Attaining Sustainable Development Goal for Newborn Survival: Reinforcing Postnatal Interventions

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ABSTRACT

Under the sustainable development goals (SDG), the target for neonatal mortality rate (NMR) was proposed to be less than 12 per 1000 live births by 2030 and may not meet the SDG 2030 NMR target. It may be prudent to focus on moderately low birth weight babies, 1500-2499 g, to reach the goal. This category of babies constitutes 37% of newborn deaths. They need supervised care for a short period that consists of the provision of warmth and breastfeeding with or without antibiotic therapy, and with or without oxygen administration. Despite knowing that these interventions can reduce neonatal deaths, deficiencies in how to implement these measures may be making all the difference to the expected outcome.

This paper suggests possible ways to enhance the effectiveness of some of the better-known interventions such as the provision of warmth, feeding, resuscitation, oxygen administration, delivery of continuous positive airway support, and antibiotic therapy.

Keywords: Development goal, low-cost newborn care, low birth weight babies, neonatal mortality, sustainable, thermal control in newborn.

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I. Introduction

In 2015, agenda was set for the Sustainable Development Goals (SDG) under which the target set for the neonatal mortality rate was less than 12 deaths per 1000 live births by 2030 [1]. There are sixty countries that are likely to miss the target [2].

A study conducted in five low and one middle- income countries (LMIC) revealed that 37% of neonatal deaths occurred among babies with birthweights between 1,500 and 2499 g, while 21% of all deaths occurred in the 33–36 weeks gestational age group [3]. Therefore, the focus of interventions to reduce NMR should be on this category of babies. There are 16 interventions-preconception, antenatal, intrapartum, and postnatal- that are expected to enhance neonatal survival. These interventions have potential to lower NMR by 41-72% neonatal deaths. The Table I presents them in a modified form and Table II gives the basis for grading the evidence. The reduction in neonatal deaths by individual intervention is expected to be as follows: Generally accepted evidence-based interventions and reduction in percent deaths at home or a facility include resuscitation of an asphyxiated baby -6 to 42%, promotion of breastfeeding -55 to 87%, keeping babies warm – 18 to 42% and use of antibiotics for pneumonia/sepsis-18-35% [4]. As a part of a bundled approach, oxygen use substantially enhanced survival in a facility-based study [5].

However, for many interventions, an absence of evidence should not be misconstrued as evidence of absence [6]. Adequately powered, well designed randomized controlled trials (RCTs) are the gold standard for clinical research.

However, conducting large definitive RCTs is difficult in resource limited set ups. The current hierarchical system for grading evidence is therefore not expected to give adequate weightage to evidence from non-RTCs [7], [8]. In absence of evidence from RCTs, it is important to consider evidence from non-RCTs reporting consistent benefits for newborn survival.

Despite knowing what interventions can reduce neonatal deaths, deficiencies in how to implement these measures may be making all the difference to the expected outcome, and the actual outcome. The service delivery modes for neonatal health interventions may matter more. This commentary suggests possible ways to enhance the effectiveness of some of the better-known interventions such as the provision of warmth, feeding, resuscitation, oxygen administration, and delivery of continuous positive airway support (CPAP) In India.

TABLE I: EVIDENCE OF EFFICACY FOR INTERVENTIONS DURING
POSTNATAL PERIOD

Intervention	Evidence Category	Reduction (%) neonatal mortality/morbidity
Resuscitation of a newborn baby	IV	6-42 %
Breastfeeding	V	55-87 %
Prevention and management of hypothermia	IV	18-42 %
Kangaroo mother care	IV	51 % (7-75 %) **
Community-based pneumonia case	V	27 % (18-35%)

^{**}Incidence of infections among low birthweight infants in health facilities.

TABLE II: CATEGORIZATION OF THE EVIDENCE		
I	Evidence of no benefits	
II	No evidence of benefit	
III	Uncertain evidence of benefit	
IV	Evidence of efficacy	
V	Evidence of efficacy and effectiveness	

A. Provision of Warmth: Need to Offer More Options

In low-resource settings such as India, hypothermia in newborns is an important cause of neonatal morbidity and mortality. Prevalence of hypothermia ranges from 32% to 85% in the hospitals and 11% to 92% at home-setting [9]. A wider variety of options for keeping infants warm need to be offered, allowing field workers, to choose the most feasible option in their context. Alternatives besides KMC on the one hand and radiant warmers/incubators, on the other hand, need to be explored. In a home-setting, kangaroo mother care (KMC) [10], plastic wrap [11], a Styrofoam box [12], and a warm room (WR) are the available choices. In a facility, they are KMC and WR [13]. The WR is a form of space heating and is typically a room that is set apart and kept sufficiently heated to meet the needs of preterm and sick babies; it could also be a small portion of a larger room with a protective barrier to retain heat. This can be achieved by electrical or solar heaters. Plastic materials used for wrapping included a transparent polythene sheet or, shopping bags. Plastic materials are affordable and ubiquitous globally. A different option for keeping babies warm, although relatively expensive, is a heated, water-filled mattress consisting of a polyvinyl chloride bag filled with 10 liters of water where the mattress is heated by a pad that includes a heated coil [14]. A Styrofoam box is another low-cost option that may be used as a home or transport incubator and may complement KMC as a home incubator.

