

A Life-course Approach for Influencing Policies to Prevent Childhood Malnutrition

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Key messages

- > Globally, one in three people suffer from some form of malnutrition, a double burden ranging from undernutrition to excessive consumption of highly processed unhealthy foods, which has enormous health, economic and social consequences.
- > During early childhood, nutritional status is an important determinant of health, and malnutrition can impair growth and neurocognitive development, predispose to obesity and increase the risk of later noncommunicable diseases (NCDs).

- > Taking a life-course perspective to tackle malnutrition emphasizes its intergenerational effects and has important implications for the prevention of NCDs, but requires long-term investment and political commitment.

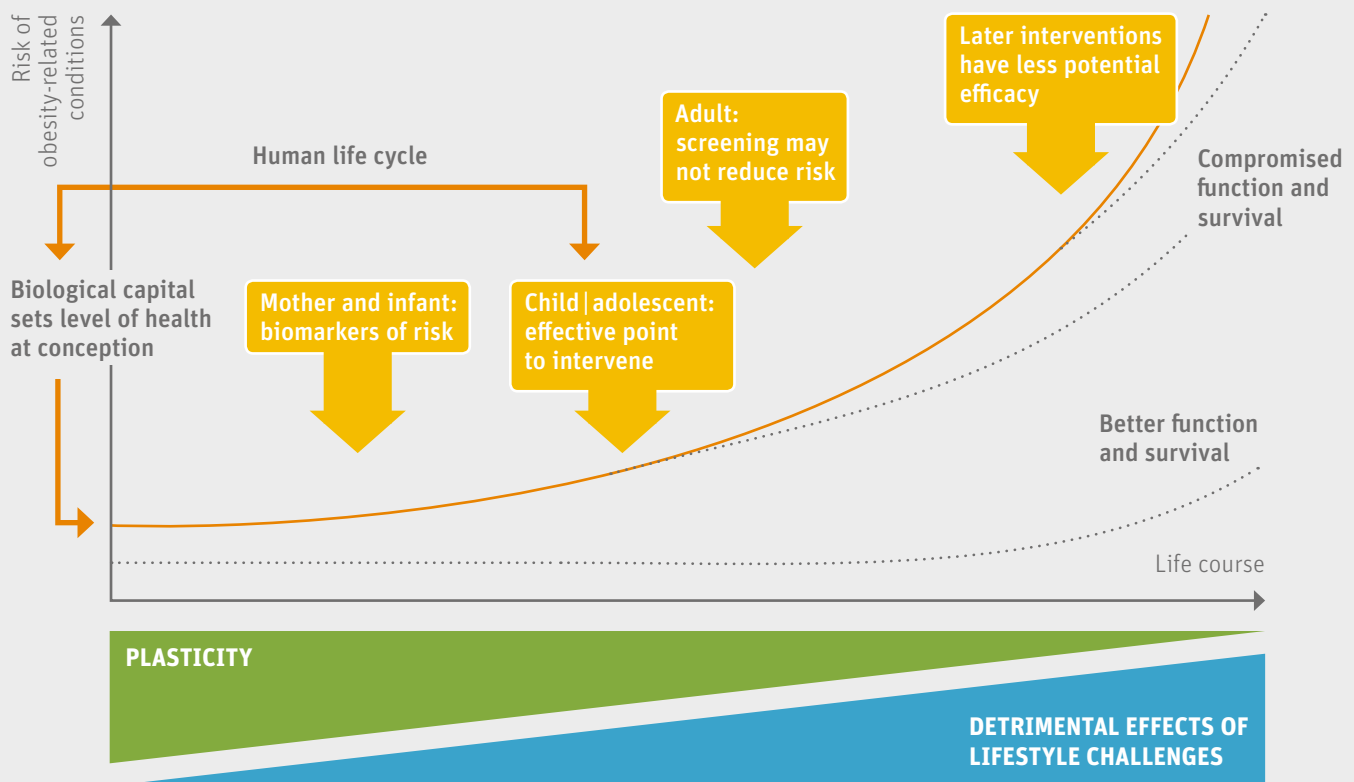
- > Intervening in the preconception period is key to improving nutritional status and health behaviors in young people and adolescents and to preventing transmission of risk to the next generation.

