

BRIDGING THE GAP: ASSESSING ANAEMIA INTERVENTIONS AND BEHAVIOUR CHANGE COMMUNICATION IN INDIA

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By

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Under the Supervision and Guidance of

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2024

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NITI Aayog

नीति आयोग
भारत सरकार
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Date: 27th June, 2024

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TO WHOMSOEVER IT MAY CONCERN

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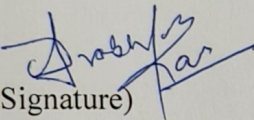

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Bridging the Gap: Assessing Anaemia Interventions and Behaviour Change Communication in India** is the bonafide record of my original researchwork. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

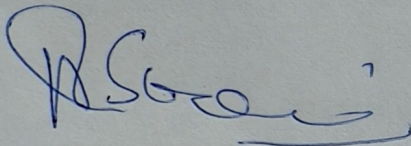

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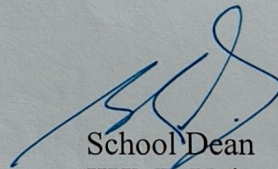
CERTIFICATE

This is to certify that dissertation titled **Bridging the Gap: Assessing Anaemia Interventions and Behaviour Change Communication in India** is a record of the research work undertaken by Prabhleen Kaur in partial fulfillment of the requirements for the award of the degree of MBA (Hospital and Health Management) from the IIHMR University, Jaipur under my guidance and supervision and his/her approach to the research study has been sincere, scientific, and analytical.



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ABSTRACT

Anaemia is a significant public health challenge in India, particularly affecting women of reproductive age, adolescents, pregnant women, and children. Despite extensive governmental interventions, the burden of anaemia remains high. This study aims to evaluate and enhance behaviour change communication (BCC) strategies targeting anaemia in India. By analyzing gaps in current anaemia programs, extracting key determinants from the National Family Health Survey-5 (NFHS-5) data, and assessing the effectiveness of current BCC interventions, this research provides tailored recommendations to strengthen BCC strategies. The findings underscore the need for improved program coverage, effective communication strategies, and a holistic approach to address the multifaceted determinants of anaemia.

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ABBREVIATIONS

1. WHO- World Health Organization
2. Hb- Haemoglobin
3. RBC- Red blood cell
4. NFHS- National Family Health Survey
5. BMI -Body mass index
6. IFA -Iron folic acid
7. ANC- Antenatal Care
8. AMB -Anaemia mukta bharat

INTRODUCTION

BACKGROUND

Anaemia is a condition where the body has an insufficient count of RBCs or Haemoglobin concentration within the RBCs to cope with the body's normal functioning. (1) The World Health Organization (WHO) considers someone anemic if their haemoglobin level falls below a specific threshold. This threshold is 110 grams per liter (g/L) at sea level for children under 5 and pregnant women, while it's slightly higher at 120 g/L for non-pregnant women. Haemoglobin, a vital protein in red blood cells, carries oxygen throughout the body. When someone has anaemia, either from a lack of red blood cells or insufficient haemoglobin, their blood can't deliver enough oxygen to their tissues. This can cause them to feel tired, weak, dizzy, and short of breath.. The ideal haemoglobin level for bodily functions can vary. Factors like age, gender, altitude of residence, smoking status, and pregnancy can all influence this value. Anaemia can develop from several causes which includes nutritional deficiencies, infections , chronic health conditions and Inherited blood disorders. Anaemia is a significant global public health concern, particularly affecting young children, menstruating adolescents, and pregnant and postpartum women

GLOBAL PREVALENCE OF ANAEMIA

A worrying number of people around the world struggle with anaemia. The World Health Organization (WHO) estimates that nearly half (40%) of young children (ages 6-59 months), almost two-fifths (37%) of pregnant women, and over a quarter (30%) of women between 15 and 49 years old are anemic. Anaemia is a global health concern affecting over 2 billion people worldwide.(2) It is one of the most common diseases worldwide and is highly prevalent in low and middle-income countries. (3) Every one in four individuals aged 10–24 years (~430 million) suffers from anaemia globally. (4)

Anaemia poses a significant worldwide public health challenge, with a pronounced impact on young children and expectant mothers. According to estimations, almost a quarter of the world's population is affected by anaemia, with a significant 89% of those affected residing in developing nations.(5) According to WHO, in 2019, the global prevalence of anaemia among women aged 15-49 was 29.9%, affecting over 500 million individuals. Among this group, non-pregnant women had a prevalence of 29.6%, while pregnant women had a higher rate of 36.5%. Since 2000, anaemia rates in women of reproductive age have remained steady, but there has

been a slight decline in pregnant women. Additionally, in 2019, 269 million children aged 6-59 months were affected by anaemia globally, with the highest prevalence in the African Region at 60.2%. Since 2000, there has been a gradual decrease in anaemia rates among children under five, although progress has stalled since 2010. About a quarter of the global population experiences anaemia, with approximately 12.7% of men affected worldwide.(5)

PREVALENCE OF ANAEMIA IN INDIA

Anaemia is a major public health problem in India, affecting a significant proportion of the population, particularly women of reproductive age (WRA), adolescent girls, lactating mothers, and children. (2)

The NFHS-5 data paints a concerning picture. Anaemia plagues a substantial portion of the Indian population, with a significant disparity across age groups and genders. Data reveals concerning rates of anaemia, affecting 67% of children between 6 and 59 months old, 59% of adolescent girls, and nearly 52% of pregnant women.. The prevalence of anaemia is higher in rural areas (63.4%) compared to urban areas (46.4%). In India, anaemia poses a significant public health concern, with prevalence ranging from 20% to 39.9%. In the country, 25% of men and 31% of adolescent boys are affected by anaemia. Recent data indicates a concerning increase in anaemia prevalence among adolescent boys (aged 15–19) in 23 states and among men (aged 15–49) in 17 states.(5)

The primary causes of anaemia in India include nutritional deficiencies, particularly iron deficiency, as well as infections, malnutrition, and chronic diseases. Iron deficiency is the most common cause, resulting from inadequate dietary intake of iron-rich foods, especially among women and children.(6) Anaemia has significant consequences for individuals and society, including reduced productivity, increased healthcare costs, and poor pregnancy outcomes, such as low birth weight and preterm labour.(7)

While iron deficiency is a well-known culprit, anaemia can also stem from a complex interplay of factors. These include inadequate intake of various nutrients like vitamins A, B6, B12, C, D, and E, alongside folate, zinc, and copper. Additionally, exposure to infectious diseases such as soil-transmitted helminths, schistosomiasis, malaria, HIV, and tuberculosis, along with chronic inflammation and genetic haemoglobin disorders, can contribute to anaemia.. While clinical explanations for anaemia are well-documented, it's equally vital to acknowledge the social, behavioural, and environmental determinants influencing its prevalence. Despite the Indian government's efforts to combat anaemia through iron and folic acid supplementation, food

fortification initiatives, and public health education campaigns, the prevalence of this condition remains a significant concern. (6)

