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REVIEW

From "*can we treat?*" to "*should we treat?*": a narrative review on resuscitation limits at the threshold of viability

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Abstract

Background Advances in perinatal and neonatal care have progressively lowered the threshold of viability and improved survival among extremely preterm infants (EPIs). However, this increase in survival has not consistently been accompanied by comparable improvements in neurological outcomes, which in a relevant proportion of cases remain poor. This discrepancy generates the ethical dilemma of deciding whether to proceed with active resuscitation at the margins of viability. Historically, decisions have relied heavily on gestational age (GA), yet this single parameter has proven insufficient.

Purpose This narrative review examines the conceptual and practical challenges in determining the limit of active resuscitation and explores how healthcare professionals and international scientific and bioethical committees have addressed this issue, as well as how families experience and cope with it.

Results Evidence demonstrates that multiple fetal and pregnancy-related factors significantly influence survival and long-term neurodevelopmental outcomes, outperforming GA alone. Simultaneously, clinicians and families are confronted with prognostic uncertainty, psychological burdens, and cognitive biases that complicate decision-making. In this context, shared decision-making emerges not as a simple transfer of information, but as an interpretative process centered on the newborn's best interests.

Conclusion No universal gestational threshold can determine when resuscitation should or should not be initiated. Rather, the "limit" is best understood as a case-specific decision point, shaped by prognosis, parental values, ethical judgment, and clinical feasibility. Future efforts should focus not on eliminating the grey area, but on developing ethically grounded strategies for navigating it responsibly, compassionately, and with intellectual humility.

What is known:
- *Gestational age alone is widely used to guide resuscitation decisions, but it is an imprecise and insufficient parameter.*
- *Multiple clinical and perinatal factors significantly influence prognosis.*

What is new:
- *The limit of resuscitation is context-dependent, shaped by prognosis, parental values, and ethical judgment.*
- *Shared decision-making is not just information sharing, but a collaborative process to determine the newborn's best interests.*

Keywords Preterm · Newborn · Viability · Active resuscitation · Outcome · Grey zone

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Abbreviations

BAPM	British Association of Perinatal Medicine
EPIs	Extremely preterm infants
GA	Gestational age
UK	United Kingdom
USA	United States of America
wGA	Weeks of gestational age

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Introduction

The definition of periviable birth originates from a joint workshop involving the Society for Maternal–Fetal Medicine, the National Institute of Child Health and Human Development, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists, and it refers to delivery occurring between $20^{+0/7}$ and $25^{+6/7}$ weeks of gestational age (wGA) [1].

Over the past two decades, advancements in perinatal and neonatal care have progressively improved survival of extremely preterm infants (EPIs), owing to developments in antenatal management, delivery room stabilization, neonatal intensive care, and postnatal follow-up [2]. Although survival at the lowest GA remains exceptional with no documented cases at 20 weeks and only sporadic reports at 21 wGA, an increasing number of single-center and multicenter studies from Japan, the United States of America (USA), France, Germany, Taiwan, and Australia have reported survival among infants born between 22 and 25 wGA [3–10]. Nevertheless, survival rates within this gestational window still vary considerably across studies and settings, ranging from approximately 8% to 86.2% [5, 7, 11–16]. Predictably, there is a striking difference between high-income countries and low-/middle-income countries [17]. However, significant variation is also observed within individual countries. In the USA, for example, survival at 22 wGA ranges from 0 to 37% across centers, a discrepancy that may reflect differences in local policies, cultural norms, and, most importantly, the provision of neonatal resuscitation and active care at the lowest GA, which accounted for 78% of the variation in survival between units [12, 13, 15].

Neonatal resuscitation has continued to advance and become more effective, paralleling the improvements in perinatal and intensive care practices. It is currently estimated that approximately 10% of newborns receive some degree of resuscitative support at birth, while only about 1% require advanced interventions such as chest compressions or epinephrine. However, these rates increase markedly among very low birthweight and extremely low birthweight infants, with 6–10% receiving extensive delivery-room cardiopulmonary resuscitation, a several-fold increase compared with the general neonatal population [18]. Nevertheless, there is still no consensus on whether advanced resuscitative measures and subsequent active care should be offered to infants born at the threshold of viability [19, 20]. This decision remains both clinically and ethically challenging for both healthcare providers and parents, largely because of the high risk of severe neurodevelopmental impairment among survivors.

