Clinical paper

Assessment of temporal variations in adherence to NRP using video recording in the delivery room

Amy J. Sloane, Kaitlin M. Kenaley, Michael T. Favara

Neonatology, Sidney Kimmel Medical College at Thomas Jefferson University and Nemours/Christiana Care, Philadelphia, PA, United States

Neonatology, ChristianaCare, Newark, DE, United States

Abstract

Introduction: Video recording and video evaluation tools have been successfully used to evaluate neonatal resuscitation performance. The objective of our study was to evaluate differences in Neonatal Resuscitation Program (NRP) adherence at time of birth between three temporal resuscitative periods using scored video recordings.

Methods: This is a retrospective review of in-situ resuscitation video recordings from a level 3 perinatal center between 2017 and 2018. The modified Neonatal Resuscitation Assessment (mNRA) scoring tool was used as a surrogate marker to assess NRP adherence during daytime, evening, and nighttime hours.

Results: A total of 260 resuscitations, of which 258 were births via Cesarean section, were assessed. mNRA composite scores were 86.2% during daytime hours, 87% during evening hours, and 86.6% during nighttime hours. There were no significant differences in mNRA composite scores between any of the three time periods. Differences remained statistically similar after controlling for complexity of resuscitations with administration of positive pressure ventilation (PPV), intubation, or chest compressions.

Conclusion: Overall adherence to NRP, as measured by composite mNRA scores as a surrogate marker, was high across all three daily resuscitative periods without significant differences between daytime, evening, and nighttime hours.

Keywords: Delivery room, Resuscitation, NRP, Video

Introduction

It is estimated that approximately 10% of newborns require some degree of resuscitation at birth, and approximately 1% require invasive resuscitative measures such as cardiac compressions and medications. The interventions performed during resuscitation have a direct influence on immediate survival and also on long-term neonatal morbidity and mortality. The Neonatal Resuscitation Program (NRP) guidelines are a set of standardized instructions guiding neonatal resuscitation. However, adherence to NRP resuscitative guidelines is challenging and performance can be variable. This has been attributed to limited experience of practitioners, high-stress environment when a neonate is distressed, poor communication amongst team members, and decline in skills over time. Video recordings and video evaluation tools allow for the observation and scoring of resuscitation practices and may result in improved resuscitation outcomes by allowing for debriefing, group audit and reflection, identification of targeted areas for training debriefing, group audit and reflection, and identification of targeted areas for training. These strategies can help to detect strengths and weaknesses in the performance of neonatal resuscitation and NRP adherence, and can facilitate future targeted education and quality improvement initiatives.

Furthermore, recent literature suggests potentially worsened outcomes of neonates resuscitated at birth during evening and nighttime hours. Shift length, shifts scheduled outside of typical daytime hours, and nighttime hours.
hours, and physician fatigue can result in increased patient load and capacity strain on perinatal providers during nighttime hours and potentially contribute to medical errors and poor outcomes. The objective of our study was therefore to compare adherence to NRP in resuscitations that occurred during daytime hours, evening hours, and nighttime hours using video recordings and mNRA scores as a surrogate marker of adherence.

**Methods/Study design**

This study is a retrospective review of prospectively collected data from a level 3 regional perinatal center with approximately 6,100 births per year. The Institutional Review Committee at ChristianaCare approved this study. Consent for video recording of resuscitations to be utilized for quality improvement purposes is incorporated into standard hospital consent obtained by obstetricians. Video recording of birth resuscitations has occurred at our institution since 2015 as part of an ongoing quality improvement project following staff buy-in. Notable resuscitations are reviewed with staff members on a regular basis for educational purposes and without punitive consequences.

Select labor and delivery rooms and all operating rooms used for Cesarean births are outfitted with overhead video cameras above resuscitation beds and resuscitations from these deliveries are recorded in real time. The cameras are mounted above the warmer and are positioned so as to provide a field of view that includes the entire infant and the hands of the resuscitation team. The cameras are switched on by a member of the resuscitation team on arrival to the birth. The resuscitation team is comprised of at minimum two providers (“small team”), and typically includes at least one member of the neonatology team (neonatal nurse practitioner, pediatric resident, neonatology fellow, neonatology attending) and a labor and delivery nurse. Higher risk births as well as emergency deliveries are frequently attended by multiple neonatal providers (“full NICU team”) as well as neonatal nurses, neonatal respiratory therapists, and labor and delivery nurses. As part of an ongoing quality improvement initiative, recordings are deidentified and reviewed periodically by members of the neonatal resuscitation quality improvement team. Recordings are stored on secure encrypted drives until review.