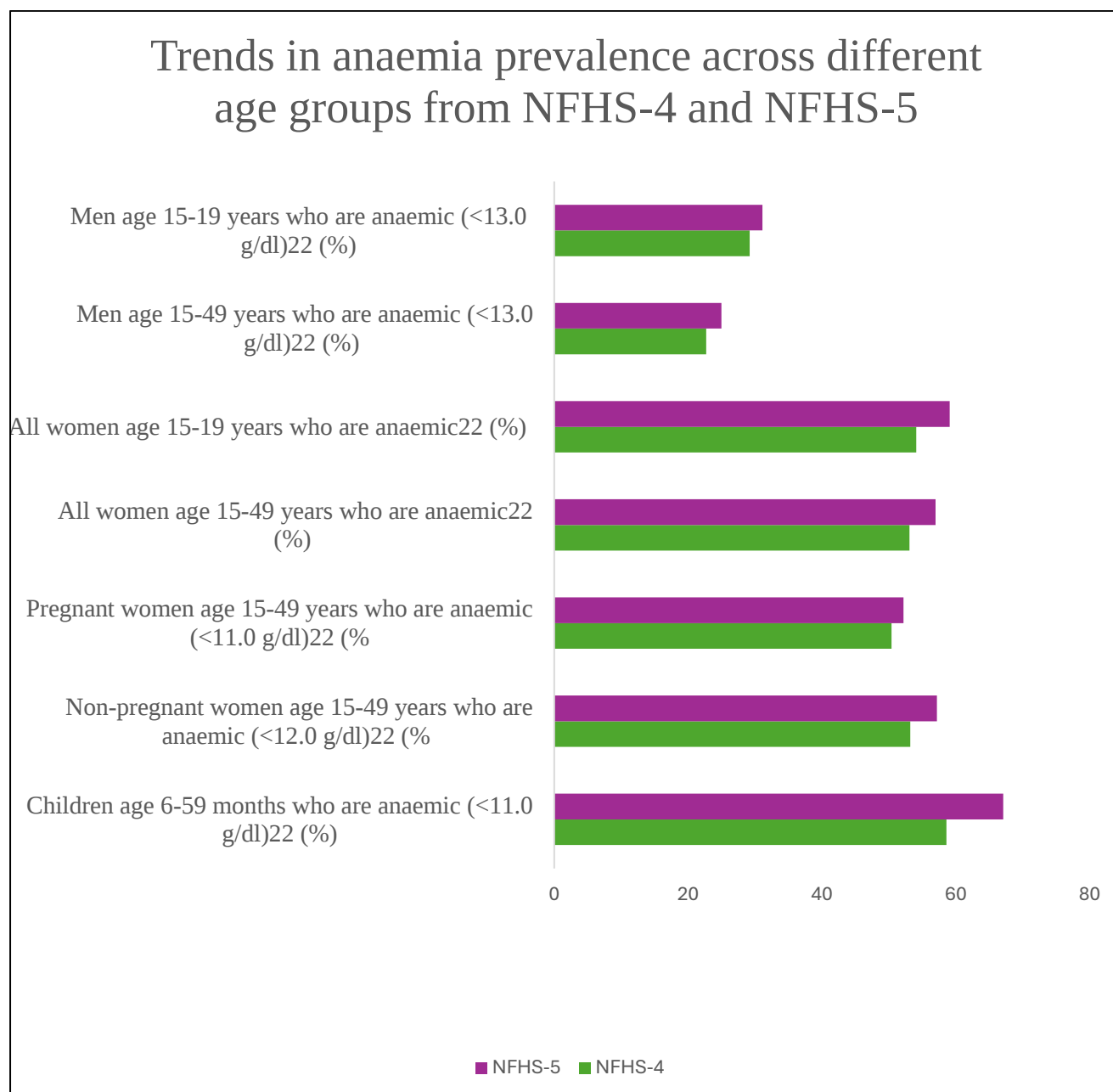


Fig- Trends in anaemia prevalence across different age groups from NFHS-4 and NFHS-5

From 1992–93 to 2015–16, India witnessed a consistent decrease in anaemia rates according to various rounds of the National Family Health Surveys (NFHS). However, in NFHS-5 (2019–20), a significant increase in anaemia has been observed among all age groups. One of the studies conducted, portrays an increase in the prevalence of anaemia among children aged 6–

59 months over the last four years. (1) Data from a comparable study shows a worrying increase in anaemia prevalence among women of reproductive age (WRA) across India. The percentage rose from 53% in a previous national survey (NFHS-4) to 57% in the most recent one (NFHS-5). This trend is particularly concerning in Aspirational Districts, where anaemia in WRA also worsened, rising from 58.7% to 61.1% between the same surveys. Furthermore, over 60% of Aspirational Districts witnessed an uptick in anaemia prevalence between 2015 and 2021. The situation is especially alarming in 29 districts, where anaemia rates jumped by at least 10 percentage points.(8)

Data from the National Family Health Survey (NFHS-4) conducted in 2015-16 revealed a troubling situation. A significant number of districts, 213 out of 640, had at least 65% of their children suffering from anaemia. A more recent survey, NFHS-5, showed a nationwide increase in the number of districts with high childhood anaemia rates (over 65%). This issue was particularly concerning in the Central and Western regions, where the number of such districts rose.

The data from NFHS-4 and NFHS-5 highlights a worrying trend of increasing childhood anaemia prevalence across India conducted using CNNS data shows that the overall prevalence of anaemia among adolescents was 28.5%, totalling more than 72 million individuals where the prevalence was higher in girls compared to boys (39.6% vs 17.6%). Anaemia was most prevalent among girls aged 15–19 years (47.5%) and least prevalent among boys aged 10–14 years (17.1%).(4)

According to the NFHS-5 data, anaemia prevalence has risen by 4% among all women and by 1.8% among pregnant women, while it has decreased by 6% among non-pregnant women. Additionally, there is a significant disparity in anaemia prevalence between urban (45.7%) and rural areas (54.3%) in India among pregnant women. (9)

A significant rise in childhood anaemia was observed in 25 out of 29 states. Among adolescents, regional variations were prominent, with anaemia prevalence ranging from 29.0% to 45.8% in girls and 10.8% to 28.4% in boys. Thirteen states reported anaemia rates of 40% or higher in girls, with West Bengal having the highest at 62.0%. For boys, Assam had the highest prevalence at 32.0%, while Kerala had the lowest at 4.1%. Uttar Pradesh experienced the highest burden, with 10.6 million girls and 4.6 million boys affected by anaemia. (4)

Another study conducted among rural men revealed that three out of ten rural men aged 15-54 years in India were anaemic. Older men (49-54 years), those without formal education,

belonging to Scheduled Tribes, Muslim, and from the poorest wealth quintile were more likely to be anaemic. The study highlighted the prevalence of anaemia among rural men as a significant public health issue that has not received sufficient attention. (10)

Another study investigating the prevalence and contributing factors of anaemia among women of reproductive age (15-49 years) in low- and middle-income countries (LMICs) found a high prevalence rate. Specifically, 45.20% of pregnant women and 39.52% of non-pregnant women in LMICs were affected by anaemia.(11)

The occurrence of anaemia among non-pregnant women is notable. Severe anaemia (SA) prevalence was recorded at 1.54%, 0.99%, and 1.16% in the years 2006, 2016, and 2021 respectively. With the adoption of a new definition, there was an approximately two-fold increase in SA prevalence over a 15-year period. Moderate anaemia exhibited similar patterns, with prevalence rates of approximately 12.66%, 11.44%, and 12.82% in the surveys conducted in 2006, 2016, and 2021 respectively.

For pregnant women, the prevalence of severe anaemia was reported as 2.13% in 2006, 1.45% in 2016, and 1.54% in 2021. Similarly, the prevalence of moderate anaemia among pregnant women was approximately 28.98% in 2006, 24.53% in 2016, and 25.12% in 2021.(12)

HISTORICAL OVERVIEW OF ANAEMIA PROGRAMS IN INDIA

India has a long history of tackling anaemia through national programs. India's battle against anaemia is a long one, marked by continuous program evolution to address this widespread public health concern. but success has been elusive. Dating back to 1970, the National Nutritional Anaemia Prophylaxis Programme (NNAPP) was launched nationwide as a pivotal effort to combat anaemia. Its goals included assessing anaemia prevalence, providing iron and folic acid (IFA) supplements, monitoring their distribution and consumption, and educating mothers. Pregnant and lactating women took one adult tablet daily for 100 days, containing 60mg iron and 500µg folic acid. Preschool children took one paediatric tablet daily. Liquid syrup was given to children who couldn't swallow tablets. Women with severe anaemia received double the dosage. The programme operated through primary health centres, with paramedical staff handling tablet distribution.

Following the 1989 evaluation by the ICMR, the Ministry of Health & Family Welfare (MoHFW) recommended increasing the iron dose for adults to 100 mg of elemental iron. In 1991, the policy guidelines were revised, renaming the program to the National Nutritional

Anaemia Control Programme (NNACP) with a focus shift from prevention to management, though objectives remained similar. In 2007, the national policy included liquid ferrous sulphate and folic acid for children and expanded coverage to school children and adolescents. In 2012, Weekly Iron Folic acid (WIFS) was launched within NNACP program with the objective of ensuring regular iron and folic acid intake to reduce anaemia prevalence by providing weekly IFA tablets to specific age groups through schools and Anganwadi centres. This strategy targeted primarily adolescent girls and boys (in school and out of school) between 10-19 years. Further, in 2013, NNACP was expanded and renamed as National Iron Plus Initiative (NIPI). NIPI was built upon the foundation laid by NNACP and WIFS with the goal of addressing deficiencies beyond just iron deficiency. This program aimed to provide multi-micronutrient tablets containing iron along with other essential vitamins and minerals and targeted children, adolescent girls, and pregnant women.

