ORIGINAL ARTICLE

Red Herrings & Way Forward In the Implementation of Anemia Mukt Bharat

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Abstract
Anaemia is a widespread public health issue affecting the most vulnerable groups. To mitigate the problem, the Prime Minister of India launched a program called "Anaemia Mukt Bharat" (AMB). This initiative focuses on reducing Anaemia across six age groups—preschool children (6-59 months), children (5-9 years), adolescents (10-19 years), pregnant women, lactating women, and women of reproductive age (15-49 years)—by implementing six intervention packages through a continuum care approach, following the Health in All Policy (HiAP), and utilizing six institutional mechanisms.

Keywords
AMB, Intergenerational life cycle approach of health care, Unified Dashboard, Feed Back loop, e-logistic Platform, QR code-based tracking

Introduction
Anaemia predominantly affects children, adolescent girls, women of reproductive age, and pregnant or lactating women. Globally, 40% of children aged 6–59 months, 37% of pregnant women, and 30% of women aged 15–49 experience anaemia. In 2019, anaemia resulted in 50 million years of healthy life loss.(1) The primary cause is micronutrient deficiency, specifically Iron, folic acid, and vitamin B12. Other factors include thalassemia, sickle cell trait, and malaria in some regions of India.(2) To combat Anemia, India launched the National Nutritional Anaemia Prophylaxis Program (NNAPP) in 1970, providing iron-folic acid supplements to vulnerable groups. (3) Health policymakers have made several changes since its inception for better implementation. In 2018, the Ministry of Health and Family Welfare initiated the Anaemia Mukt Bharat (AMB) program, aiming to reduce the prevalence of Anaemia.(4) The current anaemia rates of India are 68.3% among children aged 6–59 months, 52.2% among pregnant women, and 61.2% among lactating women. The 2016 Global Nutrition Survey ranked India 170th out of 185 countries for the prevalence of anaemia among women. (5) It is prudent to evaluate the effects of evolving programs on anaemia and propose remedial measures based on the reconstructed natural history of iron deficiency anaemia.

Objective: The objective of this article is to empower you, the reader, to review the

current Natural History of Anaemia and the epistemological basis of the 6x6x6 interventions package and its implementation service delivery strategy through the existing Healthcare delivery system. Your understanding and actions are crucial in combating anaemia.

Methods: The review involved three stages: (i) Review of the re-construction of the Natural History of Anemia, (ii) evolution of National programs on Anemia from NNAPP to AMB based on the available evidence, (iii) the current prevalence of Anemia in India against the targeted goal, (iv) Red Herrings observed and the way forward for achieving AMB.

Results & Discussion

Natural History of Anaemia (NHA): The World Health Organisation defines Anaemia as low red blood cell or haemoglobin levels, which impact oxygen delivery to tissues. This condition involves Mean Cell Volume (MCV), Mean Cell Haemoglobin (MCH), and Mean Cell Haemoglobin Concentration. (6)

The pre-pathogenesis phase encompasses dietary iron intake, genetic predispositions such as Sickle Cell Anaemia, Thalassemia, and Hemoglobinopathies, nutritional habits, health behaviours, and hygiene practices, particularly among vulnerable groups, including children, adolescents, pregnant, and lactating women. Environmental factors include socioeconomic status, sanitary conditions, food security, and access to healthcare. (7)

Iron is crucial for energy metabolism, neurogenesis, and oxygen transport during pathogenesis. Anaemia studies highlight common causes, including iron deficiency (ID), micronutrient deficiencies, infections, inflammation, and genetic conditions. ID anaemia develops as iron-limited red blood cell production fails to maintain the haemoglobin concentration above the cutoff value to define Anemia. Absent or reduced body iron stores that do not meet the need for Iron of an individual but may respond to iron supplementation are defined as Absolute ID, which contributes to only a limited proportion of Anemia. In most patients with anaemia, iron stores are insufficient due to infection or inflammation and do not respond to iron supplementation. Understanding the role of the Liver hormone Hepcidin in iron metabolism during infection and inflammation is essential. (8) Early diagnosis and treatment of infection are crucial for effectively reducing anaemia prevalence in the targeted population. (Figure 1) The policy maker of the Anaemia Control Program included the same service package in the AMB program.

