



Care of Healthy as well as Sick Newborns in India: A Narrative Review

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Abstract

Majority of neonatal deaths occur in developing countries. There is an increase in the proportion of neonatal deaths as part of the under-5 mortality over the past decade. Hence we need to accelerate further to achieve the goal of single digit neonatal mortality rate (NMR) by 2030. The two major arms of NMR reduction include facility-based neonatal care (FBNC) and home-based neonatal care (HBNC). FBNC addresses care at birth, care of the normal newborn, and care of small and sick newborns. HBNC provides continuum of care for newborn and post-natal mothers facilitated by Accredited Social Health Activist (ASHA) workers. One of the main challenges is to maintain good quality of neonatal care. Zero separation, linkage of community & facility and roles of professional bodies are considered way forward to achieve India Newborn Action Plan (INAP) goals. This review summarizes existing programs for newborn health and diseases and provides an over-arching view of the way-forward.

Keywords Newborn · Health · Mortality · India · HBNC · FBNC

Introduction

The world saw an estimated 2.3 million newborn babies die in 2021. The proportion of neonatal deaths as a share of under-5 deaths has increased from 41% in 2000 to 46% in 2021. Approximately 80% of these, are low birth weight (LBW) neonates and two-thirds are born prematurely [1]. Though India is still the major contributor to these deaths, however; a significant reduction over two decades in neonatal mortality rate in India from 44.7 (42.2–47.3) per 1000 live births in 2000 to 19.1 (17.1–21.4) per 1000 live births in 2021 [2] has been observed. The major causes of newborn deaths in India are elucidated in Fig. 1.

The survival of a child cannot be addressed in isolation, since it is closely tied to the mother's health. All national programs adhere to the continuum of care idea, which focuses care during crucial life stages to improve child survival. The provision of newborn care at several levels of health facilities – facility-based newborn care (FBNC) and essential services at home, through community outreach – home-based newborn care (HBNC) are two strategic

pillars on which newborn care is built in India (Fig. 2). Increased coverage of FBNC and improved HBNC have put India on the road to achieve India Newborn Action Plan (INAP) targets [6]. This manuscript aims to summarise the major contributors to decline in neonatal mortality in India and analyse the challenges and way forward.

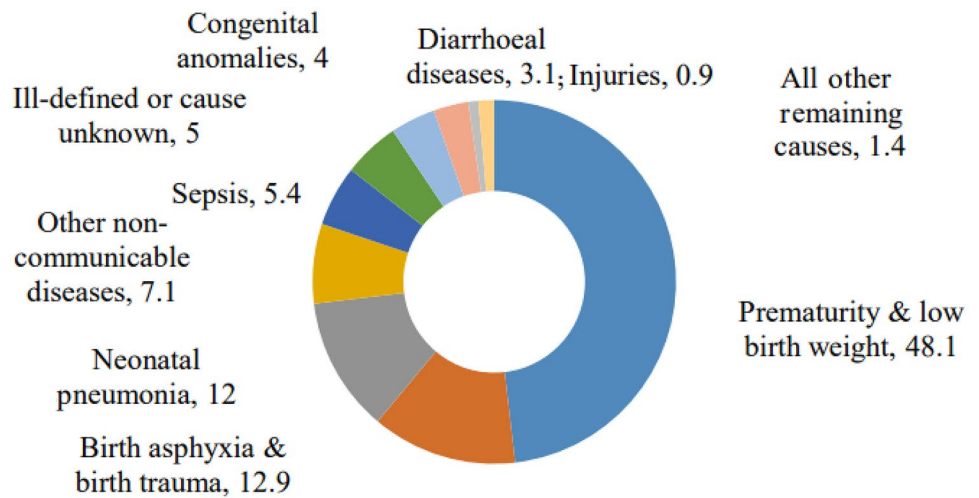
India Newborn Action Plan

The World Health Organization launched a venture in 2014 known as "Every newborn action plan (ENAP)" which was in alignment with the global strategy for Women & Children's health to focus on the quality of care at birth which would save millions of lives [7]. The action plan was launched with a vision to end all preventable neonatal deaths and ensure that infants and children survive and thrive and grow up to achieve their maximum potential [8]. India has adapted ENAP to INAP with the goal to attain a single-digit neonatal mortality rate by 2030 by ending all preventable neonatal deaths and individual states to achieve this target by 2035 [9]. Under the 6 pillars listed in INAP, programs have been conceived and successfully implemented (Table 1). Through INAP it was found that 83% of the districts in India have at least one Special newborn care unit (SNCU). Neonatal