- > Adopting a combination of top-down approaches through policy initiatives and bottom-up engagement of key stakeholders such as young people is recommended to prevent malnutrition over the first 1,000 days of life.

The double burden of malnutrition

It is estimated that nearly a third of the world's population suffers from at least one form of malnutrition: wasting, stunting (short for age), vitamin and mineral deficiency, overweight or obesity and diet-related noncommunicable diseases (NCDs).¹ While remarkable improvements in nutrition have been achieved in low- and middle-income countries (LMICs) over the past few decades, with economic growth and urbanization, undernutrition has been followed by wider consumption of diets associated with high-income Western countries, which are often highly processed and rich in fat, sugar and salt and poor in fiber and micronutrients.^{2,3} Along with rapid changes in life-style, this has led to an increase in NCDs such as diabetes and

FIGURE 1: Risk of NCDs and obesity increases throughout the life course as a result of declining plasticity (green triangle) and the resulting accumulative effects of inadequate responses to new challenges (blue triangle). The trajectory for risk is set much earlier, being influenced by factors such as the mother’s diet and body composition before and during pregnancy, as well as fetal, infant and childhood nutrition and development. Interventions in the preconception period confer a triple benefit: on young people today, for their future health, and for the health of their future children.



cardiovascular disease in LMICs.⁴ Mortality due to NCDs is projected to increase in LMICs along with the incidence of overweight and obesity.^{5,6}

Globally, an estimated 155 million children are chronically undernourished while 41 million under the age of five are overweight or obese (2016 WHO data).¹ Nearly two-thirds of the world’s obese people live in LMICs,² and the prevalence of childhood obesity is increasing rapidly in these countries. The incidence of infectious diseases is further worsened by poor nutrition, and the coexistence of NCDs and infections (including TB and HIV) threatens both health and economic progress in LMICs.⁷ Thus, the double burden of malnutrition (a term now used for both over- and undernutrition) is a global challenge, within individuals, households and populations and across the life course.³ For example, at the household level in South Africa and Brazil, stunting among children was found to coexist with overweight and obesity in mothers.⁸ Similarly, at a population level, great disparities are observed in nutritional status within countries. In the Philippines, 27% of children below the age of five were underweight, and 25% of women were overweight or obese.⁹

Although reducing malnutrition is specifically addressed in Sustainable Development Goal 2 (SDG2, Zero Hunger), it underlies all SDGs¹⁰ and the commitments of the Rome Declaration on Nutrition within the UN Decade of Action on Nutrition (2016–2025).¹¹

“The challenge of malnutrition calls for a multidisciplinary approach that targets multiple underlying factors”

The need for a life-course perspective

The challenge of malnutrition calls for a multidisciplinary approach that targets multiple underlying factors. Key stages in people’s lives have particular relevance for their health, and the life-course approach acknowledges the importance of these stages.¹² The life-course perspective highlights a time-based and social perspective, looking across an individual’s or a population’s life experiences and also across generations, to under-



Young couples hold their current and future health, as well as that of the next generation, in their hands

stand current patterns of health and disease. It recognizes that both past and present experiences are shaped by the wider social, economic and cultural context. As the incidence of NCDs rises in the later part of life, interventions have often targeted this period. However, studies based on the life-course approach and the Developmental Origins of Health and Disease (DOHaD) concepts¹³ have shown that the trajectory of risk established in early life influences the responses of an individual to later challenges, such as living in an obesogenic environment. This explains why interventions targeting middle-aged people to prevent NCDs can be less effective (Figure 1).¹⁴ Adopting such a ‘pathway dependency’ perspective allows the identification of individuals who are at higher risk earlier and thus targeting early preventive interventions to those who most need them. The use of a life-course approach aligns with efforts to meet the SDGs and has been recommended for incorporation into the areas of policy and investment, health service systems and monitoring and surveillance programs.¹⁵

The first 1,000 days

There is accumulating evidence that alterations in the expression of genes by epigenetic processes, rather than fixed genetic effects, can pass the risk of overweight, obesity and NCDs across generations.¹⁶ Together, these studies provide the basis for the rapidly growing field of DOHaD. DOHaD research has shown that low birth weight (LBW) is associated with greater risk of later NCDs,¹⁷ of particular relevance to LMICs such as India, where LBW is common and is linked to insulin resistance in children along with adverse total serum cholesterol and low-density lipoprotein cholesterol levels.¹⁸ Similarly, maternal vitamin B₁₂ deficiency also predicted higher adiposity and insulin resistance in children.¹⁹ At the other end of the spectrum, maternal obesity, excess weight gain during pregnancy and short duration of breastfeeding are

also linked with childhood obesity and later NCDs.²⁰ DOHaD processes thus operate to pass a risk of poor health between generations at multiple levels of the nutritional transition and form a key factor in the double burden of malnutrition.