Evolution of National Programs on Anaemia from NNAPP: The Evolution of the public health programs to combat the Anemia problem was based on the evolving research findings. Research findings from the Expert Committee of the Nutrition Society of India in 1968 and the WHO Nutrition Advisory Groups led to the launch of the National Nutritional Anaemia Prophylaxis Program (NNAPP) in 1970. (9) The targeted beneficiaries identified are pregnant women and women using family planning services who are to receive a prophylactic dose of Iron-Folic Acid tablets. The program is based on therapeutic trial results from the All-India Institute of Medical Sciences in New Delhi. (10) NNAPP focused on providing preventative supplements to high-risk groups with limited coverage. The distribution system depended primarily on primary health centres with minimal community outreach. NNAPP focused on providing preventive supplements to high-risk groups with limited access to care. The distribution system relies mainly on primary health centres with minimal community outreach. In 1975, the Integrated Child Development Scheme (ICDS) included Iron-Folic Acid distribution in its services through Anganwadi centres and Anganwadi Workers (AWWs). The scheme distributed Iron Folic Acid to the six targeted beneficiaries of the services, viz. Children under six years, women of reproductive age, pregnant women, and breastfeeding mothers. The supplementary nutrition package included immunisation, growth monitoring, health check-ups, referral services, preschool education for children, and nutrition and health education for mothers

and caregivers. (11). In 1991, NNAPP was renamed the National Nutritional Anaemia Program (NNAP). The program included Screening and treatment of anaemia among the targeted beneficiaries, as well as the distribution of IFA tablets.(12)

In 2007, the National Rural Health Mission (NRHM) initiated the Village Health Nutrition Day (VHND) program to deliver health services directly to communities. The VHND is held monthly, typically on Wednesdays, and is organised by the Village Health Service Committee (VHSC), comprising ASHA, AWW, ANM, and PRI representatives. The services package includes Maternal Health, Child Health, Family Planning, Reproductive Tract Infections and Sexually Transmitted Infections. A key initiative in maternal and child health is nutrition, with a focus on anaemia screening for adolescent girls and pregnant women, including counselling and referrals. (13)

In 2010, the Government of India launched the Rajiv Gandhi Scheme for Empowerment of Adolescent Girls (RGSEAG), commonly referred to as Sabla, to improve the nutritional status and break the intergenerational cycle of Anaemia among adolescents. This scheme includes the weekly administration of iron-folic acid (IFA) tablets to school-going adolescent girls at Anganwadi Centres. (14)

In 2012, Weekly Iron-folic Acid Supplements of 100mg elemental iron and 500 µg Folic acid were introduced using a fixed-day approach to address Anaemia in the adolescent population (ages 10-19). This program targeted both school-going teenage girls and boys in 6th to 12th grade, enrolled in government, government-aided, or municipal schools, as well as out-of-school adolescent girls. The program included screening target groups for moderate-to-severe anaemia and referring cases to health facilities; biannual deworming with Albendazole 400mg; and providing information and counselling on improving diet and preventing intestinal worm infestations. Convergence with key stakeholder ministries, such as the Ministry of Women and Child Development and the Ministry of Human Resource Development, is a crucial component of the implementation plan for the WIFS programme. Convergence includes collaborative planning, training for Medical Officers, AWW, Staff Nurses, and School teachers, plus monitoring and effective communication. (15)

In 2013, the WIFS program was remodelled as the National Iron Plus Initiative program (NIPI), which included age-appropriate IFA supplementation for Children, adolescents, pregnant women, and lactating mothers, Biannual deworming to prevent worm infestations, which contribute to Anaemia, Nutrition education and counselling to promote dietary practices that enhance iron intake and Screening and referral for moderate and severe anaemia cases. The program is implemented through the AWCs platform. Biweekly IFA syrup supplementation is done in AWCs. NIPI services are provided to school-going children (5-10 years) and out-of-school girls (5-10 years) in urban and rural areas through government, municipal, and AWC platforms on a fixed schedule (Monday). Teachers and AWW supervised the distribution and ingestion of IFA tablets.(16)

