

World Bank/UNICEF

Situational Analysis

**Improving economic outcomes by expanding
nutrition programming in Tajikistan.**

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Foreword

This report is the product of a collaborative effort by the World Bank and UNICEF, drawing on the expertise of a wide range of specialists. Using the global evidence base on the human and economic consequences of undernutrition, it examines and quantifies the scope of undernutrition in Tajikistan and highlights the potential human and economic gains achievable by scaling up effective nutrition interventions.

Undernutrition remains an important public health challenge in Tajikistan, causing preventable deaths of mothers and children and delaying the physical and cognitive development of girls and boys, sometimes beyond remedy. Despite improvements over the last decade, undernutrition is responsible for 35 percent of deaths of Tajik children under five, claiming more than 7,500 lives in this age group annually. In 2009, almost 29 percent of children under five were stunted, with rates in the four provinces ranging from 22 to 36.9 percent.

The burden of undernutrition on Tajikistan is also substantial in economic terms, estimated to be US\$41 million annually. Deaths in the labor force from undernutrition cost the country nearly US\$12.3 million a year, while productivity lost due to low birth weight, stunting, iodine deficiency, and anemia costs an estimated \$28.6 million to the economy.

While addressing the challenges and consequences of undernutrition in Tajikistan, this report also offers opportunities and compelling evidence of the potential to improve health and economic outcomes through scaling up nutrition interventions that have been proven to be effective in order to support the government of Tajikistan's commitment to the well-being and prosperous future of the Tajik people. This report shows that at least US\$15 million of the country's economic losses from undernutrition can be prevented by improving nutrition through a combination of behavioural changes and strengthening and scaling up of existing programmes.

The World Bank and UNICEF are striving to raise the global profile of nutritional issues. The World Bank helped forge the global consensus on the Scaling Up Nutrition Framework. Meanwhile, UNICEF has an important focus on nutrition in its Medium Term Strategic Plan (2006-2013), which includes efforts to improve young child survival and development by scaling up high-impact, cost-effective nutrition interventions.

The Copenhagen Consensus recognized nutrition programmes amongst the top priority interventions for addressing the 10 great challenges facing global development. Success in reducing undernutrition is also essential to meeting the MDGs. In short, direct nutrition interventions are that rare prize in development: a high return, low-cost investment. It is hoped that the results of this study will boost national commitment toward prioritizing nutrition interventions that have already been tested and proven their impact in the field. The World Bank and UNICEF will continue to support the Government of Tajikistan and work together with other development partners and national stakeholders to agree on a common framework for action for the improved nutritional status of the children, women and men of Tajikistan.

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List of Acronyms

ACER	Average cost effectiveness ratio
ADB	Asian Development Bank
ANC	Antenatal care
ARI	Acute respiratory infection
BF	Breastfeeding
BMI	Body mass index
CCTs	Conditional cash transfers
CEE/CIS	Central and Eastern Europe/Commonwealth of Independent States
CI	Confidence interval
DALY	Disability-adjusted life year
DCPP	Disease Control Priorities Project
DD	Diarrheal disease
DfID	Department for International Development, UK
DHS	Demographic and Health Survey
DRD	Directly ruled districts
EBF	Exclusive breastfeeding
ECA	Europe and Central Asia
FANta	Food and Nutrition Technical Assistance
FAO	Food and Agricultural Organization
GAIN	Global Alliance for Improved Nutrition
GBD	Global Burden of Disease (WHO)
GBAO	Ghorno-Badakhshan Autonomous Province
GDP	Gross domestic product
HAZ	Height-for-Age Z Score
Hb	Hemoglobin
IDD	Iodine deficiency disorders
IFA	Iron folic acid
IPT/ITN	Intermittent preventive treatment/insecticide treated nets
IUGR	Intrauterine growth retardation
IYCF	Infant and young child feeding
LBW	Low birth weight
LDF	Lifetime discounting factor
MDG	Millennium Development Goal
MICS	Multiple Indicator Cluster Survey
MMN	Multiple micronutrient
MMR	Maternal mortality rate

MN	Malnutrition
MNSS	
MoH	Ministry of Health
NGO	Nongovernmental Organization
NIP	National Investment Plan (Uzbekistan)
NPV	Net present value
OR	Odds ratio
PAF	Population attributable fraction
PC	Pragmatic coverage
PFA	Programa Familias en Accion - Colombia
PHC	Public health care
PM2A	Preventing Malnutrition in Children Under Two Approach
RCT	Randomized controlled trial
RR	Relative risk
SAM	Severe acute malnutrition
SUN	Scaling Up Nutrition (World Bank framework)
TB	Tuberculosis
UC	Universal coverage
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USI	Universal Salt Iodization
VAD	Vitamin A deficiency
VAS	Vitamin A supplementation
WASH	Water sanitation and hygiene
WAZ	Weight-for-Age Z Score
WB	The World Bank
WFP	World Food Program
WHO	World Health Organization
WHZ	Weight-for-Height Z Score
WMD	Weighted mean difference
YLD	Years lived with disability
YLL	Years of life lost

