

https://dspace.org/

Ten steps to improve outcomes of infacility neonatal resuscitation

E. E Foglia; S Rettedal; V. M Nadkarni; J. K Patterson; Sithembiso Velaphi ...

ELSEVIER IRELAND LTD
https://hdl.handle.net/10539/48397
WOS

Downloaded from a DSpace repository. https://dspace.org/

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Clinical paper

Ten steps to improve outcomes of in-facility neonatal resuscitation

Elizabeth E. Foglia[a,b,*], *Siren Rettedal*[c,d], *Vinay Nadkarni*[a,b], *Jackie K. Patterson*[e], *Peter G. Davis*[f], *Susan Niermeyer*[g], *Asmita Acharya*[h], *Santorino Data*[i], *Maria Fernanda de Almeida*[j], *Abiy Seifu Estifanos*[k], *Jorge Fabres*[l], *Qi Feng*[m], *Ruth Guinsburg*[j], *Kenechukwu Iloh*[n], *Juin Yee Kong*[o], *Estomih Mduma*[p], *Mackenzie O'Reilly*[b], *Viraraghavan Vadakkencherry Ramaswamy*[q], *Suman Rao PN*[r], *Mario Rüdiger*[s], *Sprina Joseph Ryoba*[t], *Jose Maria Solano*[u], *Krothapalli Susila*[v], *Marta Thio-Lluch*[f], *Daniele Trevisanuto*[w], *Sithembiso C. Velaphi*[x], *Gary M. Weiner*[y], *Hege L. Ersdal*[c,d]

Abstract

Background: Up to 10 % of all newborns require assistance to breathe at birth. Although neonatal resuscitation guidelines and educational platforms exist, best practices to implement high-quality neonatal resuscitation care have not been defined.

Aim: To establish a Neonatal Global Resuscitation Alliance and develop ten steps to improve outcomes of in-facility neonatal resuscitation across global settings.

Methods: Three-stage iterative consensus-based process: (1) invited input from the neonatal resuscitation community to identify pertinent measures, (2) convened a face-to-face meeting of 28 global neonatal resuscitation content experts to refine consensus steps, (3) presented draft steps and related content to stakeholders; solicited public comment and revised ten steps based on feedback.

Results: The consensus-based ten steps include: Implement effective education systems; Ensure team and equipment readiness; Identify high-risk pregnancies and prevent perinatal risks; Respond to every birth; Perform guideline based resuscitation; Deliver guideline based post-resuscitation care; Collect data throughout resuscitation care; Improve quality of resuscitation; Support parent and family well-being; Cultivate a culture of excellence. For each of these steps, key concepts and suggested approaches to put the steps into practice are identified.

Conclusion: These ten steps to improve outcomes of in-facility neonatal resuscitation represent a clear framework for healthcare professionals, institutions, and policymakers to evaluate and strengthen their readiness, training, and response to newborns who need resuscitation at birth. This consensus-based guidance can be used to optimize in-facility neonatal resuscitation and improve outcomes for newborns worldwide.

Keywords: Neonatal resuscitation, Global resuscitation alliance, Ten steps

Background

Of 130 million infants born worldwide each year, up to 10 % require assistance to breathe at birth.[1] Globally, perinatal asphyxia is a leading cause of childhood mortality and disability.[2,3] The Utstein formula for survival identifies three necessary components to improve resuscitation outcomes: medical science, educational efficiency, and local implementation.[4] Of these, local implementation is the weakest factor for neonatal resuscitation.

Medical science is assessed by the International Liaison Committee on Resuscitation (ILCOR) Neonatal Life Support Task Force,

* Corresponding author at: Hospital of the University of Pennsylvania, Division of Neonatology and Newborn Services, 3400 Spruce Street, Ravdin 8, Philadelphia, PA 19104, USA.

E-mail address: foglia@chop.edu (E.E. Foglia).

https://doi.org/10.1016/j.resuscitation.2025.110746

Received 13 May 2025; Received in Revised form 16 July 2025; Accepted 22 July 2025

0300-9572/© 2025 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (http://creativecommons.org/licenses/by/4.0/).

whose members evaluate and synthesize the available literature annually.[5] Educational materials are developed and disseminated through platforms like the Neonatal Resuscitation Program, Neonatal Life Support, and Helping Babies Breathe component of the World Health Organization Essential Newborn Care Course.[6–9] However, many birth settings lack the structure and tools to implement high-quality neonatal resuscitation.[10] Ensuring all newborns worldwide have access to effective neonatal resuscitation remains a significant challenge.

