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Stillbirths and neonatal mortality as outcomes

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Abstract

Several recent studies in low-resource countries have claimed that training in—and increased use of—newborn resuscitation resulted in reduced stillbirth rates. In the present article, we explore the ability of various types of birth attendant in some low-resource country locations to gather data that accurately differentiate a stillbirth from a live birth/early neonatal death. We conclude that, in many situations, it cannot be determined whether the infant was a stillbirth or a live birth/early neonatal death, and therefore the least-biased description of study outcomes includes a combined stillbirth and live birth/neonatal death outcome. However, because defining the burden of stillbirth and neonatal death is important from a public health perspective, every effort should be made, in low-income countries and elsewhere, to distinguish between stillbirths and live births/neonatal deaths and to report the results independently.

Keywords

Perinatal mortality; Resuscitation; Stillbirth

1. Introduction

Several recent studies in low-income countries have reported a reduction in stillbirth rates associated with the introduction of basic newborn resuscitation for asphyxiated neonates [1–5]. However, whether the stillbirth rate was actually reduced is not clear. The International Classification of Diseases defines a stillbirth as an infant after birth that “does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord,

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Conflict of interest

The authors have no conflicts of interest.

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or definite movement of voluntary muscles” [6], and a stillbirth in most high-income countries is defined as a newborn with no heartbeat, respiratory effort, or movement, and with 1- and 5-minute (perhaps even 10-minute) Apgar scores of 0 [7]. A fetus with these findings is clearly stillborn. If breathing, heart rate, and movement are not evaluated immediately after delivery or if Apgar scores are not assigned, it will not be known if the infant was born alive and subsequently died or if the infant was stillborn.

2. The assessment problem

The physiology of birth depression/birth asphyxia contributes to the assessment problem. Infants with primary apnea will have severely depressed breathing but normal–high heart rates and blood pressure [8]. Drying and stimulation, with minimal assistance to ventilation, should be sufficient to achieve a good outcome [9]. If these infants are ignored after birth, they may be erroneously classified as fresh stillbirths (i.e. a stillbirth that probably occurred during labor/delivery) [10]. Infants with secondary apnea and with low heart rates and blood pressure from severe depression are unlikely to resume respiration without skilled intervention, and left unattended they will frequently be classified as stillbirths [11].

Approximately 1 in 10 infants will need assistance with breathing beyond basic resuscitation (warming, drying, and stimulation) [12]. Neonatal resuscitation—in particular, the American Academy of Pediatrics Neonatal Resuscitation Program and the Helping Babies Breathe Program—emphasizes the initiation of bag/mask ventilation by the end of 1 minute for infants who have not established effective respiration on their own after the initial steps of resuscitation [13,14]. In both programs, assessment of heart rate is not performed until after effective bag/mask ventilation has been established. If an infant fails to establish respiration at birth in a high-income country hospital, the delivery team—often consisting of multiple skilled providers—generally begins the steps of basic resuscitation, quickly observes the infant for response, establishes bag/mask ventilation if needed, checks the heart rate, and assigns Apgar scores at 1 and 5 minutes. Because multiple providers may be present for the resuscitation process, several resuscitative steps can be performed simultaneously and before 1 minute, including assessment of heart rate. With the addition of pulse oximetry to stethoscope use and pulse palpation, resuscitation providers now have several avenues for heart rate assessment. If the infant has no heartbeat, respiratory effort, or movement for the entirety of the resuscitation, and has 1-, 5-, and perhaps 10-minute Apgar scores of 0, it is appropriately defined as a stillbirth.

3. Low-income country scenarios

In many low-income countries, the majority of births occur in a home-based setting or at a health clinic [15]. In these settings, the person conducting the delivery is often a traditional birth attendant (TBA) or unskilled birth attendant, and may be the only person present at the birth to care for both the mother and the newborn, in addition to providing resuscitation if needed. Typically, these community birth attendants are poorly educated women who read at a basic level or not at all, are often unable to count numbers, and have rarely used or do not have access to a stethoscope or watch [16]. Several studies have examined the effect of resuscitation training for TBAs on birth outcomes [17–19]. This training emphasizes basic

resuscitation followed by assisted ventilation for infants with few or no respiratory efforts, but heart rate may not be assessed within the first minute of birth. Therefore, while TBAs may be able to mount a successful resuscitation, they often do not have the information to establish whether an infant was alive or stillborn before the resuscitation was started. Studies involving TBAs may be able to show an overall reduction in perinatal mortality (neonatal death plus stillbirth) but not in stillbirth alone.