Thresholds of viability: survival, neurodevelopment, and long-term outcomes

Although clinical practice remains heterogeneous internationally (Japan, for example, has protected fetuses of ≥ 22 wGA since 1991 [21]), there is an undeniable tendency toward considering and implementing active resuscitation, stabilization, and intensive care for babies born at the limits of viability, with this threshold gradually lowering over time [22]. Guidelines have moved in the same direction. In the United Kingdom (UK), for example, the 2009 national framework published by the British Association of Perinatal Medicine (BAPM) recommended not initiating active treatment before 23 + 0 weeks and starting it from 24 + 0 weeks onwards, unless severe infant compromise was anticipated. The document also stated that "*there is no evidence to support the use of epinephrine by any route, or chest compressions, during resuscitation at gestational age < 26 weeks*" [23]. Ten years later, however, the revised 2019 BAPM *Framework for Practice* stated that active treatment from 22 + 0 weeks could be considered appropriate, provided that a careful risk assessment was undertaken and parental views were fully considered [22]. This recommendation was not merely theoretical. A recent survey conducted by Di Stefano et al. [2] revealed that UK neonatologists would, on average, consider 22 wGA as the lower threshold for initiating active treatment. This finding suggests a clear shift in both attitudes and clinical practice, since in 2008 and 2016 only a minority of UK neonatologists reported willingness to resuscitate before 23 wGA [24–26]. Although this threshold is not applied worldwide [27], several hospitals in countries such as Sweden, the USA, and Japan have reported offering active care starting at 22 wGA [25, 28–30].

Despite growing international evidence demonstrating improved survival among the most immature preterm infants [31], preterm birth remains a major contributor to preventable mortality and to significant long-term morbidity. Survivors often face chronic complications, including bronchopulmonary dysplasia, intraventricular hemorrhage, periventricular leukomalacia, retinopathy of prematurity, and necrotizing enterocolitis, as well as a broad range of mild to severe neurodevelopmental impairments [2].

Risk for neurodevelopmental impairment is inversely related to the wGA. In a large French cohort of 5567 preterm infants assessed at 24 months using the Ages and Stages Questionnaire (ASQ), 50.2% of those born at 24–26 weeks and 40.7% of those born at 27–31 weeks scored less than two standard deviations [32]. These findings are corroborated by Pascal et al. who, using confirmatory Bayley Scales testing, reported an overall prevalence

of cognitive delay of 16.9%, with the risk of moderate to severe delay among survivors born at 22, 23, 24, 25, and 26 weeks estimated at 60%, 51%, 34%, 27%, and 16%, respectively [33]. While cognitive impairment represents a major concern, other neurodevelopmental outcomes, including motor and sensory disabilities, are equally relevant in assessing long-term prognosis. In the same French cohort, the risk of cerebral palsy declined from 6.9% at 24–26 weeks to 4.3% at 27–31 weeks and 1.0% at 32–34 wGA [32].

It is important to note, however, that a diagnosis of extreme prematurity is not invariably associated with severe neurodevelopmental impairment. In Western Australia, Sharp et al. observed that over 50% of infants born at less than 24 wGA did not have major disabilities such as cerebral palsy or autism spectrum disorder, although the study did not explore mild impairment or school-related difficulties [4].

The grey zone of viability: ethical challenges and decision-making dilemmas

The legal definition of viability has traditionally been anchored to the capacity of the fetus to survive outside the uterus with the aid of advanced medical technologies. However, this definition does not account for the probability of survival nor for the anticipated quality of life. In clinical practice, the evaluation of whether a preterm infant is expected to survive without severe neurological impairment often diverges from this purely legal construct [34]. The tension between these two approaches has given rise to what is commonly described as the "*grey zone of viability*" [35].

This consideration introduces significant ethical complexities and highlights the challenge of weighing improved survival against the potential burden of disability, an assessment that guides whether active resuscitation is appropriate or whether palliative care serves the child's best interests [36]. Further complicating matters is the inherently subjective nature of how disability is perceived: an outcome deemed acceptable by one family may be deemed unacceptable by another.

Justice requires that individuals in similar circumstances be treated alike and that any differences in treatment be justified by a morally relevant distinction.

