Review Article

Ten minutes to save a baby: a narrative review of newborn assessment during first minutes of life and relationship to outcomes

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Background and Objectives: The first 10 minutes of life is the most important for a newborn infant. For the 1% of infants that require extensive resuscitation measures, rapid evaluation of vital signs, including oxygen saturation and heart rate is vital. How a clinician achieves prompt and accurate assessment of the sick newborn infant within a few minutes remains one of the most important knowledge and practice gaps in modern newborn medicine. Over the last two decades, international newborn resuscitation practice has changed considerably. The most profound development is the focus on oxygenation within the first 10 minutes of life, with a global secular shift to using "lower oxygen strategies". However, there is now emerging information of adverse consequences from low oxygenation during the first 5 minutes of life, especially in very preterm infants (<29 weeks' gestation) who are already at highest risk of death. We aim to review delivery room practice aimed to provide best and most accurate assessment of the cardiorespiratory status of sick newborn infants.

Methods: We performed a broad search of PubMed, MEDLINE, Google Scholar and scrutinized the reference lists of relevant English articles published before November 4th 2021, including systematic reviews, meta-analyses, randomized controlled trials, retrospective studies and previous narrative reviews.

Key Content and Findings: This review outlines the clinical and biometric methods of assessing the newborn in the delivery room. We explore the strengths and weakness of each modality, and highlight that the resuscitation team must synthesize clinical and biometric information to guide their care.

Conclusions: Clinicians must balance information gained from technology (e.g., pulse oximetry) with clinical judgement of the infant's progress. Significantly more knowledge is needed to inform on the best assessment methods to guide resuscitation of the sick newborn infant. Failure to do so will prevent advances in research and stagnate efforts to improve outcomes for all sick newborn infants around the world.

Keywords: Outcomes; newborn; heart rate; oxygen; resuscitation

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Introduction

The first minutes of life represent the most rapid and complex changes in human physiology. Respiratory, cardiovascular, endocrine, thermoregulatory, and biochemical systems must quickly adapt to the relatively harsh extrauterine environment (1). As the infant takes its first few breaths, pulmonary vasculature resistance falls and foetal lung fluid clears. Massive rises in cortisol and catecholamines drive increases in cardiac output, as the transition from foetal to neonatal circulation begins.

This adaptation ensures the infant sustains homeostasis, now independent from the placenta and mother. Any disruption to this delicate transitional period can cause distress to the newborn infant, and potentially lead to adverse short- and long-term outcomes (2-4). Infants with a torturous transition to extrauterine life requiring resuscitation have an increased risk of guarded outcomes, especially for death and serious neurodevelopmental morbidity (2,4-6). A clinician's role during the first 10 minutes of life is, therefore, crucial to ensure the infant experiences a 'smooth landing' to the outside world, safeguarding them from potentially lifelong adversity.

The International Liaison Committee on Resuscitation (ILCOR) provides best-practice recommendations for the support of the neonate during extrauterine transition (7). Depending upon the infant's condition, delivery room care ranges from a hands-off approach to invasive resuscitation manoeuvres. At each step, the resuscitation team must synthesise the clinical and biometric information available to them which informs the success of their care. Continual assessment and re-assessment allow targeted therapy to be delivered; for example, positive pressure ventilation (PPV) for persistent bradycardia (heart rate, HR, <100 bpm) (7).

The conundrum one faces is the relationship of these metrics to adverse outcomes.

How does the infant's status in the delivery room affect them later in life? Are we stabbing blindly in the dark with current methods of assessing the infant's response to resuscitation?

Many studies correlate the intensity of resuscitation to an increased risk of adverse outcomes (3-6), however, very few explore the effect of assessment on the intensity of delivery resuscitation. Additionally, there is uncertain evidence for the relationship of delivery room assessment to adverse outcomes.

The following review will discuss the routine assessment of the newborn during the first 10 minutes of life, with relationship to outcomes. The synthesis of clinical and biometric data to guide the need for intervention is standard-of-care. However, the question remains—is our assessment accurate and useful to predict and prevent adverse outcomes? We present the following article in accordance with the Narrative Review reporting checklist (available at https://pm.amegroups.com/article/view/10.21037/pm-21-84/rc).