India's National Health Policy (2017) and National Nutrition Strategy (2017) acknowledge anaemia's detrimental effects on maternal and child health and national productivity. Recognizing the need for intensified efforts, the government aims to combat anaemia comprehensively across all age groups through a unified strategy. India has committed to reducing anaemia among women of reproductive age by 50% by 2025 and targets a yearly reduction of 3 percentage points in anaemia prevalence among children, adolescents, and women through initiatives like POSHAN Abhiyaan (2018–2020).

Experience both globally and nationally demonstrates that with strong political commitment, targeted interventions, expanded program coverage, improved supply chain management, rigorous monitoring, and effective communication strategies, significant reductions in anaemia are achievable, particularly in vulnerable areas.

In light of this, the Anaemia Mukht Bharat strategy launched in 2018 leverages insights from programs like NIPI and WIFS to implement a comprehensive approach with a robust operational and accountability framework, aiming to eliminate anaemia through various interventions and enhanced oversight. In Anaemia Mukht Bharat (AMB) program has a 6x6x6 strategy has been designed to reduce the prevalence of anaemia in India. Six interventions, six target groups and six institutional mechanisms are involved. The interventions include prophylactic iron and folic acid supplementation, deworming, behaviour change communication campaigns, testing and treatment of anaemia using digital methods, provision of fortified foods, and screening for non-nutritional causes of anaemia.

in making India anaemia free.

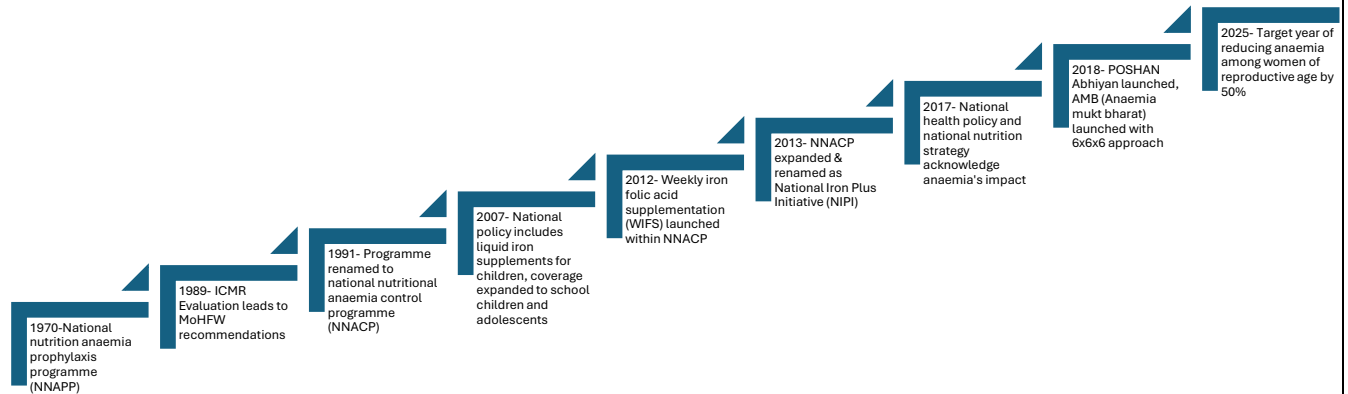


Fig - Historical Overview Of Anaemia Programs In India

BEHAVIOURAL CHANGE COMMUNICATION

Behaviour refers to an individual's observable reaction in a specific situation towards a particular target.. Behaviour is influenced by a lot of factors like personal, societal, environmental factors. Behaviour change refers to the process of modifying or embracing new behaviours. Behaviour Change Communication (BCC) is an interactive process involving communities to create tailored messages and strategies. Its goal is to promote positive behaviours, encourage individual and collective change, and sustain appropriate conduct.(13) It involves strategic use of different communication methods to encourage individuals and communities to adopt healthier and more sustainable practices. This is achieved by encouraging the adoption of positive and beneficial behaviours. (14) Its main focus lies in establishing an environment that facilitates and empowers individuals to transition their behaviour from negative to positive and its success depends on factors like access to information among target audience and whether the knowledge provided has been acquired by the audience. (15)

NEED OF BCC IN HEALTHCARE

Behaviour Change Communication (BCC) serves as a crucial link between knowledge and action in promoting health behaviours. It addresses misconceptions, provides guidance, and fosters skill development, bridging the gap between awareness and implementation.(13) Moreover, BCC empowers individuals by offering accessible information, and enabling informed decisions regarding preventive measures, treatment options, and lifestyle choices. Adherence to health interventions often necessitates sustained behavioural changes, such as medication adherence or dietary modifications. Effective BCC interventions can enhance adherence by setting realistic goals, enhancing self-efficacy, and providing ongoing support and reminder. Additionally, BCC plays a pivotal role in challenging negative social norms and promoting positive ones. Therefore, BCC emerges as a multifaceted and cost-effective approach to promoting health behaviours and improving health outcomes. Various SBCC strategies have been used in the past to reduce the prevalence of anaemia and create awareness among people.

BCC has been incredibly beneficial, in the past. India's achievements in eradicating polio and managing COVID 19 showcase the effectiveness of Behaviour Change Communication (BCC). During the polio eradication efforts BCC utilized communication channels like media, community engagement and culturally sensitive messages to debunk misconceptions about vaccines and promote widespread participation (16). . Local influencers and healthcare workers played a role in establishing trust and addressing concerns. Similarly COVID 19 campaigns used mass media, social platforms and community interactions to encourage practices like wearing masks practicing hand hygiene and maintaining distance. Interactive initiatives with celebrities and clear messaging, in languages helped counter misinformation. Promote preventive behaviours effectively. These successful BCC strategies highlight how communication can drive behaviour change and achieve health objectives.(17)

RATIONALE

Anaemia continues to be a significant public health problem amongst Indians, and the NFHS-5, data depict a rising trend of the prevalence of anaemia in all age groups. As government interventions increase in the management of anaemia, the disease burden of the condition keeps rising, thus the need for a primary research and recommendations of current strategies and the need to design appropriate behaviour change communication strategies. The objectives of this study include identifying the possible gaps in the existing anaemia programs, identifying some characteristic features of anaemia from the NFHS-5 data, and analysing the effectiveness of the presently implemented BCC interventions. The research aims to combine such disparate sources of data for generating targeted recommendations of BCC strategies pinpointing to certain determinants of anaemia as revealed in NFHS-5 analysis. It also appreciates the complexity of factors necessitating increase anaemia vulnerabilities in India while emphasizing on the centrality of BCC to address such issues. Thus, theories, methods, evidence and findings of this research initiative hope to provide proven approaches towards eradication of anaemia and, thus, promotion of health among the people of India.

REVIEW OF LITERATURE

Anaemia continues a major public health concern in India that exists in various populations and has methodological, demographic, and socio-economic characteristics. In this regard, the several interferences have been conducted, but the level of anaemia remains critically high; that is why it is urgent to analyse the contemporary approaches and their efficacy. The current literature review confines and narrows down the subject area of anaemia interventions and BCC from various research for a better understanding of the same in India.

