

Documentation during neonatal resuscitation: a systematic review

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ABSTRACT

Objective Accurate documentation in healthcare is necessary for ethical, legal, research and quality improvement purposes. In this review, we aimed to evaluate the accuracy of methods of documentation of delivery room resuscitations.

Methods A systematic literature search in MEDLINE was conducted to identify original studies that reported the quality of documentation records during newborn resuscitation in the delivery room. Data extracted from the studies included population characteristics, methodology, documentation protocols, use of gold standard and main results (initial assessment of heart rate and peripheral oxygen saturation, respiratory support and supplementary oxygen).

Results In total, 197 records were screened after initial database search, of which seven studies met the inclusion criteria and were finally included in this review. Four studies were chart reviews and three studies compared conventional documentation methods with video recording. Only one study tested an intervention to improve documentation. Documentation was often inaccurate and important resuscitation events and interventions were poorly recorded. Lack of uniformity among studies preclude pooled analysis, but it seems that complex or advanced procedures were more accurately reported than basic interventions.

Conclusions There is little literature regarding accuracy of documentation during neonatal resuscitation, but current quality of documentation seems to be unsatisfactory. There is a need for consensus guidelines and innovative solutions in newborn resuscitation documentation.

INTRODUCTION

Precise documentation of any medical act is necessary from a medicolegal, ethical and quality improvement point of view. However, the quality of documentation during resuscitation and other medical emergencies is known to be poor^{1,2} particularly regarding time intervals.³ Conventional documentation methods have been shown to be inaccurate, imprecise and incomplete.^{2,4}

In cardiopulmonary resuscitation, there are international consensus guidelines designed to facilitate and structure resuscitation research and publications, known as the Utstein templates or the Utstein style. They were initially published in 1997⁵ and updated in 2004⁶ and 2015.⁷ Since the first Utstein conference, guidelines have been published or updated for in-hospital resuscitation, paediatric resuscitation, drowning resuscitation,

What is already known on this topic?

- ▶ Accurate documentation in healthcare is necessary for ethical, legal, research and quality improvement purposes.
- ▶ Paper-based documentation during medical emergencies is often inaccurate and unreliable.
- ▶ There are no consensus templates for documenting neonatal resuscitation.

What this study adds?

- ▶ There is little literature regarding accuracy of documentation during neonatal resuscitation, but there appears to be room for improvement in this field.
- ▶ There is an urgent need for consensus guidelines and innovative solutions in newborn resuscitation documentation.
- ▶ New technology should be evaluated prospectively in clinical settings and compared with conventional paper or computer-based standards.

trauma resuscitation and disaster resuscitation.^{8,9} All recommend the essential data to be documented to facilitate comparisons, quality assurance and to support research.

The 2000 International Liaison Committee on Resuscitation (ILCOR) guidelines included the following important statements regarding documentation of resuscitation of the newborn¹⁰: “It is essential for good clinical care, for communication, and for medicolegal concerns that the findings at each assessment and the actions taken in resuscitation are fully documented [...] Complete documentation must also include a narrative description of interventions performed and their timing. An alternative is the use of a standard resuscitation record, [...] Such a standardized form offers the further advantage of uniform data collection to facilitate study and comparison of resuscitation techniques and outcomes.” Subsequent updates of the ILCOR guidelines do not specifically address the topic of documentation during resuscitation in the delivery room^{11–13} and currently there are no published recommendations in this field.

In this review, we aimed to evaluate the accuracy of methods of documentation of delivery room resuscitations.



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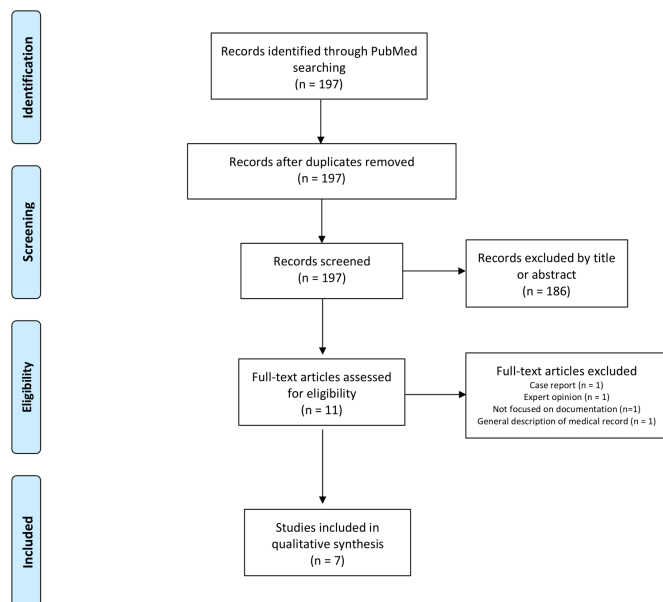


Figure 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.

