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Global gains after *Helping Babies Breathe*

Implementation of basic neonatal resuscitation in low- and middle-income settings consistently results in lives saved on the day of birth. Wrammert et al. explore the causes and timing of newborn deaths in a large maternity facility in Nepal before and after the introduction of basic newborn resuscitation through *Helping Babies Breathe (HBB)*, implemented along with quality improvement cycles aimed at changing providers' practice (1). The intervention resulted in significant decrease in fresh stillbirth, all-cause mortality within 24 hours of birth and cause-specific mortality due to intrapartum-related events through discharge or 28 days. However, overall mortality to discharge did not significantly change, remaining around 12 per 1000 live births. Deaths from prematurity were postponed, but rates of survival for prematurity, infection and congenital anomalies were unchanged.

Reductions in fresh stillbirth and first-day neonatal deaths with resuscitation open the potential for improved long-term survival. However, many implementation trials have reported only immediate outcomes or shown results similar to those in this study, with no change in overall 28-day neonatal mortality or perinatal mortality. Introduction of HBB in eight high-volume Tanzanian hospitals showed a significant reduction in fresh stillbirth (19 to 14.4/1000 births, RR 0.76; 95% CI 0.64–0.98) and deaths in the first 24 hours (13.4 to 7.1/1000 live births, RR 0.53; 95% CI 0.43–0.65) with corresponding decrease in asphyxia-related mortality (2). Follow-up to 7 and 28 days was not available. Subsequent observations in one of the Tanzanian hospitals substantiate that babies not breathing and not moving at birth are often classified as fresh stillbirths, when in fact a heart rate is present and basic neonatal resuscitation – drying, clearing the airway as needed, specific stimulation to breathe and bag-and-mask ventilation with air as necessary – effectively reverses apnoea. Babies with deeper cardiorespiratory depression either do not respond or require additional support beyond resuscitation to survive (Ersdal HL personal communication). Implementation of HBB in 12 primary health centres, rural district hospitals and urban hospitals in Karnataka, India showed similar reduction in fresh stillbirth from 17 to 9/1000 births (OR 0.54, 95% CI 0.37–0.78) and unchanged predischarge mortality of 0.1%. A population-based Maternal and Newborn Health Registry system permitted follow-up through 28 days and showed that neonatal mortality was unchanged (18/1000 live births pre and 19/1000 post, OR 1.09, 95% CI 0.80–1.47). Preterm/low birth weight accounted for the largest proportion of neonatal deaths (47.9 and 42.7% pre and post), followed by birth asphyxia (30.1 and 28.2% pre and post); neonatal deaths attributed to infection rose from 6.6 to 13.6% ($p \leq 0.001$). Again, resuscitation training improved recognition that not

all infants who fail to breathe are stillborn and reduced predischarge deaths from asphyxia (3). The stable neonatal mortality rate suggested that resuscitation did not simply defer death. A recent pre–post study of scale-up of HBB training in 71 rural and semi-urban facilities in India and Kenya showed a differential effect on stillbirth and perinatal death (fresh stillbirths and neonatal deaths within 7 days) by initial level of mortality. Significant reductions occurred in one geographic cluster of facilities with high mortality both for stillbirths (25.7 to 16.4/1000 births; estimated mean difference 11.27, 95% CI 0.95, 21.59, $p = 0.03$) and perinatal deaths (38.5 to 28.2/1000 births; estimated mean difference 11.71, 95% CI 0.39, 23.03, $p = 0.04$). In facilities with lower baseline rates of stillbirth (7.7–11.6/1000 births) and perinatal death (10.0–25.5/1000 births), there was no significant reduction post scale-up of resuscitation (4). In a post hoc analysis stratified by birthweight, the rates for LBW (<2500 g) fresh stillbirths, early neonatal deaths and perinatal deaths did decrease at one of these sites. Thus, basic neonatal resuscitation can reduce the proportion of newborns classified as fresh stillbirths without increasing neonatal mortality. Basic resuscitation consistently decreases deaths in the first 24 hours, but additional measures are needed to sustain those gains.

Much as basic neonatal resuscitation can save lives on the day of birth, Essential Newborn Care can help preserve the gains in survival through the first days and weeks of life. All babies need early assessment (weight, temperature and physical exam) to determine whether they can receive routine care or need special support. All babies need protection from hypothermia, adequate feeding and prevention or recognition/treatment of infection. Hypothermia is under-recognised, prevalent in both hot and cold climates, present in facilities and the community and strongly linked to neonatal mortality in a dose–response relationship (5). Coverage of essential newborn care practices, with the exception of breastfeeding, remains very low (under 25%) in the 75 countries monitored in the Countdown to the 2015 for the Millennium Development Goals (6). Implementation of training packages in Essential Newborn Care has produced

significant decreases in early neonatal mortality in facilities (7,8). Even in first-level facilities, skin-to-skin care immediately after birth can provide thermal support, cup feeding of breast milk can supplement direct breastfeeding, handwashing and good hygiene can be practised, and signs of infection can be recognised and treatment initiated. Basic equipment and supplies must be available, but more than technological interventions, the process of initial assessment, formulation of a plan of care, and repeated assessment avoids common complications. The successes (and failures) of neonatal resuscitation often catalyse further efforts to improve intrapartum care and avoid hypoxic-ischaemic injury and to extend essential newborn care practices and monitoring into households and communities. Basic interventions that link antenatal care, skilled birth attendance, and postnatal care across time (prepregnancy to birth and infancy) and space (community and household to ambulatory and inpatient facility) are the packages that demonstrate significant reductions in neonatal and perinatal mortality risks (9).

Building on a solid foundation of basic resuscitation and Essential Newborn Care, the next phase in ending preventable newborn death involves more specialised inpatient care of newborns. Global neonatal mortality currently averages approximately 19/1000 live births. Historical data from the decades of the 20th century when neonatal mortality first fell below this level suggest that further global reductions will depend upon more sophisticated obstetrical care (risk assessment and transport, antenatal steroids and improved foetal monitoring) and individualised neonatal care with emphasis on small and sick newborns. Respiratory support with supplemental oxygen, thermal support with kangaroo mother care, nasogastric feeding of breast milk and heightened infection prevention/treatment for more vulnerable infants are core functions that can improve survival without full neonatal intensive care. However, specialised newborn care also carries risks of unintended harm: lung injury and retinopathy of prematurity from inadequately regulated oxygen use, hyperthermia/hypothermia from lack of continuous temperature monitoring with radiant warmers or incubators, inadequate nutrition or unsafe substitutes for breastmilk, and nosocomial infection from crowding and insufficient hygiene (10). These gaps in care result not only in morbidity, but also mortality – especially from prematurity/low birth weight and infection in the first week and month after birth. Moving towards the Every Newborn Action Plan goals of national stillbirth and neonatal mortality rates ≤10/1000 births by 2035 will require maturing health systems with adequate infrastructure (physical facilities, water and electricity), information systems, staffing, training, equipment and transport/referral, as well as an intensified focus on quality of maternal and newborn care (11,12). Governments, global health organisations, donors, academic and professional organisations are now focusing on solidifying the foundation of basic resuscitation and essential newborn care and moving forward with high-quality specialised newborn care as the path to maintain and improve the gains in neonatal survival.

The views and opinions expressed in this paper are those of the author and not necessarily the views and opinions of the United States Agency for International Development.

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