Following a 2015 meeting of Emergency Medical Services (EMS) experts, the first Global Resuscitation Alliance developed a ten-step approach to improve survival from out-of-hospital cardiac arrest.[11] This strategy was subsequently adapted to adult and pediatric in-hospital settings.[12] Leading stakeholders from the global neonatal resuscitation community established a Neonatal Global Resuscitation Alliance to develop ten steps to improve outcomes for in-facility neonatal resuscitation at birth.

Scope and guiding principles

The group defined neonatal resuscitation as interventions to support the newborn who is not breathing well at birth and requires assisted ventilation (e.g., positive pressure ventilation [PPV]). This framework is designed to be relevant globally for in-facility births, defined as births occurring in healthcare facilities that provide obstetric and neonatal care (such as hospitals, clinics, and birth centers). While home births are common worldwide and may require neonatal resuscitation, home births have unique considerations and are not addressed here. This framework does not apply to neonatal resuscitation after successful transition to the extrauterine environment, such as events in the neonatal intensive care unit.

Approach

The developmental process included three phases. In the preparatory phase (July 2024), neonatal resuscitation experts (including meeting attendees) and members of vested organizations participated in an online survey (Supplemental File 1) to identify and refine candidate measures using previously published "10 step" Global Resuscitation Alliance documents as a template.[11] This informal survey was designed to inform the face-to-face meeting discussion.

From September 1–3, 2024, 28 neonatal resuscitation content experts met at the Utstein Abbey in Norway. Attendees were identified from publication records, participation in other committees, and word of mouth; they were selected to represent diverse geographical locations, backgrounds, career stages, country income status, and expertise (Fig. 1, Supplemental File 2).

The meeting followed an "Utstein-style" consensus process.[13,14] In the opening session, the chairs presented summary survey results to all attendees. Following group discussion, attendees agreed on the concepts that would be refined as the "ten steps" during the meeting. Over the next two days, working groups rotated among four stations. Each station addressed two to three steps, with a facilitator who moderated and took notes. As groups rotated through each station, they revised or added to output from previous groups. After all groups rotated through each station, moderators presented a summary of each step and key points to all participants, with a plenary discussion to confirm consensus.

Following the meeting, the draft content was summarized and presented in multiple venues to solicit feedback. These included an online webinar in September 2024, public posting on the Global Resuscitation Alliance website,[11] and presentation at the WHO "Utstein to ACAN (Acute Care Action Network)" Meeting in October 2024.[15] Most feedback received pertained to clarifying language or additional "suggested approaches" for given steps. The material presented in this document reflects revisions based on feedback.

Ethical consideration

No ethical approvals were sought. The attendee roster (Supplemental File 2) was circulated before the meeting. Attendees were asked to represent their own views and not those of any organizations to which they belong. Grant funding supported attendees' travel, lodging, and meals. Attendees were not directly compensated. A conflict-of-interest officer (MO) was designated for attendees to confidentially raise concerns during the meeting (none were raised). All attendees were invited to contribute as authors, and all authors approved the final manuscript for submission.

Ten steps to improve outcomes of in-facility neonatal resuscitation

The consensus-based ten steps are presented below (Fig. 2; Table 1). The number assigned to each step does not indicate priority of importance or specific order for adoption. Suggested approaches to put these steps into practice are provided. Every approach may not apply to all settings; they are meant to serve as potential strategies for health systems and facilities to consider and adapt locally. Approaches that apply to multiple steps are presented only once. Approaches for Steps 4 and 5 are similar and are presented with Step 5.

Although these steps target actions at the health facility level, successful and sustained implementation requires leadership, political will, and financing at the organizational and national level.[16] High-level commitment to care at birth yields excellent return on investment in terms of newborn health.[17] Engagement of governing bodies, such as health ministries, health system leadership, educational institutions, patient advocate groups, and professional organizations is fundamental to realize the ten steps within health facilities.

Step 1: Implement effective education systems

Knowledgeable, skilled, confident providers are essential to deliver high-quality neonatal resuscitation. Pre-service providers (e.g., students) do not work independently in the clinical workforce, while in-service providers are actively employed and care for patients in healthcare facilities. Ideal educational systems mandate pre-service providers attain competency before working independently, and in-service providers engage in on-going education with evaluation. Facilities should orient and incorporate newly hired providers into clinical resuscitation teams. Education systems should focus on all providers responsible for neonatal resuscitation, including maternal providers who may be first responders at birth (e.g., obstetricians, midwives).

Providers' knowledge and skills decline over time. Continuing education is paramount and should be required for all resuscitation providers, using contextually-appropriate approaches. Documenting training is necessary to track progress and ensure compliance.



Fig. 1 – Countries represented by attendees in face-to-face meeting.

Because performance during simulation does not necessarily predict clinical performance, skills should be regularly evaluated in both simulated and clinical settings.