A substantial work by Neogi et al reviewed the anaemia control programmes during pregnancy in India; that brought out number of methodological issues. Such sources of bias have comprised difference in survey techniques, methods of haemoglobin determination and application of the same haemoglobin cut off points during the different pregnancy trimesters which may contribute to exaggeration of the anaemia prevalence rate. Following the findings of the authors, Perez and Popkin call for more precise measurement procedures, most correct haemoglobin cut-offs, fundamental mapping of the factors associated with anaemia in women of reproductive age before the first antenatal care clinic appointment, and concentration of the measures on the general nutritive status of women of reproductive age.(18)

Recently, the concern over anaemia among men has emerged, where Saxena et al defined a high prevalence of anaemia differing between 20-39%. 9% nationally. They stated that; the present research found out that, areas such as Ladakh and Jammu & Kashmir for instance, revealed higher figures. This implies that the future of anaemia research and the design of policies for addressing this problem should go further than women and children only, although men are usually excluded from national surveys and policies.(5)

According to the study conducted by Singh et al., (2023) about the prevalence of anaemia in under five children, NFHS were employed in acquiring data. The studies also showed that the mothers' level of education, anaemia status of the mother and Socio-Economic factors played a great role for high prevalence of anaemia in children. They conclude that these new challenges might also require the further fine-tuning of the Anaemia Mukht Bharat Programme, noting that proposals should take into consideration some socio-economic and demographic features.(1)

One study by Singh et al. exploring haemoglobin level in among the 61,481 men aged 15–54 years, NFHS established that one-quarter of the male population in India was anaemic. Similar to the gradient in the proportion of wasting, the risk of overweight was highest among those from the Scheduled Tribe (ST) and with age 50–54 years. This also explained for mean household wealth, men's education level, and region, calling for intervention to reach men from such backgrounds.(10)

According to Let et al. 2024, the position of IDSP regarding anaemia among women of reproductive age in Aspirational Districts of India has worsened. Some of the determinants of these women were the number of children conceived as well as having three to four children, and breastfeeding, being a member of Scheduled Tribe, rated among the poorest women, and occasional fish consumption. Hence, the study reiterates the need for district-specific strategies to address the prevalence of anaemia, advocating for SDG 2 (Zero Hunger) and/or 3 (Good Health and Well-being).(8)

Several studies conducted by Kulkarni et al. 2022, NIPI appeared to show that the highest raised haemoglobin level in adolescent females was obtained from the administration of IFA supplement, vitamin C. The study recommended strengthening NIPI by integrating evidence-based measures such as Vitamin C supplementation, low-dose iron options, intensified health education, and iron-

rich food distribution. Ensuring an adequate and timely supply of IFA supplements and delegating health education responsibilities to medical and nursing colleges were also suggested.(19)

The significance of Behaviour Change Communication (BCC) strategies in addressing anaemia was highlighted by Lamstein et al. 2014. They emphasized BCC's potential to influence dietary behaviours and improve iron intake. These strategies leverage behavioural theories to address factors such as cultural beliefs, food accessibility, and maternal dietary behaviours, proving crucial for vulnerable populations, including pregnant women, infants, and young children.(20)

Another study explored the evidence-driven behavioural interventions, noting a significant gap between IFA supply and consumption among pregnant women. Despite high IFA coverage, only 26% of pregnant women consumed the tablets. Behavioural barriers included side effects, anaemia not being perceived as a health condition, the intangible payoff of IFA tablets, traditional health-related norms, and a lack of trust in IFA tablets.(21)

Ghosal et al. 2023 examined trends among tribal and non-tribal women over 23 years, revealing that despite significant socio-economic improvements, anaemia rates remained high. The study suggested that micronutrient deficiencies, particularly iron, are likely the main drivers of anaemia, unlinked to structural determinants like wealth and education. This deficiency is largely attributable to inadequate uptake and absorption of micronutrients from Indian diets.(22)

Similarly, in the review study on behaviour change communication to improve infant and young child feeding in low and middle income countries, Nair et al. (2020) underlined multilevel influences on one's health related behaviours. They discussed the barriers and solution to behaviour change and the evidence based behaviour change techniques which includes the followings; goal setting, self-

monitoring, feedback and social support as the ways of encouraging healthy behaviours.(23)

METHODOLOGY

AIM:

This study aims to assess and improve behaviour change communication (BCC) strategies within India addressing anaemia through a comprehensive analysis of gaps in the existing anaemia Programmes, identification of major determinants of anaemia from NFHS-5 data, and evaluating the efficacy of current BCC Interventions.

OBJECTIVES:

1. With a focus on exposing deficiencies in the current anaemia programs rolled out in India thereby identifying some of the problems and possible solutions.
2. Drawing from the data captured by National Family Health Survey-5 (NFHS-5), pull out major factors contributing to anaemia with emphasis put on demographics, socioeconomics and health related issues.
3. To establish if the existing behaviour change communication (BCC) interventions aimed at reducing anaemia prevalence in India are effective or not.
4. Based on NFHS-5 analysis, come up with BCC strategies recommendations for addressing specific determinants of anaemia

STUDY METHODOLOGY

1. Key Research Questions-
 - a. What are the current gaps in the existing anaemia control programs in India?
 - b. How effective are the current Behaviour Change Communication (BCC) interventions in addressing anaemia?
2. Research Design- The study employs a secondary data analysis research design, focusing on existing literature, government reports, and data from the National Family Health Survey (NFHS-5)
3. Study Population- The study population includes: Children aged 6-59 months, Adolescents, Women of reproductive age (15-49 years), Pregnant and lactating women, Men

4. Research Procedures/Approaches- The study uses both quantitative and qualitative assessments

a. Quantitative Assessment:

- i. Analysis of NFHS-5 data to identify trends and prevalence rates.
- ii. Review of statistical reports and previous survey data to understand the historical trends in anaemia prevalence.

b. Qualitative Assessment:

- i. Review of existing literature and government reports to identify gaps in current programs and effectiveness of BCC interventions.
- ii. Synthesis of findings from various studies to recommend targeted BCC strategies.

RESULTS

I. KEY DETERMINANTS OF ANAEMIA AMONG DIFFERENT TARGET GROUPS

India's placement at 170 out of 180 nations for female anaemia, as per the 2016 global nutrition survey, underscores the severity of the issue (24). Despite extensive governmental initiatives and NGO involvement, anaemia continues to cast a shadow over India, making the goal of its eradication seem increasingly distant. The challenge encompasses issues occurring at both ends of the supply chain.

Anaemia has a multifactorial aetiology, requiring comprehensive interventions for mitigation. In Low- and Middle-Income Countries (LMICs), iron deficiency is a primary cause of anaemia in pregnancy, with over 60% of cases in India attributed to it. However, nutritional factors beyond iron deficiency, such as low folate and vitamin B12 levels, contribute significantly, particularly among vegetarians and women of reproductive age.(18) Haemolytic anaemia and malaria also play substantial roles in anaemia prevalence, particularly in certain regions of India. Moreover, non-nutritional causes like worm infestations are also prevalent. There are a lot of other risk factors known to be associated with anaemia which include individual's dietary habits, water, sanitation, and hygiene. Limited accessibility to healthcare services, coupled with low awareness, poverty, and illiteracy prevalent in rural areas, contribute to higher levels of anaemia among children in such regions (25). Other factors include knowledge and awareness of IFA supplementation, Coverage of IFA supplementation, age, socio-economic status, education level etc. Younger mothers, rural residence, and lower maternal education are associated with higher anaemia rates among children. (26)

In case of *pregnant women*, lack of support from husband and family members especially mother-in-law directly impact the decision making for IFA compliance among women (27). On the contrary, A study conducted on *tribal women* suggests that the main driver of anaemia in India may not be the traditional "usual suspects" like poverty, lack of education, or food insecurity. Micronutrient deficiencies, particularly iron deficiency due to poor absorption from typical Indian diets, might be the main culprit behind the high prevalence of anaemia (28). Therefore, concentrating solely on diminishing structural factors such as poverty and illiteracy might not fully address the issue of anaemia in India.

Prevalence rates of severe and moderate anaemia (SMA) among *non-pregnant women* were affected by factors such as age, educational attainment, rural or urban residency,

socioeconomic status, obesity, and geographical region. It is worth noting that non-pregnant women lacking formal education, residing in rural areas, facing economic challenges, and those without children demonstrated higher prevalence of SMA. Moreover, employed women had a higher prevalence of anaemia compared to those who were unemployed, whereas the prevalence was lower among obese women.(12).

The determinants of anaemia among *women of reproductive age* group were examined, revealing several key factors which included socioeconomic indicators such as caste, education level, household wealth, and region of residence. Additionally, marital status was considered.(29) Compared to NFHS-4, women surveyed in NFHS-5 exhibited a 19% higher likelihood of anaemia among Women of Reproductive Age (WRA) in Aspirational Districts(8). Other factors identified in studies were belonging to Scheduled Caste (SC) and Scheduled Tribe (ST) backgrounds, those with lower education levels, belonging to poorer households, residing in rural areas, and those who were unmarried or divorced were more likely to experience anaemia compared to their counterparts.(29) Individuals with 3-4 children showed 13% higher odds compared to women without children, and breastfeeding women had 17% higher odds than non-breastfeeding counterparts. Higher education was associated with a 13% lower likelihood of anaemia compared to no education. (8). Underweight women had a 20% higher likelihood of anaemia than those with normal BMI. Occasional fish consumption was also linked to 14% higher odds of anaemia. (8)

The prevalence of anaemia among *adolescent females* in India has seen a rise from 54% to 59% between 2015-2016 and 2019-2021. Data from both NFHS-4 and NFHS-5 shed light on several socio-demographic factors influencing this prevalence. Multiple risk factors for anaemia were identified, including lower educational levels, living in multiparous households, experiencing economic deprivation, belonging to ST communities, having a low BMI, and the specific year of the survey(12).

