The Malawi Priorities Project

# Cost-benefit analysis of interventions to reduce the prevalence of stunting in Malawi - Technical Report

A National Planning Commission Report with technical assistance from the Copenhagen Consensus Center and the African Institute for Development Policy


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African Institute for Development Policy

**Report Contributors**
**Bjorn Larsen**, Independent Consultant
**Saleema Razvi**, Copenhagen Consensus Center
**Nyovani Madise**, African Institute for Development Policy
**Joseph Nagoli**, National Planning Commission, Malawi
**Brad Wong**, Copenhagen Consensus Center

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www.npc.mw
www.copenhagenconsensus.com
www.afidep.org

This work has been produced as a part of the Malawi Priorities project.



**Malawi Priorities: Background**

Malawi Priorities is a research-based collaborative project implemented by the National Planning Commission (NPC) with technical assistance from the African Institute for Development Policy (AFIDEP), and the Copenhagen Consensus Center (CCC) to identify and promote the most effective interventions that address Malawi's development challenges and support the attainment of its development aspirations. The project seeks to provide the government with a systematic process to help prioritize the most effective policy solutions so as to maximize social, environmental and economic benefits on every kwacha invested. Cost-benefit analysis is the primary analytical tool adopted by the project. Cost-benefit analysis will be applied to 20-30 research questions of national importance. Research will take place over the course of 2020 and 2021.

Research questions were drawn from the NPC's existing research agenda, developed in September 2019 after extensive consultation with academics, think tanks, the private sector and government. This sub-set was then augmented, based on input from NPC, an Academic Advisory Group (AAG) of leading scholars within Malawi, and existing literature, particularly previous cost-benefit analyses conducted by the Copenhagen Consensus Center. The research agenda was validated and prioritized by a Reference Group of 25 prominent, senior stakeholders. The selection of interventions was informed by numerous consultations across the Malawian policy space, and one academic and two sector experts provide peer review on all analyses.

Cost-benefit analyses in Malawi Priorities consider the social, economic and environmental impacts that accrue to all of Malawian society. This represents a wider scope than financial cost-benefit analysis, which considers only the flow of money, or private cost-benefit analysis, which considers the perspective of only one party. All benefit-cost ratios (BCRs) reported within the Malawi Priorities project are comparable.

The cost-benefit analysis considered in the project is premised on an injection of new money available to decision makers, that can be spent on expanding existing programs (e.g. new beneficiaries, additional program features) or implementing new programs. Results should not be interpreted as reflections on past efforts or the benefits of reallocating existing funds.

Inquiries about the research should be directed to Salim Mapila at salim@npc.mw.

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# Contents

# 1. Introduction and Context

Adequate nutrition throughout the lifecycle is the foundation for physical and cognitive development and is a major determinant of one's, education attainment, overall work productivity and lifetime asset acquisition (UNICEF, 2019). It is therefore a prerequisite for human growth and development, and an integral element for the socio-economic development of the country. According to the Cost of Hunger 2012 report, it is estimated that Malawi lost US$ 597 million due to under nutrition, equivalent to roughly 10% the Gross Domestic Product (GDP). Recognizing the importance of nutrition, the Malawi 2063 Vison has placed it as a priority area for human capital development.

Despite substantial challenges, Malawi has registered improvement in some key nutrition indicators. Malawi is on course to meet the WHO 2025 target for under-five wasting (reduction to a level of less than 5%, and maintenance of this). Low birth weight prevalence has fallen from 17.2% in 2000 to 14.5% in 2015 (Global Nutrition Report, Malawi Nutrition Profile, 2020). Notably, child stunting has decreased from 47% in 2010 (NSO, Malawi, 2011) to 37% in 2016 (NSO, Malawi, 2017). Some gains have also been made with the prevalence of anemia decreasing from 55% to 28% and Vitamin A from 59% to 4% (MNS 2009 and MNS 2015 – 16 respectively). Investments in improved nutrition are paying off, but there is still a long way to go. Current stunting prevalence is significantly higher than the global average of 21% and the African prevalence of 29% (WHO, 2020). Exclusive breastfeeding rates have also fallen 10 percentage points since 2010. Zinc deficiency is an emerging public health concern affecting over 60% of the population including children under the age of five and women of reproductive age group (MNS 2015). Continued investment in nutrition-specific programs is required, along with an integration of nutrition-sensitive features in social protection, hygiene and sanitation, and agriculture.

The underlying causes of undernutrition are multifaceted, though low household incomes seem to be an important determinant. Stunting is substantially higher in poor communities (46%) than among the wealthiest communities (24%, NSO, Malawi, 2017). In urban areas, where incomes are typically higher than in rural areas, children are twice as likely to consume a minimum acceptable diet (16.0% in urban areas, 6.8% in rural areas), and 35% less likely to be stunted (39% in rural areas, 25% in urban areas; NSO, Malawi, 2017).

Maternal education is also important with higher education being correlated with lower stunting prevalence and anemia (NSO, Malawi, 2017). A related challenge is limited knowledge of appropriate child feeding. In particular, complementary feeding is a common practice in early months (61% of babies are exclusively breastfed up to 6 months of age) and, beyond that, only 8% of children received a minimum acceptable diet between 6 and 23 months of age (NSO, Malawi, 2017).

Perhaps the most important determinant of undernutrition is the very high level of food insecurity in the country. FAO figures show that the average prevalence of severe food insecurity was 51.8% in the period 2017-19, having remained essentially constant since 2014-16. At the same time, the population has continued to grow, so the absolute number of people suffering severe food insecurity reached a three-year average of 9.4 million in 2017-2019. It is against this challenging backdrop that interventions to improve the nutritional status of young children must be assessed.

## 1.1 The Nutrition Response

The Government of Malawi has responded by developing a multipronged, multi-sectoral framework for improving nutrition in the country. At the highest level, nutrition has been placed as a priority area for human development in the Malawi Growth and Development Strategy (MGDS) III.

The subject of nutrition has evolved over the years, going from being seen mainly as a health and medical issue to its current recognition as an essential component of the country's human capital, economic growth and development. This has led to a multi-sectoral approach to nutrition that spans strategic planning and policy setting to front line service delivery. For example, the National Multi-Sector Nutrition Strategic Plan 2018–2022 explicitly operates within a context of a wider set of policies and approaches that can contribute to improved nutrition status and well-being of the Malawi population namely:

- The National Multi-Sector Nutrition Policy[1]
- National Agriculture Policy
- National Health Policy, and the Health Sector Strategic Plan II

[1] To operationalize the National Multi-Sector Nutrition Policy the government of Malawi developed the National Multi-Sector Nutrition Strategy and other program specific strategies such as: Adolescent Nutrition strategy, Maternal, Infant and Young Child Nutrition strategy, Nutrition Education and Communication strategy, Micronutrient strategy, Agriculture Sector Food and Nutrition Strategy.

- National Education Policy, and the School Health and Nutrition Strategy
- National Gender Policy
- Decentralization Policy

The Department of Nutrition, HIV and AIDS (DNHA) is responsible for the overall leadership, policy direction, coordination, resource mobilisation, capacity building, and monitoring and evaluation of the national nutrition response. It is the focal point of coordination with the sector ministries and through them the operationalization of the policy response at the community level through local assemblies, extension workers, village development councils, and frontline workers.

To ensure effective delivery of nutrition service in Malawi, the DNHA while in the Office President and Cabinet (OPC)[2] prioritised and facilitated systematic integration of nutrition in sectoral policies and programmes. This ensured that the relevant sectors prioritize nutrition in their budget and work plans. The ministries where nutrition is mainstreamed include: Health, Agriculture, Education, Gender, Information, Civic education and Local Government. Each sector has clear defined roles and responsibilities to perform in nutrition programming within and outside its sector.

At district level, all program activities are coordinated through the district council with support from Principal Nutrition HIV/AIDs Officer (PNHAO) and the district commissioner takes primary responsibility for implementation, coordination, monitoring of the program activities at both the district, area and village levels. The DNHA in OPC ensured that capacity was strengthened to plan, coordinate and implement nutrition activities at district level. Under this capacity strengthening four nutritionists have been placed in each district to facilitate implementation of nutrition activities at district level and support implementation of interventions at community level.