Suggested approaches

- Ensure pre-service education addresses neonatal resuscitation
- Institute mandatory certification and re-certification for all providers involved in neonatal resuscitation
- Utilize multiple educational methods such as low-dose, high-frequency training, textbook education, peer-to-peer evaluation, online learning, self-directed learning, adaptive learning, and group discussions
- Incorporate e-learning to enhance accessibility and reduce costs
- Provide simulation-based training for all providers involved in neonatal resuscitation
- Utilize just-in-time training (immediately before resuscitation) to maintain skills
- Use standardized skill checklists to evaluate performance
- Encourage interprofessional learning
- Utilize a provider recognition system to promote skill retention
- Link orientation programs and skills training with continuing education credits

Step 2: Ensure team and equipment readiness

Team preparation and equipment readiness are essential for timely and effective response. Preparedness includes a pre-resuscitation team briefing. Team roles (including team leader) and responsibilities should be clearly identified. Effective communication and planning should include maternal care providers and the newborn's family.

A checklist should be used to organize essential equipment for neonatal resuscitation and should include items to address thermal management, airway support, breathing assistance, circulatory support, and timekeeping (e.g., timer or clock). Equipment, supplies, and consumables that are affordable, safe, and effective for the intended use should be available for intrapartum care and newborn resuscitation. It is critical to use neonatal-specific equipment, as supplies for older children and adults differ in size and purpose. Ensuring equipment functionality requires collaboration between health care providers and those responsible for maintaining equipment (e.g., technicians).

Suggested approaches

- Perform periodic check-ins with obstetrical teams to be aware of anticipated deliveries
- Plan a feasible longitudinal budget for personnel and equipment
- Utilize applicable tax waivers and volume purchasing to mediate supply costs
- Gain access to supply chains or distribution networks for newborn-specific equipment
- Establish contracts with local manufacturers and distributors to ensure replacements and consumables are available
- Designate basic infrastructure to clean, store, and maintain equipment
- Create and distribute manuals or job aids for equipment use and maintenance
- Develop quality assurance procedures to ensure equipment functionality
- Train relevant local staff on equipment maintenance and repair

Step 3: Identify high-risk pregnancies and prevent perinatal risks

Preventing the need for neonatal resuscitation starts with open communication among maternal providers, newborn providers, and families. First trimester prenatal care and use of appropriate technology (e.g., ultrasound) are crucial for gestational dating and identifying high-risk conditions. During labor, monitoring the maternal-fetal dyad with contextually appropriate tools (e.g., partograph or fetal heart rate surveillance) facilitates early detection of perinatal risks. Appropriate therapies (e.g., antenatal corticosteroids, assisted vaginal delivery, timely emergency cesarean section) to support the at-risk