Rural men facing a greater risk of anaemia were found to be older (49-54 years old), have less education, belong to Scheduled Tribes, be in the lowest income group, and be underweight, according to a study. (10). Several chronic health problems can increase the risk of anaemia in adult men. These conditions include kidney disease, liver disease, cancers, ongoing rectal bleeding, and bone marrow disorders. Additionally, advancing age is a contributing factor, with the likelihood of anaemia increasing as men grow older (5). Moreover, lifestyle elements such as alcohol consumption and tobacco usage were found to correlate with an increased susceptibility to anaemia within this

demographic(10). Anaemia prevalence among Indian men is shaped by a multifaceted interplay of socioeconomic, geographical, health-related, and behavioural variables. Variables such as educational attainment, societal classification, religious affiliation, and dietary practices emerged as significant predictors of anaemia incidence (30). Furthermore, the rising incidence of diabetes and hypertension could indirectly influence the onset of anaemia. These chronic health problems can worsen anaemia in two ways. First, they have a direct impact on the body's ability to produce red blood cells. Second, they may even lead to people limiting their diet, which can make it harder to get the nutrients needed to fight anaemia (5).

Among *Adolescent men*, the demand of nutritional intake is high to support rapid muscle and body mass growth. Poor nutrition, especially a lack of iron, folate, vitamin A, and vitamin B12, can stunt growth and development during this critical period, leading to anaemia. Other threats include infectious diseases like malaria and hookworm, genetic conditions like haemoglobinopathies, and blood loss from violence or injuries. Socio-economic factors and dietary habits, including reduced consumption of nutritious foods, adherence to food fads, and meal skipping, further compound the risk of anaemia. These diverse factors highlight the multifaceted nature of anaemia and advocate for comprehensive intervention strategies.(5)

Several factors contribute to anaemia in Indian children between 6 and 59 months old. These include the mother's education level, her own anaemia status, limited access to information (media exposure), being born later in the birth order (having many older siblings), family wealth (socioeconomic status), whether they live in a city or rural area (place of residence), social group (caste and religion), and the child's age. (31). Mothers with anaemia had a higher chance of having children with anaemia. The study also revealed that children from poorer families, especially those in the lowest income group, faced a greater risk of anaemia. This suggests that socioeconomic factors, such as access to healthcare and nutrition, contribute to the prevalence of anaemia (1). Limited media exposure emerged as a risk factor, potentially affecting mothers' awareness of child feeding practices, disease prevention measures, and healthcare-seeking behaviours.(31)

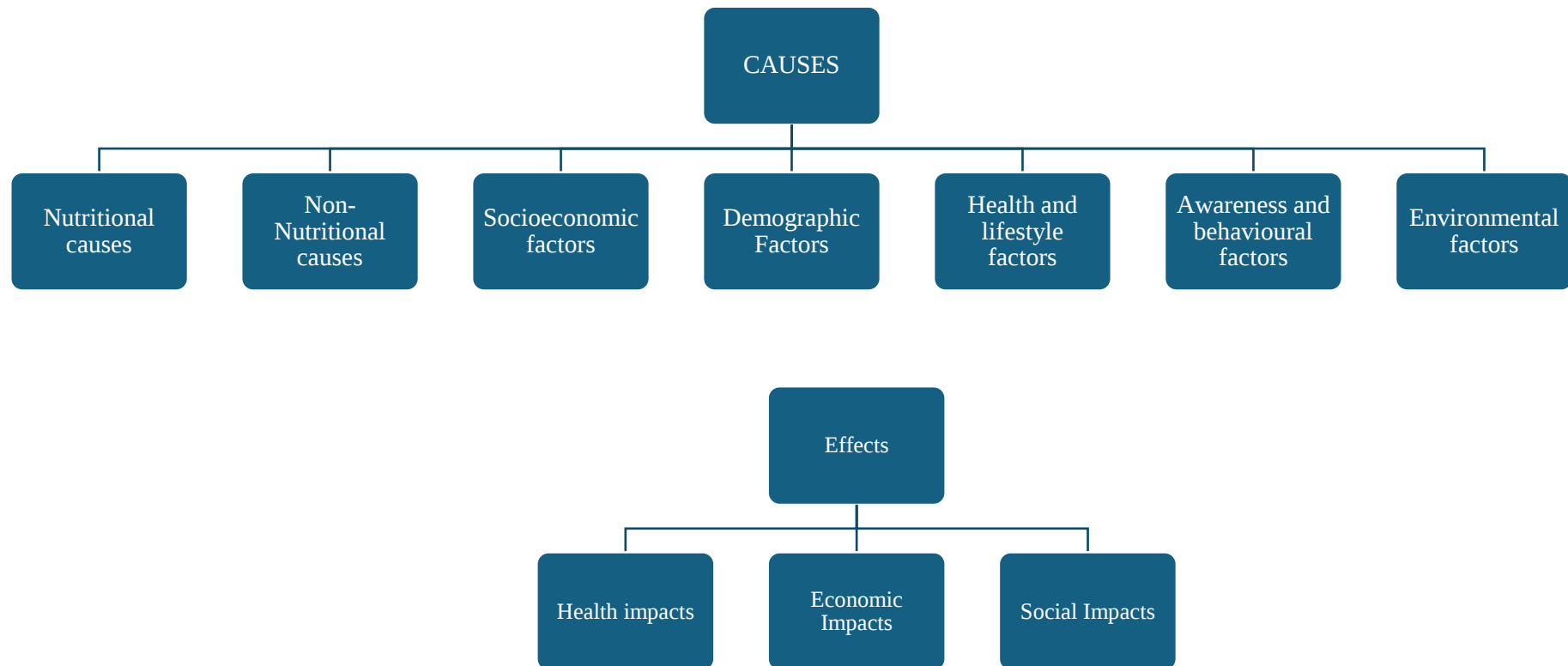


Fig- Causes and effects of anaemia

II GAP ANALYSIS OF CURRENT STRATEGIES

a. Knowledge and Awareness Gaps among Healthcare Practitioners -

Numerous studies highlight the existing deficiencies in strategies aimed at preventing anaemia. Research has shown that some Indian obstetricians lack complete knowledge, positive attitudes, and consistent practices when it comes to anaemia and its management in pregnant women. A study found that only about 10% of the total Indian obstetricians (1974) checked for anaemia (haemoglobin levels) during the second trimester of pregnancy. Additionally, nearly half (43%) relied solely on dietary changes for moderate anaemia in the first trimester, avoiding oral iron therapy due to unfounded concerns about birth defects. This highlights the need for improved education and updated practices among obstetricians.(30)

b. Comprehensive Approach to Micronutrient Deficiencies - Anaemia is indeed caused by many factors, and data from the National Family Health Surveys (NFHS-4 to NFHS-5) shows a significant change in anaemia rates across different age groups. This shift underscores the entrenched nature of the anaemia issue and highlights the multitude of factors contributing significantly to its rise in the country. IFA supplementation is a key strategy for India to combat iron deficiency anaemia, yet addressing broader nutritional deficiencies and underlying factors requires a more comprehensive approach. Iron deficiency was the biggest contributor to anaemia in this group, but other factors also played a role. These included deficiencies in vitamin A and zinc, genetic blood disorders (haemoglobinopathies), increasing age, and lower household wealth.(4)

One cross-sectional study focused on the various ways of enhancing the effectiveness of NIPI such as vitamin C and IFA, LDI and IHE, LDI and Vitamin C and including iron containing foods to the adolescent girl's diet in order to increase Hb% . The findings reveal that the maximum improvement in Hb% transpired in the group, which received IFA under NIPI along with Vitamin C fortification. Similar to the NIPI-only group, the LDI with IHE group also revealed a significant Hb enhancement which was also nearly equal. These results underscore the importance to improvement of NIPI by including more precise and extensive data depending on the present data on knowledge of sciences(19).

