Journal of Translational Science

Review Article

ISSN: 2059-268X

# Stress in healthcare personnel involved in neonatal resuscitation – A systematic review

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## Abstract

**Objective:** Stress in healthcare personnel involved in adult/children resuscitation has been extensively evaluated, but respective data in neonatal resuscitation (NR) is limited. This review aims at collecting available data on stress in healthcare personnel involved in NR.

**Study Design:** This systematic review was conducted under the PRISMA guidelines. All eligible studies from Pubmed, Embase and Scopus evaluating stress/anxiety among healthcare personnel involved in NR and published up to April 2020, were investigated. The following key-words were used: 'stress', 'anxiety', 'neonatal', 'newborn' 'resuscitation'.

**Results:** In total, 6 studies including 411 individuals were evaluated, 83% of which evaluated stress in a simulated environment. The stress assessment tools varied among studies; 2 studies measured salivary cortisol levels, 2 recorded heart rate recording, and 4 studies used questionnaires. The majority of the studies (66.6%) reported increased stress after performing NR. Two studies reported stress predictors, like: presence of more observers, negative affect experienced at time of care, negative appraisal of care given to the family and cumulative number of losses experienced.

**Conclusions:** Stress is increased during NR, although study design and data are still limited and heterogeneous. Future studies should try to evaluate further stress predictors or mitigators to improve everyday clinical practice.

## Introduction

World Health Organization (WHO) reports that all adverse events associated with birth – also called 'birth asphyxia' - account for almost one fourth of all neonatal deaths [1]. Therefore, WHO had set as a target the reduction of neonatal mortality from 20 deaths per 1000 births by 2015 to 7 deaths per 1000 births by 2035, and the way to accomplish this is by improvement of resuscitation skills [2]. Recent pooled data indicate that a standardized training program of neonatal resuscitation (NR) could improve neonatal mortality rates significantly [3]. This type of simulated training programs not only could improve knowledge and performance skills, but also reduce stress among professionals [4].

Stress of healthcare professionals involved in resuscitation of pediatric or adult patients has been extensively evaluated, but data on the issue in those involved in NR is limited [5]. Stress-inducing factors associated with adults' resuscitation include illness severity, socio-evaluative factors, noise and fatigue among healthcare personnel [5]. Stress elicited in a delivery room or a neonatal intensive care unit environment could be intensified as the life of a newborn is threatened. Therefore, this systematic review aims at collecting all studies evaluating health care personnel's stress during NR.

## Materials and methods

**Data Sources and Search:** We systematically searched Pubmed, Embase, and Scopus (last search April 2020) using the strategy: (stress OR anxiety) AND (neonatal OR newborn) AND (resuscitation). The following key-words were used for the online search: 'stress, 'anxiety', 'neonatal', 'newborn' 'resuscitation'. The desired population (P) included individuals performing neonatal resuscitation. The final outcome (O) was the incidence of stress among healthcare professionals involved in NR. Stress could be evaluated as primary or secondary outcome. Medical doctors, nurses, midwives or trainees of any kind were the eligible population under investigation. Neonatal Resuscitation could be evaluated in everyday clinical practice or within a training program.

This review was conducted according to established methods for systematic reviews in medicine (PRISMA) [6]. In addition to searching databases, reference lists of all included studies, meta-analyses and reviews were manually evaluated, including unpublished data. Only studies published in English were included in this review. References from eligible articles or textbooks were also reviewed to identify further potential sources.

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Key words: stress, neonate, resuscitation, healthcare personnel

**Received:** February 23, 2021; **Accepted:** March 17, 2021; **Published:** March 20, 2021

**Data extraction – Outcomes – Definitions:** Three authors independently completed data extraction after following search criteria and quality assessment. Disagreements were resolved by consensus or after review by the senior author of the study, when necessary. Data was obtained from tables, graphs and text as well. When data was presented in percentage, the absolute values were calculated. For each study, the following data were collected: first author, year of publication, country of origin, type of study (prospective, retrospective or randomized), total number of patients included, basic demographics (gender, age), method of stress measurement, type of outcomes, results.

**Quality assessment:** Three authors independently reviewed study eligibility and quality. Disagreements were resolved by consensus or after review by the senior author of the study, when necessary. The quality of each study was assessed using well established criteria either for randomized or observational studies, specifically evaluating: data collection, aim of the studies, incomplete outcome data, statistical analysis and other sources of bias [7,8]. Quality of each study was evaluated and reported as high, medium or low according to GRADE approach [9], based on design and methodology of study according to the aforementioned criteria.