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Fig. 1 Causes of neonatal mortality (%) in India



mortality was reduced by 60% from 1990 (57 /1000 live births to 33) and a 30% reduction from 2010 to 2018 (33 /1000 live births to 23). Currently, India has achieved three of the four ENAP coverage targets for 2025 i.e., 80% coverage of skilled birth attendant (SBA) at delivery, >60% coverage for postnatal care within 2 d for mother and baby, and >80% SNCU coverage [6].

In India, the newborn health initiatives received emphasis in the year 2005 under the Reproductive maternal newborn child & adolescent health (RMNCH+A) program under the National Health Mission (NHM) and included several programs aimed at improving newborn care (Table 2) [11]. Care for the newborn was envisaged at various levels under the facility-based newborn care program.

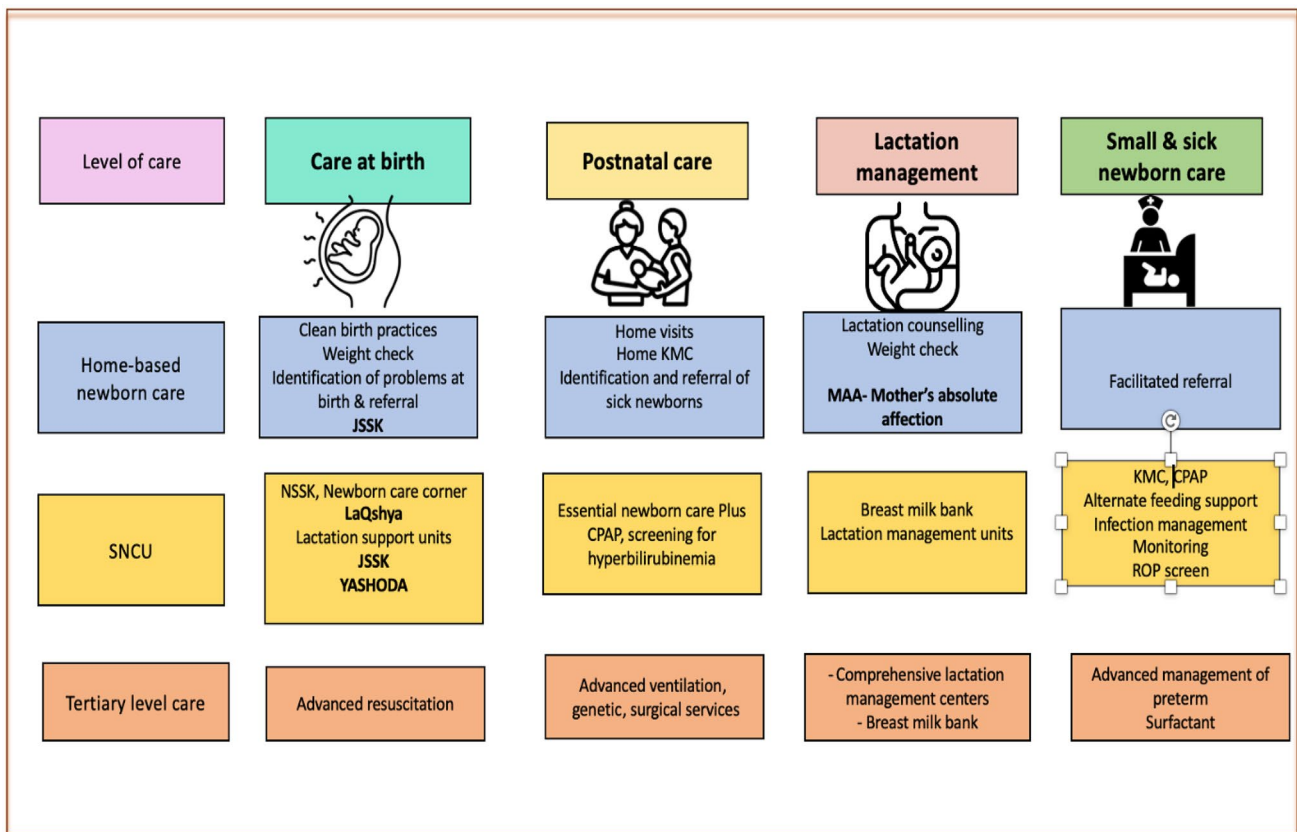


Fig. 2 Newborn care at different levels [3–5]. CPAP Continuous positive airway pressure, JSSK Janani Shishu Suraksha Karyakram, KMC Kangaroo mother care, LaQshya Labor room & quality improvement

initiative, NSSK Navajaat Shishu Suraksha Karyakram, ROP Retinopathy of prematurity, SNCU Special newborn care unit