c. Importance of Dietary Habits in Anaemia Prevention - It also points to the necessity of regarding diet choices or the population and raising funding specifically for nutritional programs at both private individuals and communities with the goal to raise consciousness on healthful eating. Such initiatives can impart long term value when it comes to community's health and can indeed alleviate health care costs through decreased incidence of diet related diseases on the society. Also, financing research where improvement of quality, availability and sustainability of food and its production could be established. It could entail partnering in cause related areas such as supporting programmes such as innovation in agriculture, food fortification and creation of better quality cheap food products. Therefore, investing in these areas may help to solve numerous problems, which are typical for the food system, and increase the quality of meeting the population's nutritional needs leading to the improvement of the people's health and making society more sustainable.

d. Compliance to IFA supplementation

DEMAND SIDE

The multiple reasons adduced for low compliance to the prescribed IFA tablets were gastric side effects such as vomiting, indigestion and darkness of stools after taking the IFA tablets among those pregnant females.(32). Lack of adequate knowledge about the appropriate IFA tablets also contributed to some women not taking the supplementation at all due to hearsay information from elders and neighbours containing misconceptions of potential harms such as affecting the development of the foetal brain and causing change of skin pigmentation. Some of the barriers that affected compliance with the daily use of the tablets included forgetfulness, busy household schedules as a result of having many children in school and irregular meal times. (33) The available government-supplied IFA tablets in terms of taste, smell, and size of the tablets was smaller compared to the IFA tablets purchased from pharmacies; this was another source of poor adherence to the tablets.(32).

Certain obstacles to adherence with IFA supplements among children aged 1-9 years were also identified. Firstly, there were notable gaps in the availability of supplements, with a significant portion of mothers reporting not receiving them. Furthermore, side effects such as nausea and vomiting were reported, leading to discontinuation of supplementation by some mothers. The non-palatable nature of the supplements, particularly the metallic

taste and iron smell, was also cited as a deterrent to children's acceptance. Additionally, issues regarding incorrect dosage administration and maternal forgetfulness were observed. A lack of awareness regarding childhood anaemia was evident among a small percentage of mothers. Moreover, inadequate distribution, coverage, and monitoring, coupled with a scarcity of measuring tools and compliance cards, were highlighted as systemic challenges. To summarize, irregular supply, side effects, unappealing taste, limited maternal awareness, and deficiencies within the health system's distribution and monitoring mechanisms were identified as the key barriers to effective implementation of the IFA supplementation program for children.(34)

For adolescents, various obstacles hinder adherence to iron and folic acid (IFA) supplementation, spanning personal, social, and environmental spheres. Personal barriers encompass fear of side effects, lack of motivation, unawareness of benefits, and forgetfulness. Social barriers include pressure from parents and peers, educators' perceptions of complexity, and community misperceptions regarding iron tablets. Environmental barriers consist of water unavailability, fasting during festivals, religious and cultural influences, and low community awareness. Addressing these barriers is crucial to improving adherence to IFA supplementation programs.(35)

SUPPLY SIDE

Challenges in Achieving Adequate IFA Supplementation Coverage - Even though IFA supplementation is our key strategy, the coverage remains low. According to NFHS-5, Only 26% of mothers reported consuming iron-folic acid supplements for 180 days or more during pregnancy, indicating low coverage of IFA supplementation. In the period from 2018 to 2019, IFA supplementation rates were 8.3% for children aged 6-59 months, 14.9% for children aged 5-9 years, 28.0% for adolescents aged 10-19 years, and 84.8% for pregnant women.(36).

IHAT conducted a study investigating opportunity gaps in the effective coverage cascade for preventing anaemia in pregnant women across India. The study revealed that the most significant gap in the cascade lies in 'user adjusted coverage' (*User Adjusted Coverage means Number IFA tablets as per guidelines whose indicator is Consumed IFA tablets for 100 and 180 or more day*) specifically the consumption of IFA tablets. This disparity stands at 44% points nationwide and varies from 5% of pregnant women in Goa to approximately 71% in Jammu and Kashmir. (37).

Bottlenecks in the supply chain of IFA supplementation- One of the issue in achieving full coverage of IFA supplementation could be the issues in the supply chain of IFA supplementation. A major issue identified was the lack of a standardized forecasting process that led to mismatches between the actual demand and the procured quantities of IFA supplements (38). Procurement delays from suppliers, with deliveries frequently delayed by 1-3 months, also contributed to stockouts and supply shortages of IFA at the peripheral levels (36). Poor inventory management practices like not maintaining buffer stocks and lack of proper systems to track expiries further exacerbated the erratic availability of IFA tablets.(38). The absence of an integrated logistics management information system (LMIS) across different levels of the supply chain hindered real-time information flow and monitoring. This was further compounded by the lack of coordination between the health and education departments for the last-mile delivery of IFA supplements, particularly for IFA blue and pink tablets meant for school-going children and adolescents.

Together, these challenges in predicting, obtaining, managing inventory, distributing, and managing information systems negatively affected the overall effectiveness of the IFA supply chain. This led to inadequate coverage of IFA supplementation among targeted groups such as children, adolescents, and pregnant women.(36)

Furthermore, the procurement processes were plagued by complexities and delays, especially in remote areas, due to lengthy tendering procedures and reliance on a single supplier. Inventory management practices were inadequate, with a lack of minimum stock level guidelines, improper storage facilities, and untrained staff. The distribution system followed an ad-hoc push model instead of a demand-driven approach, leading to unplanned and untimely supplies at the last mile.

BARRIERS	FACILITTAORS
1. Socio-cultural barriers like taboos, family compulsions	1. Knowledge and education about anaemia
2. Knowledge barrier like unaware about IFA supplementation, benefits of IFA.	2. Access to healthcare services
3. Personal barriers like forgetfulness, household chores,	3. Counselling regarding importance of IFA
	4. Adequate supply of IFA supplementation
	5. Supply of packaged IFA tablets

4. Side effects like bloating, constipation, bad taste, Headache and vomiting 5. Misconceptions like IFA tablet might affect the baby, interferes with baby's growth, does not increase Hb levels 6. Poor packaging of tablets 7. Lack of training to teachers and field workers	6. Counselling about potential side effects 7. Proper training to field workers and health care staff
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Table 1- Barriers and facilitators to IFA supplement consumption

Methodological Issues in Anaemia Measurement - Methodological challenges persist in the measurement and reporting of anaemia prevalence in large-scale surveys such as NFHS, DLHS, and AHS in India. These issues encompass various factors, including discrepancies in haemoglobin cut-offs used for anaemia definition, variations in haemoglobin estimation methods (such as HemoCue versus cyanmethaemoglobin), and differences in the models of HemoCue analyzers employed. These discrepancies can result in inconsistent estimates of anaemia prevalence across different surveys. (Neogi et al., 2022). NFHS surveys employ cutoffs of 11 g/dl for pregnant women, 12 g/dl for non-pregnant women, and <13.0 g/dl for men aged 15–49 years, with considerations for variables like smoking and altitude.. However, this approach carries the potential for generating inaccurate results and misinterpreting trends, ultimately leading to a lack of targeted interventions.(5) In an effort to mitigate the impact of such outcomes on policy and healthcare strategies, anaemia indicators have been omitted from NFHS-6. While this decision addresses certain concerns, it raises new issues, particularly the complete absence of data regarding the anaemia status of the population. Also, studies suggest that the best clinical outcomes are associated with haemoglobin levels between 95 and 105 g/l in the third trimester. Due to physiological changes causing haemodilution during pregnancy, the cutoffs for the second and third trimesters should be adjusted to 10.5 g/dl and 10 g/dl, respectively, with a postpartum level of 10 g/dl. Therefore, caution is warranted when interpreting NFHS survey results, as the uniform cutoff of 11 g/dl may not accurately reflect anaemia throughout pregnancy and the postpartum period. (18)

Apart from this another major discrepancy happens in blood samples considered for Haemoglobin measurements. In a study conducted, the overall prevalence of anaemia was lower compared to previous surveys likely because the study used venous blood samples to measure haemoglobin levels instead of capillary (finger-prick) blood samples being used in previous surveys.(39). Several studies have shown that capillary blood haemoglobin tends to underestimate the true haemoglobin concentration compared to venous blood. There are several reasons to it-

Dilution effect: Capillary blood is obtained by pricking the finger, which causes some dilution from tissue fluids, leading to a lower haemoglobin reading.

