable regression model identified two factors significantly associated with increased staff comfort with neonatal emergencies. Participants who had managed a neonate in the ED within the previous

6 months were more likely to report a higher level of comfort (OR 22.23, 95% CI 5.01–98.69). However, this occurred rarely: only 13.9% of ED staff had done so. Similarly, staff who had participated in an NRP course within the previous 2 years were more likely to be comfortable with neonatal emergencies (OR 3.11, 95% CI 1.39–6.98). We found that 33.3% of staff who had participated in an NRP course within the previous 2 years reported comfort with neonatal emergencies, whereas 10.6% of staff who had not taken NRP recently were comfortable with neonatal emergencies.

### **Perceived impact of NICU opening**

ED staff indicated that they anticipated an impact on ED volume and flow as a result of the opening of the new NICU. A total 69.4% (50 of 72) felt that an increase in pediatric volumes was very likely or likely to occur, and 62.5% (45 of 72) of staff felt that a negative impact on department flow was very likely or likely.

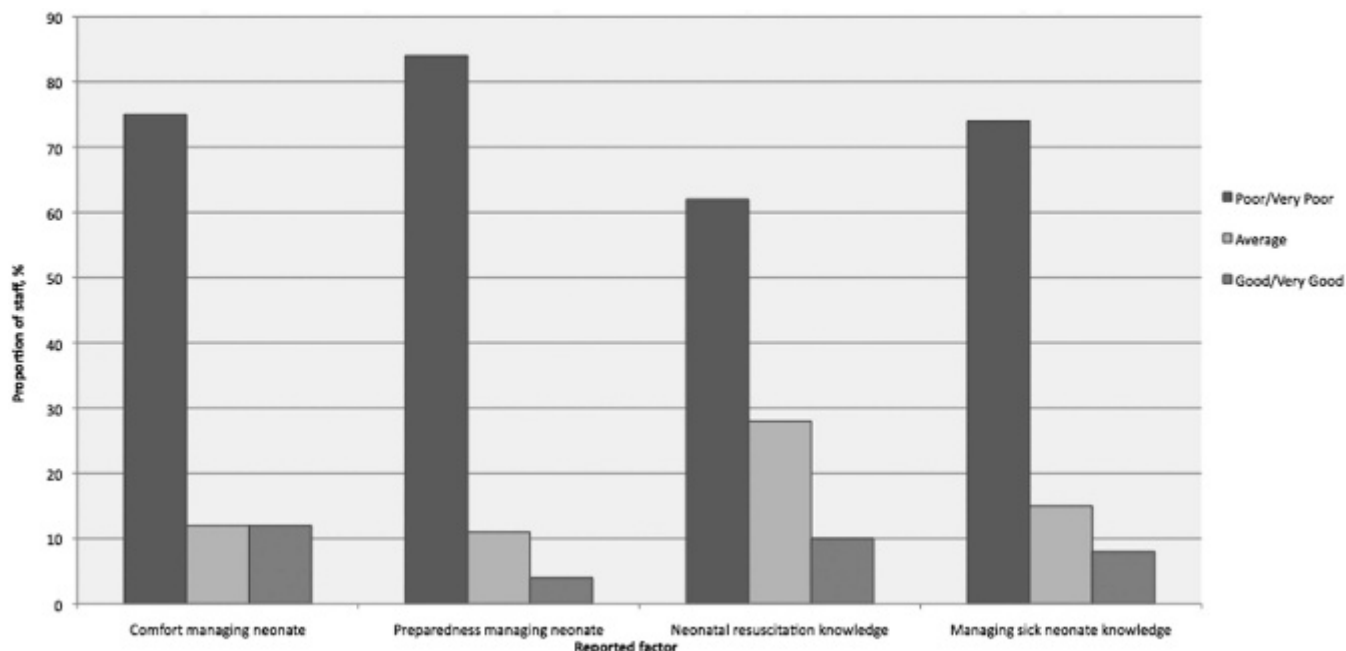
## **DISCUSSION**

Our results indicate that perceived comfort with, knowledge of, and preparedness for NNR was poor at SHSC prior to the opening of an NICU. The 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations stated that < 1% of neonates require extensive resuscitation.<sup>10</sup> This rare phenomenon of the critically ill neonate creates a challenge in maintaining skills and knowledge for ED staff. For health care teams to be successful at resuscitation, each provider must have the knowledge and confidence to function effectively.<sup>11</sup> However, other studies have revealed a lack of preparedness in different settings, similar to our findings. Jukkala and Henly looked at provider readiness for neonatal resuscitation in

**Table 3. Self-reported preparedness and knowledge (n = 72)**

Please rate	Response, n (%)				
	Very poor	Poor	Average	Good	Very good
Your comfort level in caring for neonates in the ED	31 (43.1)	23 (31.9)	9 (12.5)	5 (6.9)	4 (5.6)
The general level of preparedness of Sunnybrook ED to care for neonates	29 (40.1)	31 (43.6)	8 (11.3)	2 (2.8)	1 (1.4)
Your knowledge of neonatal resuscitation	21 (29.6)	23 (32.4)	20 (28.2)	6 (8.4)	1 (1.4)
Your knowledge of how to manage the sick neonate	23 (31.9)	32 (42.4)	11 (15.3)	5 (6.9)	1 (1.4)

ED = emergency department.