Glossary

Variable	Definition
<i>Nutrition Indicators</i>	
Stunting (Height for Age) <i>Moderate and Severe</i>	Percentage below minus two standard deviations (moderate) and three standard deviations (severe) from median height for age of reference population
Wasting (Weight for Height) <i>Moderate and Severe</i>	Percentage below minus two standard deviations (moderate) and three standard deviations (severe) from median weight for height of reference population
Underweight <i>Moderate and Severe</i>	Percentage below minus two standard deviations (moderate) and three standard deviations (severe) from median weight for age of reference population
Low Birth Weight (LBW)	Percentage of infants with low birth weight (< 2,500 grams)
Anemia	Percentage of children 6–59 months defined as hemoglobin levels < 11 g/dl
Iodine Deficiency	Percentage of iodine deficiency measured by excretion of urinary iodine (< 100 ug/L in general population, 150 ug/L in pregnant women)
Vitamin A Deficiency (VAD)	Percentage vitamin A deficiency among children—level of serum retinol lower than 0.70 µmol/L
<i>Maternal Risk Factors</i>	
Anemia	For non-pregnant women, defined as hemoglobin levels <11.0 g/dl
Low Body Mass Index (BMI)	BMI of < 18.5 (weight/height ²)
Vitamin A Deficiency (VAD)	Percentage of lactating women with a level of breast milk retinol lower than 1.05 µmol/L
Exclusive Breastfeeding 0-3 months	Percentage of children who are exclusively breastfed (< 3 months)
Exclusive Breastfeeding 0-5 months	Percentage of children who are exclusively breastfed (< 6 months)
Appropriate Complementary Feeding (6-23 months)	Percentage of children who are being fed in accordance with the WHO recommendations appropriate for their age

<i>Mortality Indicators</i>	
Child Mortality Rate	Probability of dying between birth and exactly five years of age expressed per 1,000 live births
Infant Mortality Rate	Probability of dying between birth and exactly one year of age expressed per 1,000 live births
Variable	Definition
<i>UN Food and Agriculture Organization Definitions</i>	
Undernourishment	The condition of people whose dietary energy consumption is continuously below a minimum dietary energy requirement for maintaining a healthy life and carrying out a light physical activity with an acceptable minimum body weight for attained height
Prevalence of Food Deprivation	The proportion of the population not consuming sufficient food to meet their energy needs
Prevalence of Food Poverty	The proportion of the population below the <i>critical</i> level of income (or proxy total expenditure) that represents the monetary value of the <i>minimum</i> dietary energy requirement of the population provided by a balanced energy-yielding nutrients food basket using energy-yielding nutrient prices of low-income population groups
Food Security	The condition that exists when all people, at all times, have access to sufficient, acceptable, safe, and nutritious food

Executive Summary

The Burden of Undernutrition in Tajikistan

Undernutrition in Tajikistan remains an important public health challenge, albeit a hidden problem. Stunting, iodine deficiency, and maternal and child anemia represent the largest burden of undernutrition in Tajikistan. In 2009, around 29 percent of children in all regions of the country were stunted. Iodine deficiency was observed in 53 percent of children and in 58.6 percent of women. The national prevalence of anemia in children was 28.8 percent; however, rates were as high as 39.8 percent in Ghorno-Badakhshan Autonomous Province and in 32 percent directly ruled districts (DRD). The prevalence of anemia among mothers was 24.2 percent. The long-term effects of these conditions negatively affect the health of adults throughout their life, as well as their potential productivity in the work force and possible economic contribution to the nation.

Undernutrition claims the lives of more than 7,500 children under five annually in Tajikistan. Despite improvements over the last decade, undernutrition is responsible for 35 percent of deaths of Tajik children under five, approximately 7,676 deaths annually, including neonatal deaths. Stunting, both severe and moderate, is the major type of undernutrition causing child deaths and is responsible for more than half of them. Low birth weight and wasting constitute 20 percent of all undernutrition attributable mortality in the same age group.

Undernutrition accounts for approximately 13 percent of DALYs in children under five in Tajikistan. Some conditions caused by undernutrition adversely affect long-term outcomes without causing death. However, they cause moderate to severe disability by impairing cognitive and physical activity and/or mental development. Among those, low birth weight has the biggest share, constituting about 77 percent of total undernutrition-attributable DALYs. The share of Low Birth Weight (LBW) attributable disability adjusted life year (DALYs), relative to all-cause DALYs, in children under five is as high as 10 percent out of total undernutrition attributable DALYs of 13 percent.