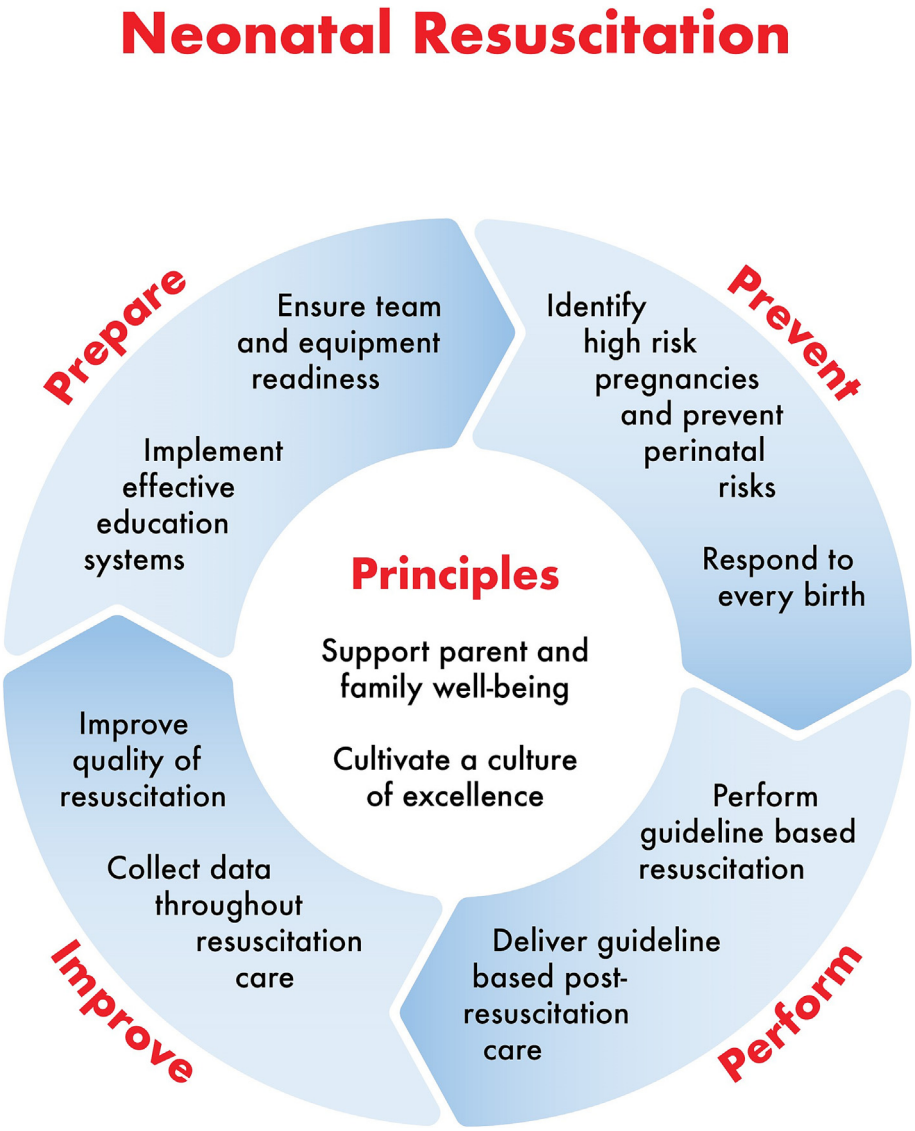

Fig. 2 – Ten steps to improve outcomes of in-facility neonatal resuscitation.

fetus reduces the need for resuscitation. In addition, care regionalization with risk stratification and referral to the appropriate facility and appropriate care team (preferably before birth) is a critical part of prevention.

Suggested approaches

- Track provision and quality of prenatal care
- Make families, communities, and policy makers aware of neonatal resuscitation
- Develop systems to facilitate standardized communication between maternal and neonatal providers, including discussions about high-risk births
- Implement telehealth systems to promote interinstitutional communication about high-risk births
- Create clear referral pathways and establish networks between lower- and higher-level care facilities to expedite triage
- Establish transportation systems (e.g., ambulances) with trained teams for urgent maternal-fetal transport
- Train maternal providers to identify patients at risk of intrapartum asphyxia
- Ensure facilities are fully equipped to perform timely emergency cesarean sections

Step 4: Respond to every birth

At least one person capable of assessing and responding to the newborn should be present at every birth. Using available perinatal information ensures the right providers and equipment are present and prepared before birth. First responders may include maternal providers. All first responders should be knowledgeable about neonatal resuscitation protocols.

Initial steps to stabilize the newborn after birth (e.g., cord management, warmth and stimulation) may reduce the need for resuscitation and should be performed according to guidelines. It is

Table 1 – Ten steps to improve outcomes of in-facility resuscitation.

Domain	Step	Summary concepts
Prepare	Implement effective education systems	• Educate all providers who may care for a newborn on evidence-based practice for neonatal resuscitation • Maintain individual skills, particularly those related to providing positive pressure ventilation and team performance • Evaluate provider performance in the clinical setting
	Ensure team and equipment readiness	• Prepare teams and equipment to facilitate timely and effective response • Make newborn-specific resuscitation equipment available in every setting where births occur
Prevent	Identify high-risk pregnancies and prevent perinatal risks	• Establish effective and timely communication between maternal providers, newborn providers and families • Provide prenatal care and intrapartum monitoring of the maternal-fetal dyad • Support regionalization of care and triage to the appropriate health facility before birth
	Respond to every birth	• Ensure a person capable of assessing and responding to the newborn is present at every delivery • Provide initial steps for stabilization after birth for all newborns • Train initial responders to recognize when a newborn is not breathing well, promptly intervene, and call for help whenever needed
Perform	Perform guideline based resuscitation	• Implement effective resuscitation interventions that are consistent with current guidelines • Clarify team roles and responsibilities throughout resuscitation
	Deliver guideline based post-resuscitation care	• Provide post-resuscitation care according to current guidelines • Develop systems to transition to higher levels of care when needed • Determine and address family's goals of care
Progress	Collect data throughout resuscitation care	• Collect and utilize local data to assess and improve performance and outcomes • Benchmark key metrics with other institutions
	Improve quality of resuscitation	• Use local data to identify gaps and drive change • Expand positive change through collaborative networks and research
Principles	Support parent and family well- being	• Focus on the psychological, physical, and emotional well-being of parents, birth companions, and families • Engage and empower families • Avoid separation of infant from family whenever possible
	Cultivate a culture of excellence	• Commit to every baby surviving and thriving • Respect the dignity of the fetus and newborn • Promote psychological safety for teams to reflect and improve • Support provider well-being

essential for first responders to provide initial steps, recognize when resuscitation is necessary, and promptly start resuscitation (including initiating PPV). When appropriate, first responders should call for help, and additional providers should be rapidly available to assist.

