

## Leveraging Ethiopia's HIV Prevention Success to Strengthen Neural Tube Defect Prevention and Maternal Health

Muleta Befkene Wayessa<sup>1\*</sup> and Heran Ararsa Nigirti<sup>2</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Yekatit 12 Medical College at Abebech Gobena Maternal and Child Health Hospital, Addis Ababa, Ethiopia

<sup>2</sup>Department of Obstetrics and Gynecology, Adama Hospital Medical College, Adama, Oromia, Ethiopia

**\*Corresponding Author:** Muleta Befkene Wayessa, Assistant Professor of Gynecology and Obstetrics, Fetomaternal Fellow, Department of Obstetrics and Gynecology, Yekatit 12 Medical College at Abebech Gobena Maternal and Child Health Hospital, Addis Ababa, Ethiopia.

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### Abstract

Neural tube defects (NTDs) remain a significant cause of neonatal mortality, disability, and adverse maternal-child health outcomes, despite strong evidence that periconceptional folic acid supplementation and food fortification can prevent most cases. In Ethiopia, recent advances in preconception care, micronutrient supplementation, and mandatory food fortification have strengthened efforts to prevent NTDs; however, these interventions remain insufficiently integrated across the continuum of care. In contrast, Ethiopia's Prevention of Mother-to-Child Transmission (PMTCT) program has achieved notable success through the implementation of the World Health Organization's four-prong HIV prevention framework. This commentary proposes adapting that proven framework to NTD prevention by focusing on: (1) preventing unintended pregnancies among at-risk women, (2) preventing NTDs during pregnancy through folic acid supplementation, fortification, counseling, and screening, (3) preventing recurrence among high-risk women, and (4) providing treatment, rehabilitation, and psychosocial support for affected children and their families. By drawing on lessons from Ethiopia's HIV response, we argue that adopting a four-prong approach could strengthen policy integration, improve maternal and child health outcomes, and accelerate progress toward reducing the burden of NTDs.

**Keywords:** Folic Acid; Maternal Health; Neural Tube Defects; PMTCT; Preconception Care

### Abbreviations

ANC: Antenatal Care; CDC: Centers for Disease Control and Prevention; EPHI: Ethiopian Public Health Institute; FMoH: Federal Ministry of Health; HIV: Human Immunodeficiency Virus; ISUOG: International Society of Ultrasound in Obstetrics and Gynecology; NTDs: Neural Tube Defects; PCC: Preconception Care; PMTCT: Prevention of Mother-to-Child Transmission; RCTs: Randomized Controlled Trials; UNAIDS: Joint United Nations Programme on HIV/AIDS; WHO: World Health Organization

### Introduction

Neural tube defects (NTDs) continue to be a significant public health concern worldwide, with serious consequences for newborn health. These defects can lead to a range of issues, including increased rates of illness, mortality, and long-term disabilities for affected

individuals. Fortunately, research has shown that a proactive step can reduce this risk. Studies conducted in Europe and North America have demonstrated that taking folic acid supplements around the time of conception can decrease the likelihood of NTDs by as much as 70% [1,2].

Ensuring adequate folate intake before and during pregnancy is fundamentally vital for prevention. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) recommend that all women of reproductive age consume 400 µg of folic acid daily [3,4]. In countries like the United States and Canada, where mandatory folic acid fortification has been implemented, there have been significant declines in the prevalence of NTDs [5]. Conversely, in Africa, limited fortification programs and a lack of awareness regarding folic acid supplementation continue to contribute to preventable cases [6,7].

Ethiopia's approach to tackling micronutrient deficiencies has evolved over time, moving from a collection of isolated efforts to a more coordinated national strategy. However, it's important to note that the most recent guidelines still don't fully embrace the comprehensive HIV four-prong model. In the past, the country focused on targeted interventions, such as providing vitamin A supplements for children under five, distributing iron and folic acid tablets to pregnant women, and implementing mandatory salt iodization in 2011 [8].

The 2016 National Micronutrient Survey highlighted a troubling reality: many women and children in Ethiopia are struggling with significant nutrient deficiencies. This finding emphasizes the urgent need for better national coordination to address these issues [8]. Similarly, the Seqota Declaration, launched in 2015, set an ambitious goal to eliminate child undernutrition by 2030 through a collaborative, multisectoral approach [9]. However, despite these efforts, many interventions still tend to be narrow in focus, targeting specific nutrients rather than taking a broader, more integrated view of nutrition and health.

In recent years, Ethiopia has taken notable strides in improving maternal health by incorporating pre-conceptional care (PCC) into its healthcare system [10]. This approach highlights the importance of nutrition before a woman becomes pregnant, aiming to mitigate risks like neural tube defects (NTDs). Research indicates that folic acid supplementation during the preconception period plays a crucial role in preventing these defects. By integrating PCC into maternal health services, Ethiopia ensures that women have access to essential micronutrients right before they enter antenatal care [10]. This shift towards early intervention reflects a growing understanding that addressing nutritional deficiencies before conception is vital for breaking the cycle of intergenerational malnutrition.