Methods

A broad search of published literature from reputable databases was undertaken to identify relevant evidence for this research question. We scrutinized the reference lists of relevant articles, including systematic reviews, meta-analyses, randomized controlled trials, retrospective studies and previous narrative reviews. The selected articles were critically evaluated by the authors prior to use in this narrative review (*Table 1*).

Delivery room assessment of the newborn infant

In the first instance, a thorough clinical assessment of the newborn provides the practitioner with vital information about the newborn infant's condition. International expert recommendations suggest a thorough assessment of the newborn in the delivery room, including clinical and biometric methods (7). This assessment guides the need for active resuscitation or intervention.

Colour

The adequacy of perfusion in the neonate is crudely assessed by the infant's colour. A blue/cyanotic baby is potentially indicative of a high concentration of deoxygenated haemoglobin, and therefore, hypoxemia (8). At normal body pH and temperature conditions, a newborn with mostly fetal haemoglobin would be expected to appear centrally cyanotic at oxygen saturations of <75–85%. This differs largely from an adult counterpart, who would appear centrally cyanotic at SpO_2 <94% (8). Additionally, the characteristics of foetal and adult haemoglobin differ; foetal haemoglobin binds more readily to oxygen, meaning oxygen saturations remain higher at relatively low arterial oxygen tensions (8).

O'Donnell *et al.* (9) found a profound incongruity between clinicians' assessment of infants' colour. There was a wide range of SpO_2 at the time-point clinicians believed infants to turn pink, thought to be partially influenced by

Table 1 Summary of search strategy

Items	Specification
Date of Search	May 2021 to November 2021
Databases and other sources searched	PubMed, MEDLINE, Google Scholar, reference lists of relevant articles, others
Search terms used	No formal search strategy was employed in this narrative review
Timeframe	Literature published up to November 4th, 2021
Inclusion and exclusion criteria	Systematic reviews, meta-analyses, randomized controlled trials, retrospective studies and previous narrative reviews

the resuscitation environment and lighting, to date, no study has examined the effect of neonatal skin tone on the precision of colour assessment in the delivery room. Overall, the reliability of colour assessment, and subsequent correlation to infants' condition, is poor. The limitations of using colour to assess perfusion or oxygenation in the delivery room must be noted. Instead, the clinician should rely upon more reliable methods of assessment to guide their resuscitation effort.

Oxygen saturation

Pulse oximetry

The measurement of peripheral arterial oxygen saturation (SpO_2) using pulse oximetry is a non-invasive tool to assess the oxygenation of the newborn during transition to extrauterine life (10). Pulse oximetry utilises the variable absorbance of light in solutions, as described by the Beer-Lambert law, to measure the proportion of oxygenated haemoglobin in pulsatile arterial blood (11). After illuminating the skin with two known wavelengths of light (660 and 940 nm), a detector allows computation of the SpO_2 from the proportion of absorbance, calibrated against standard values (11).

The effective acquisition of SpO_2 readings in the delivery room remains logistically and technically difficult. There is conflicting evidence regarding best-practice for SpO_2 sensor application in the delivery room (12,13). Whether the sensor should first be applied to the infant or connected to the oximeter remains contested. The results of a meta-analysis are awaited to further inform this practice (14).

The infant's SpO_2 evolves dynamically over the first 10 minutes of life (10,15). Observational studies documenting the transition from the relatively hypoxemic intrauterine environment to the oxygen-rich extrauterine atmosphere have shown that it takes >7 minutes to reach a stable SpO_2 >90% (15), and even longer in infants born via caesarean section (16). Dawson *et al.* (15) used data from 468 infants to develop the standard curves of transitional oximetry, which now anchor international expert recommendations of titrating supplemental oxygen to preductal SpO_2 (17). This data informs the 80–85% SpO_2 target employed by clinicians internationally (18).