In the context of resuscitation guidelines for extremely preterm neonates, this distinction has traditionally been grounded in GA [34]; however, relying on GA as the primary determinant for offering resuscitation presents several limitations. To begin with, except in pregnancies achieved through in-vitro fertilization, GA remains an estimate, with a margin of error of 3–5 days when based on a first-trimester ultrasound, increasing to 10–14 days when dating is derived from a second-trimester scan [15]. Moreover, in clinical practice, redating is only performed when the discrepancy between ultrasound dating and last menstrual period exceeds the threshold of seven days. As a result, a deliberate margin of error is tolerated and not corrected, further reducing the precision of GA estimations. In addition, fetal maturation is not a standardized process but progresses along a continuum, meaning that fetuses with the same estimated GA may exhibit different levels of physiological development [37].

As a matter of fact, most of the bioethical committees do not provide a clear-cut threshold on when active resuscitation is appropriate: for example, the Italian Committee for Bioethics states that no fixed GA threshold can be set to mandate or prohibit resuscitation and that each case must be individually assessed [38].

Determining whether active resuscitation is in the newborn's best interests

How, then, should decisions be equitably made when GA alone is not adequate to determine whether active neonatal resuscitation ought to be initiated?

If criteria are to be introduced to help predict outcomes and guide the appropriateness of initiating active resuscitation, multifactorial approaches must be adopted, integrating indicators beyond GA. Indeed, a growing body of evidence demonstrates that numerous fetal and pregnancy-related factors, such as estimated fetal weight, sex, plurality, and exposure to antenatal steroids, significantly influence survival [37] and future global outcomes. More than a decade ago, Tyson et al. proposed a strong argument for "*moving beyond gestational age*" as a standalone determinant [37]. Since then, further research has reinforced this concept. De Proost et al. showed that combining GA with birth weight, sex, plurality, and antenatal steroid exposure improved the prediction of both survival and disability compared with using GA alone and developed an online tool to support such estimation [39]. In 2020, Rysavy et al. confirmed that models incorporating multiple perinatal variables outperform any single factor, including GA, in predicting survival and introduced a new online calculator accordingly [40].

Yet, despite growing evidence, there is still no clear guidance on how these variables should be incorporated into real-time decision-making to determine whether initiating active resuscitation truly aligns with the newborn's best interests. Given the sensitivity of the topic, the inherent difficulties faced by both clinicians and families when managing decisions in the grey zone, and the absence of universally accepted guidelines, some professional societies have developed recommendations and ethical frameworks to support healthcare professionals in this challenging area.

In the UK, the 2020 *Framework for Practice* developed by the BAPM Working Group provides guidance to clinical management before and at the time of birth for perinatal care in cases of preterm delivery at < 27 wGA [41]. To estimate the risk of poor outcome if active management is undertaken, they advise a stepwise approach to decision-making, involving three key stages. The framework first recommends assessing the baby's risk using a modified risk assessment that integrates GA with additional risk or protective factors such as the gender of the baby, multiple pregnancy, congenital anomaly, poor fetal growth, prolonged pre-labor rupture of membranes, clinical evidence of chorioamnionitis, administration of antenatal steroid and magnesium sulfate, and finally the clinical setting and the experience of the staff assisting the newborn. This evaluation places the fetus/newborn into one of three categories—extremely high, high, or moderate risk—guiding decisions on palliative versus active care. However, these categories are not fully objective and should be interpreted alongside parental values. For this reason, the second point emphasizes the importance of involving families in planning for an extremely preterm birth, ensuring that information is conveyed clearly and compassionately and that parental expectations are explored. Finally, as a third point, it is recommended that a shared management plan is agreed upon between the family and the staff involved and within the health care providers.

At this stage, if a decision is made to initiate active care, all resuscitative and intensive support measures agreed upon during prenatal planning should be promptly implemented. Active care entails providing appropriate respiratory, cardiovascular, and nutritional support, as well as continuous monitoring and timely escalation of treatment when clinically warranted. However, this commitment to active care does not imply irrevocability. As the infant's condition evolves, it is essential to maintain open and regular communication with the family, sharing updated information regarding prognosis, response to treatment, and potential complications. This ongoing dialogue allows parents and clinicians to jointly re-evaluate the goals of care and, where necessary, reconsider the initial plan. In this context, the ethical principle of proportionality becomes central, ensuring that the level of intervention remains appropriate, compassionate, and aligned with both medical feasibility and the infant's welfare.