Step 5: Perform guideline based resuscitation

Guideline based neonatal resuscitation should be initiated promptly. Team members should be proficient in performing PPV, the cornerstone of effective neonatal resuscitation. Patient monitoring to assess breathing, heart rate and oxygenation should be tailored to the context. The team composition should vary according to the clinical situation and available resources. Clear team leadership with defined roles and responsibilities for all team members improves team performance. Throughout the process, closed-loop communication ensures instructions are heard, understood, and acted upon.

Suggested approaches (relevant to both Steps 4 and 5)

- Display resuscitation algorithms and cognitive aids in every delivery room; these could include mobile health tools (e.g., mobile phone apps)
- Utilize telemedicine support
- Debrief after each resuscitation to discuss opportunities for improvement
- Host regular conferences to discuss resuscitation performance
- Video record neonatal resuscitation (with appropriate consent and ethical approvals) to review and improve performance
- Assess individual provider performance periodically

Step 6: Deliver guideline based post-resuscitation care

Newborns who receive resuscitation are a high-risk population that requires specialized monitoring and care. Team members should have a clear understanding of contemporary guidelines and their institution's protocols for risk assessment and post- resuscitation care. Consultation with higher-level facilities, structured communication at care transitions, and organized transport planning (if needed) ensure continuity and safety. Family-driven goals of care should be collaboratively addressed. As relevant, providers should support continuity of care by referring for early developmental support and follow-up.

Suggested approaches

- Determine how to stratify risks and identify appropriate post-resuscitation care setting
- Initiate skin-to-skin care as soon as possible
- Provide breastfeeding support
- Create structured communication mechanisms for care transitions
- Establish regionalized care models to identify appropriate facilities for patient transfer based on resources required
- Ensure transport teams have essential neonatal equipment and training
- Develop short- and long-term follow-up systems addressing medical, developmental, and behavioral health for newborns who receive resuscitation

Step 7: Collect data throughout resuscitation care

Collecting data is essential to measure and improve resuscitation readiness, performance, and outcomes (Step 8). Therefore, data collection should encompass all phases of care (preparation, resuscitation, and post-resuscitation). Defining the cohort of newborns eligible for data collection is crucial. Standardized data capture and participation in registries enable comparisons across institutions. Governance around data collection, retention, security, and sharing vary across contexts, so each facility should establish clear rules of governance and security standards. Care providers should be aware of what data are collected, understand how the data are being used, and have access to data for review. Building upon existing data collection resources reduces the burden of data collection. Finally, collecting information about system resources, readiness, and outcomes at the facility or regional level can help improve performance throughout entire health systems.

Suggested approaches

- Create a registry of all resuscitation events; this could include every newborn who fails to breathe well at birth (per WHO)[18] or only those who receive resuscitation (per ILCOR)[19]
- Register stillbirths
- Establish a standardized neonatal resuscitation data collection form using the ILCOR Neonatal Utstein definitions and domains[19]
- Assign a dedicated person to collect data during resuscitation
- Implement efficient medical record systems to facilitate data capture
- If needed, use intermittent/convenience sample data collection to reduce the burden of data collection
- Generate incidence estimates to quantify the impact of resuscitation interventions

Step 8: Improve quality of resuscitation

Quality standards for newborn care define standards at the level of the patient, providers, facilities, and the health system. Each health facility should regularly assess its performance compared with established neonatal resuscitation guidelines and standards. Periodic data reviews reveal care gaps, identify strategies for improvement, and track progress. The momentum for positive change can be amplified through quality improvement (QI) collaboratives and research aimed at innovation in systems and implementation.

Suggested approaches

- Strengthen or establish quality improvement (QI) committees
- Ensure data are available to healthcare providers
- Create dashboards to display performance and outcome data
- Identify potential bottlenecks to care
- Encourage QI projects with locally defined questions and issues
- Create provider mentorship programs
- Develop QI collaborative networks
- Link data to maternal and perinatal death surveillance to support confidential enquiries (i.e., analysis of underlying causes)
- Support innovation and implementation research to expand and refine best practices

Step 9: Support parent and family well-being

The birthing process and uncertainty of outcomes after resuscitation result in significant physical and psychological stress. Appropriate methods to support, engage, and empower parents, birth companions and family members vary widely across cultures and facilities. These individuals might be present during resuscitation and critical phases of care, and their involvement is often integral to newborn health and their own well-being. Facilities should practice family-centered or family-integrated care and avoid separating newborns from families whenever possible. When separation is unavoidable, it should be brief, with ongoing frequent family communication provided. The care team should remain aware of families' emotional needs and arrange psychological and spiritual support when appropriate. Diversity of beliefs, traditions, and culture should be supported. Families of newborns who do not survive often have distinct needs.