The adoption of the National Health Policy (2017) and the National Nutrition Strategy (2017) in India led to intensified efforts to address all causes of Anaemia. The aim was to accelerate the reduction in anaemia prevalence across all age groups through a structured, multifaceted strategy rather than through uncoordinated programmes. In pursuit of the World Health Assembly's target for a 50% reduction in Anaemia among women of reproductive age by 2025, the Ministry of Health & Family Welfare set new goals. To comprehensively address malnutrition, including anaemia, POSHAN Abhiyaan was launched in 2018, focusing on children, pregnant women, and lactating mothers (17) (Press Information Bureau). The Anaemia Mukt Bharat (AMB) initiative, also launched in 2018 under the National Health Mission, continued a life-cycle approach to combating Anaemia. It targeted six beneficiary groups through six interventions, including iron and folic acid

supplementation and behaviour change communication campaigns. AMB aims to reduce the prevalence of anaemia among children (6-59 months), adolescents, and women of reproductive age (15-49 years) by 3% per year. The AMB approach is multi-faceted, robust, and operational, supported by an elaborate accountability framework.(18)

The following section examines the effect of public health interventions on the current prevalence of anaemia and its trend.

Prevalence of Anemia among targeted beneficiaries and its Trend: Anemia prevalence data of the NFHS-3, 4 & 5 reveal that Anemia prevalence among girls of 6–59 months of age increased from 66.9% (NFHS-3) to 68.3% (NFHS-5) and in boys from 67.6% to 68.3% with a minimal dip in NFHS-4. The prevalence of anaemia observed in NFHS-3 among girls and boys aged 15-19 years is 57.8% and 29.0%, respectively. The gender-wise difference is substantial. The increase in prevalence among Girls from 54.9% (NFHS-4) to 59.8% (NFHS-5) is more pronounced than the increase among boys, which is from 29.5% (NFHS-4) to 31% (NFHS-5). Prevalence of Anemia among Pregnant women is high in all three NFHS surveys- 57.8. % in NFHS-3, 50.4% in NFHS-4, and 52.2% in NFHS-5. In Lactating mothers, Anemia is 63.8 % in NFHS -3, 58.8% in NFHS-4 and 61.2% in NFHS -5. It is remarkable to note that the prevalence of Anemia in non-pregnant women of the 20 to 49 Age group versus the prevalence among Men of the same age group is substantial. Among women, the prevalence is 52.8% in NFHS-3, 52.8% in NFHS-4, and 66.7% in NFHS-5, compared with 21.5% in NFHS-3, 21.5% in NFHS-4, and 22.9% in NFHS-5 among men. (Figure 1). The prevalence of Anemia is not uniform throughout the country. (Figure 2) Surveys indicate a higher prevalence in rural areas than in urban areas. (Poshan newsletter.) Assam, along with other NE states, has a high prevalence of Anemia. Trends in anaemia prevalence during NFHS-4 (2015–16) and NFHS-5 (2019–21) underscore the need for coordinated intervention packages delivered to the same target group across similar programs within the existing healthcare delivery system in a mission-mode approach. An array of health programs addressing the same public health problem has an overlapping effect on implementation, which affects monitoring due to simultaneous data entry, making performance data susceptible to contamination and introducing confounding. These data highlight the importance of collaboration and coordination in addressing anaemia.(19)

Table 1: Causal link between anaemia and micronutrients—the technical basis for the National Nutritional Anaemia Prophylaxis programme.

Regimen	Mean differences in hemoglobin after therapy		SE of adjusted means	*P*
	Not adjusted for initial hemoglobin, g/100 ml	Adjusted for initial hemoglobin, g/100 ml[a]		
Main effects				
Folic acid	+0.47	+0.42	0.16	< 0.01
Vitamin B_{12}	+0.24	+0.18	0.16	NS ($P = 0.20$)
Iron	+1.51	+1.46	0.16	0.001
Interactions				
Folic acid × vitamin B_{12}	−0.04	−0.18	0.16	NS
Folic acid × iron	+0.19	+0.14	0.16	NS
Vitamin B_{12} × iron	+0.06	+0.05	0.17	NS
Iron × B_{12} × folic acid	+0.26	+0.18	0.16	NS

[a] Adjusted by a standard analysis of covariance (see Table 3). NS denotes not significant.

Figure 1 shows the difference of HB, Serum Iron, Transferrin saturation, Serum Vit B12& Serum Folic Acid among Pregnant, Non-pregnant women and men at Vellore – the basis of the NNAPP package.