Haemolysis: The process of obtaining capillary blood can cause haemolysis (rupturing) of some red blood cells, releasing haemoglobin into the plasma, falsely elevating the haemoglobin concentration.

Technical issues: Proper capillary blood collection requires skill and adherence to standardized techniques, which may not always be followed in large surveys, introducing error.

In contrast, venous blood samples are drawn from a vein, minimizing dilution and hemolysis effects. Therefore, venous blood haemoglobin levels are considered a more accurate representation of the body's true haemoglobin status (40).

Disparities in Early Antenatal Care Coverage - Another most prevalent disparity lies between pregnant women who received any Antenatal Care (ANC) and those who received early ANC. While any ANC serves as an indicator of 'contact coverage,' early ANC (within the first trimester) serves as a proxy indicator for 'quality adjusted coverage' (*Received IFA as per standards Women who had antenatal check-up in the first trimester*) suggesting the likelihood of receiving Iron and Folic Acid (IFA) according to standards during ANC (i.e., for 180 days), commencing from the beginning of the second trimester. This discrepancy amounts to 23% points nationwide, ranging from 4.7% in Kerala to 33.5% in Meghalaya, with more than half of the states analysed exhibiting a gap greater than 20% points.(37). Also the reported consumption of iron and folic acid supplements does not match with the reduction in anaemia prevalence observed between surveys, raising questions about adherence.(18)

A concerning trend highlighted by a recent study is the increase in the number of states with anaemia prevalence exceeding 60%, from 5 states in 2015–16 to 11 states in 2019–

21. (41) This underscores the urgent need for targeted interventions to address this escalating issue. Over the past five decades, the Indian government has implemented numerous programs to combat anaemia among women and children. Initiatives such as the National Nutritional Anaemia Prophylaxis Programme (NNAPP) and the Integrated Child Development Services (ICDS) have provided Iron and Folic Acid (IFA) supplements and comprehensive services. Later updates targeted in-school adolescents, with the implementation of National Nutritional Anaemia Control Programme (NNACP), followed by Weekly Iron and Folic Acid Supplementation (WIFS) Program. To strengthen anaemia related efforts further and improving coverage, the Ministry of Health launched Poshan Abhiyaan or Nutrition Campaign under its flagship programme- the National Health Mission (NHM).²¹ The anemic issues were addressed to some extent at least via a newer mission mode approach. Despite all these efforts anaemia still continues to be high among women, particularly in adolescent girls because of a multitude of reasons including low coverage, programmatic pitfalls and changing lifestyles. Success will warrant greater coordination between programs for anaemia control based on numerous evidence gathered over time; region specific interventions, bridging urban-rural disparity and regular monitoring and evaluation. Results would however not manifest unless the existing findings linking prevalence of problem to maternal health needs, maternal education ratio or nutrition indicators are used by policy makers for better health and equity results for this vulnerable population.

Addressing Anaemia in Men: An Overlooked Concern- Independent studies pointed on the need to address anaemia in men by scaling up the effort focused on the fight against anaemia through existing strategies and policies. The authors advocated for tailored interventions targeting at-risk rural male populations, routine anaemia screening, and accounting for regional disparities in prevalence when formulating policies. The study concluded that adopting a holistic approach that addresses identified risk factors and vulnerable demographic groups could effectively alleviate the anaemia burden among rural men in India.⁽¹⁰⁾

Enhancing Behaviour Change Communication Strategies -Another area of concern within programs addressing anaemia is the utilization of Behaviour Change Communication strategies. Although the Anaemia Mukta Bharat program integrates Behaviour Change Communication (BCC) campaigns aimed at promoting behaviours essential for preventing and managing anaemia. These campaigns concentrate on enhancing compliance with Iron Folic Acid (IFA) supplementation, recognizing it as a

pivotal strategy to bolster iron levels in the body, particularly for pregnant women and adolescent girls. They also recommend change in one's diet encouraging intake of food rich in iron like the green vegetables, lentils and fortified foods that are essential in the management of the condition in the longer run. However, the effectiveness of these campaigns is relative to the challenges that are encompassed in the following. First, there is a level of concern where people are aware of anaemia and its causes but fail to practice the suggested measures following a lapse in knowledge or skills..(42) Second, the social culture is strong and prevents the change of diet especially by women who are expected to produce offspring. Meals prepared bear characteristics regarding limiting nutritional value by making women eat last and denying the women the full decision-making power in the running of homes. Thirdly, misunderstanding such as the fear of side effects from taking, iron tablets and forgetfulness are leading barriers to supplement taking.

Thus, BCC strategies have to progress to a higher level of political sophistication if anaemia control efforts are to succeed in India. Given this it requires a more personalized approach for each culture to address their business and social practices, framing the message in culturally known language and using local figurative devices to add more meaning to the passage as understood by the targeted culture. The need for BCC to disrupt social norms implies that the ultimate goal is to prevent the continuation of these regressive trends ranging from health self-organisation to obtaining access to good food and health services; this means encouraging change-makers to demystify negative social practices that limit community members' ability to make constructive changes to their diet and health, for example, engaging with male elders to fight for women's rights to decide on how to improve the family Addressing misconceptions that surrounds the usage of the iron tablets together with encouraging the dissemination of information concerning the effects of the tablets through familiar means such as the community health workers and the regional media improves the adherence. It is essential to address behaviour change techniques CSR support and source of reminders for engaging in behaviour change hence steady iron supplementation and dietary transformation can be attained.

III Effectiveness of current behaviour change communication (BCC) interventions aimed at reducing anaemia prevalence in India

The given search results depict a clear understanding of different BCC interventions that endeavour to strengthen health and nutrition related knowledge, attitude, and practice among targeted populations particularly adolescents, pregnant women, and caregivers of young children. The research of treatments and prevention strategies for anaemia as well as guiding the health-conscious diet among different populations and across various contexts show significant improvement from the systematic review of interventions. The multi-component approaches, which integrated strategies such as micronutrient supplementation, nutrition education, behaviour change communication (BCC), and community engagement, demonstrated significant positive impacts. The results segregated into two sections focused on -

- 1) Compliance to IFA supplementation through BCC strategies
- 2) Enhancing nutrition knowledge and dietary practices among target audiences.

I. Compliance to IFA Supplementation through BCC Strategies

The review identified several innovative and context-specific BCC interventions that significantly enhanced compliance and usage of iron-folic acid (IFA) supplements among key target groups.

A) Contextualized IEC Materials and Counselling

In Uttar Pradesh, India the UMANG intervention involved weekly IFA supplementation coupled with deworming and monthly family life education sessions over 4 years. Contextualized approaches like culturally relevant posters in classrooms and individual compliance cards maintained by girls facilitated high compliance rates of 86% among non-school-going adolescents.(43)

In rural Philippines, redesigning the iron supplementation delivery system (ISDS) proved highly effective. It involved village health workers (VHWs) and traditional birth attendants (TBAs) in spot mapping, registration of pregnant women, distribution of IFA tablets, monitoring compliance using notebooks, and counselling aided by IEC materials like posters and flyers. This enhanced approach led to 79% of pregnant women consuming IFA tablets compared to only 57.4% in the standard ISDS area without such contextualized strategies.(44)

Another study conducted in Odisha intervened to change the social norms of Women Of Reproductive Age and their Social Networks (Eg Husbands And Mother-in-law) through educational modules and counselling (IFA supplementation, Dietary diversity, Social norms) and Interactive activities and games around prevailing social norms. This Resulted in a 315% increase in IFA consumption.(45)

A study in Nepal investigated the impact of education and pill adherence on haemoglobin levels during prenatal care among Nepalese women, employing a comprehensive educational program, direct counselling with brochure to enhance the knowledge about anaemia and IFA supplementation. This resulted into decrease in prevalence of anaemia in both education group and education with pill count group. (46)

Another study was conducted in Peru to see the effectiveness of different communication methods used like handouts, pamphlets, IPC, etc. The study showed that it led to improved haemoglobin levels from 9.6g/dl to 11.08g/dl. The prevalence of anaemia also decreased from 75% to 30%. (47)

These studies highlight how culturally resonant IEC materials, involving community health workers and family members, leveraging multimedia channels (videos, SMS) and interpersonal interactions (group discussions, counselling), and innovative reminder systems facilitated high IFA compliance among the target beneficiaries across diverse settings.