Undernutrition costs Tajikistan US\$41 million annually. These losses are caused by lost productivity due to increased mortality and reduced cognitive and physical development. Workforce lost to deaths from undernutrition costs the country US\$ 12.3 million a year; productivity lost to stunting, iodine deficiency, childhood anemia and low birth weight costs US\$ 28.6 million; together they amount to approximately US\$ 41 million. Iodine deficiency alone accounts for almost 40 percent of the workforce's lost productivity. The effects of undernutrition are sometimes invisible and not fully understood over time. Therefore, the burden of undernutrition could be even greater than estimated.

Prioritizing Nutrition Interventions in Tajikistan

About US\$ 15 million could be saved annually with key nutrition interventions. Improving the population's nutrition through a combination of behavior changes, and strengthening and scaling up of existing nutrition programs will recoup losses and improve economic performance. Effects of stunting can be treated and even reversed in children under two. Further, direct nutrition interventions bring very high development returns. Effective, evidence-based interventions addressing the immediate causes of undernutrition are ready for scaling up. The estimated future economic gains in productivity and workforce size, if nutrition intervention packages are scaled up, are US\$ 15 million in Tajikistan.

The highest priority interventions will improve infant and young child feeding. These include early initiation of breastfeeding, exclusive breastfeeding until six months of age, and timely and appropriate complementary feeding, including micronutrient powders, together with breastfeeding from 6 to 24 months of age. Strengthening and scaling up breastfeeding promotion will save lives and help to reduce stunting as would complementary feeding for babies six months and older. Promoting exclusive breastfeeding for infants under six months is the most efficacious intervention to save lives, averting nearly 20 percent of deaths in children under-five. Effective programs need to be designed to make more women aware of the benefits of breastfeeding and sound nutrition. A comprehensive, multisector approach is needed to ensure success of these interventions.

Universal salt iodization is the next highest priority intervention. Strengthening the universal salt iodization program in Tajikistan will provide the highest annual economic returns of any intervention. Fewer than half the households in Tajikistan consume salt that is adequately iodized; hence the prevalence of iodine deficiency among young children and women of reproductive age is very high carrying a substantial economic loss from lower productivity. Increased focus on iodizing the salt supply could result in annual economic gains of US\$5.8 million a year in increased productivity and cognitive function.

Management of Severe Acute Malnutrition (SAM). Almost 400 deaths would be prevented each year with universal implementation of the World Health Organization's recommendations for case management of SAM. Severe wasting causes 6 percent of under-five mortality in Tajikistan. More than one in four (27 percent) of the deaths caused by severe wasting could be prevented with this protocol. Implementing community-level growth monitoring may help to identify moderately acute malnourished children before they become severely wasted. New evidence indicates that many children with SAM can be treated in their communities without being admitted to a health facility or a therapeutic feeding center.

Supplementing pregnant women with either iron folic acid or multiple micronutrients is the next highest priority. Pregnant women require daily supplements of vitamins and minerals to meet their substantially increased requirements. In addition to the impressive reductions in perinatal mortality as a result of scaling up these interventions, the reductions in maternal mortality by reducing anemia are substantial.

Maintain twice-annually vitamin A supplementation. The country's program supplying vitamin A reaches an impressive number of people and should be made permanent, as well as mechanisms established to ensure sustained high coverage. Declines in coverage should prompt an immediate investigation to determine the strength of logistics supply, supervision, and the mechanics of community mobilization. Vitamin A supplementation should also be provided according to WHO recommendations in the management of common childhood illnesses.

Implementing a deworming program would yield US\$ 480,000 in economic benefits by reducing childhood anemia, resulting in increased productivity. Delivery costs can be lowered by combining helminth control with other programs, such as the twice-yearly vitamin A campaign.

Support Flour fortification. Efforts to fortify flour are in progress and should be supported as providing an additional source of key B vitamins including folic acid and the minerals iron and zinc.

Scale up and maintain zinc for the management of diarrhea. The 2004 revised WHO/UNICEF guidelines for the standard management of diarrhea were introduced in Tajikistan in 2007, one of the first countries in the region to do so. Further scaling up and maintaining this intervention would result in US\$ 2.3 million in economic benefits per year.

Address the underlying and basic causes of undernutrition through other sectors. While focusing on the immediate causes of undernutrition, opportunities should also be developed and exploited through other sectors. Interventions, particularly related to the availability and affordability of food, and poverty reduction strategies, are important to initiate. These multisector approaches are described in the description of the Food Security Program officially sanctioned by the government in January 2009. In addition to food security, hygiene (including handwashing) and sanitation need to be also considered as part of the multisectoral approaches to address undernutrition. Children living in conditions of poor sanitation and hygiene are at high risk of contracting tropical enteropathy – a subclinical infection which damages the small intestine affecting its digestive and absorptive capacity – and therefore are more likely to become undernourished as a result.

Recommended Immediate Next Steps

To move to the next level, both the Government of Tajikistan and the development partners could benefit from adopting the following immediate next steps.