Suggested approaches

- Engage with families starting in the antenatal period
- Provide joint family communication with neonatal and maternal providers
- Document provider-family communications
- Review resuscitation with the newborn's family afterwards
- Support families' spiritual, psychological, and religious well-being
- Provide language interpreters when needed
- Screen for perinatal mental disorders and provide services as needed
- Ensure family access to support groups and bereavement counseling
- Train staff to care for patients from different cultures
- Create parent advisory councils
- Develop an anonymized system for families to provide feedback

Step 10: Cultivate a culture of excellence

An intentional approach to cultivating a culture of excellence is key; it is important to recognize that culture can be modified. A culture of excellence is one in which providers are accountable to newborns and families and always in pursuit of improvement. Excellence includes a commitment to safe care for newborns. Success should be defined by reducing both preventable mortality and morbidity. A culture of accountability includes respect for the newborn with dignified physical handling during resuscitation (i.e., not picking up by the feet), transparent handling of deaths, and accurate classification of stillbirths and early neonatal losses.

Creating a safe environment for reflecting on practice and admitting errors also supports care providers. Psychological safety encourages every team member to speak up without fear of retaliation (e.g., no blame, no shame). Providers are often deeply affected by challenging resuscitations and should feel safe to debrief with colleagues regarding these cases. A psychologically supportive environment contributes to provider well-being.

Suggested approaches

- Reward high performance
- Encourage role modeling through facilitators
- Promote system accountability for medical errors
- Use research to improve culture and performance
- Establish an ethical framework for initiating, withholding, and discontinuing resuscitation
- Respect all cultural backgrounds
- Engage and respect interprofessional teams
- Ensure providers have access to psychological support
- Secure support from facility, ministerial and governmental leadership

Summary

The Ten Steps to Improve Outcomes of In-Facility Neonatal Resuscitation provide a framework for healthcare professionals, institutions, and policymakers to evaluate and strengthen their readiness, training, and response to newborns who need resuscitation at birth. Many identified concepts are similar to those in other "ten step" approaches,[11,12] while others (such as prenatal risk identification and supporting parents) reflect the unique neonatal population. Effecting and sustaining change takes active effort; health systems and facilities can use this framework to identify and target the most significant and appropriate interventions for the local context. These steps underscore critical areas where focused improvements can make the greatest impact to reduce preventable neonatal harm. They reflect current knowledge, broad consensus among global experts, and the public's perspective.

These steps have not been field tested. Real world data after implementation of this framework may provide further insights regarding the feasibility and effectiveness of these steps. The Global Resuscitation Alliance provides a forum for other resuscitation communities to share successful case studies.[11] The Neonatal Global Resuscitation Alliance could follow a similar approach. As neonatal resuscitation science evolves, ongoing collaborations and knowledge sharing will be vital to refine these recommendations and ensure they remain relevant. These ten steps represent the best current guidance to improve outcomes of newborn resuscitation worldwide.

CRediT authorship contribution statement

Elizabeth E. Foglia: Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Siren Rettedal:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Vinay Nadkarni:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Methodology, Conceptualization. **Jackie K. Patterson:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Conceptualization. **Peter G. Davis:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Conceptualization. **Susan Niermeyer:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Conceptualization. **Asmita Acharya:** Writing – review & editing, Visualization, Resources, Conceptualization. **Santorino Data:** Writing – review & editing, Visualization, Resources, Conceptualization. **Maria Fernanda de Almeida:** Writing – review & editing, Visualization, Resources, Conceptualization. **Abiy Seifu Estifanos:** Writing – review & editing, Visualization, Resources, Conceptualization. **Jorge Fabres:** Writing – review & editing, Visualization, Resources, Conceptualization. **Qi Feng:** Writing – review & editing, Visualization, Resources, Conceptualization. **Ruth Guinsburg:** Writing – review & editing, Visualization, Resources, Conceptualization. **Kenechukwu Iloh:** Writing – review & editing, Visualization, Resources, Conceptualization. **Juin Yee Kong:** Writing – review & editing, Visualization, Resources, Conceptualization. **Estomih Mduma:** Writing – review & editing, Visualization, Resources, Conceptualization. **Mackenzie O'Reilly:** Writing – review & editing, Project administration. **Viraraghavan Vadakkencherry Ramaswamy:** Writing – review & editing, Visualization, Resources, Conceptualization. **Suman Rao PN:** Writing – review & editing, Visualization, Resources, Conceptualization. **Mario Rüdiger:** Writing – review & editing, Visualization, Resources, Conceptualization. **Sprina Joseph Ryoba:** Writing – review & editing, Visualization, Resources, Conceptualization. **Jose Maria Solano:** Writing – review & editing, Visualization, Resources, Conceptualization. **Krothapalli Susila:** Writing – review & editing, Visualization, Resources, Conceptualization. **Marta Thio-Lluch:** Writing – review & editing, Visualization, Resources, Conceptualization. **Daniele Trevisanuto:** Writing – review & editing, Visualization, Resources, Conceptualization. **Sithembiso C. Velaphi:** Writing – review & editing, Visualization, Resources, Conceptualization. **Gary M. Weiner:** Writing – review & editing, Visualization, Resources, Conceptualization. **Hege L. Ersdal:** Writing – review & editing, Visualization, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Funding