If, on the contrary, a decision is made for palliative care after the delivery of the infant, it should not be regarded differently from an advance plan of care for a healthy newborn. Rather, it represents a proactive and comprehensive approach that addresses physical, emotional, social, and spiritual needs, with the aim of maximizing the infant's comfort while supporting the family. It includes symptom management, relief of distress, and bereavement support, and should be considered a legitimate and planned form of care, rather than the absence of treatment. When chosen, palliative care should be delivered in a setting that preserves privacy, dignity, and emotional support, ensuring warmth, pain control, and clear communication about the dying process. Throughout, the focus remains on providing compassionate, dignified, and family-centered care.

Parental experience and involvement in decision-making at the margins of viability

Recent literature strongly emphasizes the central role of families in decision-making, the importance of acknowledging their values and beliefs, and the way in which up-to-date information is communicated when managing infants who fall within the *grey zone*. Traditionally, physicians viewed their role primarily as providing parents with objective and detailed information on treatment choices and expected outcomes. However, a more contemporary view suggests that physicians should not limit themselves to the provision of information, but should actively support parents, potentially involving the broader family unit, in discerning and articulating their own values and ethical commitments as they face an unexpected and potentially life-altering situation [42]. This shift reflects an evolution toward what has been termed "*shared decision-making*," a conceptually attractive but often difficult to apply model in practice. As a matter of fact, when involving families in complex decision-making processes, it is essential to recognize that their perceptions may be influenced by a series of cognitive biases. While clinicians predominantly base their judgments on prognostic data and outcome estimates, parents often attach less weight to unfavorable statistics and focus instead on hope and perceived potential for survival. This tendency to overestimate positive outcomes even in poor-prognosis situations reflects the phenomenon known as *optimism bias*. Evidence also shows that parental decisions are shaped by how information is presented: resuscitation is more likely to be chosen when survival rates rather than mortality rates are communicated (*framing effect*) [43] and it is twice as likely to be selected when presented as the default option (*default bias*), a stronger effect than framing alone [44]. Beyond cognitive biases, several structural and relational challenges further complicate shared decision-making. Although contemporary families have greater access to medical information and are increasingly encouraged to participate in care decisions, the sheer volume, complexity, and variable reliability of available information, particularly online, may generate confusion, uncertainty, and emotional distress. Parallel to this, clinicians themselves face growing diagnostic and prognostic uncertainty, stemming from increasing evidence, evolving therapeutic options, and heterogeneity in clinical practice. Consequently, medical decisions in this context require a flexible partnership in which clinicians help families

navigate information, articulate their preferences and values, and tailor the level of guidance according to what each family needs [45].

The effort to build a partnership rather than simply providing families with numbers and probabilities is intended to yield better outcomes. An increasing number of studies now give voice to families who have experienced an extremely preterm birth: one in particular [46] explored whether parents developed any decision regret after going through such a highly distressing experience. It emerged that prenatal consultation was associated with significantly lower decision regret scores and that women indicating they were the primary decision-maker had lower decision regret scores compared with women reporting the doctor had a major role in the decision. Additionally, a survey conducted this year among Dutch respondents explored public views on the need for official guidelines on the topic and the degree of personalization in the management of extremely preterm neonates. The study showed that parents not only agree on the need for guidelines that go beyond GA, especially considering that center-to-center variability in GA thresholds to perform active resuscitation creates disparities and a sense of injustice, but also that personalization of care is perceived only when adequate prenatal counseling has taken place and a relationship with the healthcare team has been established. This reinforces the idea that a "*one-size-fits-all*" approach is not applicable in this context and that counseling cannot rely solely on numbers, but must be rooted in relationship-building [47].

Conclusions and perspectives

The issue is undeniably complex. The absence of clear-cut guidelines that dictate when active resuscitation should or should not be initiated is often perceived as unhelpful. Yet, it is likely that such rigid guidance cannot be realistically produced. Unlike other areas of medicine, the management of periviable infants is influenced by an exceptionally high degree of clinical variability, the inherent unpredictability of postnatal trajectories, and the deeply subjective interpretation of concepts such as "an acceptable quality of life" or the "neurodevelopmental outcome." For these reasons, the search for universal, prescriptive rules may not only be impractical but also ethically inappropriate.

Relying solely on GA is a simple and straightforward method, yet it is probably too simplistic. It disregards relevant biological and clinical modifiers, fails to account for prognostic uncertainty, and does not adequately support an ethically sound evaluation of what truly lies in the newborn's best interests.