Previously recorded videos of resuscitations from 01/2017 to 06/2018 were reviewed and scored using the modified neonatal resuscitation assessment (mNRA) tool. The neonatal resuscitation assessment (NRA) is a validated tool that assesses competency to NRP in seven domains: preparation and initial steps, heart rate assessment, oxygen administration, bag/mask ventilation, intubation, cardiac compressions, and medication use. We utilized a modified version of this tool, the mNRA, in order to place additional emphasis on team function and communication, which was difficult to assess in the original tool. Sections in this tool are weighted differently, and the sum of the awarded points is divided by the total points possible for that resuscitation and multiplied by 100 to yield a percentage or composite score.

Relevant data regarding the need for and appropriate use of positive pressure ventilation (PPV), continuous positive airway pressure (CPAP), endotracheal intubation attempts and technique, chest compressions, and administration of endotracheal and intravenous medications were collected. Infants of all gestational ages were included in this study. Three temporal resuscitative periods were assessed: daytime hours (0700–1459), evening hours (1500–2259), and nighttime hours (2300–0659). These specific time periods were chosen because, in our institution, a decreased number of neonatal providers is present in the hospital in the late afternoon, evening, and nighttime hours as opposed to morning and early afternoon hours. Nighttime hours were specifically evaluated due to concerns for provider fatigue occurring during this time period. Additionally, change of shift and therefore transitions of care occur within these specific time periods for both nursing and medical (physician and nurse practitioners) staff. The seniority, experience and recency of NRP training of the members of the resuscitation team for all 3 time intervals occurred at random based on routine staffing and scheduling. Data regarding these factors was not collected.

After establishing interrater reliability, three independent research team members scored the resuscitations using the mNRA tool. Only resuscitations that received CPAP or higher were included in the analysis, as it was felt that those represented more complex resuscitations with higher likelihood of deviation from NRP guidelines. Data regarding timeliness of the interventions, including initial steps of drying, warming, and tactile stimulation, as defined by then-current NRP guidelines was collected and including in the scoring, with detraction of points if interventions were performed out of sequence or were too early or delayed. Interventions were clocked by an in-video timer. Resuscitations were excluded from analysis if they included fewer than two medical providers attending the birth or if video recording was initiated after resuscitation had begun. As the data were deidentified prior to review, the videos were unable to be linked to a patient’s electronic medical record and therefore demographic information, previously identified congenital anomalies, perinatal risk factors and post-delivery outcomes were not assessed in this study. We did, however, exclude resuscitations of infants with obvious congenital anomalies as well as resuscitations of multiple births. Reviewers were not blinded to the time of day that births occurred.

Statistical analysis was performed using SPSS version 25 (IBM Corporation, Armonk, NY). Data are represented with mean ± standard deviation unless otherwise noted. Comparisons between groups were performed using Student t-tests, ANOVA with post hoc pair-wise testing, or chi-squared tests, as appropriate. Interrater reliability was measured using Cronbach’s alpha. Multiple linear regression models were performed to adjust for complexity of resuscitations. The difference between the comparison groups was considered significant for p < 0.05.

**Results**

We included a total of 260 resuscitations in the study (Table 1). The majority of births occurred during daytime (40%) and evening hours (43%). Unadjusted analyses show that PPV was provided in 196/260 (75.4%) of resuscitations and chest compressions and administration of medications were performed in only 3.5% and 0.8% of resuscitations, respectively. Mean rates of NRP adherence as measured by mNRA composite scores as a surrogate marker were 86.2% during daytime hours, 87% during evening hours, and 86.6% during nighttime hours (Table 2). There were no differences in adherence to NRP during any of the three time points (daytime vs. evening p = 0.48; daytime vs. night p = 0.78; evening vs. night p = 0.79). Multiple linear regression analyses revealed no differences after stratifying for complexity of resuscitations, including those that included PPV, intubation, or chest compressions.
Table 3 demonstrates that PPV was given more appropriately during evening compared to daytime hours (p = 0.042), which remained significant after controlling for births that required PPV or greater (p = 0.019). A consistent number of successful intubations was seen at all time periods. The number of intubation attempts as well as the time to successful intubation was not different across time periods. Team function and communication was high at all time periods.