At the service delivery level, nutrition services are provided through care groups and frontline workers from Health, Agriculture, Community Development, and volunteers. Frontline workers include Health Surveillance Assistants (HSAs), Agriculture Extension Development Officers (AEDO), Community Development Assistants (CDAs), and teachers. The use of care groups provides community driven nutrition programing that facilitate reaching to more households and ownership. The care groups approach also uses influential leaders such as traditional, faith and political leaders to champion nutrition. Community volunteers also engage in nutrition programming to support households especially on feeding practices such as breastfeeding promotion and complementary feeding, WASH, GMPs, community mobilization, behaviour change interventions, vitamin A distribution among others (SPRING and APC, 2016; Angwenyi et al., 2018).

As the above clearly shows, all aspects of nutrition programming are multi-sectoral. These arrangements have been bolstered by training and capacity building across line ministry extension workers, district officials and national stakeholders. The strengthened decentralized capacity to oversee, monitor and coordinate multisectoral activities bolsters district institutional capacity.

The multi-sectoral approach helped Malawi to reach out to more beneficiaries beyond those captured under the Health sector through other interventions. Between 2004 and 2017 there has been more sectoral engagement in nutrition programming with accountability to report on progress depending on their mandates. The DNHA also developed a harmonised multi-sectoral monitoring and evaluation framework and resource tracking system for accountability. Additionally, each of these sectors has a monitoring system in place to track their programme performance.

## 1.2 The focus of this paper

The nutrition response in Malawi reflects the holistic and multi-sectoral nature of the issue. However, given the wide reach of nutrition programs and services, a full accounting of the entire landscape is beyond the scope of this paper. The focus of this research paper is on one aspect, namely a section of frontline workers - specifically HSAs and CDAs. Other frontline workers and groups providing nutrition services (including AEDOs, care groups, teachers) are analyzed in other research papers from the Malawi Priorities series such as those focusing on Agriculture, Food Security and Early Childhood Development (forthcoming). The rationale for focusing on HSAs and CDAs is motivated by the intervention selection process, which was informed by the research agenda of the *Malawi Priorities* project. This yielded three interventions that naturally fall within the domain of HSAs and CDAs (see Section 1.3), and to avoid redundancy with other papers.

These frontline workers form a key part of the overall healthcare system. The system operates on three levels of organization, namely: primary, secondary and tertiary. These different levels are linked to each other through an established referral system with primary and secondary level care falling under district councils (Strodel and Perry, 2020). At the primary level, services are provided by health surveillance assistants (HSAs) in communities, health posts, dispensaries, maternity clinics, health centers and community hospitals. Each HSA is responsible for about 1,000 people and there are currently about 11,000 in post. HSAs mainly provide promotive and preventive health care through door-to-door visits, village clinics and mobile clinics (Ministry of Health, 2011).

[2] Now in the Ministry of Health

Malawi's healthcare system however, has faced chronic resource constraints and deficiencies in quality of services. These challenges are well-documented and include lack of sufficient human resources and HSAs reporting being overworked (Chikaphupha et al., 2016). Additionally, there are reports that, despite these shortages, there are some 2,000 health workers trained but unemployed due to lack of resources to hire them (Laterra et al, 2020). In light of these challenges, in 2017 Malawi launched the first National Community Health Strategy (2017-2022) in which the government committed to improve basic community health services throughout the country in collaboration with non-governmental organizations. Having a properly resourced, fully functional system across the country is obviously a prerequisite for the achievement of strategic goals.

In such a constrained situation, it is important to understand the costs and benefits of the various tasks undertaken by HSAs and other frontline workers. Already, there is a shortage of trained people on the ground and clear difficulty in deploying more, even if they are already trained. Expanding the workload of already overstretched frontline workers means they would spend less time on their existing tasks. It is against this backdrop that this paper undertakes a cost-benefit analysis of three nutrition interventions that can be delivered by HSAs. From an ex-ante perspective, it is useful to think of these interventions as an expansion of overall community frontline worker resources so that services can be provided to new mothers who may not yet currently receive them due to the constrained nature of current capacity.

The three interventions considered are:

1. Breastfeeding promotion (exclusive breastfeeding for infants 0-5 months and continued breastfeeding for children 6-23 months)
2. Complementary feeding promotion (children 6-23 months)
3. Complementary feeding promotion with the provision of complementary food (children 6-23 months)

The second intervention – complementary feeding promotion without provision of complementary food – is largely intended for food secure households that can respond to the promotion by providing their young children with adequate complementary food.

The third intervention with complementary food provision is mainly intended for food insecure households that lack the resources to provide adequate food for their young children. Perfectly identifying these households is, however, a challenge. The intervention is therefore assessed in two scenarios with complementary food provided to:

i) All households with children 6-23 months (no targeting of food insecure households);

ii) Only food insecure households with children 6-23 months (perfect targeting).

The difference in intervention cost and benefit-cost ratios (BCRs) in these two scenarios demonstrates the efficiency gains from being able to, even to some degree, identify and target the food insecure households for complementary food provision. In all three cases, we model a 5-year ramp up, starting at 100,000 mother-child pairs and rising linearly to 150,000 in 2024.

We find that all three interventions are effective use of resources, although to different degrees. Complementary feeding promotion has the highest benefit cost ratio at 7.2. Second is breastfeeding promotion, with a BCR of 5.4, followed by complementary feeding promotion and provision with a BCR between 2.2 (for untargeted food provision) and 2.8 (for perfect targeting for food-insecure households).

If breastfeeding promotion were to be scaled up from its current level, we estimate that it would lead to around 16,000 more women exclusively breastfeeding and over 8,700 women continuing to breastfeed for 24 months, for every 100,000 mother-child pairs targeted. This increase would avoid 334 child deaths, reduce cases of diarrhea by 31,000 and cases of respiratory infection by over 75,000 for the first cohort. Over a five-year program the total number of child deaths avoided from the intervention would be around 2,100 or around 9% of avoidable deaths for the beneficiary population. The intervention would require MWK 5,504 million over 5 years (8% discount rate), with 81% of this in direct costs and the remaining costs of time and inconvenience.

For complementary feeding promotion, the analysis indicates that around 3,100 children would avoid stunting for every 100,000 mother-child pairs targeted. This would lead to a reduction in associated deaths of 18 in the first year of the program, and an increase in lifetime productivity for every child who avoids stunting equivalent to 30% of future income. Over five years the number of deaths avoided would be 293 at a cost of MWK 307 million.

For the third intervention, in which complementary feeding is provided as well as promoted (food provision being untargeted), we find that around 5,200 children would avoid stunting for every 100,000 mother-child pairs targeted. Averted deaths in year one would rise to 29; over the five years of the full program, total deaths avoided would be 486, at a cost of MWK 3,858 million. Part of this cost is for the provision of food (the most expensive element of the program) to households including those that are already food secure. Perfectly targeting the intervention, to provide food only to those households that do not have a secure food supply, would reduce the overall cost to MWK 2,161 million. Clearly, this intervention becomes increasingly cost-effective the better targeted it is.

## 1.3 Research Context and Interventions Selection Process

The National Planning Commission (NPC), Malawi, in collaboration with the African Institute for Development Policy (AFIDEP), and the Copenhagen Consensus Center (CCC) are undertaking the Malawi Priorities project – a research and advocacy exercise to identify the most effective ways to address the nation's challenges using the framework of cost-benefit analysis. The aim is to inform both short- and long-term development priorities for the country, acknowledging that there are insufficient resources to address all of Malawi's challenges and that maximizing outcomes requires careful, evidence-based consideration of the costs and benefits of all policies.

The starting point of all research questions is the NPC's existing research agenda, structured around the six thematic areas of Sustainable Agriculture, Sustainable Economic Development, Human Capital and Social Development, Sustainable Environment, Demography, Governance, Peace, and Security, and Human Capital and Social Development.

NPC's research agenda was developed by in September 2019 after extensive consultation with academics, think tanks, the private sector and government. Consequently, the commission's research agenda, prima facie, contains questions of national importance. As a first step, Malawi Priorities drew questions from the NPC research agenda that could be answered by Cost-benefit analysis (CBA). Then, additional research questions were added based on input from NPC, an Academic Advisory Group (AAG) of leading scholars within Malawi, and existing literature, particularly previous cost-benefit analyses conducted by the Copenhagen Consensus Center. This process of identifying research questions for investigation generated a total of 38 potential research questions across all 6 thematic areas.

The research agenda was validated and prioritized by a Reference Group of 25 prominent, senior stakeholders from government, civil society and the private sector. The outcomes of the Reference Group exercise were used to inform which research questions to prioritize and which interventions to focus on within those research questions. The validation process finished in July 2020.