“DOHaD processes form a key factor in the double burden of malnutrition”

In addition to its effects on mortality and morbidity, malnutrition also affects childhood cognitive and emotional development, reducing school-readiness and subsequent academic achievement and leading to reduced economic productivity and human capital.^{21,22}

While addressing this challenge seems daunting, there is a relatively constrained period in which action is needed – the first 1,000 days of life from conception, through pregnancy, and until the child is two years of age. However, as many women do not contact healthcare professionals until the end of the first trimester of pregnancy, or not at all in some low-resource settings, it is necessary to consider interventions before the 1,000 days start, in the preconception period of the life course.²³ This is important because, while studies have suggested that targeting pregnancy and preconception periods increases nutrition awareness and influences dietary habits,²⁴ well-designed RCTs starting in pregnancy have not been effective in improving pregnancy-related outcomes, although they do help to prevent excess weight gain in pregnancy.^{25,26}

“Addressing malnutrition is particularly urgent in adolescents and young adults”

Preconception interventions

Addressing malnutrition is particularly urgent in adolescents and young adults, to ensure the best possible start in life for the developing embryo, fetus and infant over the first 1,000 days. This applies across the nutritional range, from maternal undernutrition, especially in teenage mothers, to obesity, which is of growing concern due to the accompanying increased risk of gestational diabetes, hypertension and adverse birth outcomes.²⁵ It is essential that preconception services are incorporated into a continuum from childhood to antenatal care, involving both partners and linked to interventions to promote school attendance in young girls, and the planning of first and subsequent pregnancies.²⁷

The importance of preconception interventions to prevent NCDs has also been identified as a core component of the strategy by the World Health Organization's (WHO) Commission on Ending Childhood Obesity.²⁸ This includes improving parents' lifestyle before conception, maternal health and nutrition before and during pregnancy, treatment of gestational diabetes, supporting breastfeeding and improving infant feeding practices. Large-scale food fortification programs (folic acid, iron and other micronutrients) have been used in LMICs; however, they do not always consider maternal and child health outcomes while evaluating effectiveness.²⁹ Current initiatives to address malnutrition are often limited to supplementing specific nutrients or improving calorific intake, but providing balanced protein energy supplementation has shown promise in improving maternal and neonatal outcomes in LMICs.²⁹ Similarly, while multiple micronutrient (MMN) supplementation starting during pregnancy can address maternal nutritional deficiencies, there are gaps in the evidence for its benefit for maternal and perinatal outcomes, and it does not necessarily improve childhood outcomes.^{30–32} Furthermore, studies of MMN supplementation starting before conception have not yet achieved long enough follow-up to assess the effect on outcomes in the next generation.^{26,29}

The World Health Organization's policy brief on double-duty actions for nutrition recommends a set of interventions, policies and programs to support efforts to tackle both forms of malnutrition simultaneously.³³ These include the protection and promotion of exclusive breastfeeding, improving maternal nutrition through antenatal programs, addressing environmental drivers and strengthening marketing regulations. There is a need to extend this initiative to reduce malnutrition before conception and throughout the first 1,000 days of life for the child.

Engaging key stakeholders

The focus of programs to improve malnutrition has shifted globally, from preventing hunger by providing calories towards improving diet quality and addressing the global double burden of malnutrition.¹¹ Although efforts to address parental risk factors in the preconception period such as smoking and excess alcohol intake are well established, initiatives to improve diet before pregnancy are lacking, highlighting the need to review current population-based strategies and policies that aim to improve nutritional status to include preconception women.