The structure of resuscitation teams attending births is demonstrated in Table 4. While there were fewer births during nighttime hours compared to daytime and evening hours, there was a trend towards significance (p = 0.08) in the nighttime team having a full NICU resuscitative team present. Additionally, there were no differences when comparing daytime versus evening (p = 0.89) or evening versus nighttime (p = 0.1).

There were no differences when the resuscitative periods were further divided into daytime (0700–14:59) versus nighttime hours (1900–06:59) only, as well as when births were divided into daytime (0700–1559) versus “off hours” (1600–0659) when fewer staff and providers are typically available. NRP adherence also remained similar when comparing weekdays versus weekends/holidays.

Discussion

Previous literature has shown conflicting evidence in the outcomes of neonates born in the evening and nighttime hours, which may be related to the quality of resuscitation and NRP adherence during these time periods. In this analysis, we used video recordings scored with the mNRA tool to determine if adherence to NRP differed between resuscitations of infants born during daytime, evening, or nighttime hours. We found that in our level 3 perinatal referral center, adherence to NRP did not change in nighttime resuscitations compared to daytime or evening resuscitations.

Table 1 – Characteristics of resuscitations assessed (unadjusted).

| Mode of Birth   | Cesarean | Vaginal | PPV | Intubation | Chest Compressions | Medications |
|-----------------|----------|---------|-----|------------|--------------------|-------------|
| Daytime (n = 104) | 102      | 2       | 71  | 15         | 5                  | 1           |
| Evening (n = 112)  | 112      | 0       | 90  | 18         | 3                  | 1           |
| Nighttime (n = 44) | 44       | 0       | 35  | 14         | 1                  | 0           |
| Total (n = 260)     | 258      | 2       | 196 | 47         | 9                  | 2           |

Births included in analysis involved usage of continuous positive airway pressure (CPAP) or higher during resuscitation. PPV = positive pressure ventilation.

Daytime = 07:00–14:59.

Evening = 15:00–22:59.

Nighttime = 23:00–06:59.

Table 2 – mNRA scores as a surrogate marker of NRP adherence across study periods.

| Number of Births (%) | Daytime Hours (0700–1459) | Evening Hours (1500–2259) | Nighttime Hours (2300–0659) | p-value |
|----------------------|---------------------------|---------------------------|-----------------------------|---------|
| Receiving CPAP or greater (n = 260) | 86.2 ± 8.7 | 87.0 ± 8.1 | 86.6 ± 7.9 | 0.48*; 0.78*; 0.79^ |
| Receiving PPV or greater (n = 196) | 85.5 ± 8.6 | 87.2 ± 9 | 85.7 ± 8.6 | 0.22*; 0.92*; 0.41^ |
| Intubation attempts (n = 47) | 85.4 ± 9.6 | 87.3 ± 8.5 | 84.5 ± 9.6 | 0.41*; 1.00*; 0.43^ |
| Chest compressions/medications (n = 9) | 86.7 ± 7.5 | 85.6 ± 9.7 | 79.0 ± 0 | 0.86* |

P is significant if < 0.05. mNRA scores expressed as a percentage, with 100 being a perfect score.

* = comparison between day and evening.

^ = comparison between day and night.

^ = comparison between evening and night.

Table 3 – Characteristics of PPV and Endotracheal Intubation.

| Overall Score | PPV or greater |
|---------------|----------------|
| Average       | PPV or greater |
| Day-Evening   | Day-Night      | Evening-Night  | Day-Evening | Day-Night | Evening-Night |
| PPV           | 90.6%          | 0.042          | 0.438       | 0.446     | 90.8%       | 0.019        | 0.468        | 0.291        |
| Successful Intubation | 73.7%          | 0.276          | 0.346       | 0.200     | 77.8%       | 0.396        | 0.958        | 0.385        |