METHODS

The Preferred Reporting Item for Systematic Reviews and Meta-analysis (PRISMA) statement was used to guide this review.¹⁴

SEARCH STRATEGY

In March 2020, we conducted a review of the literature on the documentation of neonatal resuscitation using the following search strategy in MEDLINE (PubMed): ((“Documentation”[Majr] OR “Medical Records”[Mesh]) AND (“Resuscitation”[Mesh] OR “Cardiopulmonary Resuscitation”[Mesh]) AND (“Infant, Newborn”[Mesh])) OR (documentation neonatal resuscitation).

Studies were included in the review if they met all the following criteria: (1) Patients included newborn infants (term or preterm) in the delivery room, (2) main goal of the study focusing on documentation, (3) results presented as rate of recording events or times and (4) full text available. Case reports were not included and there were no language restrictions.

DATA COLLECTION AND ANALYSIS

Studies were assessed for quality and bias using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.¹⁵ Two different reviewers reviewed the quality of the studies and ensured that the search did not miss any relevant articles. Data extracted from the studies included population characteristics, methodology, documentation protocols, use of gold standard and main results (initial assessment of heart rate (HR) and peripheral oxygen saturation (SpO₂), respiratory support and supplementary oxygen).

RESULTS

In total, 197 records were screened after initial database search, of which 172 articles were rejected on the basis that the title was not related to the topic. Another 14 were rejected after reviewing the abstracts for the same reason. Finally, 11 articles were assessed for eligibility, of which another four were excluded (one was a case report,¹⁶ one was an expert overview rather than a clinical study,¹⁷ one was a study aimed to evaluate neonatal resuscitation in which documentation issues were secondary findings¹⁸

and one was a description of a medical record without data on documentation accuracy).¹⁹ Seven studies were included in the review.^{20–26} Figure 1 shows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart for the selection process.

Table 1 provides an overview of the seven studies included. In general, these studies met the guidelines outlined in the STROBE statement and all the included studies had similar scores for quality.¹⁵

Although we planned to perform a meta-analysis of the most important events or interventions during resuscitation (ie, rate of positive pressure ventilation (PPV) and intubation, timings and changes in fraction of inspired oxygen (FiO₂)), paucity of studies and diversity in study design and presentation of results shifted our focus to provide descriptive summaries of the data.

There were two study designs clearly identified: four studies were chart reviews performed to determine the accuracy of predefined interventions and observations^{20–22–24} and three studies compared conventional documentation methods with a gold standard (video recording).^{21–25–26} Only one study tested an intervention to improve documentation.²⁵

Studies reviewing medical records

Berglund and Norman, in a Swedish study aiming to evaluate adherence to guidelines for neonatal resuscitation, showed that documentation was inaccurate in up to 45% of infants and completely absent in 5.1%.²⁰ Braga *et al* published the results of a multicentre study conducted in six North American hospitals evaluating neonatal resuscitation documentation.²² The authors developed a comprehensive list of 29 items that should be included in neonatal resuscitation documentation. They reviewed the medical records of 263 infants ≤1500 g and assessed the number of items documented per record. They found a mean of 13.5 items documented per record, with significant heterogeneity among institutions. Completeness of documentation was more dependent on the institution than on the characteristics of the infant or provider, but this did not seem to be specifically related to the size or resources of the unit.²²

Heathcote *et al* aimed to describe the real-life timing of events in a retrospective series of infants >25 weeks' gestation with an Apgar score of 0 at 1 min and who received full resuscitation (PPV, external cardiac compressions and at least one attempt at central venous access) in a single tertiary centre.²³ They found the timing of important resuscitation events was often lacking in the medical records. A record of times of some events was absent in >40% of cases. A retrospective study in Italy based on resuscitation data neonates with hypoxic-ischaemic encephalopathy also showed that documentation was often unsatisfactory and reporting of key interventions (PPV, cardiovascular support and medications) were poorly recorded.²⁴