In another scenario, the person or team responsible for resuscitation in a low-income country hospital may have the skills to determine heart rate and the other variables that distinguish a live birth from a stillbirth. However, in order to provide rapid respiratory support for a non-breathing infant, an assessment of heart rate may not be a priority. Here, too, it will not be known whether the infant was a nonresponsive, non-breathing liveborn with secondary apnea or a stillborn without a heartbeat. If, at any time before 5 minutes, there is a heartbeat or breathing, that infant is not a stillborn. Resuscitation may have saved the newborn's life, but the life saved was that of a liveborn infant.

If resuscitation is delayed by the caregiver trying to decide whether the infant is stillborn or liveborn, and if that delay leads to worse outcomes, initiating resuscitation of a non-breathing, non-macerated infant as quickly as possible is the right course of action from a clinical care perspective. If this is the case, it raises an important question: does classifying the infant as liveborn or stillborn make a difference? We believe that it does. If a study has either stillbirth or early neonatal death as a primary outcome, unintended biases may be introduced by the classification because these are competing outcomes. This is especially true when a study intervention, such as resuscitation, may influence the classification of the outcome. Thus, we believe that studies evaluating interventions around the time of birth should not evaluate these outcomes independently. Because, in many situations, it cannot be determined whether the infant is a stillbirth or a live birth/neonatal death, the least biased description of a trial outcome should include a combined stillbirth and live birth/neonatal death outcome.

4. An intrapartum fetal death/early neonatal mortality indicator

In part because distinguishing between stillbirth and live birth/early neonatal death is often difficult in low-income settings, Fauveau [19] described an indicator to determine in-hospital perinatal mortality that would reveal the percentage of deaths likely to be preventable by appropriate obstetric and neonatal care, focusing on infants weighing 2500 g or more. This indicator determines which fetuses are alive at time of admission for delivery [20]. The fetuses with detectable heart tones at admission—best estimated using a doppler—are the denominator for infants at risk, and infants delivered and discharged alive are the numerator [20]. Fetal deaths occurring prior to admission or neonatal deaths occurring after discharge, neither of which should be preventable by an in-hospital intervention, are excluded from this measure. For this indicator, live births followed by early neonatal death do not need to be distinguished from stillbirths.

5. Conclusion

In summary, we believe that distinguishing between a stillbirth and a live birth resulting in early neonatal death is difficult, especially for community health workers with limited resources. Therefore, a measure that includes both fetal and neonatal deaths, such as perinatal mortality—or, better still, the Fauveau indicator [19]—would be more appropriate for evaluating interventions in low-income countries aimed at reducing fetal or neonatal mortality around the time of birth. However, because defining the burden of stillbirth and neonatal death is important from a public health perspective, every effort should be made, in low-income countries and elsewhere, to distinguish between stillbirths and live births/neonatal deaths and to report the results independently.