One key research question that came out of this and is the focus of this paper is: *How does Malawi most effectively reduce child stunting and other nutrition challenges?*

The project team completed a scan of all potential interventions which were beneficial in reducing stunting and improving nutritional status, as part of the process of narrowing down the number of interventions for cost-benefit analysis. The selection process started with a wide range of potential interventions drawn from literature, stakeholder interviews and advisor input. We also interviewed several local experts[3].

From here, the prioritization of interventions takes in a number of several important factors:

1. **Sector expert priority** – An intervention is accorded higher priority if sector experts note that it is important. There were several avenues from which experts provided input into the process, such as the Reference Group questionnaire, direct interview, inferences from the National Planning Commission (NPC) research agenda, and via our academic advisory group.
2. **High benefit-cost ratio or cost-effectiveness in similar previous research** – The purpose of the Malawi Priorities project is ultimately to identify interventions giving outsized benefits relative to costs. Input into this factor is determined from the economics literature, particularly previous research conducted by the Copenhagen Consensus Center. In the Center's experience BCRs above 15 are among the highest across all interventions. Due consideration is given to contextual differences between previous research and the current situation in Malawi in determining the effect of this criterion.
3. **Addresses a problem of sufficient size** – some interventions could be considered highly effective but only address a small part of a larger overall problem, limiting the overall net benefits of the approach. To avoid focusing on solutions that are too small, each intervention must have the potential to address a problem that is significant.
4. **Significant gap in current coverage levels of an intervention** – all analysis conducted in Malawi Priorities focuses on marginal benefits and costs. Therefore if an intervention already has high coverage rates, additional resources provided towards that intervention are unlikely to be effective, or will suffer from the 'small-size' problem.
5. **Availability of crucial data or credible knowledge of impact** – due to time and resource constraints, all analyses conducted by *Malawi Priorities* are based on secondary data triangulated by interviews with key experts. Therefore, a full assessment of each intervention is constrained by the availability of data. In many cases, one key constraint is knowledge concerning the impact of a particular course of action. It is typical to formally deal with uncertainty via sensitivity analyses. However, in some cases the uncertainty is so great that it precludes even researching the intervention at all.

The universe of potential nutrition interventions also draws from previous Copenhagen Consensus projects conducted in other developing countries, which analyzed multiple interventions. The process of screening and prioritizing interventions is summarized in Table 1, drawing on the factors described above.

[3] Including: Janet Guta, Ministry of Health, Government of Malawi, Prof. Alistair Munthali, *Centre for Social Research, University of Malawi*, Prof Jesman Chintsanya, *Chancellor College, University of Malawi*, Dr. Chrissie Kantukule, *Centre for Social Research, University of Malawi.*

***Table 1:*** *Intervention Screening Process*

| Intervention considered | Sector expert priority | High BCR or cost-effectiveness | Addresses a problem of sufficient size | Significant gap in current coverage of intervention | Availability of data | Overall |
|---|---|---|---|---|---|---|
| **Nutrition Specific Interventions** | | | | | | |
| Breastfeeding Promotion | Yes, sector experts noted declining rates of exclusive breastfeeding as well as generally poor child nutrition outcomes | High BCR - previous research from Ghana indicates a BCR of 24 | Yes, exclusive breastfeeding is only 61% and has actually reduced over the last decade | Yes, there was no data found on % of mothers of children 0-23 months receiving counselling, support or messages on optimal breast-feeding. | Yes | High |
| Complementary Feeding Promotion | Yes, focus on stunting in infants and lack of minimum acceptable diet in children under 5 years noted by sector experts | Very high BCR - previous research from India and Ghana indicates BCR between 36 and 61. | Yes, only 8 % of children aged 6 to 23 months received a minimum acceptable diet. National stunting rate is 37%. | Yes, 74% of children under 2 and 75% of children 2-5 years participate in growth monitoring and promotion sessions (NHP, 2018). | Yes | High |
| Bio-fortification of maize with zinc | Yes, noted as important intervention by sector experts | High BCR - literature review indicates BCRs between 15 – 20 however unclear if these are specifically for maize-zinc combination | 62.5% women and 60% of preschool and school going children have zinc deficiency. Zinc deficiency contributes to preventable childhood deaths from diarrhea, pneumonia, and malaria. | Zinc bio-fortified varieties of maize have not been developed yet. Technical feasibility is unclear. | No – it does not appear that zinc bio-fortified maize is available generally | High but feasibility unclear |
| Multiple Micronutrient Supplementation for pregnant mothers | Yes, poor nutritional quality of diet noted by sector experts. | Moderately high to high BCRs - previous research from CCC indicates BCR between 8 and 19. | Prematurity is a leading cause of neonatal mortality in Malawi, which can be partially addressed by multiple micronutrient (MMN) supplementation. | Yes, though 90% of pregnant women received antenatal iron supplementation, there is No coverage of MMN supplementation. | Yes | High (Analyzed in a different paper on maternal and child health). |
| Calcium supplementation for pregnant mothers | Yes, poor nutritional quality of diet noted by sector experts. | Moderately high to high BCRs - previous research from CCC indicates BCR between 8 and 19. | Prematurity is a leading cause of neonatal mortality in Malawi, which can be partially addressed by CA supplementation. Literature shows national prevalence of inadequate dietary calcium in Malawi of around 49%. | Yes, though 90% of pregnant women received antenatal iron supplementation, there is no coverage of Ca supplementation. | Yes | High (Analyzed in a different paper on maternal and child health |

| Intervention considered | Sector expert priority | High BCR or cost-effectiveness | Addresses a problem of sufficient size | Significant gap in current coverage of intervention | Availability of data | Overall |
|---|---|---|---|---|---|---|
| **Nutrition Specific Interventions** | | | | | | |
| Complementary Feeding Provision | Yes, focus on stunting in infants and lack of minimum acceptable diet in children under 5 years noted by sector experts | Moderately high BCR - Previous research from India indicates BCR around 10. Expensive to implement. | Yes, only 8 % of children aged 6 to 23 months received a minimum acceptable diet. National stunting rate is 37%. High prevalence of food insecurity, with 39% of the population being food insecure. | Yes, less than 20% of children 6–23 months received micronutrient powders - 30 sachets, (MNP, 2018). | Yes | High |
| Zinc Supplementation | No, though poor quality of diets noted by sector experts. | Fair BCR - previous analysis suggests BCRs between 2 – 3 | 60% of preschool and school going children have zinc deficiency. Zinc deficiency contributes to preventable childhood deaths from diarrhea, pneumonia, and malaria. | Yes, there is no supplementation given currently, but 28.1% of children with diarrhea receive zinc supplements | Yes | Medium |
| School feeding programme | Yes, noted by sector experts as an important program to provide healthy food to children. | Moderately high BCR - previous research from CCC in Ghana indicates BCR of 6 | Undernourishment is high in children, and one nutritious meal helps alleviate hunger. However school feeding cannot address stunting. | Yes, 46% of schools operate school meals, and current coverage is about 30% as noted in the MNNP, 2018. | Yes | Medium |
| Vitamin A Supplementation | No | Moderately high BCR - literature review suggests BCR of around 12 | Prevalence of Vitamin A deficiency is low. Less than 4% preschoolers and less than 1% women, men and school aged children in Malawi are deficient. | No, 99% of children aged 6-59 months received Dose 1 of vitamin A supplements and 91% received Dose 2. | Yes | Low |
| Flour Fortification | No, though poor nutritional quality of diet noted by sector experts. | Previous research from CCC in Haiti indicates a BCR of 24, however this was in a context where milling is centralized and therefore cheaper to implement. | 84% of Malawians live in rural areas. Maize is the principal food crop which creates a lack of dietary diversity. Congenital defects are the fourth leading cause of neonatal mortality, which can be ameliorated with folic acid fortified wheat. | No, flour fortification is already being implemented in Malawi and reaching urban households. In rural Malawi, it is difficult to implement given that most rural households grind their own flour at village level mills. | Yes | Low |
| Salt Iodization | No | Uncertain | No, 90% of HH use iodized salt | No, 90% of HH use iodized salt | Yes | Low |

| Intervention considered | Sector expert priority | High BCR or cost-effectiveness | Addresses a problem of sufficient size | Significant gap in current coverage of intervention | Availability of data | Overall |
|---|---|---|---|---|---|---|
| **Nutrition Sensitive Interventions** | | | | | | |
| Conditional/ Unconditional Cash Transfers | Yes, noted as useful by sector experts for food security but unsure of exact impact on infants and children. | Uncertain, BCRs typically low to medium depending on conditionalities and externalities generated. Requires large ongoing fiscal outlay. | Food insecurity is associated with insufficient purchasing power, linked to poverty. Cash transfers aid in improving dietary diversity at household level. | Social Cash Transfer Program reaches 1.5 million beneficiaries in all 28 districts. | Uncertain | Medium |
| Nutrition sensitive agriculture | Yes, noted as useful by sector experts in providing nutritious foods to women and children. | Low BCRs - previous research from Ghana indicates BCR between 1.3 and 1.6. | Food insecurity is associated with unavailability of food, insufficient purchasing power, inappropriate distribution, or inadequate use of food, all linked to poverty. | Yes, only 22% households have backyard gardens established and only 39% of households practice integrated household farming. | Yes | Medium |
| Water, sanitation and hygiene | Yes, noted by sector experts that improved sanitation and handwashing are important determinants of stunting. | Previous research from CCC indicates generally low to moderate BCRs from improved water, sanitation and hygiene. | 87% of population use improved sources of drinking water, and 55% use improved sanitation facilities, unsanitary practices lead to prevalence of diarrhea which rises from 13% at <6 months, to 41% in 6-11 months, remaining high at 37% at 12-24 months. | Uncertain | Yes | Medium |

