Accuracy of real-time delivery room resuscitation documentation

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ABSTRACT

Objective To assess the accuracy of real-time delivery room resuscitation documentation.
Design Retrospective observational study.
Setting Level 3 academic neonatal intensive care unit.
Participants Fifty infants with video recording of neonatal resuscitation.
Main outcome measures Vital sign assessments and interventions performed during resuscitation. The accuracy of written documentation was compared with video gold standard.
Results Timing of initial heart rate assessment agreed with video in 44/50 (88%) records; the documented heart rate was correct in 34/44 (77%) of these. Heart rate and oxygen saturation were documented at 5 min of life in 90% of resuscitations. Of these, 100% of heart rate and 93% of oxygen saturation values were correctly recorded. Written records accurately reflected the mode(s) of respiratory support for 89%–100%, procedures for 91%–100% and medications for 100% of events.
Conclusion Real-time documentation correctly reflects interventions performed during delivery room resuscitation but is less accurate for early vital sign assessments.

What is already known on this topic?

► Accurate recording of delivery room resuscitation is essential for complete medical documentation and supports research and quality assurance interventions.
► Retrospective documentation of assessments and interventions during neonatal resuscitation is often incomplete and/or inaccurate.

What this study adds?

► Real-time documentation accurately captures interventions performed during delivery room resuscitation.
► Real-time documentation of vital signs is often inaccurate at the start of resuscitation and improves by 5 min of life.
► Real-time documentation may represent an improvement over retrospective documentation.

INTRODUCTION

Accurate recording of delivery room resuscitation is essential for complete medical documentation and supports research and quality assurance interventions. The Neonatal Resuscitation Program recommends that resuscitation events are documented as they occur and supplemented with a retrospective narrative summary.[1] In many settings, documentation occurs after resuscitation, but retrospective recording is often inaccurate.[2] Real-time documentation, in which a scribe records assessments and interventions as they occur, may provide a more accurate method of recording neonatal resuscitation. The objective of this study was to assess the accuracy of real-time documentation of clinical assessments and interventions during newborn resuscitation after birth.

METHODS
Study design and population

This was a retrospective observational study conducted at the Hospital of the University of Pennsylvania, a level 3 academic neonatal intensive care unit, from 20 June 2017 through 10 December 2017. High-risk resuscitations are conducted in a specialised infant resuscitation room and are routinely video recorded for quality assurance. We planned to enrol 50 infants who underwent resuscitation with complete video recordings, consistent with previous studies.[2] Parental consent for video recording is obtained as part of the general hospital admission form. The University of Pennsylvania Institutional Review Board reviewed and exempted this study as a quality assurance initiative.

Equipment
Video recordings

A B-Line LiveCapture ultraportable unit (B-Line Medical, Washington, DC) synchronises video and audio feed from two mounted cameras in the infant resuscitation room and one video stream from the vital sign monitor. Digital files are securely stored on the hospital server for 4 weeks before they are automatically deleted.

Physiological monitoring

High-risk resuscitations are monitored using ECG and pulse oximetry with a Philips Intellivue monitor (Phillips, Amsterdam, Netherlands).

Resuscitation documentation

A neonatal nurse documents infant demographics, vital signs, respiratory interventions and settings, medications and procedures in real time on a paper form, which becomes part of the medical record (online supplementary figure). Recording nurses were aware of video recording but were unaware

that the accuracy of written documentation was being assessed in the current study.

Measures

Time and date of birth were obtained from each infant's electronic medical record; the remaining variables were abstracted from each video recording. Vital sign assessments included the first heart rate (HR) ascertained during resuscitation—from the vital sign monitor or as announced by a provider's clinical assessment. Pulse oximetry oxygen saturation (SpO_2) was not abstracted for the initial assessment, as this value is often not available in the first minute of resuscitation. At 5 min of life (MOL), HR and SpO_2 were abstracted from the vital sign monitor.

We collected the following resuscitation variables: mode(s) of respiratory support, maximum pressure setting(s) for each mode of support and maximum fraction of inspired oxygen (FiO_2) during resuscitation. In our hospital, team members verbally announce all changes to respiratory support (including pressure and FiO_2 settings) to the recording nurse, who often stands at a slight distance from the team and cannot easily visualise the equipment settings. We used both the visual and audio components of the video to abstract these data for respiratory interventions. In addition, we collected data for all procedures performed and medications administered.

We collected the same variables from the paper medical record for the duration of the resuscitation captured by video recording. To account for minor differences between clocks,[1] we recorded the range of vital signs documented for the duration of time inclusive of the minute before and after 5 MOL.

Data analysis

For each measure, medical record documentation was compared with video recording gold standard, and the completeness and per cent agreement for each variable was reported. Because a range of HR and SpO_2 values were recorded for the 5 MOL assessment, we considered values with any overlap between the video and medical record to agree.