However, the standard SpO_2 curves are developed from data of healthy full-term infants born at sea level (15,19) which limits the generalisability of these references to infants with pulmonary pathology, including premature infants, infants with known congenital pathology and infants requiring resuscitation at birth. Additionally, contemporary delivery room practices such as delayed cord clamping (DCC) >30 s have been shown to increase SpO_2 during the first five minutes of life in vaginal deliveries of term infants (20). One recent systematic review and meta-analysis demonstrated a decreased risk of death after DCC, however, it is unknown whether this effect was due to initial improvement in oxygenation (21).

Further studies are warranted to scrutinize the current SpO_2 targets, which are anchored in observational data from healthy term and late preterm infants who did not require resuscitation in the delivery room. Therefore, emerging research aims to assess: (I) the feasibility of current SpO_2 targets in infants requiring resuscitation; (II) the relationship of various SpO_2 targets to adverse outcomes.

An individual patient data (IPD) meta-analysis of eight randomised controlled trials (RCT) (22) enrolling infants <32 weeks gestation examined the outcomes related to predetermined SpO_2 targets in the delivery room. Only 12% of infants had peripheral oxygen saturations within the target range (80–85% at 5 minutes of life), 46% did not reach the target and 42% exceeded it. Prematurity, low initial FiO_2, and low birth weight increased odds of SpO_2 outside the acceptable range. In an RCT of infants

24–30 weeks gestation, Dekker *et al.* (23) demonstrated that infants receiving pure oxygen better-achieved oxygen saturation targets than infants receiving low oxygen (23). This suggests that high initial concentrations of initial oxygen may be advantageous to preterm infants. The feasibility of reaching SpO_2 targets in infants of other gestations remains to be studied.

There are no clear guidelines on how fast and at what increment FiO_2 should be titrated to achieve current SpO_2 targets. The continual adjustment of FiO_2 to dynamic SpO_2 targets is a complex task even for well-trained resuscitation teams, especially during the first few minutes of life. Using a graphic display of SpO_2 targets, coupled with real-time SpO_2 data, has been shown to improve the time spent within the target range (24). The effect of using these tools on improving the time spent within target ranges and other outcomes requires further study. The development of technology for the automatic titration of FiO_2 to real-time SpO_2 data during delivery resuscitation is ongoing (25). Dargaville and colleagues examined an automated oxygen titration system with a rapidly responsive adaptive algorithm for preterm infants receiving non-invasive respiratory support for respiratory insufficiency. In 60 crossover studies in 35 infants, automated oxygen titration resulted in greater target range time [mean (range)% for manual titration = 59% (51–64%) *vs.* automated = 81% (72–85%)] (26). Adapting this technology will offer an exciting possibility for improving precision in the delivery room care of sick newborn infants.

Near-infrared spectroscopy (NIRS) in delivery room assessment

NIRS is a non-invasive tool for the measurement of regional cerebral oxygen saturation ($rScO_2$) (27). NIRS utilises near-infrared light (700–1,000 nm); these wavelengths easily penetrate the thin skin and bone overlying the neonatal cranial vault. NIR light is absorbed at different wavelengths by oxygenated and de-oxygenated haemoglobin, allowing various detectors to compute the $rScO_2$. The $rScO_2$ provided by NIRS is mostly representative of the venous saturation (75%) (27). The nuances of technicalities surrounding NIRS are beyond the scope of this article; however, they are detailed well in existing literature (28).

Data from 381 neonates have been used to define the reference range for $rScO_2$ immediately after birth. At five minutes, the 10^{th} and 90^{th} centiles were 65% to 90% (median 68%). However, most of these data are from caesarean deliveries, with very few from preterm infants <37 weeks gestation (29). None of these infants received any respiratory support. Katheria *et al.* assessed the utility of cerebral NIRS to predict adverse neurological outcomes (30). They found that infants with severe intraventricular haemorrhage (IVH) (grade 3–4) or infants who died within 3 days of life had significantly lower cerebral NIRS during the first 10 minutes of life (30). Additional data are needed to further explore this relationship.