**Figure 2.** Self-reported knowledge, comfort, and preparedness for managing neonates.

a rural hospital and found that many had not delivered resuscitation measures such as bag-valve mask ventilations or chest compressions in the previous year.<sup>12</sup>

Professional regulatory bodies such as the Royal College of Physicians and Surgeons and the Canadian Nurses Association require that physicians and nurses regularly reflect on their own practice and skill set to identify areas for self-directed learning.<sup>11,13</sup> During the 2 years leading up to the addition of the obstetric and neonatal services at SHSC, 45.3% of participants reported having taken a form of pediatric advanced life support course. Such courses teach providers to recognize and treat critically ill infants and to respond to them in a timely fashion. Staff confidence in their ability to provide quality care to a critically ill neonate is key.<sup>12</sup> The NRP course designed and delivered by the Canadian Paediatric Society is specific to resuscitation of the critically ill neonate and allows practitioners to practice their skills in the safety of a simulated environment.<sup>14</sup> It is perhaps for this reason that participants in our study reported increased comfort with neonatal care after taking the NRP course. It merits mention that ED staff had the opportunity to participate in this course 1 month prior to the opening of the NICU, a time period that coincided with study participation. The close temporal relationship to the course and the study period may have been factors in the self-reported increased comfort following the course.

Health professionals require more than just simulated training to feel confident in their abilities. There is likely no substitute for real-life experience when it comes to nurses and physicians feeling comfortable with their skills. van Amerongen and colleagues found that among pediatricians who participated in a PALS course, only 42% felt adequately equipped for life-threatening emergencies.<sup>15</sup> Similarly, Jukkala and Henly found that although physicians were not more knowledgeable about neonatal resuscitation than nurses, they were more comfortable and reported more recent experience performing neonatal resuscitation, and nurses' comfort was significantly correlated with experience performing resuscitation skills.<sup>12</sup> Our study revealed that staff rated their comfort level and sense of preparedness poorly. However, similar to the findings of Jukkala and Henly,<sup>12</sup> we found that staff who had a neonatal clinical encounter within 6 months were more comfortable with neonatal emergencies.

Exposure to neonatal training is a modifiable factor associated with improved confidence. Explanations for the limited neonatal resuscitation training of the ED staff at SHSC include the possibility that staff traditionally may have not have viewed neonatal resuscitation as part of their usual practice and did not anticipate a need to maintain their neonatal skills. Other possible explanations supported in the literature include a lack of time due to clinical demands, a lack of

readily accessible educational opportunities, and a lack of administrative support.<sup>12,16</sup> Neonatal knowledge and skill may be improved with regular simulation drills, which allow staff to learn new skills and practice current proficiencies.<sup>12</sup> A number of studies have looked at the utility of medical simulation training in improving neonatal resuscitation skills.<sup>17,18</sup> Lee and colleagues evaluated the change in score achieved on a validated neonatal resuscitation scoring tool among emergency medicine residents who undertook neonatal resuscitation simulation training compared to residents exposed to a traditional curriculum.<sup>19</sup> They concluded that simulation-based educational interventions may be used to improve emergency medicine residents' knowledge of and performance with neonatal resuscitation. Allan and colleagues described and evaluated an interprofessional simulation-based educational program within a busy 24-bed pediatric cardiac intensive care unit.<sup>20</sup> Participants completed pre- and postcourse assessments of their confidence and preparedness, and course participants perceived themselves to be better prepared to participate and lead future resuscitation events after the intervention.

Our future goal is to implement and assess a simulation intervention specifically designed to improve the neonatal knowledge and skills of ED staff. ED staff would participate in simulation training exercises conducted in situ in the ED requiring active employment of neonatal resuscitation skills using a high-fidelity mannequin. The term *in situ* is used in the simulation literature to describe simulations conducted at the point of care, using the same bedspace, equipment, and supplies as used for real patients.<sup>21</sup> Our plan is to employ a team approach to the training exercises, allowing practice of effective team communication skills. Educators with expertise in neonatal resuscitation would conduct debriefing sessions after each scenario to explore learners' decision processes and challenges encountered during the exercise. Guided facilitation of debriefing would allow participants to discover where errors may have occurred and improvements could be made.<sup>22</sup>

### **LIMITATIONS**

Some limitations should be considered. Our 67.3% response rate suggests that sampling bias may have occurred. In addition, the survey instrument depended on self-reported measures and thus may have been

subject to social acceptability or response bias. Finally, our study was performed at a single urban centre and targeted ED staff, and as such, our results may not be generalizable to community hospitals or other specialties.

### **CONCLUSION**

Perceived comfort with, knowledge of, and preparedness for neonatal resuscitation were poor in an urban, general ED prior to the opening of an NICU. Recent neonatal clinical encounter and participation in the NRP course were the strongest predictors of improved neonatal resuscitation comfort. In future work, we intend to assess the impact of simulation-based training on comfort with resuscitation among ED staff who primarily treat adults.

**Competing interests:** None declared.

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