RESULTS

There were 57 resuscitations with video recordings during the study period. We excluded seven due to incomplete video recordings. Of 50 resuscitations analysed, 82% occurred on a weekday and 60% occurred during the daytime (07:00–19:00).

Timing of the first ascertained HR agreed with video in 44/50 (88%) records; the documented HR value was correct in 34/44 (77%) cases. When inaccurate, the documented HR was lower than video gold standard in 4/10 and higher in 6/10 cases. The 5 MOL HR and SpO_2 values were documented in 90% of records and were accurate in 100% and 93% of these, respectively (table 1). Documented SpO_2 was lower than video in two records (−3% and −24%) and higher in one (+4%).

The mode of respiratory support was documented more accurately than the maximum pressure settings used (table 1). Medication and fluid administration and invasive procedures were accurately recorded in 100% of cases when they occurred. There was only one instance when an intervention (positive pressure ventilation) was documented in the record but did not occur.

DISCUSSION

We sought to assess the accuracy of real-time documentation of delivery room resuscitation. Vital sign documentation was often inaccurate in the first minute of resuscitation and improved by

Table 1 Accuracy of real-time documentation of delivery room assessments and interventions

Resuscitation characteristics	Documentation complete	Documentation accurate if completed
Demographic information		
Birth date	98% (49/50)	100% (49/49)
Birth time	98% (49/50)	98% (48/49)
Vital signs		
First heart rate assessment*	88% (44/50)	77% (34/44)
Heart rate at 5 MOL	90% (45/50)	100% (45/45)
SpO_2 value at 5 MOL	90% (45/50)	93% (42/45)

Interventions	Occurred and documented	Accurate documentation of maximum setting
CPAP	89% (34/38)	74% (25/34)
PPV mask	100% (28/28)	93% (26/28)
PPV-ETT	92% (12/13)	67% (8/12)
Maximal FiO_2 during resuscitation	100% (50/50)	82% (41/50)
Delayed cord clamping	91% (20/22)	NA
Intubation	100% (13/13)	NA
Chest tube placement	100% (1/1)	NA
Thoracentesis	100% (1/1)	NA
Surfactant	100% (5/5)	NA
Normal saline fluid bolus	100% (1/1)	NA

*Complete documentation of first heart rate assessment refers to concordant timing (±1 min) of first ascertained heart rate between written record and video recording.

CPAP, continuous positive airway pressure; ETT, endotracheal tube; FiO_2, fraction of inspired oxygen; MOL, minute of life; NA, not applicable; PPV, positive pressure ventilation.

5 MOL. Real-time documentation correctly captured most resuscitative interventions but reflected the specific details of respiratory support less accurately.

Although accurate recording of delivery room resuscitation is important for complete medical documentation, research and quality assurance initiatives, resuscitation documentation is often incomplete and/or inaccurate.[2–4] Schilleman *et al* reported that retrospective documentation accurately reflected the mode of respiratory support in 83%, FiO_2 use in 57% and initial HR assessment in 37% delivery room resuscitations.[2] In contrast, documentation of each of these measures was more frequently accurate in our study. These results suggest that real-time documentation represents an improvement over retrospective documentation for neonatal resuscitation.

Su *et al*[3] compared the accuracy of real-time documentation during paediatric cardiac arrest resuscitation with video and monitor recordings. While the interventions in place were recorded correctly in 100% of resuscitations, paper records accurately reflected the patient's initial rhythm/condition in only 7/15 (47%) of events. Similarly, we found that the initial HR was the assessment that was least accurately documented in the written record. It is possible that the initial minutes of resuscitation may be more chaotic and cause discrepancies in the quality of data capture for initial physiological assessments, even with real-time documentation.

Video recording captures more objective and consistent information than both retrospective and in-person documentation.[2–4] However, technical and implementation barriers limit the reliability of video recording,[5] as evident by the seven resuscitations excluded from our study due to incomplete recordings. A

combination of both video recording and real-time documentation may provide the most complete and accurate method to document neonatal resuscitation.

One study limitation is that we relied on verbal announcement of respiratory settings, rather than downloading objective recorded data. However, this is the method used to communicate this information to the documenting nurse in our hospital. While it is possible these verbalisations do not accurately reflect the actual respiratory settings, we would expect data recorded on the resuscitation form to correspond to the data abstracted from the video, as they were based on the same verbalisations.

CONCLUSION

Real-time documentation correctly records interventions performed during delivery room resuscitation. Vital sign documentation is often inaccurate at the start of resuscitation and improves by 5 MOL. Documentation in real time may represent an improvement over retrospective documentation.

Contributors CEF designed this study, collected and analysed the data and wrote the first draft of this manuscript. DDW and EEF designed this study, interpreted the data and critically reviewed this manuscript. AM interpreted the data and critically reviewed the manuscript. All authors approved the final version of this manuscript.

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