Cerebral NIRS is only indicative of oxygenation in the brain, as $rScO_2$ does not necessarily correlate with oxygenation elsewhere in the body. Cerebral autoregulation maintains cerebral blood flow (CBF) despite changes in blood pressure elsewhere in the body (31). Therefore, despite reassuring $rScO_2$, an infant may be hypoxic and/or hypoperfused in other oxygen-sensitive tissues. This significantly limits the utility of NIRS in the delivery room, as it is vital to assess both cerebral and global oxygenation. Additional studies exploring the association between $rScO_2$ and peripheral SpO_2 would be useful to further scrutinise the ability of NIRS to detect peripheral hypoxia. NIRS may have a role as an *adjunct* method of monitoring the neonate's response to transition, however, given the present body of evidence, NIRS is not yet appropriate for use as the sole method of measuring oxygenation in the delivery room.

Respiratory function monitoring (RFM)

Measurement and surveillance of respiratory function during neonatal resuscitation is an important modality during neonatal resuscitation. RFMs are useful devices that synthesise airway pressure values, flow and tidal volume waves (32). These can be displayed graphically in waveforms, or shown as numeric values [e.g., peak inspiratory pressure (PIP) or positive end-expiratory pressure (PEEP)] (32). The application of these devices includes confirming the correct placement of endotracheal tubes (ETT), assessing for airway obstruction or respiratory rate (32). A survey of training clinicians demonstrated that advanced neonatal trainees found RFM useful in the resuscitation setting (33). Although RFMs are accurate in various gaseous conditions (i.e., temperature changes) (34) and favoured by many clinicians, they are not recommended for routine use in international guidelines (7). A recent multicentre study of infants concluded that RFM usage did not improve the proportion of inflations within a target volume range (35). Additionally, no differences were noted for most clinical outcomes between the RFM visible and not visible groups. Of note, however, the relative risk of

IVH was marginally higher in the RFM not visible group (RR 0.71, 95% CI: 0.50 to 1.0, P=0.049). Despite providing objective biometric data to the resuscitation team, there is insufficient evidence to demonstrate that RFM use improves clinical outcomes during neonatal resuscitation.

Measuring diaphragmatic electrical activity

Conventionally, measuring the electrical activity of the diaphragm has been invasive, therefore, limiting its utility in delivery room resuscitation settings (36). Recently, transcutaneous methods of measuring electrical diaphragmatic activity (dEMG) have been developed, inviting the application of this modality to delivery room resuscitation settings. A recent study of preterm infants (mean gestation 28 weeks) found modest correlation between invasive methods of measuring work-of breathing and dEMG (36). In addition to this, dEMG has also been shown to feasibly measure respiratory rate and heart rate (37). However, the accuracy of this application is more sensitive to electrode positioning, and therefore, human error (38). Until more data on the use of dEMG to measure HR are available, HR by dEMG should be interpreted with caution.

Heart rate

An accurate-or inaccurate-heart rate measurement has the potential to greatly influence delivery room practice. Several clinical practice guidelines (7,39) recommend the initiation of PPV if HR remains <100 bpm after initial steps, and chest compressions if HR remains <60 bpm after attempts have been made to establish effective ventilation (7,39). Thus, selecting a reliable method of measuring HR is vital.

Heart rate by auscultation

Expert guidelines recommend the initial assessment of heart rate (HR) by auscultation before the availability of biometric outputs such as HR by oximetry or electrocardiography (ECG) (7,39). Auscultation allows HR to be rapidly detected with reasonable accuracy (median 14 s; IQR 10–18 s) (40), however, the use of auscultation slightly underestimates HR compared to ECG and pulse oximetry (40). Simulation studies have demonstrated poor precision in the clinical assessment of HR (41,42). In a simulated study, Voogdt *et al.* (42) found that the mean time to auscultate a heart rate varied between 7–17 s and 26–31% of these simulated assessments were found to be inaccurate. 28% of the time these inaccuracies would have influenced management. The majority (78%) of inaccurate assessments were overestimates, potentially causing failure to intervene appropriately (42). In a small (n=26) study of healthy newborn infants, Kamlin *et al.* noted that clinical assessment by 23 random observers inaccurately and significantly underestimated infant heart rate compared to ECG monitoring by up to 22 beats per min (43). This may be clinically insignificant in a healthy infant not requiring intervention but could impact on the escalation of care for sicker infants e.g., transition to cardiac massage or inotropic drugs. Further assessment of outcomes with routine use of biometric assessment of heart rate in the delivery room is needed.