The National Micronutrient Deficiency Prevention and Control Guideline (2023) mark a significant step forward in Ethiopia's nutrition strategy. It mandates the fortification of essential staples like wheat flour, edible oil, and salt, while also promoting supplementation and dietary diversification. This holistic approach aims to address nutrient deficiencies more effectively. However, it's important to note that, in contrast to the successful four-prong framework used in the prevention of mother-to-child transmission (PMTCT) of HIV, the new micronutrient guideline does not explicitly embrace this integrated model [11]. Drawing from Ethiopia's experience with HIV, we see an opportunity to adapt a similar framework for preventing neural tube defects (NTDs). This adaptation could enhance collaboration and ensure a more comprehensive approach to maternal and child health, ultimately leading to better outcomes for future generations.

The proposed adaptation includes:

1. Prevention of unintended pregnancies among atrisk women.
2. Prevention of NTDs during pregnancy.
3. Prevention of recurrence in highrisk women.
4. Provision of treatment, care, and support for infants born with NTDs.

### Prong one: Prevention of unintended pregnancies among atrisk women

Women with a prior NTDaffected pregnancy face a recurrence risk of 2 - 3% [12]. Similarly, women with epilepsy or diabetes are vulnerable due to teratogenic medications and metabolic imbalances [13,14]. Globally, the integration of family planning with preconception counseling improves folic acid uptake and reduces recurrence rates [2,15]. In Africa, limited access to family planning and preconception services contributes to high rates of unintended pregnancies among atrisk women [6,7]. In Ethiopia, hospitalbased studies report NTD prevalence ranging from 6.1 to 12 per 1,000 births [16,17], and most women initiate folic acid supplementation only after pregnancy recognition [18]. The best option for Ethiopia is to strengthen family planning services, integrate preconception counseling into routine reproductive health care, and ensure folic acid supplementation before conception, consistent with national policy priorities. A view that integrates nutritional interventions with existing healthcare structures, Ethiopia can ensure that women and children receive the support they need to thrive, ultimately contributing to healthier generations ahead.

### Prong two: Prevention of NTDs during pregnancy

Daily folic acid supplementation of 400 - 800 µg is crucial for preventing neural tube defects (NTDs), with higher doses suggested for women at increased risk [3,15]. Prenatal screening techniques, including maternal serum alpha-fetoprotein testing and detailed ultrasounds at 11 - 14 and 18 - 22 weeks, play a vital role in the early detection of potential anomalies [19,20]. Advanced anatomic scanning can help identify severe defects that may not be compatible with life, allowing for informed decision-making within ethical and legal boundaries [21,22]. In addition to folic acid supplementation, avoiding hyperthermia and exposure to teratogens during the early stages of pregnancy is important in reducing risk [23,24]. Worldwide, the implementation of mandatory folic acid fortification has led to a significant decrease in NTD prevalence, particularly in countries like the United States, Canada, and South Africa [5,25]. In Ethiopia, while policy provisions for the fortification of wheat flour, edible oil, and salt have been approved, the actual implementation is still in progress. Antenatal care remains the primary channel for delivering essential supplements and screenings. Recognizing the need for improved access to advanced imaging, Ethiopia took a proactive step by launching the Basic Obstetrics Ultrasound Training for mid-level health professionals in April 2024 [26]. This program aims to decentralize the capacity for anomaly detection, enabling healthcare providers in regional and rural areas to conduct basic scans and identify significant congenital anomalies, including NTDs [26,27]. To enhance maternal health outcomes, it is crucial to accelerate the implementation of fortification programs, extend ultrasound services beyond urban centers through effective training for mid-level providers, and integrate counseling on avoiding teratogenic risks into routine antenatal care. Together, these strategies can strengthen Ethiopia's secondary prevention efforts by combining supplementation, fortification, and scalable ultrasound-based anomaly detection.

### Prong three: Prevention of recurrence in highrisk women

Structured reproductive health programs for women with epilepsy and diabetes emphasize planned pregnancies, medication review, and folate supplementation before conception [13,14]. Globally, targeted counseling for women with prior NTDaffected pregnancies reduces recurrence risk [15]. In Ethiopia, policy action should prioritize counseling for high-risk women, community awareness campaigns, and integration of chronic disease management with reproductive health services. The best option is to establish targeted counseling programs within maternal health services, ensuring that women with prior NTDaffected pregnancies or chronic conditions receive specialized support.

### Prong four: Provision of treatment, care, and support

Surgical repair for conditions like spina bifida and encephalocele improves both survival and functional outcomes [28,29]. A multidisciplinary approach that includes neurosurgery, orthopedics, rehabilitation, and psychosocial support enhances the quality of life for patients [30]. For lethal anomalies such as anencephaly, palliative care ensures dignity and supports families during difficult times [31]. In Africa, access to surgical and rehabilitative services remains limited, with most facilities concentrated in urban centers [6,25].

In Ethiopia, surgical repair is available in tertiary hospitals like Tikur Anbessa Specialized Hospital; however, rural populations often face limited access, and rehabilitation and psychosocial services are underdeveloped [16,17]. Strengthening surgical capacity, expanding rehabilitation programs, and integrating psychosocial and palliative care into maternal and child health services are consistent with Ethiopia's national policy goals for equitable and comprehensive care.

In conclusion, by reframing the approach to preventing micronutrient deficiencies, Ethiopia has the opportunity to build upon its existing pre-conception care (PCC) initiatives and the successful four-prong framework used in HIV prevention. This strategic shift could pave the way for a more robust, multisectoral model that addresses nutritional deficiencies throughout the life course.

### Conflict of Interest

No competing interest.

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