**Inclusion and exclusion criteria:** Studies included in this review met the following criteria: (i) studies evaluating stress/anxiety among healthcare personnel involved in NR, (ii) studies referring to everyday clinical practice or training programs, (iii) studies evaluating stress/anxiety as a primary or a secondary outcome, (iv) studies evaluating stress/anxiety using any methodology, (v) studies evaluating stress/anxiety among any type of participants (doctors, nurses, midwives, trainees). If more than one study reported results from overlapping populations (from same institutions and during overlapping time periods), then the study with the largest number of patients and the largest time period of treatment would be included in the review.

Exclusion criteria included: (i) Types of publication other than clinical studies such as reviews, letters, meta-analyses, case reports or editorials, (ii) Series including less than 10 participants; (iii) Abstract-only publications or abstracts from conferences; (iv) Studies not published in English; (v) Studies evaluating stress during other types of resuscitation.

## Results

After applying the inclusion/exclusion criteria, 6 studies [10-15] were identified as appropriate for analysis and overall, 2,522 studies were excluded (Figure 1). All included studies were published between 2012 and 2020. In total, 411 individuals (599 initially invited) were evaluated. Overall, there were 3 randomized trials, 2 prospective observational studies and 1 retrospective study. All randomized trials originated from Canada, and the rest of studies were conducted in Italy, USA and UK. The quality of studies ranged from medium (2 studies) to high (4 studies). No study was found to be of low quality. (Table 1)

The populations evaluated in the studies were heterogenous, including resident doctors, nurses or midwives. The majority of studies (5 out of 6) evaluated stress in a simulated environment while only one study evaluated it in real-life setting. Stress was investigated as primary outcome only in two studies. Male gender rate was reported in 4 studies and mean age only 3 studies. (Table 2)