While scientific advances have progressively lowered the threshold of viability and improved survival outcomes, they have simultaneously introduced an ethical and decisional dilemma by exposing the tension between *can we treat* and *should we treat*. In this delicate *grey zone*, decision-making should increasingly rely on multifactorial prognostic assessment, integrating GA with additional biological, clinical, and contextual variables, rather than GA alone. Within this framework, shared decision-making emerges not as a simple transfer of information, but as a collaborative, interpretative process, in which clinicians help families understand prognostic uncertainty, explore what truly constitutes the child's best interests, and make decisions that are medically reasonable, ethically justifiable, and personally meaningful.

So, where is the limit of active resuscitation and when should it be applied?

Current evidence suggests that there is not a clear threshold that can serve as a universal limit. Rather, the limit is best understood as a context-dependent decision point, defined not only by physiological parameters but also by prognosis, parental values, institutional capabilities, and the dynamic interpretation of what constitutes the newborn's best interests. It is less a fixed line and more an evolving boundary, negotiated through informed, ethically sensitive, and case-specific deliberation.

Looking ahead, meaningful progress will not come from establishing more stringent numerical cut-offs, but from refining prognostic tools, enhancing perinatal counselling, acknowledging uncertainty with intellectual honesty, and strengthening relational competence in shared decision-making. Ultimately, the goal is not to eliminate the grey zone, but to navigate it responsibly, balancing scientific evidence, ethical reflection, and compassionate care.