Biometric assessment of heart rate

Data from RCTs and observational studies suggest that ECG is the most precise and expeditious (44-47). In their pilot study of 40 premature infants, Katheria *et al.* (45) concluded that ECG produced an HR reading 48 seconds earlier than pulse oximetry. Similar results were produced by Murphy *et al.* (47) who found ECG had a shorter time to first HR than pulse oximetry {median [IQR] 24 [19, 39] *vs.* 48 [36, 69]}. Although ECG is the gold-standard to detect HR quickly, there are no studies that demonstrate the use of ECG improves clinical outcomes compared to other HR assessment modalities. The use of ECG may not be readily available in lower resourced settings. Therefore, without robust evidence to demonstrate the association between ECG and improvement in clinical outcomes, clinicians may opt to use an alternate cheaper modality: auscultation. It is important to note the possibility of pulseless electrical activity (PEA)—a form of cardiac arrest not accurately detected by ECG (48). This is an important limitation of ECG in the delivery room, as ECG may provide a heart-rate reading in an infant without cardiac output. Therefore, ECG should not be relied upon as a sole measurement for HR in the delivery room.

There is a smorgasbord of modalities to assess the infant's overall condition in the delivery room (*Figure 1*). It is vital that the clinician recognises the strengths and weaknesses of each method (*Table 2*).

How does delivery room status affect the outcomes of preterm infants?

The infant's status in the first minutes of life has a profound ability to influence the rest of their life. Population and cohort data have associated an arduous transition to extrauterine life with an increased risk of death