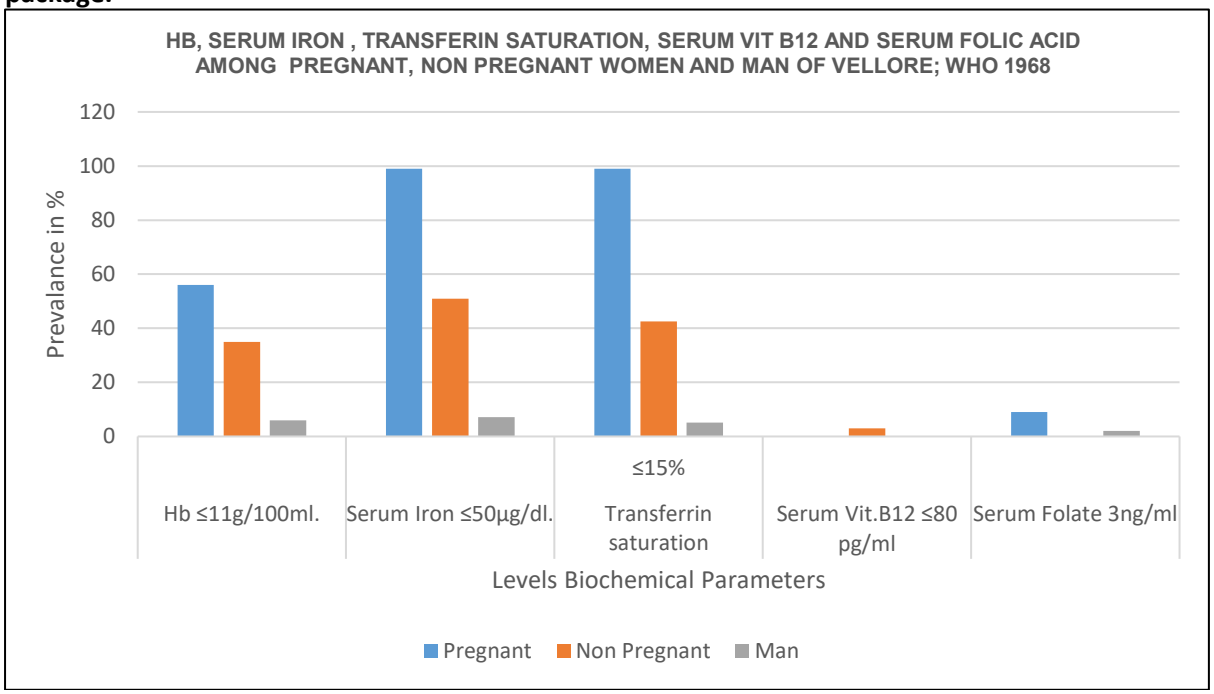


Figure 2 – Natural History of Nutritional Anaemia- Conceptual framework for applying the different levels of prevention.