Studies assessing accuracy of documentation against a gold standard

All studies in this category used video recording as gold standard. Schilleman *et al* evaluated the accuracy of documentation in the delivery room resuscitations of 54 infants <32 weeks of gestation.²¹ They observed that the information recorded was often incomplete and that important details were lacking (eg, HR and oxygen saturations were only correctly documented in 37% and 13% of cases, respectively). Fishman *et al* studied 50 infants with video recording to assess the accuracy of completion of a paper resuscitation form, filled in real time by a neonatal nurse. Although they found that the paper-based documentation

Table 1 Overview of studies regarding documentation in neonatal resuscitation

Author (year)	Population and sample size	Study design and data source	Main outcome	Main results
Berglund and Norman (2012) ²⁰	Infants with an Apgar score <7 at 5 min of age and a gestational age of ≥33 weeks with normal CTG on admission (n=313)	Retrospective observational population-based cohort study. Data collected from standardised obstetric records.	Adherence to guidelines for neonatal resuscitation	Documentation unsatisfactory 45% No documentation at all 5.1% Documentation incomplete 40% Duration of artificial ventilation missing 24% Duration of heart compressions missing 22% Time for spontaneous breathing not noted 46% Time for endotracheal intubation not documented 25%
Schilleman <i>et al</i> (2014) ²¹	Infants <32 weeks (n=54)	Retrospective observational cohort study. Medical records (paper or digital) compared with video recordings	Accuracy of documentation	Clinical condition of the infant at birth documented 76% Respiratory support correctly documented 83% HR correctly documented 37% SpO ₂ correctly documented 13% Quality of breathing correctly documented 61% Type of respiratory support correctly documented 65% Maximum level of FiO ₂ correctly documented 48% Intubation correctly documented 57% Subjective medical terms used 35% Non-medical terms used 7%
Braga (2015) ²²	Very low birthweight (≤1500 g) infants born sequentially in six different institutions (n=263)	Multicentre retrospective observational cohort study. Chart review to detect concordance with 29 resuscitation data items previously decided by experts.	Number of items documented per record	Oxygen use documented 77% CPAP documented 64% Bag mask ventilation documented 68% Intubation documented 65% Multivariate analysis: the institution and having a resident documenting the resuscitation were significantly associated with better documentation
Heathcote (2018) ²³	Newborn infants >26 weeks who had undergone full resuscitation (who need all the following: PPV, cardiac compressions and at least attempted venous access) (n=27)	Retrospective observational cohort study. Case review in maternity databases.	Timing of key resuscitation events	Timing of cardiac compressions not documented 44% Timing of chest movement achieved not documented 42% Timing of endotracheal intubation success not documented 4% Timing of central venous access achieved not documented 7% Timing of first-dose intravenous epinephrine not documented 12%
Cavallin (2019) ²⁴	Neonates with hypoxic-ischaemic encephalopathy who received therapeutic hypothermia born in 25 centres (n=75)	Multicentre retrospective observational cohort study. Chart review.	Documentation and timing of resuscitation interventions	Face-mask PPV documented 89% Face-mask PPV timing documented 13% Intubation documented 72% Intubation timing documented 50% Chest compressions documented 29% Chest compressions timing documented 59% Umbilical line placement documented 95% Umbilical line placement timing documented 0% Epinephrine documented 19% Epinephrine timing documented 43%
Root (2019) ²⁵	Infants receiving support during transition (n=212)	Retrospective observational pre-post cohort study. Medical records compared with video recording before and after the implementation of weekly resuscitation audits.	Accuracy of documentation	Total number of correctly documented items in medical records increased from 39% to 65% In the post-quality improvement cohort: HR assessment at birth correctly documented 59% Type of first respiratory support correctly documented 99% Starting time of respiratory support correctly documented 30% PPV given correctly documented 80% Starting FiO ₂ correctly documented 51% Use of supplementary oxygen correctly documented 98% Indication for oxygen therapy correctly documented 35% Maximum level of FiO ₂ correctly documented 82% Duration of oxygen therapy correctly documented 4%
Fishman (2020) ²⁶	Infants who underwent resuscitation (n=50)	Retrospective observational cohort study. Medical records (paper) compared with video recordings.	Accuracy of documentation	Timing of the first HR assessment correctly documented 88% HR value correctly documented 77% HR and SpO ₂ values at 5 min of life accurately recorded in 100% and 93% of these, respectively CPAP maximum setting correctly documented 74% PPV-mask maximum setting correctly documented 93% PPV-ETT maximum setting correctly documented 67% Medication, fluid administration, invasive procedures accurately recorded 100%