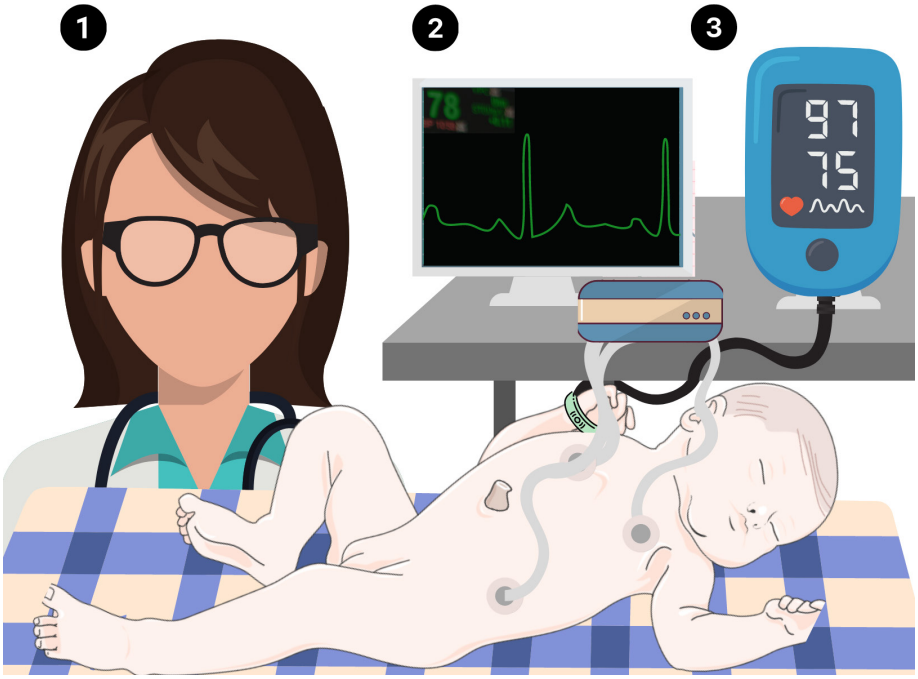

Figure 1 Delivery room assessment of the newborn. 1. In the first instance, a clinical assessment of the newborn infant is vital. This may include assessment of colour, tone and respiratory effort. 2. More standardised methods of assessment are also required, as there is a high degree of cognitive bias. Heart rate is best assessed using electrocardiography (ECG). 3. Pulse oximetry provides valuable information on the dynamics of blood oxygen saturation (SpO_2) during the first ten minutes of life. Infants should reach SpO_2 of 80–85% by five minutes of life. Figure made using Servier Medical Art and Canva.com.

and long-term neurological sequelae (2,49-52).

Short-term outcomes

Both poor oxygenation and heart rate in the delivery room have been associated with adverse short-term outcomes. In a retrospective IPD analysis of 8 RCTs, Oei *et al.* (22) demonstrated the odds of IVH and short-term mortality were significantly higher in infants with poor SpO_2 (<80%) at five minutes of life in preterm infants <32 weeks' gestation. Statistical significance remained for only IVH after accounting for confounders. In a separate IPD analysis of the same 8 RCTs, Kapadia *et al.* (53) demonstrated that prolonged bradycardia (<100 bpm for ≥2 min) increased the odds of in-hospital mortality (OR 1.6, 95% CI: 1.2–2.5). The duration of bradycardia was positively correlated with the incidence of BPD, IVH, and mortality. If infants had both prolonged bradycardia and failed to reach SpO_2 80% by five minutes of life, the odds of in-hospital mortality were increased 18-fold (53).

There is a paucity of evidence for delivery room outcomes of infants of other gestational ages, including moderate-late preterm infants (MLPT) who account for >84% of all preterm births (54) and who are at high risk of respiratory morbidity as well as cognitive and developmental morbidity (55-57). Indeed, there is an urgent need for robust RCTs to further scrutinise the effect of SpO_2 in the delivery room across gestations.

Long-term outcomes

Long-term outcomes are regarded as critically important to practitioners when studying resuscitation in the delivery room (18,58). The impact of a few minutes of hyperoxia or hypoxia on the neurodevelopment of survivors remains unclear. In a follow-up of infants recruited to the Resair 2 study (term hypoxic infants randomised to either air or 100% initial oxygen for respiratory support at birth) (59), Saugstad *et al.* found no significant differences at 18–24 months in survivors for cerebral palsy and/or mental or other delay (air:

Table 2 Summary of advantages and disadvantages of assessment modalities for newborn infants in the delivery room

	Advantages	Disadvantages
Oxygenation		
Colour	• Able to be performed without expensive equipment (available in lower-resourced settings) • Quick assessment modality	• Confounded by properties of foetal haemoglobin • High inter-clinician variability • Non-precise method of assessment • Unvalidated in infants of various neonatal skin tones
Oxygen saturation by pulse oximetry (SpO_2)	• Non-invasive • Accurate • Simultaneously provides heart-rate reading	• Logistically and technically difficult • More research required to explore SpO_2 targets • Expensive and may not be readily available in lower-resourced settings
Oxygen saturation by cerebral NIRS ($rScO_2$)	• Non-invasive	• Logistically and technically difficult • More research required before widespread implementation • Expensive and may not be readily available in lower-resourced settings • Only indicative of oxygenation in the brain
Respiratory function		
Respiratory function monitors (RFM)	• Non-invasive • Accurate despite changes to gas conditions • Graphical/numeric display of key respiratory parameters	• Limited evidence correlating an improvement to clinical outcomes • More suitable to advanced/experienced staff
Transcutaneous diaphragmatic electromyography (dEMG)	• Non-invasive • Can also reliably record respiratory rate and heart rate	• Expensive and may not be readily available in lower-resourced settings • Sensitive to human error (electrode placement)
Heart rate		
Auscultation	• Quick measurement • Able to be performed before establishment of biometric reading	• Relatively inaccurate • Commonly overestimated à failure to intervene
Heart rate by pulse oximetry	• Accurate • Simultaneously provides SpO_2	• Slower than ECG • Unavailable in lower-resourced settings
Hear rate by electrocardiography (ECG)	• "Gold-standard" • Quicker than pulse oximetry • Accurate	• No studies demonstrate ECG > PO impacts outcomes • Inaccurate in pulseless electrical activity • Unavailable in lower-resourced settings