B) Multimedia Campaigns and Interpersonal Communication

In Odisha, India , a multimedia BCC campaign was organized that utilized health communication videos made by local people, tailored for specific audiences (pregnant, non-pregnant women, husbands, mothers-in-law), followed by group discussions, facilitated a remarkable increase in IFA consumption among non-pregnant women from 5.4% to 31.7% over 30 months.(42)

In Vadodara, India pregnant women were counselled using a culturally appropriate flip chart with illustrations depicting stories of anaemic and non-anaemic pregnant women, coupled with involvement of family members (husbands, mothers-in-law) in the counselling process. As a result, over 90% of women started consuming the recommended IFA dose.(27)

C) Mobile Messaging and Reminders

An intervention in Ahvaz, Iran sent weekly SMS reminders to pregnant women about regular IFA intake, tips for better absorption, consequences of anaemia, and motivational messages. This approach led to significantly higher mean IFA tablet consumption (80.5 vs 67.2 tablets) and compliance rate (94% vs 66%) in the intervention group compared to the control group.(48)

Another similar study conducted in Indonesia used WhatsApp personal chat to send daily educational messages to pregnant women in 1st and 2nd trimester. This led to increase in the mean IFA consumption and had a significant effect on anaemia prevention knowledge (49)

II. Enhancing Nutrition Knowledge and Dietary Practices

A) Participatory Group Education and Counselling

In rural Tanzania, monthly nutrition group meetings conducted by community health workers focused on promoting optimal infant and young child feeding practices like dietary diversity and incorporating biofortified orange-fleshed sweet potatoes. This participatory approach resulted in significantly higher household dietary diversity, child dietary diversity scores, and vitamin A intake among children under 5 years who attended the sessions compared to non-attendees.(50)

In Sri Lanka, interactive small group sessions (4-5 mothers) conducted by trained personnel covered topics like anaemia, importance of IFA, absorption enhancers/inhibitors, and specific dietary instructions (timing of intake, avoiding inhibitors like tea/coffee, etc.). This interpersonal counselling approach led to substantial increases in mean haemoglobin levels (from 11.1 to 11.97 g/dL) and reductions in anaemia rates (from 46.8% to 14%) among pregnant women in the study group compared to the control group receiving routine antenatal care.(51)

Another study conducted in Ethiopia to address the challenge of anaemia among children, Mothers of these children were targeted and were given counselling through oral explanations and figure charts with the target to change their attitude and knowledge towards their child feeding practices. As a result of this study Prevalence of iron deficiency anaemia was seen to be reducing (study 17)

B) Integrated School-based Nutrition Curricula

In rural China, a 6-month intervention adopted a comprehensive school-based approach involving weekly interactive in-class nutrition curricula (15 minutes per week for 26 sessions), monthly peer-support activities (30 minutes each for 6 months), and distribution of knowledge brochures. This multi-component strategy significantly improved nutrition knowledge, attitudes towards nutrition's role in health, and increased the rates of daily vegetable consumption among rural adolescent students.(52)

In Indonesia, a school-based intervention combined weekly 30-minute interactive learning sessions facilitated by teachers, SBCC messaging campaigns, appointment of student ambassadors, and weekly IFA supplementation for adolescent girls over 15 months. This integrated approach enhanced overall nutrition knowledge scores (from 13.9 to 17.2 out of 20), raised IFA compliance from 40.9% to 99.1%, and fostered better dietary habits like increased fruit/vegetable consumption and reduced unhealthy snack intake.(53)

C) Multi-Component Community Interventions

In Ethiopia , a comprehensive intervention package involving interpersonal communication by health extension workers during home visits, agricultural activities (promoting homestead gardening), community mobilization (food demonstrations, community conversations, religious sermons), and mass media (radio dramas) achieved remarkable impacts. It resulted in significant improvements in maternal child-feeding knowledge, minimum dietary diversity among children aged 6-23.9 months (from 5.2% to 10.2%), and minimum acceptable diet (from 4.1% to 18.2%) in the intensive intervention areas.(54)

These studies underscore the effectiveness of participatory group learning methods, integration of nutrition education in school curricula, employment of behaviour change strategies through diverse communication channels (interpersonal, mass media, social media), and adoption of multi-component community-based approaches. The synergistic effects of these strategies facilitated substantial improvements in nutrition literacy, dietary practices, and healthy behaviours across different target groups like mothers, adolescents, and children.

In summary, this comprehensive review accentuates the pivotal role of innovative, tailored, and context-specific BCC interventions in enhancing IFA compliance and fostering positive nutritional behaviour change. The remarkable success of these approaches across diverse settings underscores their potential for large-scale implementation through robust policies and programs to combat anaemia and malnutrition effectively, particularly in high-burden regions like India

DISCUSSION

This systematic review was conducted to present a comprehensive analysis of behaviour change communication (BCC) strategies for the prevention and control of anaemia in low- and middle-income countries, including India. Anaemia is a complex problem with multiple causes that requires a multi-faceted approach; thus, there is increasing recognition that interventions need to address both supply- and demand-side challenges in order to be successful.

Key findings emphasise the importance of context specific BCC interventions to improve compliance to IFA supplementation and healthy dietary practices. Context specific culturally sensitive IEC material, multimedia based IEC, interpersonal counselling and community participation has been found closely related with increased adherence to IFA in pregnant women, adolescents and children. These approaches help in overcoming common myths suspected barrier and reinforces sociocultural norms by targeting at all levels of the socioecological model of behavioural change.

However, serious supply-side challenges limit the effectiveness of anaemia control efforts. Forecasting errors, procurement time lags, poor stock management and distribution problems result in intermittent access to IFA supplements, undermining the potential of BCC strategies and weakening user confidence in health systems. Methodological difficulties impede accurate measurement and reporting of anaemia prevalence. Variability across surveys and studies in haemoglobin cut-off points, estimation methods and types of samples used lead to inconsistent estimates of prevalence, making evidence-based decision-making and targeting interventions difficult

Addressing broader nutritional deficiencies past iron is essential for sustainable anaemia manage. While IFA supplementation remains pivotal, comprehensive techniques integrating vitamins like vitamin A and zinc, and addressing elements inclusive of haemoglobinopathies, infections, and socio-monetary determinants are essential.

Tailored interventions are imperative, mainly for demographic agencies dealing with disproportionate anaemia burdens due to socio-financial and cultural elements. Strategies must encompass various communication channels and engage stakeholders at more than one stages, including households, communities, and healthcare vendors, to efficiently mitigate anaemia's impact. Expanding the audience to encompass influential family contributors, together with moms-in-law and husbands, is crucial to deal with social norms and choice-making dynamics that impact dietary practices and IFA compliance amongst women and adolescent ladies. Developing centred messaging and communicate channels for these influencers can enhance the effectiveness of the interventions.

Benefits of technology for reminders and education, as shown in a study, using SMS or voice messages as reminders to accompany IFA and deliver educational content can be an effective way Digital channels others to explore, such as mobile apps or social media, could further increase demographics and participation in BCC services. Organizing focus group discussions with women and fostering open dialogue, including with in-laws, can address concerns, dispel myths, and provide access a shared understanding of the importance of nutrition and IFA supplementation during pregnancy

Strengthening comprehensive anaemia education in the school health curriculum will equip the younger generation with the knowledge and skills necessary to prevent anaemia. Community engagement through annual campaigns that combine the fun of a community kitchen with interactive, playful educational components can improve nutrition and blood pressure physical prevention has been an exciting and memorable experience. Empowering frontline employees by providing them with services that enhance their interpersonal skills is essential. Equipped with the necessary skills to effectively manage social norms creates an environment where women's food needs are prioritized and valued.

We are yet to find out any research mainly specializing in nutrition training and BCC interventions for adolescent adult males, indicating an area for further investigation.

In end, fighting anaemia needs progressive and integrated procedures that bridge behavioural alternate with sturdy healthcare supply systems, correct incidence dimension, and comprehensive dietary techniques. Addressing those multifaceted challenges is critical for achieving sustainable anaemia manipulate in diverse international contexts. Future studies should consciousness on filling existing gaps, which includes vitamins

schooling for adolescent men, to ensure a complete approach to anaemia prevention and control.

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