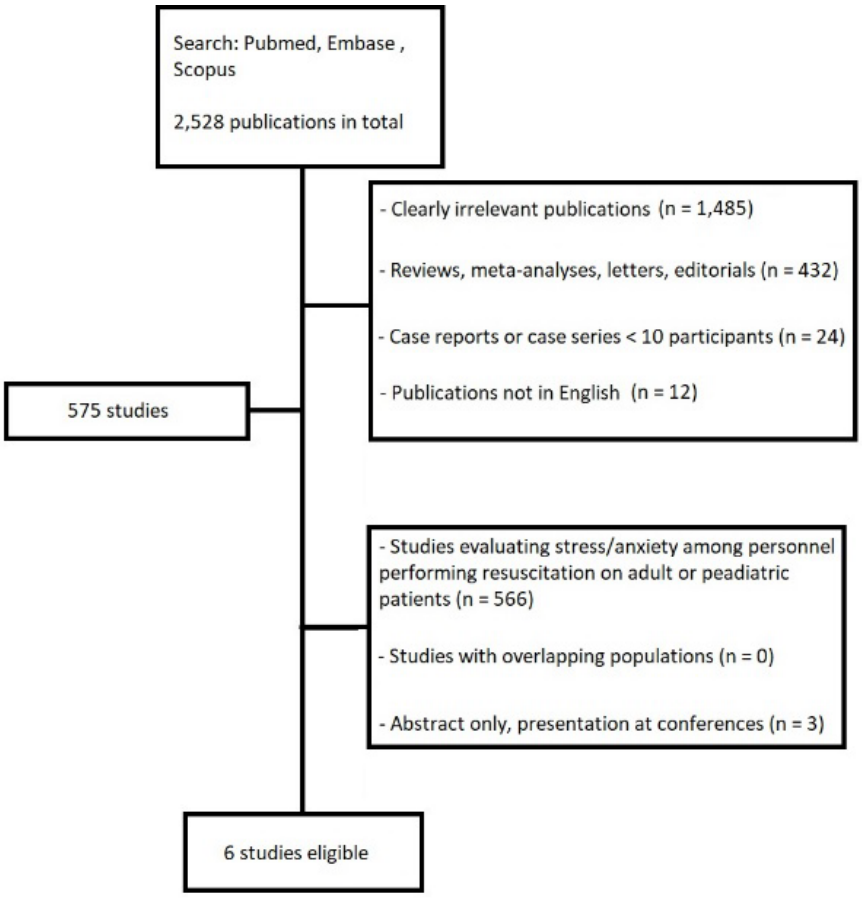


**Figure 1.** Flowchart of this review

**Table 1.** Studies evaluating stress during neonatal resuscitation

| Studies | Year of publication | Country of origin | Design of study | Total number of participants (n) | Type of participants | Setting for stress evaluation | Quality of study |
|---|---|---|---|---|---|---|---|
| Bensouda et al. | 2018 | Canada | Randomized (Group A: one observer vs Group B: 5 observers) | 49 | First-year residents | Simulation: Neonatal mannequin - endotracheal intubation | High |
| Finan et al. | 2012 | Canada | Randomized (high-fidelity simulation vs low-fidelity simulation) | 16 | Neonatal/perinatal fellowship trainees | Simulated resuscitation sessions (intubation, catheter insertion, thoracocentesis, ventilation) | High |
| Lizotte et al. | 2017 | Canada | Randomized (death scenario vs survival scenario) | 62 (42 completed the study) | Paediatric trainees | Resuscitation simulation (intubation, ventilation, cardiac massage) | High |
| Redmond et al. | 2020 | USA | Prospective | 14 (12 completed the study) | Emergency Medicine residents in their 1st and 2nd postgraduate years | Simulations scenarios (low, medium and high stress) | Medium |
| Trevisanuto et al. | 2016 | Italy | Prospective | 108 | Physicians and nurses | Simulation scenarios (airway management, chest compressions, umbilical catheter, medicine administration) | Medium |
| Wallbank et al. | 2013 | UK | Retrospective | 184 (350 invited) | Physicians, nurses, midwives | Working at a maternity or gynecology ward + experience of a loss in a professional capacity within the previous 18 months | High |

**Table 2.** Studies evaluating stress during neonatal resuscitation

| Studies | Male gender (%) | Mean age (years) | Outcomes investigated | Method of stress measurement | Results |
|---|---|---|---|---|---|
| Bensouda et al. | 28% | 25 (IQR: 24–27) | Primary: time to successful intubation<br>Secondary: stress | Heart rate | The presence of more observers increases stress of the resuscitator. Group A heart rate: (mean difference − 11.9 beats/min, 95% CI -15.98 to − 7.78). |
| Finan et al. | 18.8% | 35.1±3.9 | Primary: Technical and non-technical team performance<br>Secondary: Stress evaluation | Salivary cortisol levels | Cortisol levels increased after simulation but without any difference between the two types of training. |
| Lizotte et al. | 88.1% | NR | Primary: Performance assessment<br>Secondary: Objective and perceived stress assessment | Salivary cortisol levels plus questionnaire | Perceived stress level was 6/10 in survival group vs 7/10 in death group ($p = 0.19$).<br>Salivary cortisol increased significantly from lecture to presimulation ($p < 0.01$).<br>Postsimulation cortisol levels were significantly higher than presimulation ($p < 0.001$),yet this increase was not scenario dependent ($p = 0.41$) nor associated with performance on either scenario. |
| Redmond et al. | NR | NR | Knowledge and perceived stress | Questionnaire (Likert scale)<br>Heart rate | Changes in HRV were noted during all scenarios irrespective of subjective self-assessment of stress. Procedural proficiency suffered during more stressful scenarios. |
| Trevisanuto et al. | NR | NR | Primary: perceived time intervals between interventions<br>Secondary: self-perceived stress | Questionnaire | Health care providers underestimate the passage of time, irrespective of their role in a simulated complex neonatal resuscitation. Participant's self-assessed levels of stress and preparation were not related to the accuracy of their time perception. |
| Wallbank et al. | 10% | 40.9 | Primary: staff stress, coping strategies, perception of working environment | Lazarus and Folkman's transactional model of stress, Impact of Events (IES) Scale | IES scores revealed 55% of participants reporting subjective distress levels indicating a 'high' level of clinical concern.<br>No socio-demographic variable predicted distress.<br>Negative affect experienced at time of care ($p = .002$; CI 0.164–0.683) negative appraisal of care given to the family ($p = .003$; CI 0.769–3.358), cumulative number of losses experienced ($p = 0.004$; CI 0.713–3.778), maladaptive ways of coping ($p = .000$; CI 0.482–1.136), and staff perceptions of support outside work significantly predicted distress ($p = 0.023$; CI 4.818 to 0.355). |

Regarding stress assessment, different methods were used in each study. Heart rate was measured in 2 studies and salivary cortisol levels in 2 studies as well. Non validated questionnaires for stress evaluation using a Likert scale were used in 4 studies although only one study used an established stress measurement scale, namely the Impact of Events Scale (IES).