Development partners could:

Disseminate the report's findings among stakeholders for review. Country stakeholders need to review and discuss the report's conclusions and recommendations. Their input is an important consideration before the recommendations can be finalized. The dissemination process is an opportunity to involve stakeholders in the development process to strengthen the political commitment and stewardship required to scale up and sustain the priority nutrition policies and programs.

Identify and exploit every opportunity to build national and regional capacity to design and manage nutrition policy programs.

Work closely with government to mobilize resources to scale up the highest-priority interventions.

Direct nutrition interventions that will reduce the immediate causes of undernutrition include breastfeeding, complementary feeding, universal salt iodization, maternal supplementation with vitamins and minerals, and other approaches to increasing vitamin and mineral intakes, such as fortification.

Whereas, the Government of Tajikistan could:

Incorporate recommendations from the report into nutrition strategies and plans. In particular, strengthen the design and implementation of the monitoring and evaluation components within each of these plans. Where possible, update the analyses presented in the report using more rigorous program coverage data and the latest prevalence data.

Develop mechanisms to engage the social protection and agricultural sectors to address the underlying and basic causes of undernutrition. Identifying effective approaches will require additional research, evidence-based advocacy, and the institutional capacity to coordinate the design and implementation of multisectoral nutrition interventions in these sectors

1. Overview

1.1 Report Rationale and Objective

The World Bank and The United Nations Children’s Fund (UNICEF) jointly developed this report to calculate the potential human and economic benefits to be gained from increasing nutrition investments in Tajikistan. This report provides compelling evidence of the potential to improve health and economic outcomes through scaling up effective nutrition interventions and introducing new, proven interventions to reduce the direct causes of undernutrition in order to support the government of Tajikistan’s commitment to the well-being and prosperous future of the Tajik people.

This situational analysis examines and quantifies the scope of undernutrition in Tajikistan by presenting: (1) the epidemiology of undernutrition; (2) an estimate of the health consequences of undernutrition in terms of mortality and DALYs, and the economic losses due to lost workforce and productivity; (3) the health, social protection, agriculture, and food intervention systems relevant to delivering interventions for improving nutrition; (4) the current coverage of nutrition interventions; and (5) the potential economic gains achievable by scaling up effective nutrition interventions.

The current context is very favorable for scaling up nutrition interventions in Tajikistan given the growing political commitment. Investing in nutrition has increasingly proven to have excellent development and health returns. The international development community and the government of Tajikistan has recognized (1) the need to scale up nutrition interventions; (2) the potential for public-private partnerships; and, (3) a growing consensus around a common framework for action. Reducing undernutrition worldwide is a priority for the World Bank and UNICEF, and also critical to achieving the Millennium Development Goals (MDGs).

The authors acknowledge an imbalance between the detailed analyses undertaken on the direct causes of undernutrition, which were available, and the more superficial analyses of the indirect or underlying causes, such as poverty, agriculture, and education, which were less available. This imbalance results from a lack of epidemiological evidence on the impact of interventions that affect these indirect causes of undernutrition. Such evidence is nonetheless required to analyze the economic benefits of the various interventions, which are essential to prioritize them, and should be the area of focus for future work. Despite the full complement of detailed analyses, the authors strongly advocate for the recommended multisectoral nutrition interventions – supported by best international practice – to begin; and look forward to discussing the feasibility of the available options with national stakeholders in the next phase of this assessment process.

The reader should be mindful of important caveats in interpreting the report’s findings. First, the best available data were used for the analyses presented, but, despite best efforts, some key data are missing and others are out-of-date. Second, while the models used in the epidemiological and economic analyses have been updated since the analysis for this report was prepared, this would not dramatically alter the presented results.

Because of these caveats, the findings, conclusions, and recommendations presented in this report are intended as a basis for discussions with the Government of Tajikistan and local stakeholders on the best way to proceed with investing in nutrition interventions in the immediate next steps.

2. Putting Nutrition in Perspective

2.1 Global Burden of Undernutrition

Undernutrition¹ is one of the world's most serious health problems, yet, it remains among the least addressed. Undernutrition encompasses low birth weight, low weight-for-age (underweight), low height-for-age (stunting), low weight-for-height (wasting), and inadequate intake of key vitamins and minerals (micronutrient deficiencies). In developing countries, nearly one-third of children are underweight or stunted (Black and others 2008). Globally, undernutrition interacts with repeated bouts of infectious disease to cause an estimated 3.5 million preventable maternal and child deaths annually. An estimated 35 percent of child deaths are attributable to undernutrition (Black and others, 2008). The economic costs of undernutrition, in terms of lost national productivity and economic growth, are huge, and these costs fall hardest on the very poor.