References

1. Langli Ersdal H, Mduma E, Svensen E, Sundby J, Perlman J. Intermittent detection of fetal heart rate abnormalities identify infants at greatest risk for fresh stillbirths, birth asphyxia, neonatal resuscitation, and early neonatal deaths in a limited-resource setting: a prospective descriptive observational study at Haydom Lutheran Hospital. *Neonatology*. 2012; 102(3):235–42. [PubMed: 22907583]
2. Jain L, Ferre C, Vidyasagar D, Nath S, Sheftel D. Cardiopulmonary resuscitation of apparently stillborn infants: survival and long-term outcome. *J Pediatr*. 1991; 118(5):778–82. [PubMed: 2019934]
3. Carlo WA, Goudar SS, Jehan I, Chomba E, Tshefu A, Garces A, et al. Newborn-care training and perinatal mortality in developing countries. *N Engl J Med*. 2010; 362(7):614–23. [PubMed: 20164485]
4. Goudar SS, Somannavar MS, Clark R, Lockyer JM, Revankar AP, Fidler HM, et al. Stillbirth and newborn mortality in India after helping babies breathe training. *Pediatrics*. 2013; 131(2):e344–52. [PubMed: 23339215]
5. Xu T, Wang HS, Ye HM, Yu RJ, Huang XH, Wang DH, et al. Impact of a nationwide training program for neonatal resuscitation in China. *Chin Med J (Engl)*. 2012; 125(8):1448–56. [PubMed: 22613652]
6. World Health Organization. ICD-10: International statistical classification of diseases and related health problems. 10th Revision. 2http://www.who.int/classifications/icd/ICD-10_2nd_ed_volume2.pdf. Published 2004
7. Flenady V, Middleton P, Smith GC, Duke W, Erwich JJ, Khong TY, et al. Stillbirths: the way forward in high-income countries. *Lancet*. 2011; 377(9778):1703–17. [PubMed: 21496907]
8. Wall SN, Lee AC, Carlo W, Goldenberg R, Niermeyer S, Darmstadt GL, et al. Reducing intrapartum-related neonatal deaths in low- and middle-income countries-what works? *Semin Perinatol*. 2010; 34(6):395–407. [PubMed: 21094414]
9. Frøen JF, Gordijn SJ, Abdel-Aleem H, Bergsjø P, Betran A, Duke CW, et al. Making stillbirths count, making numbers talk - issues in data collection for stillbirths. *BMC Pregnancy Childbirth*. 2009; 9:58. [PubMed: 20017922]
10. Lee AC, Cousens S, Wall SN, Niermeyer S, Darmstadt GL, Carlo WA, et al. Neonatal resuscitation and immediate newborn assessment and stimulation for the prevention of neonatal deaths: a systematic review, meta-analysis and Delphi estimation of mortality effect. *BMC Public Health*. 2011; 11 (Suppl 3):S12. [PubMed: 21501429]
11. Kattwinkel, J. Neonatal Resuscitation Textbook. 5. Elk Grove Village, IL: American Academy of Pediatrics, American Heart Association; 2006.
12. Singhal N, Lockyer J, Fidler H, Keenan W, Little G, Bucher S, et al. Helping Babies Breathe: global neonatal resuscitation program development and formative educational evaluation. *Resuscitation*. 2012; 83(1):90–6. [PubMed: 21763669]

13. Zaichkin J, Weiner GM. Neonatal Resuscitation Program (NRP) 2011: new science, new strategies. *Adv Neonatal Care*. 2011; 11(1):43–51. [PubMed: 21285656]
14. Darmstadt GL, Lee AC, Cousens S, Sibley L, Bhutta ZA, Donnay F, et al. 60 Million non-facility births: who can deliver in community settings to reduce intrapartum-related deaths? *Int J Gynecol Obstet*. 2009; 107 (Suppl 1):S89–112.
15. Garces A, McClure EM, Chomba E, Patel A, Pasha O, Tshetu A, et al. Home birth attendants in low income countries: who are they and what do they do? *BMC Pregnancy Childbirth*. 2012; 12:34. [PubMed: 22583622]
16. Sibley LM, Sipe TA, Barry D. Traditional birth attendant training for improving health behaviours and pregnancy outcomes. *Cochrane Database Syst Rev*. 2012; 8:CD005460. [PubMed: 22895949]
17. Neonatal Mortality Formative Research Working Group. Developing community-based intervention strategies to save newborn lives: lessons learned from formative research in five countries. *J Perinatol*. 2008; 28 (Suppl 2):S2–8.
18. Gill CJ, Guerina NG, Mulenga C, Knapp AB, Mazala G, Hamer DH. Training Zambian traditional birth attendants to reduce neonatal mortality in the Lufwanyama Neonatal Survival Project (LUNESP). *Int J Gynecol Obstet*. 2012; 118(1):77–82.
19. Fauveau V. New indicator of quality of emergency obstetric and newborn care. *Lancet*. 2007; 370(9595):1310. [PubMed: 17933644]
20. Goldenberg RL, McClure EM, Kodkany B, Wembodinga G, Pasha O, Esamai F, et al. A multi-country study of the “intrapartum stillbirth and early neonatal death indicator” in hospitals in low-resource settings. *Int J Gynecol Obstet*. 2013; 122(3):230–3.

Synopsis

In low-resource countries, assessment of perinatal mortality rather than stillbirth may decrease bias of outcomes caused by early newborn interventions.

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