Successful intubation: defined as 2 attempts or less.
Neonatal resuscitation is one of the most frequently practiced forms of acute resuscitation. Precise resuscitative steps and adherence to standard NRP guidelines are crucial in preventing neonatal morbidity and mortality. Despite this, deviations from NRP occur frequently, and reasons for this are multifactorial. Shift length, off-hours shifts, and physician fatigue have long been implicated as contributors to medical errors and poor outcomes. Several studies have identified no significant temporal variations in rates of intrapartum providers at all times in tertiary care centers such as ours may therefore have limited generalizability to hospitals with smaller staffing. Our study was performed in a high-acuity tertiary care center with around-the-clock availability of multidisciplinary resuscitation teams, the establishment of such a shared mental model with anticipated need for resuscitations was more feasible and likely was responsible for uniform NRP adherence in off-hour resuscitations. Performance improvement initiatives focusing on enhancing teamwork and communication may therefore be of particular benefit to improving NRP adherence and performance.

Although several studies have evaluated perinatal outcomes depending on timing of birth, this is to our knowledge, the first study to evaluate temporally related NRP adherence. Our findings demonstrate a high prevalence of adherence to NRP across all three daily resuscitative periods without differences between daytime, evening, and nighttime hours. These findings may be explained by the fact that our study was performed in a high-acuity perinatal center with a dedicated response team. Our findings may therefore have limited generalizability to hospitals with smaller delivery volumes and without a similarly dedicated team, particularly in lower resource settings. Furthermore, while prior studies suggest that infants born at night and during “off hours” are at an increased risk of adverse complications, such data was not available to sufficient levels of care in our study population.

### Table 4 - Characteristics of Team Members Present at Births.

|                        | Small Team at Birth | Full NICU Team at Birth |
|------------------------|---------------------|-------------------------|
|                        | Number of Births | Percent | Number of Births | Percent |
| **Daytime**            | 73                 | 60% | 49 | 40% |
| **Evening**            | 55                 | 59% | 39 | 41% |
| **Nighttime**          | 19                 | 43% | 25 | 57% |
| **Total**              | 147                |         | 113 |        |

Small team at birth: 2–3 Pediatric/Neonatal members (one neonatal nurse practitioner + one pediatric resident or two pediatric residents and one neonatal fellow).

Full NICU team at birth: 4–6 Pediatric/Neonatal members (one attending neonatologist, neonatal fellow, two NNP s or pediatric residents, neonatal nurse, and neonatal respiratory therapist).

P-value for Day-Evening: p = 0.89.

Day-Night: p = 0.08.

Evening-Night: p = 0.1.
available to us specific to our institution. We did not have evidence, either before or during the study, of a difference in resuscitation outcomes or later outcomes by birth time.

A significant limitation of our study is that the majority of births in our study were via Cesarean section secondary to camera placement in all obstetric ORs (compared to camera presence in only 2 out of 16 labor and delivery rooms), which has the potential to create a selection bias in terms of potential acuity of infants that would necessitate larger team presence at birth.

The large proportion of Caesarean births may also limit the external validity, both to vaginally-born infants in the investigators’ own hospital or in other birth hospitals.

Furthermore, in our sample, PPV was provided in a significantly higher proportion than the 10% of infants who, per global estimates, are generally expected to require respiratory resuscitation at birth1, but again may create a selection bias. Only 3.5% and 0.8% of the resuscitations received chest compressions and administration of medications, respectively, a proportion which is low but consistent with national estimates1.

Ongoing continuous monitoring of resuscitations is imperative to encourage sustained compliance to NRP guidelines. Longitudinal monitoring of individual resuscitators may also be helpful to follow performance over time and individual function at different temporal periods. Nonetheless, it should be noted that strict compliance with NRP may have both advantages and disadvantages for individual patients. Clinical expertise should also allow for deliberate deviation from the NRP algorithm for infants with atypical presentations or responses and may result in even better patient outcomes than strict protocol adherence.

Conclusion

In a level 3 perinatal referral center, there were no temporal variations noted when comparing NRP adherence across several time intervals (daytime vs evening vs nighttime hours). At an individual institution level, investigation of temporal variation in birth resuscitation performance and NRP adherence can be a useful tool to identify targeted areas for performance improvement. Further research is needed in investigating NRP adherence at non-tertiary centers or in institutions without a dedicated neonatal resuscitation team, as well as reviewing NRP adherence at resuscitations of vaginally delivered infants with known perinatal risk factors.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Dr. Sloane conceptualized the study, searched literature, collected and analyzed data, drafted initial manuscript and approved the final manuscript as submitted.