Nutrition interventions are critical to achieving the Millennium Development Goals (MDGs) (World Bank, 2006). A United Kingdom consultation nutrition paper emphatically made this point. It underscored the “clear evidence of the critical importance of nutrition to the achievement of all MDGs and in maximizing the effectiveness of all development interventions” (DFID, 2008). Table 1 illustrates the impact of a set of selected nutrition interventions on the MDGs.

Table 1. Impact of undernutrition interventions on the Millennium Development Goals

MDG 1. Eradicate extreme poverty and hunger	Reducing “prevalence of underweight children under five years of age” is an agreed target.
MDG 2. Achieve universal primary education	Reducing undernutrition increases cognitive development and contributes to learning and school completion rates.
MDG 3. Promote gender equality	Maternal education and empowerment lead to better nutrition and health practices. Reduces discrimination against girls in family feeding practices.
MDG 4. Reduce child mortality	Enormous impact of improved nutrition in decreasing child mortality
MDG 5. Improve maternal health	Improved maternal nutrition and reduced maternal mortality through programs of behavior change and iron and folic acid supplementation.
MDG 6. Combat HIV/AIDS, malaria, and other diseases	Reduces maternal and child mortality due to negative interaction of undernutrition with HIV/AIDS and other infectious diseases.
MDG 7. Ensure environment sustainability	Improving food and nutrition security reduces households' need to adopt environmentally unfavorable practices.
MDG 8. Global partnership for development	Coalescing around the need to increase awareness of world hunger and malnutrition.

A major reason the MDGs are not on track in many countries is that nutrition has been neglected for far too long. The recent and startling awareness that achievement of the MDGs is vitally linked to improved nutrition has invigorated donors and governments. They are collectively considering the potential of renewing and broadening their focus on nutrition through synergistic multisectoral actions aimed at prevention and intensifying proven traditional nutrition interventions.

Nutrition problems are often “hidden”. For example, while most micronutrient deficiencies have no visible or clinical signs, they can be deadly, e.g., by reducing immunity. Stunting is another unnoticed

¹ The term *malnutrition* includes both undernutrition and overnutrition or obesity. This report focuses exclusively on undernutrition. Country nutrition strategies will normally address obesity as well.

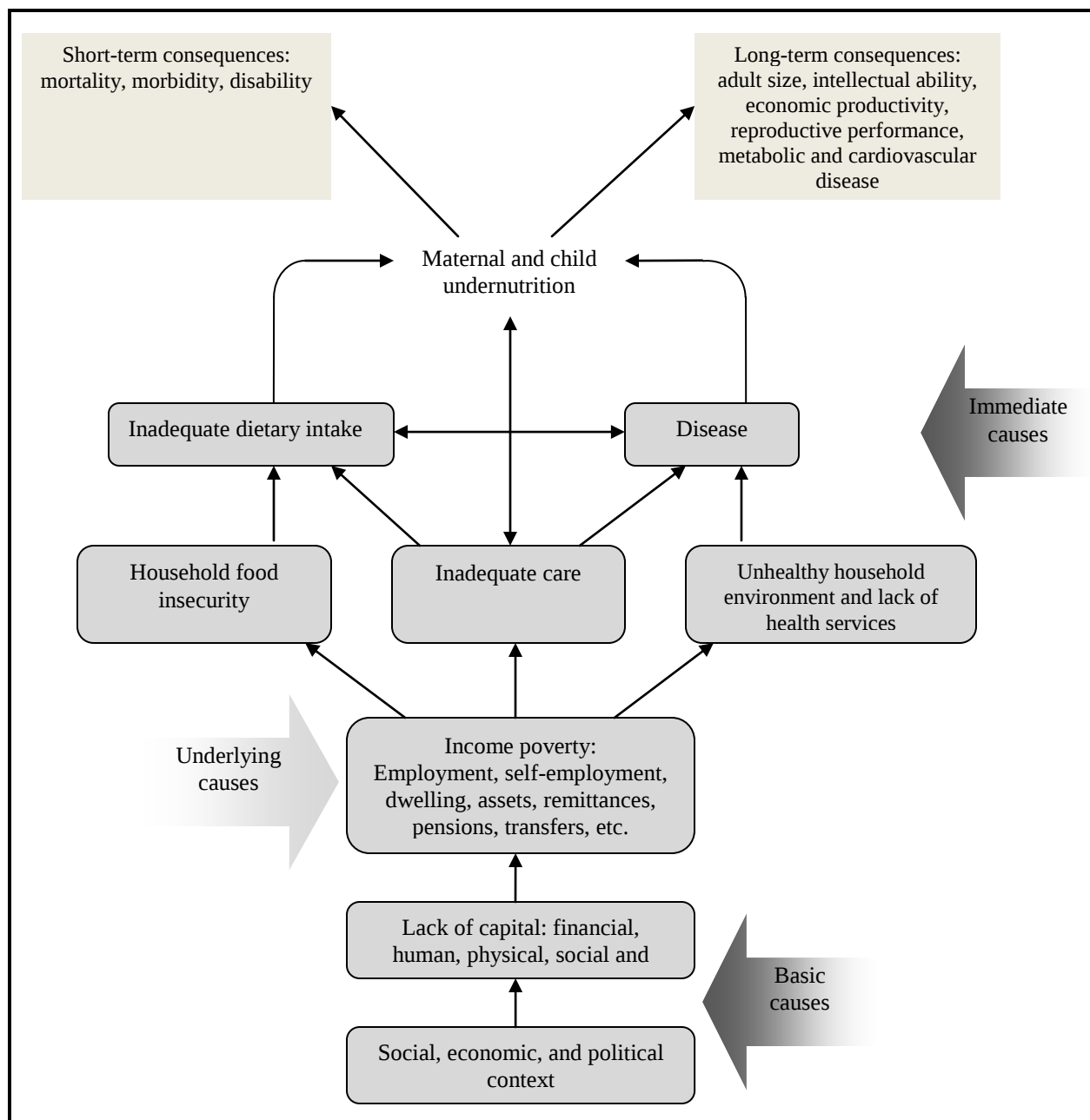
malady with long-term damaging health and economic effects. Stunting can become normalized when most children in a community suffer from it. Because the situation is perceived as “normal,” actions are not undertaken to resolve the problem. Those most in need of life-saving nutrition interventions—the fetus, young children, and pregnant women—are the weakest members of society with the smallest voices or none at all. They need concerned voices to speak and act on their behalf.