10%, 100% oxygen: 7%) (60). However, only 66% of eligible infants were assessed and assessment methods included a combination of parental questionnaires and neurological examinations rather than formal neurodevelopmental testing e.g., Bayley Scale of Infant Development. It must be noted that oxygen concentrations in the Resair study were not titrated and SpO_2 was not monitored, which again, limits the generalisability of these outcomes to today's practice. Unfortunately, due to the overwhelming secular shift to lower oxygen strategies (61), it is unlikely that further evidence from well-designed and sufficiently large RCTs will be generated to inform on this major knowledge gap (62).

There is more information in preterm infants but again, no study is powered sufficiently to examine long-term neurodevelopmental outcomes after resuscitation with higher or lower oxygen strategies. Nevertheless, individual participant data from 543 infants from 3 studies who were randomised to either lower (≤0.3) or higher (≥0.6) initial FiO_2 for resuscitation found no difference in risk death and/or disability (difference –0.2%, 95% CI: –7% to 7%, P=0.96) or with cognitive scores <85 (2%, 95% CI: –5% to 9%, P=0.5) (63). However, infants who reached 5-minute

SpO_2 ≥80% had decreased risk of disability/death (14%, 95% CI: 7% to 21%) and cognitive scores >85 (10%, 3% to 18%, P=0.01), suggesting that oxygenation even within the first 5 minutes of life, is crucial for both short-term (death) and longer-term outcomes and further study is required. Currently, the HiLo (NCT03825835) and the Torpido 3060 (ACTRN12618000879268) aim to recruit >2,500 preterm infants <29 weeks gestation to determine impact of oxygenation during the first few minutes of life on infant mortality and neurodevelopment.

Future directions

To ensure the multitude of infants born requiring resuscitation are subject to evidence-based intervention, future studies must address several knowledge deficits. Best practice for expeditious attainment of pulse oximetry readings remains unknown. The results of a Cochrane review for this question are awaited (14). Additionally, there remains uncertainty surrounding oxygen saturation targets across gestations. It is unknown whether these targets are *feasible* and *appropriate* to prevent adverse outcomes. Indeed, additional data are required to further explore pulse oximetry in the delivery room across gestations. Although ECG is the fastest method to attain an HR reading, it is unknown whether its use in the delivery room prevents adverse clinical outcomes. Additional research is warranted. There is a plethora of exciting future research directions for delivery room care of newborn infants. These additional data are urgently required to inform practice to the millions of infants born around the world each year.

Health equity

It is critically important to recognise the issue of health equity in delivery room practice. Many preterm infants are born in lower-resourced settings of neonatal care (54,64), who may not have access to the necessary equipment to provide recommended care. A recent international survey of 21 countries found imbalances in equipment availability between high- and middle-income countries (18). This included oxygen blending equipment, which is necessary to adhere to currently recommended oxygen supplementation strategies for preterm infants (7).

Addressing deficits in equipment availabilities in lower-resourced centres is difficult. Until a time where each delivery worldwide is attended to with all necessary equipment, clinicians should use the equipment that is available to them. In lower-resourced settings, this may be simple clinical assessment modalities only. Health equity and access to appropriate equipment/services must be recognised in future studies of new technologies for the delivery room care of newborns.

Conclusions

What happens to the infant immediately after birth has the potential to influence the course of their life. An effective and precise delivery room assessment allows the clinical team to intervene where appropriate, and to estimate the risk of morbidity and mortality. The strengths and weaknesses of each assessment modality must be noted during this assessment. No single method of assessment alone is reliable. Future studies of delivery room practice must address knowledge deficits to ensure each newborn infant can experience prosperous first minutes of life.

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