CPAP, continuous positive airway pressure; CTG, cardiotocography; ETT, endotracheal tube; FiO₂, fraction of inspired oxygen; HR, heart rate; PPV, positive pressure ventilation; SpO₂, peripheral oxygen saturation.

correctly reflected interventions in the delivery room, it is noteworthy that some important interventions were either missing or inaccurate (23% of the initial HR assessments that were documented were not accurate).²⁶

Studies with an intervention to improve documentation quality

Root *et al* conducted an observational pre-post cohort study to assess the effectiveness of the introduction of weekly plenary reviews of video recorded resuscitations. Although they showed an overall beneficial effect (proportion of correctly documented items increased from 39% to 65%), there were still some interventions and some times in the post-intervention cohort that were poorly documented (starting time of respiratory support

reported in 30% of cases, HR assessment in 59% and starting FiO₂ in 51%).²⁵

In these three studies, the initial HR that was correctly recorded was variable (37% to 77% of cases). Rates of correct recording of SpO₂ were lower, between 13% and 18%.^{21 25 26} Only one study documented HR and SpO₂ assessments at 5 min of life with 100% and 93% accuracy, respectively.²⁶

Quality of documentation

The quality of the data documented is important for audit purposes. Subjective medical terms were frequently used when completing free text fields in paper documentation forms. In the study of Schilleman *et al*, these terms were found in 35% of

medical records. Examples cited by the authors were 'low heart rate', 'pink' or 'looking bad'.²¹

DISCUSSION

This review presents the current evidence regarding documentation of neonatal resuscitation in the delivery room and shows that standards need to improve. A complete resuscitation record is valuable not only for research and quality assurance but also as a guide to immediate and subsequent post-resuscitation management in the neonatal unit.²⁷ However, as in many other healthcare areas, documentation during neonatal resuscitation is traditionally paper-based, handwritten, often retrospective, often delegated to a team member who has not received formal training for this role and not formally protocolised. It is known that each of these limitations can lead to inaccuracy and bias in the recorded data.^{20 22}

Ideally, every intervention performed during resuscitation should be recorded together with the time at which each was performed. Most of the early studies of documentation of resuscitation were retrospective reviews of whether or not important events were recorded in the medical notes. Due to their design, these studies are not able to reliably evaluate the accuracy of documentation. However, rates of documented interventions among resuscitated infants can be used as a surrogate of the quality of documentation. Although the included studies focused on different interventions, all showed that important information is frequently lacking in medical records.^{20 22–24} Intubation was the only intervention assessed in all studies and this procedure was documented from 65% to 72% of infants in whom it took place. However, these rates are far from our goal of documenting 100% of intubations. Moreover, methodology varies significantly among studies. The rate of documentation of a particular intervention should be calculated among infants that needed that intervention, not using all the infants with documentation as a denominator. Although in some studies this is clearly stated, it is not the case in others.

Studies using video recording as gold standard are more useful to extract data regarding the accuracy of documentation. Again, lack of uniformity in reporting results and population profile preclude combining results from different studies. It seems that complex or advanced procedures are more accurately reported than basic interventions. Initial assessment of an infant's condition using HR and SpO₂ was frequently inaccurately reported. It is noteworthy that interventions in neonatal resuscitation algorithms are mainly guided by these two parameters. Accurate recording of maximum FiO₂ occurred in 48% to 82% in studies using a video as gold standard. Similarly, correct documentation of maximum pressures used during resuscitation ranged from 14% to 77%.^{21 25} Intubation was correctly documented in the two most recent studies,^{25 26} but poorly documented (57%) in the study of Schilleman *et al.*²¹

How can these results be improved?