Most of the studies (66.6%) revealed that participation in simulated scenarios increases stress among healthcare personnel involved in NR. This increase of stress seems not to differ between high- or low-fidelity simulation according to Finan, *et al*. and not to be affected by socio-demographic variables according to Wallbank, *et al*. Additionally, one study did not correlate stress with accuracy of time perception by the staff. Finally, two studies evaluated potential risk factors for stress. Wallbank, *et al*. identified the following predictors for personnel's stress: negative affect experienced at time of care, negative appraisal of care given to the family, cumulative number of losses experienced, maladaptive ways of coping and staff perceptions of support outside work. Bensouda, *et al*. found that the participation of more than one observer increases stress during NR as well. (Table 2)

## Discussion

Current evidence indicates that studies evaluating stress among professionals involved in NR are limited and include a small number of participants. Additionally, a large heterogeneity was found regarding study design and method of stress evaluation.

The majority of the included studies in this review evaluated stress in the setting of simulated scenarios. This is justified, as stress levels among healthcare professionals involved in resuscitation are measured more accurately during simulation-based training compared to traditional tutorial-based training [16]. Moreover, adequate training through simulation-based programs could improve cognitive, technical and behavioral skills in order to ameliorate any stress generation [17]. Randomized data further indicate that simulation promotes teamwork during NR, improves the efficiency of the team, increases trainees' confidence and potentially reduces their stress [18]. Simulation is the most appropriate setting to evaluate stress among resuscitators as performance during these training sessions is strongly associated with stress or overload [19]. However, recent data indicates that virtual reality simulations do not provide the same physiological stress changes as mannequin-based or real-life resuscitations [20].

A certain type of stress has been identified among emergency department and intensive care unit personnel when they perform cardiopulmonary resuscitation [5]. However, data specifically for NR remains limited. Stress usually leaves the resuscitator with a sense of fatigue and uncertainty that could lead to chronic anxiety, depression and exhaustion [21]. The emotion of grief or unsuccessfulness could also be generated and intensify stress, especially when a patient is lost despite resuscitation [22]. Much more so, when this patient is a newborn. All major steps of NR could easily induce stress when not completed such as endotracheal intubation, thoracic compressions, proper ventilation, and umbilical cord catheterization [23]. In this review, however, only two studies evaluated potential risk factors for stress during NR that included cumulative number losses, maladaptive way of coping, staff perceptions of support outside of work and the participation of more than one observer [10,15].

Regarding stress evaluation, the included studies used various methods, such as salivary cortisol measurement, heart rate recording and different questionnaires. This distinct heterogeneity of study design has also been reported among studies evaluating stress during other types of resuscitation [24]. Cortisol is a marker that reliably responds to acute psychological and physiological stress, and therefore, it has been established as the classical biomarker of stress in literature [25]. Both studies that used cortisol measurement in this review reported an increase of stress after the simulation although there was no difference among types of training or scenarios [11,12]. Heart rate measurement is also an established method of stress evaluation during resuscitation that was used in two studies included in this review. Although heart rate increase is a sign of distress or anxiety during resuscitation [26], heart rate variability has shown an inverse association with performance during simulated programs [24]. Finally, there are several established stress-evaluating questionnaire tools such as the IES, the Clinical Administered PTSD Scale (CAPS), the Post-Traumatic Stress Disorder Checklist (PCL) or the State-Trait Anxiety Inventory (STAI) [5,27]. However, only one of the studies in this review used one of these tools, with the rest of them using non-validated questionnaires.

This lack of studies investigating stress predictors during NR prevents from identifying stress-reducing strategies, therefore, the need for future research is imperative. First, there are specific risk factors that increase the risk for NR such as preterm delivery, low newborn's weight, meconium-stained amniotic fluid or emergency cesarean section [28]. These factors should be detected as early as possible, so that the staff is prepared and periprocedural stress is limited. Second, the use of a management algorithm and role allocation to specific positions around the warmer in the delivery room are factors that could reduce stress among personnel and improve outcomes [29]. Additionally, working on quality improvement in the delivery room, checking and preparing equipment seems to be of high priority in order to increase the sense of readiness and reduce stress [30].