Table 1 India Newborn Action Plan [9]

Pillar	Program	Gist of goals
1. Pre-conception and antenatal care	Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA)	Launched in June 2016. It is for free of cost assured and quality antenatal care to all pregnant women
	Anemia Mukht Bharat (AMB) strategy	This program aims to reduce anemia amongst young children, adolescents, and women
	Rastriya Kishor Swasthya Karyakram (RKSK)	This program focuses on adolescent reproductive health
2. Care during labor & childbirth	Pradhan Mantri Matru Vandana Yojana	This scheme provides cash transfers for first pregnancy
	Labour room Quality Improvement Initiative (LaQshya) (2017)	Assess, identify, and correct gaps in quality of care during labor and immediate post-partum
	Midwifery	Training of midwives at all high case load delivery points
	Dakshata	It includes a 3-d training capsule for building skills of healthcare workers
3. Immediate newborn care	JSY & JSSK	Elucidated in Table 2
	Newborn care corner (NBCC)	20,337 NBCC are operationalized and provide essential newborn care at birth
	Navajaat Shishu Suraksha Karyakram (NSSK)	Elucidated above
4. Care of healthy newborn	Universal immunization program	Immunization of newborns and infants
	Mother's Absolute Affection (MAA)	Promotion of breastfeeding through IEC campaign
5. Care of small and sick newborn	Home based newborn care	Early identification and referral of newborns
	Newborn stabilization unit	Basic care and pre-referral stabilization
6. Care beyond survival	Special newborn care unit	894 SNCU have been established with 12 lakh annual admissions
	RBSK	Elucidated above. Includes ROP
	Follow-up of high-risk infants	It is done by ASHA in community
	Home based care of young child	To improve nutrition and health of young child (<15 mo) for proper growth & development

Facility-Based Newborn Care

The Lancet survival series has estimated that health-facility based interventions can reduce neonatal mortality by as much as 23-50% [12]. Facility-based newborn care (FBNC

services at different levels of healthcare facilities) is one of the key strategies adopted by the Ministry of Health and Family Welfare, Government of India (MoHFW, GoI) under the NHM and Reproductive Child Health II (RCH II) to improve the status of newborn health in the country. While,

Table 2 National programs for newborn care

Name of program	Year	Gist of program strategy
Janani Suraksha Yojana (JSY) [9]	2005	Vision of increasing institutional deliveries through demand side financing
Integrated management of childhood illness (IMNCI) & Facility based- Integrated management of childhood illness (F-IMNCI) [9]	2007	Simple & standardised triage and treatment of neonatal & childhood illnesses in the community and facility
Navajaat Shishu Suraksha Karyakram (NSSK) [3]	2009	Basic neonatal resuscitation training program
Janani Shishu Suraksha Karyakram (JSSK)	2011	Provision of free healthcare for maternal and infant problems
Facility based neonatal care & Home-based neonatal care [4, 5]	2011	Simple algorithms for management of neonatal illnesses. Establishment of Special newborn care units (SNCU)
Rastriya Bal Swasthya Karyakram	2013	Early identification and treatment of children with defects, deficiency, development delays
Mother's Absolute Affection (MAA)	2016	Focuses on promotion of optimum infant feeding practices including early initiation of breastfeeding
Labor room & quality improvement initiative (LaQshya) [10]	2017	Labour room quality initiative
Surakshit Matritva Aashwasan (SUMAN)	2019	Respectful and quality healthcare and zero tolerance to denial services to every woman and newborn
MusQan	2021	Quality child-friendly facility-based services

WHO classifies the three levels of newborn care as Essential Newborn care (Primary), Special newborn care (Secondary), and Intensive care (Tertiary). FBNC addresses care at birth, care of the normal newborn, and care of small and sick newborns (Table 3).