This joint World Bank/UNICEF report is an initial effort to provide compelling evidence of the potential to improve the health and economic consequences of the Tajik people through effective nutrition interventions and to support policy makers in their commitment to the future well-being of their country.

2.2 Determinants of Undernutrition

The determinants of undernutrition must be understood to identify their causes and the range of feasible interventions that are likely to have an impact on them. UNICEF developed a conceptual framework to describe the causes of undernutrition (see figure 1) (UNICEF 1990). This food-care-health framework describes three levels of undernutrition causes: immediate, underlying, and basic. The causes at each level influence the other levels. The immediate causes of undernutrition are inadequate dietary intake and disease. These immediate causes are impacted directly by inadequate access to food, inadequate care provided to children, and insufficient health and environmental services. Underlying the immediate causes of undernutrition is income poverty. Directly impacting poverty are employment opportunities and access to productive agricultural land and technologies. Other basic determinants of undernutrition are gender equality, girls’ education, and general governance issues, including rural/urban/other biases in government resource allocations that do not favor the poor.

Figure 1. The causes and consequences of undernutrition²



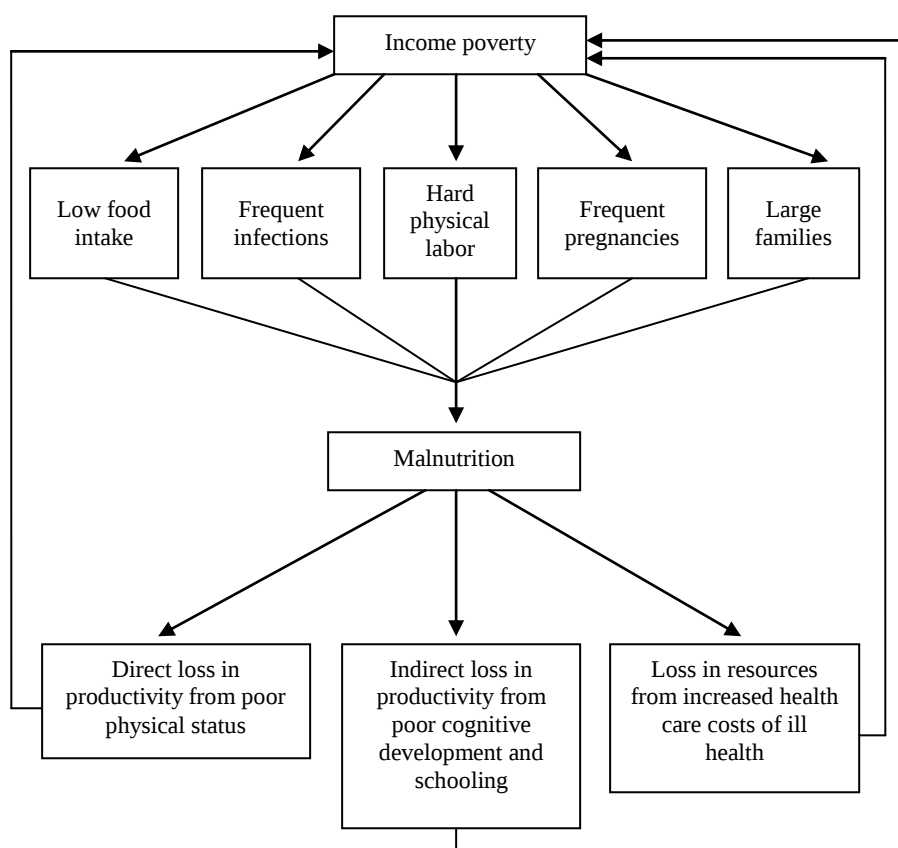
Provision of treatment and preventive health services, including hygiene and sanitation, are major determinants of undernutrition. Measures that reduce infections reduce nutritional losses associated with the infections, thus reducing “child frailty” and improving nutritional status and survival. Pneumonia and diarrhea remain the leading causes of death in children, and many children experience multiple episodes each year. Infections during pregnancy dramatically increase health risks for mother and child, and contribute to poor food absorption and utilization. Basic hygiene reduces the risk of infection, thereby reducing nutritional losses incurred by infection. Handwashing in older infants reduces infection risk and