Routine video recording, automated records of parameters and the use of electronic medical records are among potential methods for improving documentation, but the only intervention tested in the studies included in this review was the use of weekly audits using video records by Root *et al.*²⁵ First reported almost 20 years ago,²⁸ video recording allows for a more objective evaluation of resuscitation interventions. However, video recordings are not intended to replace standard documentation. Privacy of the patient and caregivers must be guaranteed and a

huge amount of data can be generated, which makes sometimes difficult to integrate them into the infant's medical records.²¹

Electronic medical records have replaced paper documentation in many hospitals worldwide, but we did not find any studies testing new electronic documentation methods in neonatal resuscitation. Studies in simulated adult emergency scenarios showed an improvement in documentation quality with the use of tablet computer-based applications compared with standard documentation. In these studies, tablet usage was associated with high levels of satisfaction among users and maintenance of clinical performance.^{29–31}

Regardless of the method used for documentation, it has been suggested that an authoritative body such as ILCOR should create a list of core items which would serve as an international standard.²² These guidelines could be applied in both settings where complex and innovative devices are available and in low-technology settings using paper records. Currently, international consensus on documentation templates is non-existent, and several authors have made suggestions for a standardised neonatal resuscitation proforma.^{22–24}

Limitations

There are some limitations in this review. First, there is heterogeneity in the study populations and design, and the number of studies identified was small, which limit our ability to draw firm conclusions. Second, we included studies in which a gold standard was used and also studies in which the main methodology was the review of medical records. This may have led to a selection bias. In our opinion, excluding the four records that are mainly chart review studies would have led to a loss of important and useful data.

Conclusion and future challenges

Despite the importance of documentation during neonatal resuscitation, there is little literature regarding this topic. There are no consensus recommendations on how to document meaningful events, there are no consensus templates and quality of recorded data seems to be poor. In this context, further research and quality improvement in neonatal resuscitation are hampered by the inherent inaccuracies of current documentation methods. Hence, there is a need for innovative solutions in this field.

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Contributors AA-A and MT conceived the systematic review. The protocol was created by AA-A, MT and PGD. Searches were performed by AA-A. All search results were reviewed by AA-A and MT. The first draft of the manuscript was written by AA-A. MT, PGD and COFK edited and reviewed the manuscript, making important intellectual contributions. Final version was approved by AA-A, MT, PGD and COFK.