Drs. Kenaley and Favara conceptualized and designed the study, analyzed data, critically reviewed and revised the manuscript and approved the final manuscript as submitted.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resplu.2021.100162.

REFERENCES

1. Wyckoff MH, Aziz K, Escobedo MB, Kapadia VS, Kattwinkel J, Perlman JM, Simon WM, Weiner GM, Zaichkin JG. Part 13: Neonatal Resuscitation: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2015;132(18 suppl 2):S543–60. https://doi.org/10.1161/CIR.0000000000000267.

2. Textbook of Neonatal Resuscitation (NRP), 7th Ed. 7th ed. American Academy of Pediatrics and American Heart Association; 2016.

3. Foglia E, Patel J, Niles D, Aslani PH, Nadkami V, Ades A. Provider Adherence to Neonatal Resuscitation Program Recommendations for Coordinated Neonatal Chest Compressions and Ventilations. Anälg Resusc. Jul 25 2013;Suppl 1do:10.4172/2324-903X.S1-010

4. Maya-Enero S, Botet-Mussons F, Figueras-Aloy J, Izuquierdo-Renau M, Thio M, Irisondo-Sanz M. Adherence to the neonatal resuscitation algorithm for preterm infants in a tertiary hospital in Spain. BMC Pediatr. Oct 9 2018;18(1):319. doi:10.1186/s12887-018-1288-3

5. Lindback C, Kc A, Wrammert J, Vitракoti R, Ewald U, Malqvist M. Poor adherence to neonatal resuscitation guidelines exposed; an observational study using camera surveillance at a tertiary hospital in Nepal. BMC Pediatr. Sep 16 2014;14:233. doi:10.1186/1471-2431-14-233

6. Finer N, Rich W. Neonatal resuscitation for the preterm infant: evidence versus practice. J Perinatol Oct 2010;30(Suppl):S57–66. https://doi.org/10.1038/jp.2010.115.

7. Finer NN, Rich W. Neonatal resuscitation: toward improved performance. Resuscitation Apr 2002;53(1):47–51. https://doi.org/10.1016/s0300-9572(01)00494-4.

8. Layouni I, Danan C, Durrmeyer X, Dassieu G, Azcona B, Decobert F. [Video recording of newborn resuscitation in the delivery room: technique and advantages]. Arch Pediatr. Jul 2011;18 Suppl 2:S72- Enregistrement video de situations reelles de reanimation en salle de naissance: technique et avantages. doi:10.1016/S0909-2693(X11)71094-6

9. Kaczorowski J, Levitt C, Hammond M, et al. Retention of neonatal resuscitation skills and knowledge: a randomized controlled trial. Fam Med Nov-Dec 1996;30(10):705–11.

10. Carbone DN, Finer NN, Knodel E, Rich W. Video recording as a means of evaluating neonatal resuscitation performance. Pediatrics Oct 2000;106(4):654–6. https://doi.org/10.1542/peds.106.4.654.

11. Gelbart B, Hiscock R, Barfield C. Assessment of neonatal resuscitation performance using video recording in a perinatal centre. J Paediatr Child Health Jul 2010;46(7–8):378–83. https://doi.org/10.1111/j.1440-1754.2010.01747.x

12. Santora TA, Trooskin SZ, Blank CA, Clarke JR, Schinco MA. Video assessment of trauma response: adherence to ATLS protocols. Am J Emerg Med Oct 1996;14(6):564–9. https://doi.org/10.1016/S0735-677X(96)01010-X.

13. Nadler I, Sanderson PM, Van Dyken CR, Davis PG, Liley HG. Presenting video recordings of newborn resuscitations in debriefings for teamwork training. BMJ Qual Saf Feb 2011;20(2):163–9. https://doi.org/10.1136/bmjqs.2010.043547.
14. Root L, van Zanten HA, den Boer MC, Foglia EE, Willox R, Te Pas AB. Improving Guideline Compliance and Documentation Through Auditing Neonatal Resuscitation. Front Pediatr 2019;7:294. https://doi.org/10.3389/fped.2019.00294.