² Black and others (2008) are cited as being derived from the UNICEF framework, 1990.

improves nutritional status as effectively as it does with their mothers. Available water for handwashing is critically important to promoting these behaviors.

Figure 2 illustrates the vicious cycle of income poverty and undernutrition. Undernutrition is both a cause and a consequence of income poverty. Undernutrition causes productivity losses in three ways: directly through restricted physical growth; indirectly through restricted cognitive development and hence lower learning through schooling; and by costs incurred through increased health care expenses. Undernutrition hampers both the physical capacity to perform work and earning ability. A recent longitudinal study in Guatemala of male children who received fortified complementary food during their first three years found that their wages as adults were 46 percent higher than the adults who had been the control children (Hoddinott and others, 2008).

Figure 2. The vicious cycle of poverty and malnutrition



Access to productive agricultural land and technologies is another key determinant of food and nutrition security. The pathways linking agricultural and nutrition are complex and changing. The two most direct pathways are subsistence-oriented production and income-oriented production, and these depend upon access to arable land and the technologies developed over the last few decades. Access to land remains a major obstacle to the very poor who would benefit most from agricultural interventions harnessed to reduce undernutrition.

The empowerment of women is particularly important to improve household nutrition outcomes, especially for children's nutrition. Women are consistently more likely than men to invest in their children's well-being. The income and resources that women control have disproportionately strong positive effects on the health and nutrition of their children (Hawkes and others, 2008). Access to

education, particularly for girls and women, is a further critical determinant of undernutrition. For example, school curricula should include basic knowledge of good nutrition, including family nutrition practices. The significance of women’s education to the health and nutrition of their children is an established axiom of development planning.

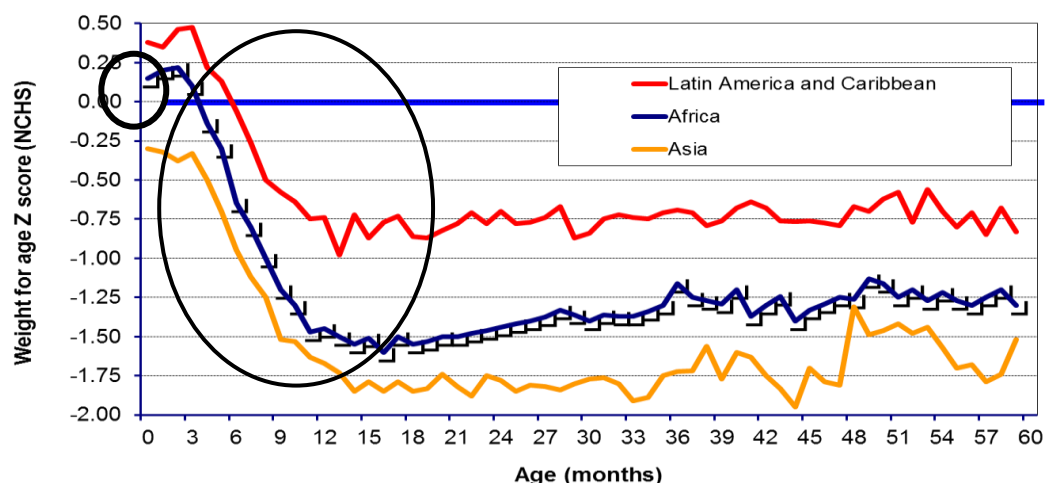
The scope of the current assessment includes brief discussions of the health, social protection, and agriculture sectors as they relate to nutrition. These descriptions are intended as a basis for future discussions about future potential interventions with local stakeholders, rather than a thorough examination of the linkages.