Furthermore, lack of supervisor support was also correlated with negative coping strategies in the study by Wallbank, *et al*. [15]. Therefore, each institution should be prepared to handle such cases and support their employees. Avoidance of back-to-back shifts and adequate rest of the staff could help improve performance and limit stress. Groombridge, *et al*. identified cognitive aids including checklists, stress management training and meditation to be mitigators of stress during adults' resuscitation [5]. However, data on NR are limited. Finally, team briefing before delivery as well as debriefing after resuscitation could play a significant role. Predelivery briefing helps to optimize the performance of key behavioral skills such as leadership, anticipation and workload delegation [31]. Post-resuscitation debriefing helps analyzing and evaluating any problem or difficulty during resuscitation in order to improve future performance, increase confidence and decrease any related stress [32,33].

## Conclusion

This review has certain limitations. First, the number of eligible studies and the total number of participants is low. However, the majority of studies were randomized and of high quality, increasing the strength of the review. As mentioned above, there was a high heterogeneity regarding study design and stress evaluating tools, although this could not be measured due to lack of quantitative evidence. The majority of questionnaires used in the studies were not validated, and not all studies used biomarker measurement or recording of physiologic parameters (heart rate) to verify the findings. Additionally, no statistical analysis could be conducted due to this heterogeneity of data.

In conclusion, stress is increased during NR, although data are still limited and show heterogeneity. Future studies should be better

designed and try to evaluate certain stress predictors or mitigators in order to improve everyday clinical practice.

## Conflicts of interest

No potential competing interests are present.

## Funding source

No funding was utilized for this report.