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“Mere provision of health information may not improve the nutritional status of populations”

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Studies investigating the management of obesity and NCDs have shown that mere provision of health information may not improve the nutritional status of populations. Hence, starting early in the life course by engaging young people and future parents, before and during the development of preconception programs, is crucial. A change in attitudes and increased motivation form an essential part of empowering individuals to change behavior. Such 'bottom-up' activities are being tested in community settings in high-income and LMIC settings.²⁵ The LifeLab program in Southampton, UK,³⁴ is a good example of a school-based intervention in a high-income setting aimed at developing adolescents' motivation for improving their diet and physical activity levels through hands-on engagement with current science. The program also emphasizes the benefits for their future children and provides support for behavior change. A focus on achieving optimal nutrition and cardio-metabolic fitness, as opposed to simply managing weight, is important in motivation. Extending this approach calls for a social movement that aims to optimize nutritional status and health behaviors before conception. This needs to be complemented by 'top-down' approaches through policy initiatives by central and local governments. A broad range of healthcare practitioners and community health workers need to be engaged in providing a continuum of care before, during and after pregnancy, and with couples with and without the intention to conceive.²⁷ To influence policy, health information producers (e.g., researchers) need to engage with key stakeholders such as policymakers to provide the best available evidence that can be incorporated into national programs to reduce the double burden of malnutrition.

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“Researchers need to engage with policymakers”

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Providing multicomponent intervention packages that recognize the socioeconomic and cultural drivers of malnutrition in different countries – commencing in the preconception period and sustained through pregnancy and infancy and into childhood – is essential to prevent the passage of malnutrition to the future generations. Cultural barriers and poverty influence people's capacity to choose healthy diets, calling for effective policy-making using a systems approach. Multisectoral collaboration is needed to broaden strategies to improve preconception health by addressing the wider socioeconomic determinants of health. Productive avenues for addressing the double burden of malnutrition include: developing evidence-based and implementation-focused dietary guidelines; integrating policies for overnutrition with those for undernutrition; supporting social policies to improve gender equality and women's health; and

supporting the implementation of urban food policies as outlined by the WHO³³ in preparing for the Decade of Action on Nutrition. All will assist with achieving the SDGs and thus confer far-reaching long-term benefits.