B. Feeding in the First Few Days of Life: The Place for Complementary Feeding

If feeding relies solely on breast milk, a preterm/low birth weight baby may develop hypoglycemia in the first 2-3 days of life. Breastfeeding-friendly interventions such as dextrose gel prevent hypoglycemia [15] when affordable. In homesetting of low resource areas boiled cane sugar water or fresh animal milk may be the only available options, alongside intensive breastfeeding efforts and support [16]. At a busy community hospital, feeding donor human milk may be possible [17]. For feeding a baby, at home, a small spoon, and at a health facility, an orogastric tube is advisable. A preceding sucking effort at the breast is desirable so that a baby receives colostrum. In a hospital setting, orogastric tubes are preferable in low-birth-weight babies. There is hesitation on the part of nurses, without pediatric training, to nasogastric placement [18], [19]. Besides, a significant pulmonary compromise occurs with nasogastric insertion [20].

C. Resuscitation of the Newborn: The Place for Mouth-to-Mouth Breathing

Mouth-to-mouth breathing, in the present-day era, may sound a regressive suggestion. Unfortunately, there may be no option in case of home deliveries conducted by the traditional birth attendants and the relatives of the mother. In such a scenario, mouth-to-mouth breathing may be the only

available option. In one study from India, traditional birth attendants were successfully trained in essential newborn care, including mouth-to-mouth resuscitation of babies, not breathing [21], [22]. At the start of the program, the perinatal mortality rate was 75 per 1000 live births, and this declined to 29 per 1000 live births after three years. However, the effect of resuscitation training may not be isolated, as other interventions such as thermal protection was delivered simultaneously. It is challenging to get breathing bags of reasonable quality in large numbers and to impart training to such a vast number of trainees. Therefore, the WHO guide recommends that "every birth attendant should be trained in mouth-to-mouth ventilation in case there is no equipment or equipment fails" [23]. The most effective strategy may vary by setting and the cadres available. Therefore, the use of a bag may not be always the best option in home-setting in most of the situations. According to an estimate that a birth attendant attends 20 births a year, and one of them may need resuscitation [24]. It may be challenging to retain the skills of bag-mask ventilation, even if trained, with a low utilization rate (approximately 1–2 uses per year). Many studies have shown that community health workers can contribute to reduction in neonatal deaths by performing resuscitation with an estimated effect of a 20% reduction in intrapartum-related neonatal deaths, which in most cases may mean only stimulation that occurs during drying and rubbing [24].

D. The Widespread Availability of Oxygen: The Place for Industrial Oxygen and Low Flow Delivery?

Extensive use of oxygen and CPAP was associated with the most significant decline in mortality due to respiratory distress [25]. These two interventions can reduce neonatal deaths in low-resource settings, with an appropriate supportive infrastructure and general newborn care. With industrialization in countries such as India, oxygen availability is improving beyond metropolitan cities as well. Industrial oxygen may complement medical oxygen to facilitate the use of oxygen therapy. The method of oxygen extraction from the atmosphere is common to both. Besides, industrial oxygen is less expensive, and purity is no concern (suppl. 1).

Low-flow delivery of oxygen: Oxygen is a scarce commodity and expensive too. Therefore, low-flow methods of its delivery may be preferred [26]. Headbox oxygen (HBO) is wasteful and nasal prongs are expensive. Nasopharyngeal (NP) catheter tends to stimulate mucus secretion, causing a nasal obstruction that may be fatal at times [27]. Oropharyngeal delivery of oxygen to children may be a suitable option to overcome this problem [28]. Extensive clinical trials, however, are necessary to confirm its effectiveness [29]. Intranasal oxygen using a nasal catheter may be a user-friendly option in some settings. A thin, flexible tube may be passed through the nose with its tip in the nasal cavity. Nasal catheters are usually well-tolerated, and they are unlikely to be dislodged [27]. However, nasal catheters, too, may require frequent cleaning.

E. Continuous Positive Airways Pressure Delivery: Place for Home-made Devices

In developed countries, CPAP is administered by conventional mechanical ventilators or mechanized bubble-CPAP units. A country like India may find the mechanized

bubble-CPAP units to be expensive.