## 1.4 Interventions selected for cost-benefit research

The interventions considered for further research are explored in more detail below.

### Breastfeeding Promotion

Exclusive breastfeeding prevalence in Malawi remained low at 61% in 2016, having dropped 10 percentage points since 2010 according to the Malawi DHS surveys. Literature reviews suggest that poor breastfeeding and complementary feeding practices are factors associated with stunting and underweight among children under five (Lutter and Morrow, 2013). Meta-analyses have noted a significant reduction in diarrheal disease (a substantial contributor to stunting and child mortality) associated with exclusive breastfeeding relative to non-exclusive breastfeeding (Lamberti et al. 2013; Sankar et al. 2015). In Malawi, the tendency to give traditional liquids and early complementary feeding is common, with studies suggesting that inappropriate complementary feeding was one significant contributor to stunting among children in rural Malawi (Lagrone et al, 2010). An important factor is the high prevalence (11%) of HIV-infected women of reproductive age (DHS 2016). The mistaken assumption that transmission will occur through breastmilk contributes in part to poor rates of breastfeeding. However global guidelines for HIV-infected mothers recommend exclusive breastfeeding, with studies showing that postnatal mother-to-child-transmission through breastfeeding is less likely in infants who are exclusively or predominantly breastfed than in those given mixed feeds in the first 6 months of life. Kuchenberg et al, (2017) show the positive association between advice from health workers on breastfeeding promotion and exclusive breastfeeding.

### Complementary Feeding Promotion

Nutrition education can positively influence nutrition outcomes, especially for infants and young children, if mothers are targeted. In a project in Mchinji district, female volunteers repeatedly visited mothers around the time of childbirth and provided information about the nutritional needs of infants, covering breastfeeding, weaning, and complementary foods. The program was shown to improve child nutrition, household food consumption, and children's growth, including height (Fitzsimons et al. 2016). Also, the UN Food and Agriculture Organization's project *Improving Food Security and Nutrition Policies and Programme Outreach* improved children's dietary diversity when agricultural activities were paired with an educational component regarding children's nutritional needs (Kuchenbecker et al. 2017).

### Complementary Feeding Provision

Globally, inappropriate complementary feeding practices have been shown to be associated with stunting (Black et al., 2013); in Malawi, this relationship has also been found to be true (Espo et al., 2002). Overall, the diets of young children across the country are inadequate with only 8% of all children aged 6–23 months consuming a minimum acceptable diet (MAD) (National Statistical Office, ICF Macro, 2017). In rural Malawi, complementary feeding diets are of poor nutritional quality with the majority of calories from grains, roots and tubers – particularly maize – and very little consumption of foods of animal origin (Lutter et al, 2020). Provision of highly nutritious and energy dense spreads, which are simple to produce, need no cooking before use, and can be stored for months even in warm conditions, or small quantity lipid based nutrients (SQLN) can be a crucial pathway for providing the necessary nutrition to young infants and children in order to prevent stunting and wasting.

# 2. Cost benefit Analysis

## 2.1 General parameters and assumptions

As with all analyses in the Malawi Priorities series we adopt three different discount rates: 5%, 8% and 14%. All figures are reported in 2020 Malawian Kwacha (MWK) unless otherwise indicated. GDP in 2020 is projected to be MWK 6.6 trillion, with a COVID-influenced 2% growth rate for 2020 based on analysis undertaken by the World Bank (World Bank, 2020). Projections for the next three years are 3.3%, 4.0%, 5.0%. Thereafter, projections use the growth rates implied by GDP estimates in the IIASA database as discussed in Van Vuuren et al. (2017). We use the SSP2 scenario and median estimate by OECD and IIASA. Growth figures are only provided every 5 years, so we assume a constant growth rate per 5-year period.

Mortality benefits are monetized as per the standard Malawi Priorities protocol, which follow the Guidelines for the Conduct of Benefit-Cost Analysis in Global Health and Development (Robinson et al. 2019, see appendix to this document for further detail). Specifically, each child death avoided is assumed to save between 64 to 60 years of life depending on the age of avoided death. Each life year saved is valued at 0.6x-0.7x GDP per capita depending on the calendar year and projected GDP per capita.

Morbidity avoided benefits are derived using a cost-of-illness approach. For diarrhea cases avoided, we use figures presented in Hendrix *et al.*, (2017) which imply a 2020 cost of MWK 16,200 per case. This includes a non-trivial proportion of cases (12%) that require costly hospitalization.

We monetize stunting cases avoided by estimating the avoided productivity loss estimated at a 30% boost to lifetime income. This is based on a survey of nine longitudinal studies of stunted children from LMICs which shows that avoiding stunting is associated with a 6cm increase in height in adulthood or adolescence (Gallaso and Wagstaff, 2016) and a review of thirteen studies that shows that 1cm of height is associated with 5% increase in wages (4% increase in wages for men, and 6% increase in wages for women, controlling for confounding factors; McGovern et al. 2017).[4] Applying these figures we estimate that in 2021, an avoided case of low birth weight leads to a lifetime earnings gain of MWK 380,000 while the equivalent value for an avoided case of stunting is MWK 1,255,000 at an 8% discount rate.

## 2.2 Breastfeeding Promotion

Breastfeeding has a number of important health benefits. Exclusive breastfeeding for the first six months of a child's life, with continuation alongside appropriate complementary feeding after weaning, reduces the risk of infection and associated morbidity and mortality. In the longer term, improved cognitive development and reduced risk of non-communicable diseases (for both mother and child) helps to increase human capital (Rollins et al, 2016; Victoria et al, 2016). The intervention proposed is promotion of breastfeeding via health surveillance assistants (HSAs).

We apply as a baseline the percentage of exclusive, predominant, partial and non-breastfed children among 0-5 months olds, and rate of continued breastfeeding among 6-23 months olds from the Malawi DHS 2015-2016. Table 2 reports the changes in breastfeeding in the target population after applying these effects. The "with intervention" share of partial, predominant and no breastfeeding is estimated by assuming that any change in exclusive breastfeeding leads to a reduction in the three other states, weighted by the size of the share in the pre-intervention state. We estimate that the intervention will increase exclusive breastfeeding of 0-5 months old infants by 21.6 percentage points from 60.9 to 82.5 percent or 21,600 women per 100,000 mothers, while continued breastfeeding of 6-23 months olds will increase by 8.8 percentage points from 71.5 to 80.3 percent or 8,800 women per 100,000 targeted.

[4] See discussion in a previous Copenhagen Consensus paper Aryeetey et al. (2020)

***Table 2:*** *Estimated rates of breastfeeding on the target population with and without the intervention*

| | Without intervention prevalence of breastfeeding | With intervention prevalence of breastfeeding |
|---|---|---|
| **0-5 months** | | |
| Exclusive | 60.9% | 82.5% |
| Predominant | 13.4% | 6.0% |
| Partial | 18.4% | 8.3% |
| None | 7.3% | 3.3% |
| **6-23 months** | | |
| Continued | 71.5% | 80.3% |
| Not continued | 28.5% | 19.7% |

*Source: Baseline prevalence of breastfeeding is from Malawi DHS 2016. Intervention prevalence is estimated using odds ratios for intervention effects on breastfeeding from Sinha et. al. (2017).*

The following calculations closely follow the methodology reported in a previous Copenhagen Consensus paper in Ghana (Aryeetey et al. 2020). The key parameters are repeated here for clarity.