This work was supported by a grant from the Laerdal Foundation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: "Asmita Acharya reports a relationship with Laerdal Global Health that includes: employment. Jackie Patterson reports a relationship with Laerdal Global Health that includes: funding grants. Vinay Nadkarni reports a relationship with National Institutes of Health that includes: funding grants. Vinay Nadkarni reports a relationship with Agency for Healthcare Research and Quality that includes: funding grants. Vinay Nadkarni reports a relationship with US Department of Defense that includes: funding grants. Vinay Nadkarni reports a relationship with Zoll Medical that includes: funding grants. Vinay Nadkarni reports a relationship with Laerdal Foundation that includes: funding grants. Vinay Nadkarni reports a relationship with Nihon Kohden that includes: funding grants. Vinay Nadkarni reports a relationship with Philips that includes: funding grants. Vinay Nadkarni reports a relationship with Society of Critical Care Medicine that includes: board membership. Vinay Nadkarni reports a relationship with International Liaison Committee on Resuscitation that includes: board membership. Vinay Nadkarni reports a relationship with Citizen COR Foundation that includes: board membership. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.".

Appendix A. Supplementary material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.resuscitation.2025.110746.

Author details

[a]*University of Pennsylvania Perelman School of Medicine, 3400 Civic Center Blvd, Philadelphia, PA 19104, USA*[b]*Children's Hospital of Philadelphia, 3401 Civic Center Blvd, Philadelphia, PA 19104, USA* [c]*Stavanger University Hospital, Postboks 8100, 4068 Stavanger, Norway* [d]*University of Stavanger, Kjell Arholms Gate 41, 4021 Stavanger, Norway*[e]*University of North Carolina School of Medicine, 101 Manning Dr, Chapel Hill, NC 27599, USA* [f]*The Royal Women's Hospital, University of Melbourne, 20 Flemington Rd, Parkville, VIC 3050, Australia*[g]*University of Colorado School of Medicine, 13121 E 17th Pl, Aurora, CO 80045, USA* [h]*Laerdal Global Health, Tanke Svilandsgate 30, P.O. Box 377, N-4002 Stavanger, Norway*[i]*Mbarara University of Science & Technology, P. O Box 1410, Mbarara, Uganda*[j]*Escola Paulista de Medicina, Universidade Federal de Sao Paulo, R. Botucatu, 740 – Vila Clementino, São Paulo, SP 04023-062, Brazil*[k]*Center for Implementation Sciences (CIS), Addis Ababa University, NBH1, 4killo King George VI StAddis Ketema Sub-city, Addis Ababa, Ethiopia* [l]*Department of Neonatology, School of Medicine, Pontificia Universidad Católica de Chile, Diagonal Paraguay 362, Santiago 8330077, Chile*[m]*Peking University First Hospital, No. 8, Xishiku Street, Xicheng District, Beijing 100034, China* [n]*University of Nigeria, Obukpa Rd, Nsukka 410105 Enugu, Nigeria* [o]*KK Women's and Children's Hospital, 100 Bukit Timah Rd, Singapore 229899 Singapore* [p]*Haydom Lutheran Hospital, R24G +F74, Haydom, Tanzania*[q]*Ankura Hospital for Women and Children, Opposite NH65, Bagh Ameer, Sumitra Nagar Colony, Kukatpally, Hyderabad, Telangana 500072, India* [r]*St. John's Medical College Hospital, Bangalore 560034, India* [s]*Saxonian Center for Feto/Neonatal Health, Faculty of Medicine and University Hospital Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany* [t]*Government Hospital Dodoma, RP9V+3Q2, Hospital Rd, Dodoma, Tanzania*[u]*Hospital Militar Central-Tv, 3C, 49-02 Bogotá D. C/Clínica de Marly Cl.50 # 9-67, Bogotá D.C, Colombia* [v]*Andhra Pradesh Nurses & Midwives Council, Old Government General Hospital, Hanumanpet, Main Road, Vijayawada 520001 Andhra Pradesh, India* [w]*University of Padova, Via Nicolò Giustiniani, 2, 35128 Padova, PD, Italy*[x]*University of the Witwatersrand, Faculty of Health Sciences, 29 Princess of Wales Terrace, Parktown, Johannesburg 2193, South Africa* [y]*University of Michigan, C.S. Mott Children's Hospital, 1500 E. Medical Center Drive, Ann Arbor, MI 48109, USA*