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References

1. American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine (2017) Obstetric care consensus No. 6: periviable birth. Obstet Gynecol 130:e187–e199. https://doi.org/10.1097/AOG.0000000000002352
2. Di Stefano LM, Wood K, Mactier H et al (2021) Viability and thresholds for treatment of extremely preterm infants: survey of UK neonatal professionals. Arch Dis Child Fetal Neonatal Ed 106:F596–F602
3. Mehler K, Oberthuer A, Keller T et al (2020) Survival among infants born at 22 or 23 weeks' gestation following active prenatal and postnatal care. JAMA Pediatr 174:913. https://doi.org/10.1001/jamapediatrics.2020.3127
4. Sharp M, French N, McMichael J, Campbell C (2018) Survival and neurodevelopmental outcomes in extremely preterm infants 22–24 weeks of gestation born in Western Australia. J Paediatr Child Health 54:188–193. https://doi.org/10.1111/jpc.13678
5. Watkins PL, Dagle JM, Bell EF, Colaizy TT (2020) Outcomes at 18 to 22 months of corrected age for infants born at 22 to 25 weeks of gestation in a center practicing active management. J Pediatr 217:52-58.e1. https://doi.org/10.1016/j.jpeds.2019.08.028
6. Puia-Dumitrescu M, Younge N, Benjamin DK et al (2020) Medications and in-hospital outcomes in infants born at 22–24 weeks of gestation. J Perinatol 40:781–789. https://doi.org/10.1038/s41372-020-0614-4
7. Lorthe E, Torchin H, Delorme P et al (2018) Preterm premature rupture of membranes at 22–25 weeks' gestation: perinatal and 2-year outcomes within a national population-based study (EPIPAGE-2). Am J Obstet Gynecol 219:298.e1-298.e14. https://doi.org/10.1016/j.ajog.2018.05.029
8. Shafey A, Bashir RA, Shah P et al (2020) Outcomes and resource usage of infants born at ≤ 25 weeks gestation in Canada. Paediatr Child Health 25:207–215. https://doi.org/10.1093/pch/pxz002
9. Kono Y, Yonemoto N, Nakanishi H et al (2018) Changes in survival and neurodevelopmental outcomes of infants born at <25 weeks' gestation: a retrospective observational study in tertiary centres in Japan. BMJ Paediatr Open 2:e000211. https://doi.org/10.1136/bmjpo-2017-000211
10. Kusuda S, Fujimura M, Sakuma I et al (2006) Morbidity and mortality of infants with very low birth weight in Japan: center variation. Pediatrics 118:e1130–e1138. https://doi.org/10.1542/peds.2005-2724
11. Chang J-H, Hsu C-H, Tsou K-I, Jim W-T (2018) Outcomes and related factors in a cohort of infants born in Taiwan over a period of five years (2007–2011) with borderline viability. J Formos Med Assoc 117:365–373. https://doi.org/10.1016/j.jfma.2018.01.018
12. Stoll BJ, Hansen NI, Bell EF et al (2015) Trends in care practices, morbidity, and mortality of extremely preterm neonates, 1993–2012. JAMA 314:1039. https://doi.org/10.1001/jama.2015.10244
13. Rysavy MA, Li L, Bell EF et al (2015) Between-hospital variation in treatment and outcomes in extremely preterm infants. N Engl J Med 372:1801–1811. https://doi.org/10.1056/NEJMoa1410689
14. Boghossian NS, Geraci M, Edwards EM et al (2020) Regional and racial–ethnic differences in perinatal interventions among periviable births. Obstet Gynecol 135:885–895. https://doi.org/10.1097/AOG.0000000000003747
15. Patel RM, Rysavy MA, Bell EF, Tyson JE (2017) Survival of infants born at periviable gestational ages. Clin Perinatol 44:287–303. https://doi.org/10.1016/j.clp.2017.01.009
16. Chen YJ, Yu WH, Chen LW et al (2021) Improved survival of periviable infants after alteration of the threshold of viability by the neonatal resuscitation program 2015. Children 8:23. https://doi.org/10.3390/children8010023
17. Li YX, Hu YL, Huang X et al (2024) Survival outcomes among periviable infants: a systematic review and meta-analysis comparing different income countries and time periods. Front Public Health. https://doi.org/10.3389/fpubh.2024.1454433
18. Goel D, D'cruz D, Jani P (2019) Outcomes of infants born at borderline viability (23–25 weeks gestation) who received cardiopulmonary resuscitation at birth. J Paediatr Child Health 55:399–405. https://doi.org/10.1111/jpc.14210
19. Byrne S, Szyld E, Kattwinkel J (2008) The ethics of delivery-room resuscitation. Semin Fetal Neonatal Med 13:440–447. https://doi.org/10.1016/j.siny.2008.04.014
20. Wyckoff MH, Aziz K, Escobedo MB et al (2015) Part 13: neonatal resuscitation. Circulation 132. https://doi.org/10.1161/CIR.0000000000000267
21. Nishida H, Ishizuka Y (1992) Survival rate of extremely low birthweight infants and its effect on the amendment of the eugenic protection act in Japan. Pediatr Int 34:612–616. https://doi.org/10.1111/j.1442-200X.1992.tb01020.x
22. Mactier H, Bates SE, Johnston T et al (2020) Perinatal management of extreme preterm birth before 27 weeks of gestation: a framework for practice. Arch Dis Child Fetal Neonatal Ed 105:232–239. https://doi.org/10.1136/archdischild-2019-318402
23. Wilkinson AR, Ahluwalia J, Cole A et al (2009) Management of babies born extremely preterm at less than 26 weeks of gestation: a framework for clinical practice at the time of birth. Arch Dis Child Fetal Neonatal Ed. https://doi.org/10.1136/adc.2008.143321
24. Duffy D, Reynolds P (2011) Babies born at the threshold of viability: attitudes of paediatric consultants and trainees in South East England. Acta Paediatr 100:42–46. https://doi.org/10.1111/j.1651-2227.2010.01975.x
25. Wilkinson D, Verhagen E, Johansson S (2018) Thresholds for resuscitation of extremely preterm infants in the UK, Sweden, and Netherlands. Pediatrics 142:S574–S584. https://doi.org/10.1542/peds.2018-0478I
26. Kariholu U, Godambe S, Ajitsaria R et al (2012) Perinatal network consensus guidelines on the resuscitation of extremely preterm infants born at <27 weeks' gestation. Eur J Pediatr 171:921–926. https://doi.org/10.1007/s00431-011-1647-7
27. Cavolo A, Dierckx de Casterlé B, Naulaers G, Gastmans C (2019) Physicians' attitudes on resuscitation of extremely premature infants: a systematic review. Pediatrics 143:e20183972. https://doi.org/10.1542/peds.2018-3972
28. Weiss AR, Binns HJ, Collins JW, deRegnier R-A (2007) Decision-making in the delivery room: a survey of neonatologists. J Perinatol 27:754–760. https://doi.org/10.1038/sj.jp.7211821
29. Martinez AM, Partridge JC, Yu V et al (2005) Physician counselling practices and decision-making for extremely preterm infants in the Pacific Rim. J Paediatr Child Health 41:209–214. https://doi.org/10.1111/j.1440-1754.2005.00589.x
30. Arzuaga B, Adam H, Ahmad M, Padela A (2016) Attitudes towards the resuscitation of periviable infants: a national survey of American Muslim physicians. Acta Paediatr 105:260–267. https://doi.org/10.1111/apa.13222
31. Arnon S, Dolfin T, Reichman B et al (2017) Delivery room resuscitation and adverse outcomes among very low birth weight preterm infants. J Perinatol 37:1010–1016. https://doi.org/10.1038/jp.2017.99
32. Pierrat V, Marchand-Martin L, Arnaud C et al (2017) Neurodevelopmental outcome at 2 years for preterm children born at 22 to 34 weeks' gestation in France in 2011: EPIPAGE-2 cohort study. BMJ: j3448. https://doi.org/10.1136/bmj.j3448
33. Pascal A, Govaert P, Oostra A et al (2018) Neurodevelopmental outcome in very preterm and very-low-birthweight infants born over the past decade: a meta-analytic review. Dev Med Child Neurol 60:342–355. https://doi.org/10.1111/dmcn.13675