Impacts of breastfeeding promotion are based on a meta-analysis by Sinha et al. (2015) across a range of LMICs. We use the odds ratio reported by them for counselling on exclusive breastfeeding of 1-5 month old babies, which is 3.02 (95% confidence interval (CI): 2.19, 4.18). This meta-analysis covers promotion of breastfeeding in a home or community setting, but similar results have been reported in healthcare facilities. It seems that the message has similar impacts wherever it is delivered. The Sinha et al (2015) study reports a lower odds ratio (1.62; 95% CI: 1.16, 2.27) for continuing breastfeeding to 23 months, which we also use in this study. The results in Table 2 are derived using these factors.

The costs of providing breastfeeding promotion can be categorized under three headings:

- Direct costs of breastfeeding promotion
- The time cost of breastfeeding promotion
- Time commitment required from the mother for exclusive breastfeeding

### Direct cost of breastfeeding promotion

We estimate the direct cost of breastfeeding promotion on the basis of a global breastfeeding intervention costing exercise (Holla-Bahr et al, 2015). We adopt the unit cost figures of elements from that study that most closely correspond to the intervention envisaged here (Table 3). The total cost for these four components is $26.75 (2015 Int$) per infant, which converted to MWK and adjusted to 2020 by the GDP deflator is MWK 7,338 per child. For the first year intervention target of reaching 100,000 mothers, the cost is MWK 734 million.

***Table 3:*** *Cost of breastfeeding promotion (MWK per child)*

| | |
|---|---|
| Baby friendly hospital initiatives (BFHI) | 4,085 |
| Community support | 2,719 |
| Training of health workers | 510 |
| Training in breastfeeding code implementation | 25 |
| **Total** | **7,338** |

*Source: Adapted from Holla-Bhar et al (2015).*

### Time cost of breastfeeding promotion

The intervention is expected to require six consultations of 30 minutes from each mother over the course of pre- and post-pregnancy, with most of the consultations occurring after birth. Since these consultations occur when the woman is already at the facility or in her home, travel costs are absent. The value of women's time is based on Malawi Priorities' standard assumptions of half of relevant wage and is equal to MWK 100/hour. Thus the time cost is MWK 300 per mother. This time cost is applied against all women who receive the intervention. For the first year intervention target of reaching 100,000 mothers, the cost is MWK 30 million.

### Time commitment required for exclusive breastfeeding

The intervention aims to provide information to help more mothers make the choice to breastfeed, but compliance also requires time from mothers, and this should be included in the overall costs. There is a time cost associated with exclusive breastfeeding, which must be considered against other uses of each woman's time, if these might generate more welfare. There is also an inconvenience cost, since the number and times of feeds cannot be fully predicted. There is little hard information available on these time costs; the fact that breastfeeding can be done at the same time as other activities, makes this particularly difficult to estimate.

Cohen et al (1995) found that women in Honduras actually saved time by breastfeeding exclusively, spending 64-73 minutes each day on feeding compared to 99-108 minutes daily for women to provide solid food as well as breastfeeding. On the other hand, Smith and Forrester (2013) found that Australian women spent five hours a week extra to breastfeed exclusively, while a study by Pugh et al (2002) found that women in the United States spent 40 hours more over six months if they breastfed exclusively. To add to this, we need to make some allowance for the inconvenience cost, for which no hard data is available.

Taking all this into account, we use an hour extra a day inconvenience time for women who breastfeed exclusively following the intervention and who would not otherwise have done so. Thus the cost is MWK 18,237 for half a year of exclusive breastfeeding per mother who switches from partial or no breastfeeding (we do not apply this cost to women who would have otherwise predominantly breastfed). This translates to a total cost of MWK 193 million for the first year of intervention.

Adding the cost of time required for exclusive breastfeeding to the two cost components above, we come to a total cost of MWK 1,022 million to deliver this intervention in the first year. The cost then rises to 1,611 million in 2024 with a target of 150,000 mothers (Table 4).

***Table 4:*** *Total costs of delivering breastfeeding promotion*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| **Total cost (MWK million)without time cost** | 764 | 863 | 971 | 1,090 | 1,236 |
| **Total cost (MWK million) with time cost** | 1,022 | 1148 | 1282 | 1431 | 1611 |

Three benefits of the breastfeeding intervention are quantified here:

i) Averted child mortality from infectious diseases

ii) Averted child morbidity from infectious diseases

iii) Averted stunting

An estimated 382 deaths are averted from the first year of the intervention (Table 5). This rises to 574 averted deaths from the fifth year as the number of mothers targeted increases from 100,000 to 150,000. An estimated 36,726 cases of diarrhea and acute lower respiratory infections are also averted from the first year of the intervention (Table 6), rising to 55,088 in the fifth year. These benefits are derived using associations between rates of breastfeeding and infectious disease morbidity and mortality risk reductions in Lamberti et al (2013), Lamberti et al (2011) and Sankar et al (2015) Finally, 304 children avoid stunting from the first year of the intervention, rising to 457 children from the fifth year. Estimates of stunting avoided are derived from Checkley et al., (2008) who found that the odds of stunting is 1.025 per diarrheal episode in young children.

***Table 6:*** *Averted child morbidity from breastfeeding promotion*

| Cause | Cases avoided 0-5 months | Cases avoided 6-11 months | Cases avoided 12-23 months | Total cases avoided by cause |
|---|---|---|---|---|
| Diarrhea | 23,831 | 5,358 | 6,416 | 35,606 |
| Lower respiratory infections | 872 | 75 | 173 | 1,120 |
| **Total by age group** | **24,704** | **5,433** | **6,589** | **36,726** |

Benefits of the intervention are presented in Table 7. Mortality benefits from averted deaths account for 83% of total benefits while morbidity benefits account for 10% and productivity benefits from averted stunting account for 7%.

***Table 7:*** *Benefits of breastfeeding promotion, MWK million*

| | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|
| Mortality benefits | 4,216 | 5,029 | 5,689 | 6,463 | 7,470 | 446 |
| Morbidity benefits | 488 | 656 | 731 | 805 | 879 | 160 |
| Productivity benefits | 372 | 437 | 507 | 583 | 664 | 0 |
| **Total benefits** | **5,077** | **6,123** | **6,927** | **7,850** | **9,013** | **606** |

*Note: At 8% discount rate. 2025 figures represent the year after the 2024 cohort is provided the intervention only.*

The benefits over the life of the program are shown in table 8 for discount rates ranging from 5 to 14%.

***Table 8:*** *Total benefits of breastfeeding promotion (8% discount rate), MWK million*

| Discount rate | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|
| 5% | 5,726 | 6,885 | 7,812 | 8,867 | 10,172 | 606 |
| 8% | 5,077 | 6,123 | 6,927 | 7,850 | 9,013 | 606 |
| 14% | 4,780 | 5,774 | 6,523 | 7,386 | 8,485 | 606 |

Using these figures, the benefit-cost ratio of breastfeeding promotion comes to 5.4 (at 8% discount rate). This is relatively insensitive to the discount rate; at 5%, the BCR increases to 6.1, at 14%, it becomes 5.1. These figures assume we include the inconvenience time cost. Without this, the BCR rises to some extent: to 8.1 (5% discount rate), 7.2 (8%) or 6.7 (14%). The benefit-cost ratios are summarized in table 9.

***Table 9:*** *Benefit-cost ratios calculated for breastfeeding promotion*

| Without Inconvenience cost | Benefit (MWK million) | Cost (MWK million) | BCR |
|---|---|---|---|
| 5% | 35,872 | 4,425 | 8.1 |
| 8% | 29,953 | 4,169 | 7.2 |
| 14% | 25,188 | 3,736 | 6.7 |

| With Inconvenience cost | Benefit (MWK million) | Cost (MWK million) | BCR |
|---|---|---|---|
| 5% | 35,872 | 5,839 | 6.1 |
| 8% | 29,953 | 5,504 | 5.4 |
| 14% | 25,188 | 4,935 | 5.1 |

*Benefit and cost are present values (PV) over 2020 to 2025*

## 2.3 Complementary Feeding Promotion

This intervention – promotion of complementary feeding – targets mothers about to begin weaning their infants to include complementary feeding (from six months of age). In the first year, 100,000 mothers are targeted, with the number rising to 150,000 in year five. Ideally, this builds on a base of six months of exclusive breastfeeding to provide a continuing good standard of nutrition to developing infants and reduce the level of stunting.