A vigorous exploration of the place of locally assembled inexpensive CPAP units is essential for reliability and safety before recommending its widespread use. One clinical trial used a humidified gas source as the pressure-generating system consisting of a bottle containing 6-8 cm water and binasal prongs as a patient interface [30]. An air pump, readily available at a pet shop for pumping air in a fish tank, is introduced in the CPAP circuit to deliver pressurized air via a T-piece. The second end of the T piece receives humidified oxygen. Thus, an air-oxygen mix generates CPAP [31]. The unit costs INR 300 (USD 4.5).

F. Antimicrobial Therapy: Place for Oral Medications

In a study conducted in India, cotrimoxazole and gentamicin were used for the treatment of sepsis suspected by clinical algorithm [32]. The treatment resulted in a 76% reduction in the neonatal mortality caused by sepsis. The studies to ascertain causes of death in newborns are scarce in LMIC. The safety profile of second-generation cephalosporins is good and their spectrum of activity is like cotrimoxazole. They may be even useful in the situations of cotrimoxazole-resistant pneumococci [33]. It is increasingly recognized that ciprofloxacin is safe in newborns. Its liquid formulations can facilitate the use.

In summary, the paper stresses the need to make efforts to lower mortality among babies with birthweights between 1,500 and 2499 g to attain neonatal mortality target of as low as 12 deaths per 1,000 live births by 2030. The well-identified postnatal interventions need to be reinforced. For example, for providing warmth more options should be explored, early complementary feeds may be needed to prevent hypoglycemia, mouth-to-mouth breathing has a place for resuscitation when that is the only available option, to ensure widespread availability of oxygen, the industrial oxygen may complement the medical oxygen, low-flow delivery of oxygen should be popularized to save oxygen, locally assembled inexpensive CPAP units should be developed, and oral antimicrobial therapy needs to be encouraged.

PATIENT AND PUBLIC INVOLVEMENT STATEMENT Patients were not involved in the study.

ETHICS APPROVAL

Not applicable (This is not an original study. In this commentary, the studies from literature are simply quoted).

CONSENT TO PARTICIPATE

Not applicable (This is not an original study. In this commentary, the studies from literature are simply referred to).

CONSENT FOR PUBLICATION Not applicable, no personal data used.

AVAILABILITY OF DATA AND MATERIAL

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

AUTHORS' CONTRIBUTIONS

SD, the sole author, conceptualized the idea and wrote the manuscript.

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REFERENCES

- World Health Organization. Newborns: reducing mortality. [Internet] 28, 2018]; September Available https://www.who.int/news-room/fact-sheets/detail/newbornsreducing-mortality.
- Dandona R, Kumar GA, Henry NJ, Joshua V, Ramji S, Gupta SS, et al. Subnational mapping of under-5 and neonatal mortality trends in India: The Global Burden of Disease Study 2000-17. The Lancet. 2020; 395(10237): 1640-1658.
- Belizán JM, McClure EM, Goudar SS, Pasha O, Fabian EF, Patel A, et al. Neonatal death in low- to middle-income countries: a global network study. American Journal of Perinatology. 2012; 29(08): 649-
- [4] Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L, Lancet Neonatal Survival Steering Team. Evidence-based, costeffective interventions: how many newborn babies can we save? Lancet. 2005; 365(9463): 977-88.
- Daga S, Daga A, Mhatre S, Ghane V. Enhancing neonatal survival: what can we do today? Journal of Perinatology. 2016; 36(8): 681-684.
- Anderson P. Absence of evidence is not evidence of absence. BMJ. 2004; 328 (7438): 476-477
- Hillier S, Grimmer-Somers K, Merlin T, Middleton P, Salisbury J, Tooher R, et al. FORM: An Australian method for formulating and grading recommendations in evidence-based clinical guidelines. BMC Medical Research Methdology. 2011; 11: 23.
- Barbui C, Dua T, van Ommeren M, Yasamy MT, Fleischmann A, Clark N, et al. Challenges in developing evidence-based recommendations using the GRADE approach: the case of mental, neurological, and substance use disorders. PLoS Medicine. 2010; 7: e1000322
- World Health Organization. Essential newborn care course. [Internet] [cited March 21, 2020]; Available https://www.who.int/maternal child adolescent/documents/newbornc are course/en/doi:
- [10] Lunze K, Bloom DE, Jamison DT, Hamer DH. The global burden of neonatal hypothermia: a systematic review of a major challenge for newborn survival. BMC Medical Research Methodology. 2013; 11: 24.
- [11] Conde-Agudelo A, Díaz-Rossello JL. Kangaroo mother care to reduce morbidity and mortality in low-birth-weight infants. Cochrane Database and System Reviews. 2016; 3: CD002771.
- [12] Li S, Guo P, Zou Q, He F, Xu F, Tan L. Efficacy and safety of plastic wrap for prevention of hypothermia after birth and during nicu in preterm infants: a systematic review and meta-analysis. PLoS One. 2016; 11(6); e0156960.
- [13] Daga S. Reinforcing kangaroo mother care uptake in resource-limited settings. Maternal Health, Neonatology, and Perinatology. 2018; 4: 26.
- [14] World Health Organization. Safe Motherhood. Thermal Control of the Newborn: a practicalguide. [Internet], [cited 2019]; Available from: https://www.who.int/maternal child adolescent/documents/ws42097t
- [15] Sarman I, Tunell R. Providing warmth for preterm babies by a heated, water-filled mattress. Archieves in Disease in Childhood. 1989; 64: 29-
- Cooke RJ, Embleton ND. Feeding issues in preterm infants. Archives of Disease in Childhood-Fetal and Neonatal Edition. 2000; 83: F215-