Essential Newborn Care

Care at birth, breastfeeding support, prevention of hypothermia, and infections, identification of problems including birth defects and prompt referral, and discharge counseling are the key aspects of ENC addressed by the new Navjat Shishu Suraksha Karyakram [3]. In 2022, WHO published new recommendations for the normal newborn [13] & newborn screening for hearing impairment, hyperbilirubinemia, and eye abnormalities have been introduced.

Special Newborn Care

Small and sick newborns need inpatient care (24/7) in a facility with a focus on the provision of warmth, feeding and breathing support, prevention and treatment of infection, and detection and management of birth defects and complications such as hypoglycemia, jaundice, anemia, apnea, necrotizing enterocolitis, neonatal encephalopathy and seizures [14]. Kangaroo mother care (KMC) and continuous positive airway pressure are key aspects of care for a small newborn.

Intensive Newborn Care

Some very small and sick newborns need mechanical ventilation, surfactant therapy, parenteral nutrition, surgical and genetic services which are provided in intensive care units.

Essential newborn care is provided at all levels of facilities in the Newborn care corner (NBCC) and sick newborn care is provided in the Newborn stabilization units (NBSU) and the SNCU. Intensive care is provided in the Neonatal intensive care unit (NICU), usually attached to medical colleges. Under the FBNC program, SNCUs have been established at any health facility where the delivery load is more than 3000 per year i.e., at most district hospitals and some of the sub-district hospitals and includes all care for small and sick newborns including continuous positive air pressure (CPAP) except for assisted ventilation and major surgeries.

Since its inception in 2003, SNCUs have been the pillar of FBNC and >900 SNCUs have been established covering >83% of the districts in India [15]. Emphasizing the importance of breastfeeding to reduce neonatal mortality rate (NMR), MoHFW has set up comprehensive lactation management centers (CLMC) at medical colleges, high-load districts, and lactation management units (LMU) at district hospitals. and lactation support units (LSU) at delivery points [16]. The breast milk bank at CLMC supports the small and sick newborns admitted to the SNCUs. As of FY 2020-2021, 15 CLMCs and 3 LMUs are established in seven states. The SNCU also provides post-discharge follow up and babies identified with problems are referred to the District Early Intervention Center (DEIC) under the Rashtriya Bal Swasthya Karyakram (RBSK). MoHFW has developed an "Operational Guide" [14] not only for providing care but also for record keeping and monitoring. UNICEF supported the NHM to develop a real-time monitoring system – "SNCU online" - to assess SNCU performance and track newborns post-discharge. More than 90% of facilities are reporting online. This system records vital information related to antenatal care and care in the labour

Table 3 Facility based newborn care at different levels of care [4]

	Newborn care corner (at all delivery points)	Newborn stabilization units First Referral Units (FRUs)/ Community Health Centres (CHCs)	Special newborn care unit (Sub-district/District)
Care at birth	Resuscitation, provision of warmth, prevention of infection Early initiation of breastfeeding, weighing the newborn	Resuscitation, provision of warmth Prevention of infection, early initiation of breastfeeding Weighing the newborn	Resuscitation, provision of warmth, prevention of infection, early initiation of breastfeeding and weighing the newborn
Care of normal newborn	Breastfeeding/feeding support	Breastfeeding/ feeding support	Breastfeeding/feeding support
Care of sick newborn	Identification and prompt referral of 'at risk' and 'sick' newborn	Management of low birthweight infants ≥1800 g with no other complication Phototherapy for newborns with hyperbilirubinemia Management of newborn sepsis Stabilization and referral of sick newborns and those with very low birth weight (rooming in) Referral services	Managing of low birthweight infants <1800 g Managing all sick newborns (except those requiring mechanical ventilation and major surgical interventions) Follow-up of all babies discharged from the unit and high-risk newborns Referral services

room, SNCU care and post-discharge follow-up care. It aids in the rapid review of the performance of each SNCU and for benchmarking [15].

The FBNC model of care in India is based on the principle of regionalized care with an appropriate referral systems which has shown to reduce NMR [4]. It also resulted in more very low birth weight (VLBW) neonates being transferred to the higher center. Linkages between the higher and lower facilities, mechanisms for in-utero transfer of high-risk pregnancies, and safe transfers of newborns are essential for optimal use of resources.