34. Mercurio MR, Carter BS (2020) Resuscitation policies for extremely preterm newborns: finally moving beyond gestational age. J Perinatol 40:1731–1733
35. Fanczal E, Berecz B, Szijártó A et al (2020) The prognosis of preterm infants born at the threshold of viability: fog over the gray zone - population-based studies of extremely preterm infants. Med Sci Monit 26:e926947
36. González-Melado FJ (2015) Dominic Wilkinson: death or disability? The "Carmentis Machine" and decision-making for critically ill children. Theor Med Bioeth 36:363–368. https://doi.org/10.1007/s11017-015-9335-7
37. Tyson JE, Parikh NA, Langer J et al (2008) Intensive care for extreme prematurity — moving beyond gestational age. N Engl J Med 358:1672–1681. https://doi.org/10.1056/NEJMoa073059
38. Italian Committee for Bioethics. Premature infants. Bioethical notes (2008) Premature infants. Bioethical notes. https://bioetica.governo.it/en/opinions/opinions-responses/premature-infants-bioethical-notes/
39. De Proost L, Ismaili M'hamdi H, Verhagen AAE et al (2020) On the limits of viability: toward an individualized prognosis-based approach. J Perinatol 40:1736–1738. https://doi.org/10.1038/s41372-020-00793-x
40. Rysavy MA, Horbar JD, Bell EF et al (2020) Assessment of an updated neonatal research network extremely preterm birth outcome model in the Vermont Oxford Network. JAMA Pediatr 174:e196294. https://doi.org/10.1001/jamapediatrics.2019.6294
41. MacTier H, Bates SE, Johnston T et al (2020) Perinatal management of extreme preterm birth before 27 weeks of gestation: a framework for practice. Arch Dis Child Fetal Neonatal Ed 105:F232–F239
42. Gaucher N, Nadeau S, Barbier A et al (2016) Personalized antenatal consultations for preterm labor: responding to mothers' expectations. J Pediatr 178:130-134.e7. https://doi.org/10.1016/j.jpeds.2016.08.006
43. Haward MF, Murphy RO, Lorenz JM (2008) Message framing and perinatal decisions. Pediatrics 122:109–118. https://doi.org/10.1542/peds.2007-0620
44. Haward MF, Murphy RO, Lorenz JM (2012) Default options and neonatal resuscitation decisions. J Med Ethics 38:713–718. https://doi.org/10.1136/medethics-2011-100182
45. Ennis BJ, Reed DJ, Lantos JD (2022) Current controversies in neonatal resuscitation. Semin Perinatol 46:. https://doi.org/10.1016/j.semperi.2022.151627
46. Belden L, Kaempf J, Mackley A et al (2025) Evaluating decision regret after extremely preterm birth. Arch Dis Child Fetal Neonatal Ed 110:F191–F199. https://doi.org/10.1136/archdischild-2024-327287
47. De Proost L, de Boer A, Verhagen E et al (2025) Voices of experience: insights from Dutch parents on periviability guidelines and personalisation. Arch Dis Child Fetal Neonatal Ed 110:F165–F170. https://doi.org/10.1136/archdischild-2024-327398