The intervention is largely intended for food secure households among the targeted population that can respond to the promotion by providing their young children with adequate complementary food. The families have the capacity to feed their children satisfactorily, but may not have the nutritional knowledge to do this optimally.

The complementary feeding promotion has two cost components:

i) Cost of promotion

ii) Cost of incremental food provided by mothers to their children

The cost of promotion includes the cost of frontline workers providing consultations to mothers and the time that that mothers spend for these consultations. For the first year of the intervention, this is estimated at MWK 345 million (Table 10).

***Table 10:*** *Cost of promotion for the first year of intervention (MWK million per year)*

| Metric | Value | Source |
|---|---|---|
| Targeted number of mothers | 100,000 | |
| Average number of consultations | 6 | Panjwani and Heidkamp (2017) |
| Average time per consultation for community health worker (CHW) (minutes) | 30 | Bhutta et al (2013) including travel time |
| Average time per consultation for mother (minutes) | 15 | Author assumption |
| Cost of CHW (MWK per hour) | 1,100 | UNICEF 2017, including 70% training and overhead cost |
| Cost of time for mother (MWK per hour) | 100 | 50% of average female wage rates |
| Annual cost of CHWs (MWK million) | 330 | |
| Annual cost for mothers CHWs (MWK million) | 15 | |
| **Total annual cost of Promotion (MWK million)** | **345** | |

The expected behavioral response of mothers to the promotion program is that those who currently provide inadequate complementary feeding will increase food provision to their young children. The cost of such incremental food provision is estimated at a little over MWK 32,000 per child for the complementary feeding period (6-23 months). This estimate is based on food consumption expenditure in Malawi (own produced and purchased), food energy requirements and complementary feeding deficits (Table 11).

***Table 11:*** *Cost of incremental food consumption (MWK per child)*

| | | |
|---|---|---|
| GDP per capita (MWK), 2020 | 327,500 | Projection |
| Household consumption share of GDP | 82% | World Bank (2020) and IFAD (2018) |
| Consumption per capita (MWK/year) | 267,003 | Calculated from above |
| Food consumption expenditure (% of consumption) | 63% | World Bank (2016) |
| Food consumption per capita (MWK/year) | 167,678 | Calculated from above |
| Average household size | 4.5 | Malawi DHS 2015-16 |
| Food consumption per household (MWK/year) | 754,551 | Calculated from above |
| Household food consumption (kcal/day) | 8,800 | Based on average kcal requirement by age |
| Complementary feeding requirement (kcal/day/child) | 750 | Based on average kcal requirement of 6-23 months old children, less kcal from continued breastfeeding |
| Complementary feeding deficit (kcal/day/child) | 250 | 1/3 of requirement |
| Complementary feeding deficit (% of household) | 2.8% | Calculated from above |
| **Cost of incremental food consumption (MWK/child)** | **32,154** | **For 18 months, calculated from above** |

The annual cost of incremental food consumption associated with the complementary feeding promotion is estimated at MWK 307 million for the first year of the intervention with a target population of 100,000 (see table 12). The cost is almost as high as the cost of the promotion program and is based on a behavioral response rate of 22% of targeted mothers among those households that are food secure and expected to have the resources to increase food provision. The response rate of 22% is estimated based on response rates reported by Fitzsimons et al (2016) from a study in Malawi and studies from other countries reviewed by Panjwani and Heidkamp, (2017).

***Table 12:*** *Cost of incremental food consumption in first year of intervention (MWK million)*

| | | |
|---|---|---|
| Targeted number of mothers | 100,000 | |
| Food secure households (% of all households) | 44% | Malawi IHPS 2016 |
| Targeted mothers from food secure households | 44,000 | Calculated from above |
| Mothers responding to the Promotion (% of target) | 22% | Estimate based on Fitzsimons et al (2016) and studies reviewed by Panjwani & Heidkamp (2017) |
| Mothers responding to the Promotion | 9,549 | Calculated from above |
| Cost of incremental food consumption (MWK/child) | 32,154 | From Table above |
| **Total cost of incremental food consumption (MWK million/year)** | **307** | **Calculated from above** |

The total cost of the intervention is presented in table 13. The annual cost increases with the projected rate of growth in wages, and the increase in the number of mothers targeted by the intervention, from 100,000 in the first year to 150,000 in the fifth year. The annual cost of incremental food consumption increases pro rata as the number of mothers targeted increases.

***Table 13:*** *Cost of intervention, MWK million*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Target population | 100,000 | 112,500 | 125,000 | 137,500 | 150,000 |
| Cost of promotion | 345 | 390 | 438 | 492 | 558 |
| Cost of incremental food consumption | 307 | 345 | 384 | 422 | 461 |
| **Total cost** | **652** | **735** | **822** | **915** | **1,019** |

The two benefits of complementary feeding promotion quantified here are averted child mortality and averted loss of lifetime income from reduced rates of stunting among children. The prevalence of stunting among children in food secure households is estimated to decline from 29% to 22% (Table 14) as a result of this intervention, representing a 24% reduction. This is estimated based on an average improvement in z-score of 0.22 from a review of studies of complementary feeding promotion for food secure households by Panjwani and Heidkamp (2017). Thus 3,119 cases of stunting are avoided in every target population of 100,000 children in the first year of the promotion program, increasing to 4,679 cases avoided among the target population of 150,000 children in the fifth year. The avoided cases of stunting are among the children in food secure households, or among 44% of the target population.

***Table 14:*** *Averted cases of stunting among children in the first year target population*

| | Stunting prevalence rate | | Number of avoided cases of stunted children for a target population of 100,000 |
|---|---|---|---|
| | Without intervention | With intervention | |
| Moderate stunting (2-3 s.d. below reference group mean) | 23.2% | 18.4% | 2,129 |
| Severe stunting (>3 s.d. below reference group mean) | 6.2% | 3.9% | 991 |
| Total (>2 s.d. below reference group mean) | 29.4% | 22.3% | 3,119 |

This reduction in stunting has a short-term benefit for infant and child health, but there is a continuing benefit through adult life. As noted above, this is assumed to be a 30% increase in lifetime wages. We apply this value to the stream of future income projected under the *Malawi Priorities* standardized assumptions, assuming individuals work from age 15 to age 60. Results indicate that at an 8% discount rate, the productivity benefit (increased wages) attributable to avoided stunting is approximately MWK 3,817 million in year one, rising to MWK 6,800 million by year five.

The reduction in stunting prevalence is estimated to avert 53 deaths among the target group of 100,000 in the first year of the promotion program (Table 15), increasing to 79 averted deaths among the 150,000 targeted in the fifth year. This is estimated by using the relative risks of child mortality from stunting in Olofin et al (2013). Higher height-for-age Z scores (HAZ scores) are associated with lower risks of infection and reduced rates of mortality. Table 18 summarizes the relative risks of mortality from various causes for different degrees of stunting. There is a six-fold increase of risk of dying from diarrhea, acute lower respiratory infection or measles for severely stunted children, and even those with mild stunting have a significantly higher risk of mortality from common diseases.

***Table 15:*** *Averted cases of stunting among children in the first year target population*

| | Severe | Moderate | Mild | None |
|---|---|---|---|---|
| All-cause mortality | 5.48 | 2.28 | 1.46 | 1.00 |
| Diarrhea | 6.33 | 2.38 | 1.67 | 1.00 |
| Acute lower respiratory infections (ALRI) | 6.39 | 2.18 | 1.55 | 1.00 |
| Measles | 6.01 | 2.79 | 1.25 | 1.00 |
| Malaria | 1.92 | 1.06 | 0.74 | 1.00 |
| Other infectious diseases | 3.01 | 1.86 | 0.95 | 1.00 |

*Source: Olofin et. al., (2013). ALRI is acute lower respiratory infections. Other infectious diseases include neonatal sepsis, tuberculosis, and meningitis. Severe stunting refers to a HAZ less than -3. Moderate stunting refers to a HAZ between -2 and -3. Mild stunting refers to a HAZ between -1 and -2. Relative risks are in relation to stunting according to the WHO Child Growth Standards.*

Using these risks in combination with the known rates of stunting and current mortality by disease, we arrive at the figures shown in table 16; a total of 53 lives saved in the first year of the program.