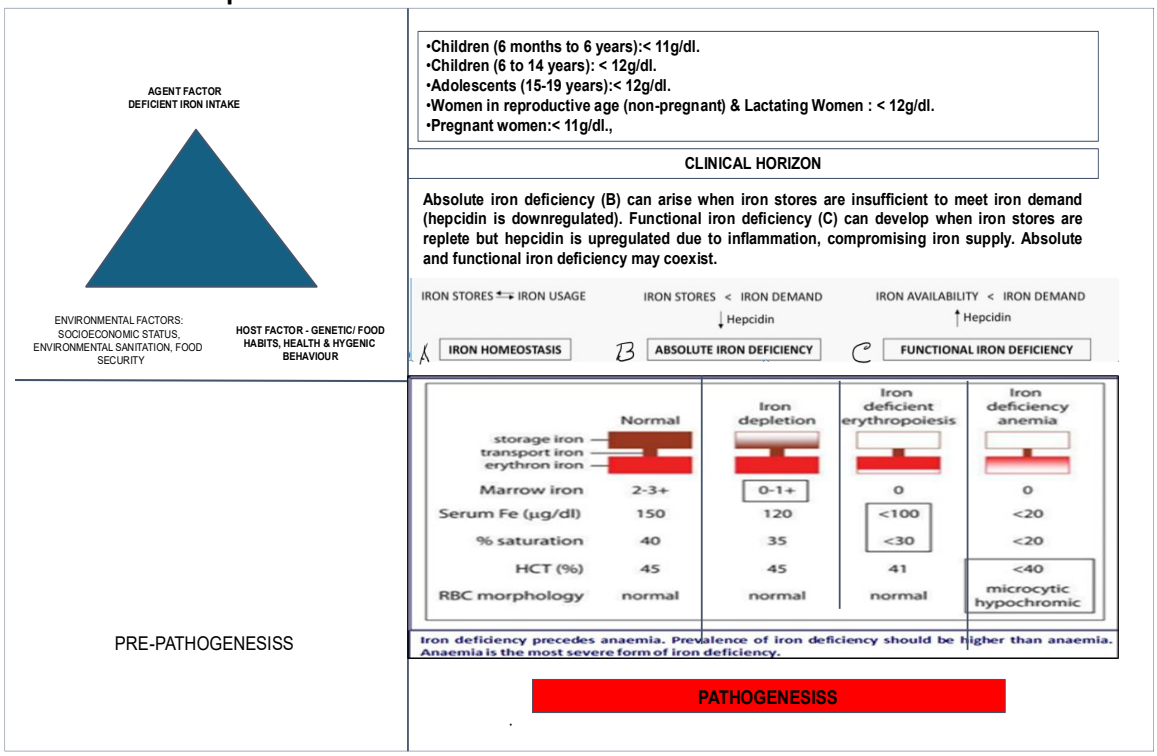
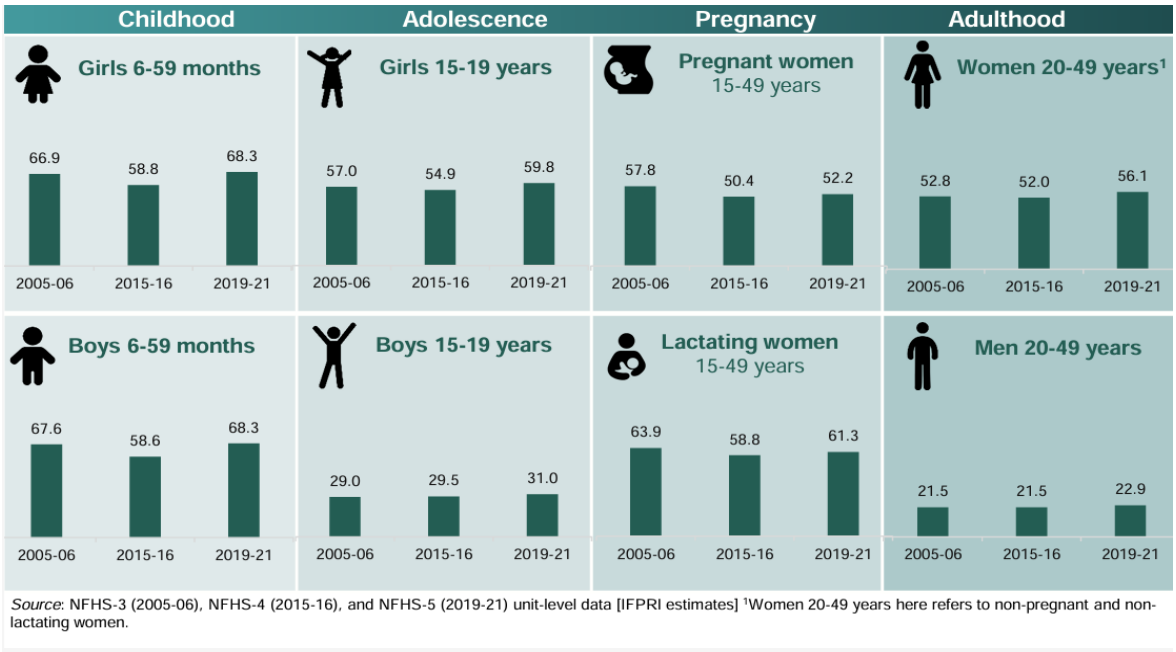


Figure constructed based on the data from "Biology of Anaemia: A Public Health Perspective" The Journal of Nutrition 153 (2023) S7–S28

Figure 3 Comparison of Prevalence of Anaemia among Children (Girls and Boys 6-59 months) , Adolescents (Girls and Boys 15-19 Yrs), pregnant and Lactating women, adult women and men 20-49 Yrs. Based on NFHS 3-4-5 data.