REFERENCES

1. Eckart F, Kaufmann M, Mense L, Rüdiger M. Descriptive dataset analysis of a Survey on Currently applied Interventions in Neonatal resuscitation (SCIN). Resuscitation 2025:208. https://doi.org/10.1016/j.resuscitation.2025.110536.
2. Murray CJL, Lopez AD. Measuring the global burden of disease. N Engl J Med 2013;369(5):448–57. https://doi.org/10.1056/NEJMra1201534.
3. Steinmetz JD, Seeher KM, Schiess N, et al. Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. Lancet Neurol 2024;23(4):344–81. https://doi.org/10.1016/S1474-4422(24)00038-3.
4. Søreide E, Morrison L, Hillman K, et al. The formula for survival in resuscitation. Resuscitation 2013;84(11):1487–93. https://doi.org/10.1016/j.resuscitation.2013.07.020.
5. Greif R, Bray JE, Djärv T, et al. 2024 International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations: summary from the basic life support; advanced life support; pediatric life support; neonatal life support; education, implementation, and teams; and first aid task forces. Circulation 2024. https://doi.org/10.1161/CIR.0000000000001288.
6. Weiner G, Zaichkin J, editors. Textbook of neonatal resuscitation. American Academy of Pediatrics and American Heart Association; 2021.
7. Niermeyer S. From the neonatal resuscitation program to helping babies breathe: global impact of educational programs in neonatal resuscitation. Semin Fetal Neonatal Med 2015;20(5):300–8. https://doi.org/10.1016/j.siny.2015.06.005.
8. Essential newborn care course second edition. Accessed March 4, 2025. https://www.who.int/tools/essential-newborn-care-course.
9. European Resuscitation Council. Newborn life support course. Accessed April 17, 2025. https://www.erc.edu/courses/newborn-life-support.
10. Shukla VV, Carlo WA, Niermeyer S, Guinsburg R. Neonatal resuscitation from a global perspective. Semin Perinatol 2022;46(6) 151630. https://doi.org/10.1016/j.semperi.2022.151630.
11. Global Resuscitation Alliance. Accessed February 20, 2025. https://www.globalresuscitationalliance.org/.
12. Chan PS, Greif R, Anderson T, et al. Ten steps toward improving in-hospital cardiac arrest quality of care and outcomes. Resuscitation 2023;193:109996. https://doi.org/10.1016/j.resuscitation.2023.109996.

13. Cummins RO, Chamberlain DA, Abramson NS, et al. Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest: the Utstein style. A statement for health professionals from a task force of the American Heart Association, the European Resuscitation Council, the Heart and Stroke Foundation of Canada, and the Australian Resuscitation Council. Circulation 1991;84 (2):960–75. https://doi.org/10.1161/01.cir.84.2.960.
14. Ersdal HL, Singhal N, Msemo G, et al. Successful implementation of helping babies survive and helping mothers survive programs—an Utstein formula for newborn and maternal survival. PLOS ONE 2017;12(6)e0178073. https://doi.org/10.1371/journal.pone.0178073.
15. Acute Care Action Network (ACAN). Accessed February 14, 2025. https://www.who.int/groups/acute-care-action-network.
16. Kamala BA, Ersdal HL, Moshiro RD, et al. Outcomes of a program to reduce birth-related mortality in Tanzania. N Engl J Med 2025;392 (11):1100–10. https://doi.org/10.1056/NEJMoa2406295.
17. Kamuyu R, Tarus A, Bundala F, et al. Investment case for small and sick newborn care in Tanzania: systematic analyses. BMC Pediatr 2023;23(2):632. https://doi.org/10.1186/s12887-023-04414-2.
18. Perinatal asphyxia. Accessed March 5, 2025. https://www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/newborn-health/perinatal-asphyxia.
19. Foglia EE, Davis PG, Guinsburg R, et al. Recommended guideline for uniform reporting of neonatal resuscitation: the neonatal Utstein style. Pediatrics 2023;151(2)e2022059631. https://doi.org/10.1542/peds.2022-059631.