### References

1. WHO (2014): Health-Related Millennium Development Goals. World Health Statistics. (accessed February 2018 at http://www.who.int/gho/publications/world_health_statistics/2014/en/).
2. Kamath-Rayne BD, Berkelhamer SK, Kc A, Ersdal HL, Niermeyer S, et al. (2017) Neonatal resuscitation in global health settings: an examination of the past to prepare for the future. *Pediatr Res* 82: 194-200.
3. Pammi M, Dempsey EM, Ryan CA, Barrington KJ (2016) Newborn Resuscitation Training Programs Reduce Early Neonatal Mortality. *Neonatology* 110: 210-24. [Crossref]
4. Rakshasbhuvankar AA, Patole SK (2014) Benefits of simulation-based training for neonatal resuscitation education: a systematic review. *Resuscitation* 85: 1320-1323.
5. Groombridge CJ, Kim Y, Maini A, Smit V, Fitzgerald MC, et al. (2019) Stress and decision-making in resuscitation: A systematic review. *Resuscitation* 144: 115-122. [Crossref]
6. Liberati A, Altman DG, Tetzlaff J (2009) The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol* 62: e1-e34.
7. Calvert M, Blazeby J, Altman DG (2013) Reporting of patient-reported outcomes in randomized trials: the CONSORT PRO extension. *JAMA* 309: 814-822.
8. Von Elm E, Altman DG, Egger M (2014) The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *Int J Surg* 12: 1495-1499.
9. Guyatt GH, Oxman AD, Vist GE (2008) GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ (Clinical research ed)* 336: 924-926. [Crossref]
10. Bensouda B, Mandel R, Mejri A, Lachapelle J, St-Hilaire M (2018) Effect of an audience on trainee stress and performance during simulated neonatal intubation: a randomized crossover trial. *BMC Med Educ* 18: 230.
11. Finan E, Bismilla Z, Whyte HE, Leblanc V, McNamara PJ, et al. (2012) High-fidelity simulator technology may not be superior to traditional low-fidelity equipment for neonatal resuscitation training. *J Perinatol* 32: 287-292.
12. Lizotte MH, Janvier A, Latraverse V (2017) The Impact of Neonatal Simulations on Trainees' Stress and Performance: A Parallel-Group Randomized Trial. *Pediatr Crit Care Med* 18: 434-441. [Crossref]
13. Redmond B, Joseph M, Ray J (2020) Stress as tool or toxin: physiologic markers and subjective report in neonatal simulation [published online ahead of print, 2020 Feb 11]. *Pediatr Res*.
14. Trevisanuto D, De Bernardo G, Res G (2016) Time Perception during Neonatal Resuscitation. *J Pediatr* 177: 103-107.
15. Wallbank S, Robertson N (2013) Predictors of staff distress in response to professionally experienced miscarriage, stillbirth and neonatal loss: a questionnaire survey. *Int J Nurs Stud* 50: 1090-1097.
16. Bong CL, Lightdale JR, Fredette ME, Weinstock P (2010) Effects of simulation versus traditional tutorial-based training on physiologic stress levels among clinicians: a pilot study. *Simul Healthc* 5: 272-278.
17. Sawyer T, Leonard D, Sierocka-Casteneda A, Chan D, Thompson M, et al. (2014) Correlations between technical skills and behavioral skills in simulated neonatal resuscitation. *J Perinatol* 34: 781-786. [Crossref]
18. Thomas EJ, Williams AL, Reichman EF, Lasky RE, Crandell S, et al. (2010) Team training in the neonatal resuscitation program for interns: teamwork and quality of resuscitations. *Pediatrics* 125: 539-546. [Crossref]
19. Hunziker S, Laschinger L, Portmann-Schwarz S, Semmer NK, Tschan F, et al. (2011) Perceived stress and team performance during a simulated resuscitation. *Intensive Care Med* 37: 1473-1479. [Crossref]
20. Chang TP, Beshay Y, Hollinger T, Sherman JM (2019) Comparisons of Stress Physiology of Providers in Real-Life Resuscitations and Virtual Reality-Simulated Resuscitations. *Simul Healthc* 14: 104-112.
21. Laws T (2001) Examining critical care nurses' critical incident stress after in hospital cardiopulmonary resuscitation (CPR). *Aust Crit Care* 14: 76-81.
22. Hamric A, Blackhall L (2007) Nurse-physician perspectives on the care of dying patients in intensive care units: collaboration, moral distress and ethical climate. *Crit Care Med* 35: 422-429. [Crossref]
23. Perlman JM, Wyllie J, Kattwinkel J (2015) Part 7: neonatal resuscitation: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Circulation* 132: S204-41.
24. Hunziker S, Semmer NK, Tschan F, Schuetz P, Mueller B, et al. (2012) Dynamics and association of different acute stress markers with performance during a simulated resuscitation. *Resuscitation* 83: 572-578. [Crossref]
25. Hellhammer DH, Wüst S, Kudielka BM (2009) Salivary cortisol as a biomarker in stress research. *Psychoneuroendocrinology* 34: 163-171.
26. Tramèr L, Becker C, Hochstrasser S, Marsch S, Hunziker S, et al. (2018) Association of electrocardiogram alterations of rescuers and performance during a simulated cardiac arrest: A prospective simulation study. *PLoS One* 13: e0198661. [Crossref]
27. Kragh AR, Folke F, Andelius L, Ries ES, Rasmussen RV, et al. (2019) Evaluation of tools to assess psychological distress: how to measure psychological stress reactions in citizen responders- a systematic review. *BMC Emerg Med* 19: 64.
28. Berazategui JP, Aguilar A, Escobedo M (2017) Risk factors for advanced resuscitation in term and near-term infants: a case-control study. *Arch Dis Child Fetal Neonatal Ed* 102: F44-F50.
29. Hunziker S, Tschan F, Semmer NK, Howell MD, et al. (2010) Human factors in resuscitation: lessons learned from simulator studies. *J Emergencies, Trauma, Shock* 3: 389-394.
30. Brown T, Tu J, Profit J, Gupta A, Lee HC, et al. (2016) Optimal criteria survey for preresuscitation delivery room checklists. *Am J Perinatol* 33: 203-207.
31. Sawyer T, Lee HC, Aziz K (2018) Anticipation and preparation for every delivery room resuscitation. *Semin Fetal Neonatal Med* 23: 312-320. [Crossref]
32. Carolan-Olah M, Kruger G, Brown V, Lawton F, Mazzarino M, et al. (2016) Development and evaluation of a simulation exercise to prepare midwifery students for neonatal resuscitation. *Nurse Educ Today* 36: 375-380.
33. Sawyer T, Loren DJ, Halamek L (2016) Post-event debriefings during neonatal care: why are we not doing them, and how can we start? *J Perinatol* 36: 415-419. [Crossref]

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