- [17] Daga SR, Dighole RV, Patil RP. Domiciliary management of very low birth weight babies in rural areas of developing countries. World Health Forum. 1996; 17: 289-290.
- [18] Daga S, Naktode N, Borade A, Gawali S. Introducing donor milk in a neonatal intensive care unit: a developing country's perspective. Indian Journal of Pediatrics. 2016; 83(12): 1514.
- [19] Khalil N. (2017). Impact of implementing an educational program regarding care of nasogastric tube feeding on nurses' knowledge and performance. Journal of Nursing and Health Science. 2017; 6(1): 101-
- [20] Daga SR, Lunkad NG, Daga AS, Ahuja VK. Orogastric versus nasogastric feeding of newborn babies. Tropical Doctor. 1999; 29(4): 242-243.
- [21] Stocks J. Effect of nasogastric tubes on nasal resistance during infancy. Archieves of Disease in Childhood. 1980; 55(1):17-21.
- [22] Daga SR, Daga AS, Dighole RV, Patil RP, Dhinde HL. Rural neonatal care: Dahanu Indian Pediatrics 1992; 29(2): 189-93.
- [23] Daga AS, Daga SR, Dighole RV, Patil RP, Patil MR. Evaluation of a training programme for traditional birth attendants in newborn care. Indian Pediatrics. 1997; 34(11): 1021-1024.
- [24] World Health Organization. Basic Newborn Resuscitation: a practical guide. WHO; Geneva: [Internet] [cited on July 6, 2009]; Available
 - http://www.who.int/reproductivehealth/publications/maternal perinat al_health/MSM_98_1/en/index.html.
- [25] Wall SN, Lee AC, Niermeyer S, English M, Keenan WJ, Carlo W, et al. Neonatal resuscitation in low-resource settings: what, who, and how to overcome challenges to scale up?. International Journal of Gynecology & Obstetrics, 2009; 107(Supplement), S47-S64.
- [26] Beena DK, MacGuire ER, McClure EM, Goldenberg RL, Jobe AH. Neonatal mortality from respiratory distress syndrome: lessons for lowresource countries. Pediatrics. 2011; 127(6): 1139-1146.
- [27] Frey B, Shann F. Oxygen administration in infants. Archives of Disease in Childhood-Fetal and Neonatal Edition. 2003; 88: F84-F88.
- [28] Daga SR, Verma B, Gosavi DV. Oropharyngeal delivery of oxygen to children. Tropical Doctor. 1999; 29: 98-99.
- [29] Wilkinson DA. Methods of oxygen delivery in children: which is best? (editorial) Tropical Doctor. 1999; 29:65.
- [30] Daga S, Mhatre S, Borhade A, Khan D. Home-made continuous positive airways pressure device may reduce mortality in neonates with respiratory distress in low-resource setting. Journal of Tropical Pediatrics. 2014; 60: 343-47.
- [31] Daga S, Joshi H, Gunjal P, Mhatre S. An innovative air-oxygen blender for continuous positive airway pressure support in resource-poor locations: a feasibility study. Journal of Tropical Pediatrics. 2016; 63(4): 269-273.
- [32] Bang AT, Bang RA, Stoll BJ, Baitule SB, Reddy HM, et al. Is homebased diagnosis and treatment of neonatal sepsis feasible and effective? Seven years of intervention in the Gadchiroli field trial (1996 to 2003). Journal of Perinatology. 2005; 25(1): S62-S71.
- [33] Darmstadt GL, Batra M, Zaidi AKM. Oral antibiotics in the management of serious neonatal bacterial infections in developing country communities. Pediatric Infectious Disease Journal. 2009; 28: S31-S36.