The Mathematics of Morality for Neonatal Resuscitation

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KEYWORDS

• Resuscitation • Neonatal ethics • Neonatal outcomes • Prognostication
• Distributive justice

KEY POINTS

- This article introduces data regarding three separate aspects of the morality of resuscitation for neonatal infants: money, outcomes, and predictive ability.
- There are no credible financial arguments against neonatal ICU (NICU) care for infants born at the border of viability.
- NICU care for extremely low birth weight infants is particularly cost-effective when compared with medical interventions in adults, even when post-NICU care is included in the calculations.
- For parents who view starting NICU intervention as a worthwhile option, counseling about resuscitation as a function of gestational age seems to have limited support from the data.
- Antenatal and delivery room predictions are inadequately accurate, and prediction at the time of discharge is too late. Abnormal head ultrasound and a health care professional's intuition that the child will "die before discharge" may offer a positive predictive value of greater than 95% for the combined outcome of death or survival with neurodevelopmental impairment.

INTRODUCTION

Most neonates do not need resuscitation. A bit of drying, a slap on the butt, and they are good to go. Some neonates unexpectedly need resuscitation. Their antenatal histories yield no hint that at the time of birth they will need extra efforts to get them going. There are almost no ethical dilemmas for these infants. They need resuscitation and they receive it.

However, some babies, predictably, are born at a time when it is not clear whether physicians should offer, perform, deny, or accede to resuscitative efforts. These babies are born extremely prematurely, at the border of neonatal viability.

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Resuscitation of these babies provokes passionate debates and disagreements. This article discusses the data that underlie these debates.

The issues that arise for doctors are different from those facing parents or policy makers. Doctors might want to know the data on the likelihood that resuscitative efforts will be successful. How many infants in similar conditions responded to resuscitative efforts? Of those that survived, how many were in the hospital for months at enormous expense? How many had poor long-term outcomes?

A public policy-maker might want to know how many such babies were born, how much their treatment cost (initially and long-term), and how these expenses compare with other public health expenses, either in children or adults. A public policy-maker might want to know if money spent to prevent preterm birth would lead to lower overall costs.

Parents want to know the answer to only one question, "What will happen to the baby?" It would not help to know that, of 100 similar babies, 50 die and half the survivors have neurocognitive problems. Parents want to know what will happen to their baby and they want to know as early as possible in the baby's treatment course so that they can make the right decision at the right time.

Data are available that speak to the morality of neonatal resuscitation from the perspective of what is sometimes called evidence-based ethics. This article discusses three lines of evidence concerning the morality of neonatal resuscitation: money, outcomes, and predictability.

FINANCIAL CONSIDERATIONS FOR NEONATAL RESUSCITATION

Approximately 4 million babies are born each year in the United States. Approximately 3 million people die. Approximately 1% of 4 million, or 40,000 infants, are born each year weighing less than 1000 g (extremely low birthweight [ELBW], roughly 28 weeks gestation). Of the 4 million births, 0.6% (24,000) die. Half die of complications of prematurity. The other half die of congenital anomalies. Those babies raise a set of complicated issues that are related to, but not identical to, the issues raised by premature babies. This article focuses only on premature babies.

The first financial consideration regarding resuscitation for extremely premature infants is the percentage of neonatal ICU (NICU) resources expended on ELBW infants are devoted to infants who will die in the NICU compared with the resources devoted to infants who will survive to be discharged. **Fig. 1** depicts data from the University of Chicago hospitals.[1,2] At the higher ELBWs (eg, >800 g), mortality is so low (<20%) that most NICU expenses (closely approximated by NICU bed-days) are devoted to infants who survive to discharge.

The surprising feature of **Fig. 1** is that even at the lower end of the ELBW distribution (birthweight 450–600 g) at which survival is less than 50%, most NICU expenses (>80%) are still expended on infants who will survive to discharge, as opposed to those infants who will die in the NICU. This occurs because doomed infants die relatively quickly (median day of death is <7days), because the smallest and the sickest die sooner, and because survivors stay in the NICU for an extended time.

This is not the case in the adult medical ICU (MICU). There, the relationship between ultimate survival and overall cost is the inverse of the relationship that holds in the NICU.[3,4] **Fig. 2** presents comparable data for the NICU and adult MICU, contrasting survival and expenses devoted to nonsurvivors, for patients with low, moderate, or high risk of dying in the hospital. The data are striking. In the NICU, at every risk of death, only a small percentage of resources are expended on doomed infants; most NICU bed-days are occupied by patients who will be discharged, independent of their initial risk of dying.