Referral services and transport are integral to regionalized care and influence NMR. Free ambulance service is now available in almost all parts of the country to facilitate referral under NHM & state initiatives [17, 18]. However, only a few are geared for transport of sick neonates in terms of personnel and quality of care. In a study from North India, 40% of the referred neonates were not accompanied by health personnel, only 15% had a complete referral note, and two-thirds were hemodynamically stable at arrival; these had a significant effect on the outcome. In Tamil Nadu, government partnership with GVK Emergency Management and Research Institute (GVK EMRI) has ensured that 80% of the babies reach the facility in stable clinical condition resulting in 94% survival of transported infants [19].

The FBNC model has contributed significantly to a reduction in NMR to 19 per 1000 live births in 2021. A review of the effectiveness of FBNC on neonatal outcomes found that high patient volume (>2,000 deliveries/year), inborn status, availability of referral system and inter-facility transfers, and adequate nursing care staff in neonatal units demonstrated protective effect in reducing neonatal mortality rates [17, 20, 21]. Neonatal mortality is higher in the SNCUs than in the NBSU due to high referral and the pattern in the SNCUs is higher among LBW and preterm babies, emphasizing the need to strengthen care for these small babies [22]. Neonatal jaundice is one of the most common causes of admission in SNCUs [23, 24] resulting in overcrowding.

There is however an urgent need to bring in the culture of quality & safety in neonatal care. It is estimated that 60% of the one million newborn deaths are due to poor quality of care [21]. While in districts with high quality of care, institutional deliveries reduce NMR by about 8/1000 live births, the NMR in institutional deliveries at the lowest quintile of quality of care is higher [25].

Home-Based Newborn Care (HBNC)

Home-based newborn care (HBNC) is a strategy implemented by government of India to overcome the burden of newborn mortality in the first week of life. It provides

continuum of care for newborn and post-natal mothers. HBNC introduced since 2011 is centred around Accredited Social Health Activist (ASHA) and it is the main community-based approach to newborn health [5]. The ASHAs visit the mother-baby dyad six times in the first 6 wk to provide advice on newborn care practices, breastfeeding support, keeping warm, KMC and identification of illness, and administration of antibiotics where referral is not possible. Under this scheme, funds are allocated for training of ASHAs, supportive supervision by ASHA facilitators, incentive to ASHAs for home visits and purchase of HBNC kits. ASHAs are paid an incentive of Rs. 250 for visiting each newborn. The HBNC is feasible and effective in various settings [26].

The Gadchiroli trial in tribal Maharashtra has been the basis for HBNC [27], where it has sustained for >23 y with decreasing mortality [28]. The HBNC model has been evaluated in a cluster randomized trial by ICMR-HBMYI study group and found to be effective in reducing neonatal and infant mortality even in setting with high rates of facility births [29]. Implementation research initiatives [30, 31] have shown that high-impact interventions such as KMC, and home treatment of neonatal sepsis can be scaled up through the HBNC model with additional training and supportive supervision of ASHAs [32]. Establishing linkages between the facility and the ASHAs is crucial to provide a continuum of care. Similarly, a study done by Pathak et al., 2021 in Uttar Pradesh, has found that majority of newborns got all the age-appropriate home visit [33]. The Home-based Newborn Care Programme is being implemented under National Rural Health Mission (NRHM) in all States and UTs except for Himachal Pradesh, Goa, Kerala, Chandigarh, Daman & Diu, and Puducherry [34].

The SNCU Plus initiative aims at facilitating contact with babies discharged from SNCUs. A recent review of the program found that among those followed up, the coverage of all three visits was 97% and the mortality till 6 wk was 1.5%; although it was higher among LBW babies (2.02%), highlighting that follow-up at critical time points can improve survival of small and sick newborns discharged from SNCUs. As per State Report, during FY 2020-21, more than 1.33 Crore newborns were visited by ASHAs under the HBNC program [35].