(19) Source

WAY FORWARD

1. The Anaemia Mukt Bharat (AMB) program, introduced by the Government of India in 2018, builds upon previous programs such as NNAPP, NACP, and NIPI. AMB employs a comprehensive 6x6x6 strategy, comprising six target groups, six interventions, and six institutional mechanisms, integrating insights from previous programs such as POSHAN Abhiyan and the School Health Program. Six programs—NACP, VHND, Sabala, WIFS, NIPI, and Poshan—operate in conjunction with AMB. The ICDS program, which supports children's growth, nutrition, health, and education, and aids pregnant and lactating women, also implements AMB's 6x6x6 strategy. The service package under the AMB program, which includes distributing Iron and Folic Acid tablets, deworming medication, and conducting haemoglobin testing, may be routed through ICDS, Rashtriya Bals Swasthya Karyakram (RBSK) and National Sickle cell Elimination Program's (NSCEP) service delivery networks. Involving Anganwadi Workers (AWWs) in service delivery is vital for AMB's behaviour change strategy. Enhancing ICDS reporting systems to integrate with AMB digital tools will improve tracking and accountability. Community delivery points at Anganwadi Centres (AWCs) may continue to implement AMB for children under six, pregnant or lactating women, while adolescents may be covered under the RKSB and Sabala schemes. Effective inter-ministerial coordination is essential for implementing AMB, with ICDS providing foundational support.

Despite these innovations, AMB faces major challenges in its effective implementation: A. Infrastructure limitations such as poor connectivity and a lack of device availability, digital literacy gaps resulting from insufficient training of frontline workers in effectively using and applying these devices. Both hinder real-time data entry, which in turn undermines accurate and timely reporting and impedes effective monitoring of program implementation. B. Another major area that requires consideration is the fragmented approach to training healthcare providers. We shall discuss the two areas individually.

A**. Digital Infrastructure limitations, digital literacy gaps, and supply chain logistics:**

Remedial measures include enhancing digital infrastructure, data triangulation, gathering feedback, and strengthening supply chain logistics. Each measure contributes to the overall efficiency of AMB.

- **Strengthening Digital Infrastructure**: Ensure digital tools are usable, accessible, and reliable. Provide device access and training for ANMs and ASHAs, utilising tablets with apps such as AMB Tracker or ANMOL. Design user-friendly tools with icons, voice prompts, and minimal text. Offer digital literacy training in local languages, including video tutorials and helplines.
- Streamlining Data Triangulation & Feedback Loops: ICDS, AMB, school health programs, and HMIS gather overlapping service data without coordination or sharing. Integrating data from AMB, ICDS, and school health into a single analytics platform, referred to as "Unified Dashboards," will enable cross-verification and minimise duplication. Establishing "Feedback Loops" using real-time dashboards to generate automated alerts for low coverage, stockouts, or data anomalies enables the sharing of results with district officials and frontline workers, potentially improving the efficacy of program monitoring. Institutionalising monthly "data huddles" at the block and district levels, periodic reviews at the state level, and annual reviews at the central level may aid in effective review and trend identification, enabling corrective actions. Introducing community scorecards, involving VHSNC and SHG, to validate and provide feedback on service delivery can inform improvements.
- **Building a Robust Supply Chain**: Stock-outs of IFA tablets, deworming meds, and hemoglobinometers can impede AMB's progress. To counteract this, utilise tools such as e-Aushadhi or Drug Inventory Management Systems to track stock levels in real time, along with e-Logistics Platforms and QR Code-Based Tracking to monitor distribution and expiry. Implement Buffer Stock Protocols with mandated minimum stock levels at the PHC and block levels, along with automatic replenishment triggers. Empower districts to locally procure emergency supplies when central stocks are delayed. These measures are systemic upgrades, not just minor adjustments.

B. Training of Health Care Providers: The National Health Mission (NHM) promotes integrated in-service training at the primary and community health levels. The objective is to equip health workers, such as ANMs, ASHAs, and Medical Officers, with a skill set that includes maternal health, child health, nutrition, communicable diseases, and AYUSH services. This approach aims to reduce duplication of effort, save time and resources, and encourage holistic service delivery through a single window. Despite this vision, in practice, a hybrid model is employed, with an increasing emphasis on integration, while also maintaining vertical training where necessary. Frontline workers (ASHAs, ANMs, AWWs) receive integrated training modules. Medical Officers and Specialists undergo both integrated modules for general service delivery and vertical training for specialised roles. District Program Managers receive training in planning, monitoring, and data use, which can be either integrated or program-specific. AMB offers specialised modules for IFA distribution, haemoglobin testing, and digital reporting. Additionally, each program, such as ICDS and RKSB, has its training modules, which overlap and may create confusion among healthcare providers regarding integrated implementation. These issues require immediate attention for effective and successful implementation of AMB.

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Conflict of Interest

There are no conflicts of interest.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

The author check only Grammar.

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