***Table 16:*** *Averted deaths among children in the first year target population*

| Cause | Deaths avoided by cause |
|---|---|
| Diarrhea | 12 |
| Lower respiratory infections | 15 |
| Other infectious diseases | 26 |
| **Total by age group** | 53 |

Benefits of reduced stunting and mortality among children in first year target population are presented in table 17. The benefits are MWK 4,346 million in the base case with 8% discount rate. Productivity benefits from avoided lifetime income losses account for nearly 90% of total benefits in this case.

***Table 17:*** *Benefits of intervention from first year target population (MWK million)*

| Discount rate | Health benefits | Productivity benefits | Total benefits |
|---|---|---|---|
| **5%** | 569 | 10,472 | 11,041 |
| **8%** | 529 | 3,817 | 4,346 |
| **14%** | 462 | 779 | 1,241 |

Total benefit of the intervention is presented in table 18. Annual benefit over the five years of the complementary feeding promotion program from 2020 to 2024 is dominated by the productivity benefit which increases with the rate of growth of the target population and projected growth in annual wages. The benefit from 2025 to 2028 is the value of averted deaths among 1 to 4 year olds.

***Table 18:*** *Total benefit of intervention, MWK million*

| Discount rate | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|
| **5%** | 10,680 | 12,640 | 14,762 | 17,065 | 19,579 | 652 | 544 | 402 | 223 |
| **8%** | 4,025 | 4,823 | 5,692 | 6,645 | 7,706 | 652 | 544 | 402 | 223 |
| **14%** | 987 | 1,255 | 1,554 | 1,893 | 2,291 | 652 | 544 | 402 | 223 |

Benefits and costs of the five year program are presented in Table 19. Benefits are over 7 times larger than the costs in the base case with 8% discount rate.

***Table 19:*** *Benefit-cost ratios of intervention*

| | Benefit (MWK million | Cost (MWK million) | BCR |
|---|---|---|---|
| **5%** | 68,309 | 3,726 | 18.3 |
| **8%** | 25,450 | 3,513 | 7.2 |
| **14%** | 6,743 | 3,150 | 2.1 |

*Note: Present value of benefits and costs from the five years of the Promotion program.*

The base case BCR remains above 5 for 30% lower productivity or mortality benefits, or for 30% increase in program cost of promoting incremental feeding. The BCR is most sensitive to changes in productivity benefit as this is the largest benefit component, and least sensitive to changes in mortality benefits. The BCR is equally sensitive to changes in either of the two cost components as they constitute approximately an equal share of total cost.

***Table 20:*** *Sensitivity of BCRs to changes in benefits and costs*

| | BCR |
|---|---|
| **Base case** | **7.2** |
| 30% lower productivity benefit | 5.3 |
| 30% less averted deaths | 6.9 |
| 30% increase in Promotion program cost | 6.2 |
| 30% increase in cost of incremental feeding | 6.3 |

*Note: Base case BCRs with 8% discount rate.*

## 2.4 Complementary Feeding Promotion with Food Provision

Promotion of complementary feeding is an effective intervention for households that have a secure food supply, but if families lack the resources to feed their children adequately promotion alone is not enough. In this case, food provision is needed to ensure that the diet fed to young children improves. Perfectly identifying these households is, however, a challenge. The intervention is therefore assessed in two scenarios in which complementary food is provided:

i) To both food insecure and food secure households with children 6-23 months (no targeting of food insecure households);

ii) To only food insecure households with children 6-23 months (perfect targeting).

The difference in intervention cost and benefit-cost ratios (BCRs) in these two scenarios demonstrates the magnitude of the potential efficiency gains from being able to, even if only to some degree, identify and target the food insecure households for complementary food provision.

The cost of the complementary feeding promotion with food provision has three components:

i) Cost of promotion: This cost applies to both scenarios and is the same in magnitude as for the promotion only intervention assessed above.

ii) Cost of food provision by the program: This cost is incurred first and foremost for food insecure households in both scenarios, but also for food secure households in the scenario of no targeting (Table 21). This cost is not incurred in the promotion only intervention.

***Table 21:*** *Sensitivity of BCRs to changes in benefits and costs*

| | **No targeting** (food insecure and secure households) | **Targeting** (food insecure households only) |
|---|---|---|
| Targeted number of mothers | 100,000 | 100,000 |
| Food provision (% of mothers) | 100% | 56% |
| Mothers receiving food provision | 100,000 | 56,000 |
| Base cost of food provision (MWK/child) | 32,154 | 32,154 |
| Distribution cost (% of base cost) | 20% | 20% |
| Cost of food provision (MWK/child) | 38,585 | 38,585 |
| **Total cost of food provision (MWK million/year)** | **3,858** | **2,161** |

iii) Cost of incremental food consumption: This is cost of the incremental food that mothers give to their children in food secure households. The cost per child is the same as for the promotion only intervention. The cost is incurred only to the extent that the promotion with food provision intervention is targeted at food insecure households. Thus in the first scenario the cost is zero, while in second scenario with perfect targeting, the cost of incremental food consumption in food secure households is the same magnitude as in the promotion only intervention.

The total costs of the intervention for the two scenarios are presented in Tables 22 and 23. The annual cost of promotion is the same in each scenario. The cost of food provision by the intervention program is substantially higher in the scenario with no targeting than in the scenario when food provision is only distributed to the food insecure households. The difference in this cost between the scenarios is the potential cost savings from being able to target the food provision.

***Table 22:*** *Cost of intervention, MWK million (no targeting)*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Target population | 100,000 | 112,500 | 125,000 | 137,500 | 150,000 |
| Cost of promotion | 345 | 390 | 438 | 492 | 558 |
| Cost of food provision | 3,858 | 4,341 | 4,823 | 5,305 | 5,788 |
| **Total cost** | 4,203 | 4,731 | 5,261 | 5,798 | 6,346 |

***Table 23:*** *Cost of intervention, MWK million (targeting)*

| | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Target population | 100,000 | 112,500 | 125,000 | 137,500 | 150,000 |
| Cost of promotion | 345 | 390 | 438 | 492 | 558 |
| Cost of food provision to food insecure households | 2,161 | 2,431 | 2,701 | 2,971 | 3,241 |
| Cost of incremental food consumption in food secure households | 307 | 345 | 384 | 422 | 460 |
| **Total cost** | 2,813 | 3,166 | 3,523 | 3,885 | 4,260 |

The two benefits of complementary feeding promotion with food provision are the same as for promotion alone, i.e., averted child mortality and averted loss of lifetime income from reduced stunting among children. There is, however, a difference in the magnitude of benefits as this intervention reduces child mortality and stunting among children in both food insecure and food secure households.

The prevalence of stunting among children in food insecure households is estimated to decline from 39% to 35% (Table 24); a 10% reduction in prevalence rate. This is estimated based on an average improvement in z-score of 0.10 from a review of studies of complementary feeding promotion for food secure households by Panjwani and Heidkamp (2017). Thus 2,106 cases of stunting are avoided among the food insecure target population of 100,000 children in the first year of the program, increasing to 3,159 cases avoided among the target population of 150,000 children in the fifth year.

For the entire target population, avoided cases of stunting among children in food secure and food insecure households are 5,227 in the first year, rising to 7,840 in the fifth year.

***Table 24:*** *Averted cases of stunting among children in the first year among food insecure households*

| | Stunting prevalence rate | | Number of avoided cases of stunted children for a target population of 100,000 |
|---|---|---|---|
| | Without intervention | With intervention | |
| Moderate stunting (2-3 s.d. below reference group mean) | 28.7% | 26.5% | 1,199 |
| Severe stunting (>3 s.d. below reference group mean) | 9.8% | 8.2% | 907 |
| Total (>2 s.d. below reference group mean) | 38.5% | 34.7% | 2,106 |

The reduction in stunting prevalence in food insecure households also averts 35 more deaths, giving a total of 88 among the target group of 100,000 in the first year of the program (Table 25), increasing to 132 averted deaths among the 150,000 targeted in the fifth year.

***Table 25:*** *Averted deaths among children in food secure and insecure households in the first year target population*

| Cause | Deaths avoided by cause |
|---|---|
| Diarrhea | 19 |
| Lower respiratory infections | 24 |
| Other infectious diseases | 44 |
| **Total** | 88 |

The benefits of reduced stunting and mortality among children in the first year target population in food secure and food insecure households are presented in table 26. Health and productivity benefits are the same in the two scenarios. This is because food secure households have the resources to respond to the promotion program whether or not food provision is included. However, in the scenario with no targeting, food provision to food secure households is simply a transfer. This transfer is included in the benefits for households as well as in the cost of the program.