Way Forward – Actionable Recommendations

We need to act now to strengthen facility and home based newborn care if we are to attain the INAP targets. Table 4 provides some actionable recommendations to further reduce the three major causes of neonatal mortality. The recent Lancet series on the “small vulnerable newborn” [36] has highlighted the need to integrate stillbirths to

Table 4 Actionable recommendations to reduce neonatal mortality [36, 37]

Interventions to prevent small vulnerable newborn births and improve outcomes	<ul style="list-style-type: none"> ● Multiple micronutrient supplementation ● Balanced protein and energy supplementation ● Low-dose aspirin ● Progesterone ● Smoking cessation education ● Malaria prevention ● Treatment of asymptomatic bacteriuria ● Treatment of syphilis ● Antenatal corticosteroids ● Delayed cord clamping ● Immediate Kangaroo mother care
Interventions to reduce asphyxia	<ul style="list-style-type: none"> ● Skilled intrapartum care ● Safe delivery practices ● Timely and appropriate resuscitation
Interventions to reduce infection	<ul style="list-style-type: none"> ● Zero-separation ● Kangaroo mother care ● Bundle care ● Antibiotic stewardship
Interventions that reduce multiple causes of newborn mortality	<ul style="list-style-type: none"> ● Thermal control ● Appropriate respiratory support and CPAP ● Exclusive “Mothers own milk” feeding ● Training healthcare professionals ● Respectful care for every newborn ● Quality improvement

CPAP Continuous positive airway pressure

burden assessment and to implement 10 proven interventions [37] to achieve global targets in preventing neonatal mortality. Implementation research [38] to understand “how to” rapidly scale-up proven interventions nationally to achieve global targets is the need of the hour.

With a focus on small and sick newborn care [39], there is a need to strengthen health systems to provide high-quality FBNC. Though zero-separation of the mother-baby dyad is recommended [13], separation of the LBW is the norm (39.5% to 51.4%) [40]. The recent iKMC trial [41] has shown that zero separation for the unstable LBW is not only feasible but can reduce newborn mortality by an additional 25%, introducing the concept of M-NICU (Mother-Newborn Intensive Care Unit), a paradigm shift in how small infants are cared for. There is a need to implement and scale up the new WHO recommendations for the normal newborn [13] and preterm and low birth weight with inclusion of family participatory care [39].

While India has made great strides in establishing SNCUs in every district, there are challenges in implementation and quality of care [42]. There is wide variation in the quality of maternity and neonatal care across facilities with scope for improvement both in the public and private sectors [43, 44]. Interventions to improve intrapartum care contribute to the maximum reduction in neonatal mortality. Dakshata [45] skill training and LaQshya, launched in 2017 aim to strengthen key processes related to delivery care in public health facilities [10]. “SUMAN – Surakshit Matritva Aashwasan” launched

in 2019 aims to provide respectful and quality healthcare to every woman and newborn visiting the public health facilities. In 2021, MoHFW launched the MusQan initiative to ensure quality child-friendly facility-based services. This initiative ensures the provision of quality child-friendly facility-based services (SNCU, NBSUs, Pediatric Wards/ HDUs/ ICUs) in public health facilities to children from birth up to 12 y of age. It has also shown promising steps towards strengthening facility based newborn care with aims to reduce preventable newborn and child morbidity and mortality.

A training package to improve knowledge and clinical skills using point of care quality improvement (POCQI) has been shown to improve neonatal outcomes [46]. Onsite mentoring improves neonatal outcomes [47] and hub and spoke model with the medical colleges serving as hubs have been proposed [48]. With the routine data collected by SNCU online, a composite index that serves as a proxy marker of quality of clinical service – the SNCU Quality of Care Index-SCQI tool has been developed [49]. The SCQI implementation has helped identify bottlenecks and address quality concerns by the district and facility teams [50].

India has taken steps to strengthen primary healthcare through health and wellness centres [51] under Ayushman Bharat program [52]. This is a great opportunity to revive and fully integrate and address challenges and bottlenecks in delivery of newborn and maternal health interventions. The community process and platforms which have been created in last two decades [53] should also be optimally utilised.

Professional bodies like National Neonatology Forum and Indian Academy of Pediatrics have focused on developing and implementing training packages like Navjaat Shishu Suraksha Karyakram (NSSK), neonatal resuscitation, and preterm care using novel mobile-based e-learning [54]. The Federation of Obstetric and Gynaecological Societies of India (FOGSI) offers a quality improvement and certification initiative called “Manyata” for the private sector.

Conclusions

Continuum of care starting from the antenatal period, FBNC, and continued support in the community by HBNC has achieved moderate to high coverages. Implementation research to accelerate coverage of key interventions, zero separation of the mother-baby dyad, and focus on the quality of care are the ways forward to achieve INAP targets set for 2030.

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Declarations

Conflict of Interest None.

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