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REFERENCES

- 1 Su L, Waller M, Kaplan S, *et al.* Cardiac resuscitation events: one eyewitness is not enough. *Pediatr Crit Care Med* 2015;16:335–42.
- 2 Allan N, Bell D, Pittard A. Resuscitation of the written word: meeting the standard for cardiac arrest documentation. *Clin Med* 2011;11:348–52.
- 3 Kaye W, Mancini ME, Truitt TL. When minutes count—the fallacy of accurate time documentation during in-hospital resuscitation. *Resuscitation* 2005;65:285–90.
- 4 Bergrath S, Skorning M, Rörtgen D, *et al.* Is paper-based documentation in an emergency medical service adequate for retrospective scientific analysis? an evaluation of a physician-run service. *Emerg Med J* 2011;28:320–4.
- 5 Cummins RO, Chamberlain D, Hazinski MF, *et al.* Recommended guidelines for reviewing, reporting, and conducting research on in-hospital resuscitation: the in-hospital “Utstein style”. A statement for healthcare professionals from the American Heart Association, the European Resuscitation Council, the H. *Resuscitation* 1997;34:151–83.
- 6 Jacobs I, Nadkarni V, Bahr J, *et al.* Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. A statement for healthcare professionals from a task force of the international liaison Committee on resusci. *Resuscitation* 2004;63:233–49.
- 7 Perkins GD, Jacobs IG, Nadkarni VM, *et al.* Cardiac arrest and cardiopulmonary resuscitation outcome reports: update of the Utstein resuscitation registry templates for out-of-hospital cardiac arrest: a statement for healthcare professionals from a task force of the International Liaison Committee on resusci. *Resuscitation* 2015;96:328–40.
- 8 Idris AH, Biersens J, Perkins GD, *et al.* Revised Utstein-style recommended guidelines for uniform reporting of data from drowning-related resuscitation: an ILCOR Advisory statement. *Resuscitation* 2015;2017:147–58.
- 9 Zaritsky A, Nadkarni V, Hazinski MF, *et al.* Recommended guidelines for uniform reporting of pediatric advanced life support: the pediatric Utstein style. A statement for healthcare professionals from a task force of the American Academy of pediatrics, the American heart association, and the European resuscitation Council. *Resuscitation* 1995;30:95–115.
- 10 Kattwinkel J, Niermeyer S, Nadkarni V, *et al.* Resuscitation of the newly born infant: an Advisory statement from the pediatric Working group of the International liaison Committee on resuscitation. *Resuscitation* 1999;40:71–88.
- 11 International Liaison Committee on Resuscitation. 2005 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Part 7: neonatal resuscitation. *Resuscitation* 2005;67:293–303.
- 12 Wyllie J, Perlman JM, Kattwinkel J, *et al.* Part 11: neonatal resuscitation: 2010 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Resuscitation* 2010;81:e260–87.
- 13 Wyllie J, Perlman JM, Kattwinkel J, *et al.* Part 7: neonatal resuscitation: 2015 international consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. *Resuscitation* 2015;95:e169–201.
- 14 Moher D, Liberati A, Tetzlaff J, *et al.* Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6:e1000097.
- 15 Vandenbroucke JP, von Elm E, Altman DG, *et al.* Strengthening the reporting of observational studies in epidemiology (STROBE): explanation and elaboration. *PLoS Med* 2007;4:e297.
- 16 Näther A, Uphoff R. [Collaboration and coordination of birth attendants and neonatologists with special reference to documentation]. *Kinderkrankenschwester* 2015;34:453–5 <http://www.ncbi.nlm.nih.gov/pubmed/26946631>
- 17 Finer N, Rich W. Neonatal resuscitation for the preterm infant: evidence versus practice. *J Perinatol* 2010;30:S57–66.
- 18 Berglund S, Norman M, Grunewald C, *et al.* Neonatal resuscitation after severe asphyxia—a critical evaluation of 177 Swedish cases. *Acta Paediatr* 2008;97:714–9.
- 19 Walker CH. Neonatal records and the computer. *Arch Dis Child* 1977;52:452–61.
- 20 Berglund S, Norman M. Neonatal resuscitation assessment: documentation and early Paging must be improved! *Arch Dis Child Fetal Neonatal Ed* 2012;97:F204–8.
- 21 Schilleman K, Witlox RS, van Vonderen JJ, *et al.* Auditing documentation on delivery room management using video and physiological recordings. *Arch Dis Child Fetal Neonatal Ed* 2014;99:F485–90.
- 22 Braga MS, Kabbur P, Alur P, *et al.* Current practice of neonatal resuscitation documentation in North America: a multi-center retrospective chart review. *BMC Pediatr* 2015;15:1–7.
- 23 Heathcote AC, Jones J, Clarke P. Timing and documentation of key events in neonatal resuscitation. *Eur J Pediatr* 2018;177:1053–6.
- 24 Cavallin F, Pavan G, Cavichio ME, *et al.* Multicentre study found that documentation on resuscitating asphyxiated neonates was often unsatisfactory. *Acta Paediatr* 2019;108:562–3.
- 25 Root L, van Zanten HA, den Boer MC, *et al.* Improving guideline compliance and documentation through auditing neonatal resuscitation. *Front Pediatr* 2019;7:1–7.
- 26 Fishman CE, Weinberg DD, Murray A, *et al.* Accuracy of real-time delivery room resuscitation documentation. *Arch Dis Child Fetal Neonatal Ed* 2020;105:222–4.
- 27 Peleg B, Globus O, Granot M, *et al.* “Golden hour” quality improvement intervention and short-term outcome among preterm infants. *J Perinatol* 2019;39:387–92.
- 28 Carbine DN, Finer NN, Knodel E, *et al.* Video recording as a means of evaluating neonatal resuscitation performance. *Pediatrics* 2000;106:654–8.
- 29 Peace JM, Yuen TC, Borak MH, *et al.* Tablet-based cardiac arrest documentation: a pilot study. *Resuscitation* 2014;85:266–9.
- 30 Grundgeiger T, Albert M, Reinhardt D, *et al.* Real-time tablet-based resuscitation documentation by the team leader: evaluating documentation quality and clinical performance. *Scand J Trauma Resusc Emerg Med* 2016;24:1–7.
- 31 Grigg E, Palmer A, Grigg J, *et al.* Randomised trial comparing the recording ability of a novel, electronic emergency documentation system with the AHA paper cardiac arrest record. *Emerg Med J* 2014;31:833–9.