15. Skåre C, Boldingh AM, Kramer-Johansen Jo, Calisch TE, Nakstad B, Nadkarni V, Olasveengen TM, Niles DE. Video performance-debriefings and ventilation-refreshers improve quality of neonatal resuscitation. Resuscitation 2018;132:140–6. https://doi.org/10.1016/j.resuscitation.2018.07.013.

16. Pasupathy D, Wood AM, Pell JP, Fleming M, Smith GC. Time of birth and risk of neonatal death at term: retrospective cohort study. BMJ. Jul 15 2010;341:c3498. doi:10.1136/bmj.c3498

17. de Graaf JP, Ravelli AC, Visser GH, et al. Increased adverse perinatal outcome of hospital delivery at night. BJOG. Aug 2010;117 (9):1098-107. doi:10.1111/j.1471-0528.2010.02611.x

18. Stephansson O, Dickman PW, Johansson AL, Kieler H, Cnattingius S. Time of birth and risk of intrapartum and early neonatal death. Epidemiology. Mar 2003;14(2):218-22. doi:10.1097/01.EDE.0000037975.55478.C7

19. Reif P, Pichtler G, Griesbacher A, et al. Do time of birth, unit volume, and staff seniority affect neonatal outcome in deliveries at >34+(+0) weeks of gestation? BJOG Jun 2018;125(7):884–91. https://doi.org/10.1111/1471-0528.15000.

20. Lyndon A, Lee HC, Gay C, Gilbert WM, Gould JB, Lee KA. Effect of time of birth on maternal morbidity during childbirth hospitalization in California. Am J Obstet Gynecol. Nov 2015;213(5):705 e1-11. doi:10.1016/j.ajo.2015.07.018

21. Tavares S, Cavaco-Gomes J, Moucho M, Severo M, Mateus M, Ramalho C, Visser G, Montenegro N. 24/7 Presence of Medical Staff in the Labor Ward: No Day-Night Differences in Perinatal and Maternal Outcomes. Am J Perinatol May 2017;34(06):529–34. https://doi.org/10.1055/s-0036-1593809.

22. Luo ZC, Liu S, Wilkins R, Kramer MS, Fetal, Infant Health Study Group of the Canadian Perinatal Surveillance S. Risks of stillbirth and early neonatal death by day of week. CMAJ. Feb 3 2004;170 (3):337–41.

23. Knight Hannah E, van der Meulen Jan H, Guroi-Urganci Ipek, Smith Gordon C, Kiran Amit, Thornton Steve, Richmond David, Cameron Alan, Cromwell David A, Myers Jenny E. Birth “Out-of-Hours”: An Evaluation of Obstetric Practice and Outcome According to the Presence of Senior Obstetricians on the Labour Ward. PLoS Med Apr 2016;13(4):e1002000. https://doi.org/10.1371/journal.pmed.1002000.

24. Edwards Erika M, Soll Roger F, Ferrelli Karla, Morrow Kate A, Suresh Gautham, Celenza Joanna, Horbar Jeffrey D. Identifying improvements for delivery room resuscitation management: results from a multicenter safety audit. Matern Health Neonatal Perinatol 2015;1(1). https://doi.org/10.1186/s40748-014-0006-x.

25. Thomas EJ, Sexton JB, Lasky RE, Helmreich RL, Crandell DS, Tyson J. Teamwork and quality during neonatal care in the delivery room. J Perinatol Mar 2006;26(3):163–9. https://doi.org/10.1038/sj.jp.7211451.

26. American Heart A. 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: pediatric advanced life support. Pediatrics May 2006;117(5):e1005–28. https://doi.org/10.1542/peds.2006-0346.

27. Sawyer T, Lee HC, Aziz K. Anticipation and preparation for every delivery room resuscitation. Semin Fetal Neonatal Med Oct 2018;23 (5):312–20. https://doi.org/10.1016/j.siny.2018.06.004.

28. Colby CE, Carey WA, Blumenfeld YJ, Hintz SR. Infants with prenatally diagnosed anomalies: special approaches to preparation and resuscitation. Clin Perinatol Dec 2012;39(4):871–87. https://doi.org/10.1016/j.clp.2012.09.012.

29. Chang Catherine, Perlman Jeffrey. Anticipation and preparation for delivery room emergencies. Semin Fetal Neonatal Med 2019;24 (6):101031. https://doi.org/10.1016/j.siny.2019.101031.