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References

- WHO. Malnutrition key facts 2018. Internet: www.who.int/news-room/fact-sheets/detail/malnutrition (accessed 10 August 2018).
- Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014 Aug 30;384(9945):766–81.
- WHO. The double burden of malnutrition: policy brief. Geneva: WHO; 2016.
- Popkin B, Adair L, Ng S. Global nutrition transition and the pandemic of obesity in developing countries. *Nutrition Res*. 2012 Jan 1;70(1):3–21.
- Mathers C, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLOS Medicine*. 2006 Nov 28;3(11):e442.
- Abegunde DO, Mathers CD, Adam T, et al. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet*. 2007 Dec 8;370(9603):1929–38.
- Remais JV, Zeng G, Li G, Tian L, Engelgau MM. Convergence of non-communicable and infectious diseases in low and middle-income countries. *Int J Epidemiol*. 2012 Oct 13;42(1):221–7.
- Doak CM, Adair LS, Bentley M, Monteiro C, Popkin BM. The dual burden household and the nutrition transition paradox. *Int J Obes*. 2005 Jan;29(1):12–36.
- FAO. The double burden of malnutrition. Case studies from six developing countries. Rome: FAO; 2006.
- Rockström J, Sukhdev P. How food connects all the SDGs. Stockholm Resilience Centre. Internet: www.stockholmresilience.org/research/research-news/2016-06-14-how-food-connects-all-the-sdgs.html (accessed 10 August 2018).
- WHO, FAO. United Nations Decade of Action on Nutrition 2016–2025. Rome: FAO; 2016.
- Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *Int J Epidemiol*. 2002 Apr;31(2):285–93.
- Gluckman PD, Hanson MA, Buklijas T. A conceptual framework for the developmental origins of health and disease. *J Dev Orig Health Dis*. 2010 Feb;1(1):6–18.
- Darnton-Hill I, Nishida C, James WPT. A life-course approach to diet, nutrition and the prevention of chronic diseases. *Public Health Nutr*. 2004;7(1a):101–21.
- Kuruville S, Sadana R, Montesinos EV, et al. A life-course approach to health: synergy with sustainable development goals. *Bull World Health Organ*. 2018;96(1):42–50.
- Godfrey KM, Gluckman PD, Hanson MA. Developmental origins of metabolic disease: life course and intergenerational perspectives. *Trends Endocrinol Metab*. 2010;21(4):199–205.
- Darnton-Hill I, Nishida C, James WP. A life course approach to diet, nutrition and the prevention of chronic diseases. *Public Health Nutr*. 2004 Feb;7(1a):101–21.
- Bavdekar A, Yajnik CS, Fall CH, Bapat S, Pandit AN, Deshpande V, et al. Insulin resistance syndrome in 8-year-old Indian children: small at birth, big at 8 years, or both? *Diabetes*. 1999 Dec 1;48(12):2422–9.
- Yajnik CS, Deshpande SS, Jackson AA, Refsum H, Rao S, Fisher DJ, et al. Vitamin B12 and folate concentrations during pregnancy and insulin resistance in the offspring: the Pune Maternal Nutrition Study. *Diabetologia*. 2008 Jan 1;51(1):29–38.
- Robinson SM. Preventing childhood obesity: early-life messages from epidemiology. *Nutr Bull*. 2017 Sep;42(3):219–25.
- Daelmans B, Darmstadt GL, Lombardi J, Black MM, Britto PR, Lye S, et al. Early childhood development: the foundation of sustainable development. *Lancet*. 2017 Jan 7;389(10064):9–11.
- Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet*. 2008 Jan 26;371(9609):340–57.
- Hanson MA, Bardsley A, De-Regil LM, Moore SE, Oken E, Poston L, et al. The International Federation of Gynecology and Obstetrics (FIGO) recommendations on adolescent, preconception, and maternal nutrition: “Think Nutrition First”. *Int J Gynaecol Obstet*. 2015 Oct;131:S213–53.
- Szwajcer EM, Hiddink GJ, Koelen MA, van Woerkum CM. Nutrition awareness and pregnancy: implications for the life course perspective. *Eur J Obstet Gynecol Reprod Biol*. 2007 Nov 1;135(1):58–64.
- Hanson M, Barker M, Dodd JM, Kumanyika S, Norris S, Steegers E, et al. Interventions to prevent maternal obesity before conception, during pregnancy and post partum. *Lancet Diabetes Endocrinol*. 2017 Jan 1;5(1):65–76.

26. Ramakrishnan U, Grant F, Goldenberg T, Zongrone A, Martorell R. Effect of women's nutrition before and during early pregnancy on maternal and infant outcomes: a systematic review. *Paediatr Perinat Epidemiol.* 2012 Jul 1;26:285–301.
27. Barker M, Dombrowski SU, Colbourn T, et al. Intervention strategies to improve nutrition and health behaviours before conception. *Lancet.* 2018;391(10132):185–64.
28. WHO. Report of the Commission on Ending Childhood Obesity: implementation plan: executive summary. Geneva: WHO; 2017.
29. Dean SV, Lassi ZS, Imam AM, Bhutta ZA. Preconception care: nutritional risks and interventions. *Reprod Health.* 2014 Dec;11(Suppl 3):S3.
30. WHO. WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO; 2016.
31. Smith ER, Shankar AH, Wu LS, Aboud S, Adu-Afarwah S, Ali H et al. Modifiers of the effect of maternal multiple micronutrient supplementation on stillbirth, birth outcomes, and infant mortality: a meta-analysis of individual patient data from 17 randomised trials in low-income and middle-income countries. *The Lancet Global Health* 5.11 (2017): e1090–e1100.
32. Haider BA, Bhutta ZA. Multiple-micronutrient supplementation for women during pregnancy. *Cochrane Database of Systematic Reviews* 2017, Issue 4. Art. No.: CD004905. DOI: 10.1002/14651858.CD004905.pub5.
33. WHO. Double-duty actions for nutrition: policy brief. Geneva: WHO; 2017.
34. Woods-Townsend K, Leat H, Bay J, Bagust L, Davey H, Lovelock D, et al. LifeLab Southampton: a programme to engage adolescents with DOHaD concepts as a tool for increasing health literacy in teenagers – a pilot cluster-randomized control trial. *J Dev Orig Health Dis.* 2018 Oct;9(5):475–80.