***Table 26:*** *Benefits of intervention from first year target population (MWK million)*

| Discount rate | Health benefits | Productivity benefits | Total benefits (w/ targeting) | Transfer benefits (no targeting) | Total benefits (no targeting) |
|---|---|---|---|---|---|
| **5%** | 944 | 17,548 | 18,492 | 1,415 | 19,907 |
| **8%** | 877 | 6,396 | 7,273 | 1,415 | 8,688 |
| **14%** | 766 | 1,306 | 2,071 | 1,415 | 3,486 |

Benefits and costs of the five year program of complementary feeding promotion with food provision are presented in Tables 27-29. Benefits are 2.2 times larger than the costs in the base case with 8% discount rate when food provision is distributed to all household (no targeting). Targeting raises the benefit-cost ratio to 2.8 given the substantial program cost savings. Thus, while perfect targeting of insecure households is difficult, there are substantial gains in cost savings from even partially being able to identify and target the food insecure households.

***Table 27:*** *Benefit-cost ratios of intervention (no targeting)*

| Discount rate | Benefit (MWK million) | Cost (MWK million) | BCR |
|---|---|---|---|
| **5%** | 122,365 | 23,711 | 5.2 |
| **8%** | 50,101 | 22,362 | 2.2 |
| **14%** | 17,994 | 20,073 | 0.9 |

*Note: Present value of benefits and costs from the five years of the Promotion program.*

***Table 28:*** *Benefit-cost ratios of intervention (w/ targeting)*

| Discount rate | Benefit (MWK million) | Cost (MWK million) | BCR |
|---|---|---|---|
| **5%** | 114,404 | 15,884 | 7.2 |
| **8%** | 42,592 | 14,980 | 2.8 |
| **14%** | 11,253 | 13,445 | 0.8 |

*Note: Present value of benefits and costs from the five years of the Promotion program.*

As in the case of complementary feeding promotion only, the BCR is most sensitive to changes in productivity benefit as this is the largest benefit component. With regards to cost, the BCR is most sensitive to changes in cost of food provision as this cost represents by far the largest share of total costs.

***Table 29:*** *Sensitivity of BCRs to changes in benefits and costs*

| | BCR | |
|---|---|---|
| | No targeting | Targeting |
| **Base case** | **2.2** | **2.8** |
| 30% lower productivity benefit | 1.7 | 2.1 |
| 30% increase in cost of provision | 1.8 | 2.3 |

*Note: Base case BCRs with 8% discount rate.*

# 3. Summary and conclusions

There remains a high level of stunting among children in Malawi – 37% in 2016, although this has declined from 47% in 2010, (National Statistical Office 2011; National Statistical Office and ICF, 2017). Despite the improvements, this puts Malawi at the top end of the average range for Africa. The primary cause of stunting is chronic undernutrition, and addressing this is a challenge. Many low income households are food insecure, but this is compounded by poor infant feeding practices. Only 61% of babies are exclusively breastfed up to 6 months of age, and only 8% of children receive a minimum acceptable diet between 6 and 23 months of age (DHS 2015-16).

The Government of Malawi has responded by developing the National Multi-Sector Nutrition Strategic Plan 2018–2022, which aims to have a well-nourished population that effectively contributes to the economic growth and prosperity of the country. Delivery of nutrition services at community level is mainly via care groups and frontline workers from Health, Agriculture, Community Development, and Volunteers. Frontline workers include Health Surveillance Assistants (HSAs), Agriculture Extension Development Officers (AEDO), Community Development Assistants (CDAs), and teachers.

Malawi's health system however, has faced chronic resource constraints and deficiencies in quality of services. Having a properly resourced, fully functional system across the country is obviously a prerequisite for the achievement of strategic goals, but there is a shortage of trained people on the ground and clear difficulty in deploying more, even if they are already trained. This makes it particularly important that any interventions proposed to improve infant nutrition are cost-effective.

We have assessed three interventions in this report:

1. Breastfeeding promotion (exclusive breastfeeding for infants 0-5 months and continued breastfeeding for children 6-23 months)
2. Complementary feeding promotion (children 6-23 months)
3. Complementary feeding promotion with the provision of complementary food (children 6-23 months)

The second intervention – complementary feeding promotion without provision of complementary food – is largely intended for food secure households that can respond to the promotion by providing their young children with adequate complementary food.

The third intervention with complementary food provision is mainly intended for food insecure households that lack the resources to provide adequate food for their young children. Perfectly identifying these households is, however, a challenge. The intervention is therefore assessed in two scenarios with complementary food provided to:

i) All households with children 6-23 months (no targeting of food insecure households)
ii) Only food insecure households with children 6-23 months (perfect targeting)

All three interventions are cost-effective, but the highest benefit cost ratio – 7.2 – is for complementary feeding promotion (all BCRs at an 8% discount rate). Breastfeeding promotion is also cost effective, with a BCR of 5.4. Complementary feeding promotion with food provision is the most expensive option and, not surprisingly, has the lowest benefit cost ratio. This varies between 2.8 (if targeted perfectly at food insecure households) to 2.2, for the untargeted intervention.

If breastfeeding promotion were to be scaled up from its current level, we estimate that it would lead to around 16,000 more women exclusively breastfeeding and over 8,700 women continuing to breastfeed for 24 months, in the first year of the program. This increase would avoid 334 child deaths, reduce cases of diarrhea by 31,000 and cases of respiratory infection by over 75,000 for the first cohort. Over a five year program the total number of child deaths avoided from the intervention would be 2,088 or around 9% of avoidable deaths for the beneficiary population. The intervention would require MWK 5,150 million over 5 years (8% discount rate), with 81% of this direct costs and the remaining costs of time and inconvenience.

For complementary feeding promotion, the analysis indicates that 3,119 children would avoid stunting. This would lead to a reduction in associated deaths of 18 in the first year of the program, and an increase in lifetime productivity equivalent to 30% of future income. Over five years the number of deaths avoided would be 293 at a cost of MWK 307 million.

For the third intervention, in which complementary feeding is provided as well as promoted (food provision being untargeted), we find that 5,227 children would avoid stunting. Averted deaths in year one would rise to 29; over the five years of the full program, total deaths avoided would be 486, at a cost of MWK 3,858 million. Part of this cost is for the provision of food (the most expensive element of the program) to households that are already food secure. Perfectly targeting the intervention, to provide food only to those households that do not have a secure food supply, would reduce the overall cost to MWK 2,161 million. Clearly, this intervention becomes increasingly cost-effective the better targeted it is.

On the basis of this study, we recommend that the key intervention to consider is complementary feeding promotion, which would make a significant contribution to reducing the rate of stunting in a cost-effective way. However, if resources are available, expanding promotion of breastfeeding from its current level, although costing considerably more, would avert around 9% of avoidable childhood deaths – more than 2,000 in total – over a five-year period cost-effectively.

# 4. References


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# 5. Appendix: Valuation of mortality risk reduction

We value each death avoided using a value of statistical life year (VSL) of $9.4m USD (2015 dollars) – representing approximately 160 times income as measured by income per capita PPP - transferred to Malawi using an income elasticity of 1.5.

To estimate these values, we take the GDP per capita figure in 2018 Int$ for both Malawi and the USA, and estimate the VSL, in time t=0, 2018.

$$VSL_t = \left(\frac{GDP\ pc_{Malawit}}{GDP\ pc_{USAt}}\right)^{0.5} * 160 * GDP\ pc_{Malawit} \quad \text{(Eq. 1)}$$

Following Cropper et al. (2019) we estimate each subsequent VSL in the time series according to the following formula:

$$VSL_{t+1} = VSL_t * [(1+g_t)]^e \quad \text{(Eq. 2)}$$

Where $g_t$ is the GDP per capita growth rate between period t and t+1 and e=1.5.

Robinson, Hammitt and O'Keeffe (2019) suggest that when the beneficiaries of health interventions are likely to be the very old or the very young, analysts should also include an approach that values each life year lost from an avoided death. This time series of value of statistical life year (VSLY) across years *t* is calculated by:

$$VSLY_t = \frac{VSL_t}{LE_t\ (average\ adult\ age_t)} \quad \text{(Eq. 3)}$$

where the numerator, VSL is given by the equation 1, and the denominator LE (average adult age) is the life expectancy of the average adult age, where adult is defined as anyone aged 15 and above. Age profiles to estimate average age are sourced from Riahi et al. 2017 (SP2 medium term scenario) while the life table for Malawi is sourced from WHO (2019). The benefit of avoided mortality is VSLY * avoided years of life lost from each avoided death.

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