2.3 Focusing on the “Window of Opportunity”

The consensus of scientists and leading policy makers in nutrition—noted in The World Bank’s “Repositioning Nutrition” (World Bank, 2006), and a central conclusion of *The Lancet* series on undernutrition—is that the damage to physical growth, brain development, and human capital formation that occurs in the period before pregnancy to 24 months of age is extensive and largely irreversible. Figure 3 shows the impact of undernutrition on regional growth patterns. The growth pattern for Central Asian babies likely lies between those of Asia and Africa. At birth (identified in the figure by the small oval shape), the babies of Asia are on average well below the expected weight of babies born in Africa, Latin America, or in richer countries. This discrepancy is due to poor maternal nutrition and health, and can only be corrected through interventions addressing these maternal issues. The larger oval shape in the figure highlights the dramatic falloff in growth during the critical first two years of life.

The window of opportunity is very brief—only about 1,000 days. To be effective in preventing irreversible damage, nutrition interventions must focus on this critical period of life. Investments after this period are much less likely to improve the child’s health or nutrition.

Figure 3. The window of opportunity for addressing undernutrition



Source: World Bank 2006.

Small oval: Low birth weight indicating maternal undernutrition and poor health.

Large oval: Critical period for addressing growth faltering, brain development, and human capital formation.

2.4 Effective Interventions Are Ready for Scaling Up

The options and rationale for investing in nutrition today differ greatly from those of several decades ago. In January 2008, *The Lancet*—one of the world’s most respected medical journals—issued a special five-part series on nutrition. This series filled a long-standing knowledge gap by marshalling systematic evidence of the impact of undernutrition on infant and child mortality and its largely irreversible long-term effects on health and on cognitive and physical development. The authors also demonstrated the availability of proven interventions that could address these problems and save millions of lives. The identified set of interventions in the series focused on the “window of opportunity” from minus 9 to 24 months (i.e., from pregnancy to two years old) for high-impact interventions to reduce death and disease and avoid irreversible harm to the child. The authors estimated that universal nutrition coverage with a full package of proven interventions (at the currently observed levels of program effectiveness) would prevent about one-quarter of child deaths under 36 months of age, reduce the prevalence of stunting at 36 months by about one-third, and avert 60 million DALYs in the 36 worst-affected countries (Bhutta and others 2008). Other studies drawing on a similar set of interventions have demonstrated very high cost-effectiveness with high returns to cognitive development, individual earnings, and economic growth.

Using the evidence presented in *The Lancet* series as a foundation, a broad group of nutrition community leaders came together to build consensus around a framework for scaling up actions to address nutrition. This resulted in the Framework for Action to Scale Up Nutrition, or SUN (United Nations, 2010). The SUN Framework calls for two complementary approaches to reducing undernutrition. One is direct nutrition-specific interventions, focusing on pregnant women and children aged less than two years, with short-term public health interventions that are known to be effective, such as promoting good nutritional practices, increasing intake of vitamins and minerals, and complementary feeding to prevent and treat severe undernutrition. The second is a broader multisectoral nutrition-sensitive approach to development. This approach acts to counter the determinants of undernutrition by specifically promoting agriculture and food interventions to improve the availability, access to, and consumption of nutritious foods by improving social protection (including emergency relief), and by ensuring access to health care (including maternal and child health care, water and sanitation, immunization, and family planning).

2.5 Why Act Now?

There are several reasons for a major effort to address undernutrition in Tajikistan. Partners working toward consensus on how to reduce undernutrition most effectively in the global context articulated these most recently (UN, 2010).

1. Undernutrition is largely preventable, and the evidence of exceptionally high development returns for a number of direct nutrition interventions is conclusive. A recent study by the World Bank estimated the costs and the potential benefits of scaling up selected nutrition interventions at a global level (Horton and others, 2010) (see table 2). Costs per DALY saved were as low as US\$ 3 (vitamin A supplementation), and benefit-cost ratios were as high as 30:1 (salt iodization). The Copenhagen Consensus 2008 brought together world-renowned economists to consider 30 interventions as the “best buys” for addressing the 10 great challenges facing global development.³ Five of the top 10 priority interventions identified were nutrition programs. For example, supplementation with vitamin A and zinc were recognized as the first priorities, and iron fortification and salt iodization as the third priority (see table 3).
2. Success in reducing undernutrition is essential to meeting the MDGs and equally in contributing to achieving the human rights of health and freedom from hunger.

³ Copenhagen Consensus. <http://www.copenhagenconsensus.com/Default.aspx?ID=1318>. Accessed June 3, 2010.

3. Subsequent to the publication of *The Lancet* (2008) series on maternal and child undernutrition, a consensus has been growing among development partners on how to reduce undernutrition, and acceptance is increasing of the imperative to share advocacy for collective action.
4. Relying on improvement in underlying socioeconomic determinants of undernutrition, such as income growth, would be a serious mistake and further prolong international development's long-standing neglect of nutrition. Evidence shows nutrition improvement lags substantially behind income growth (Haddad and others 2003). Further, families with ample incomes for adequate food intake suffer from surprisingly high rates of undernutrition (Ergo, Gwatkin, and Shekar, 2009).
5. The private sector has become more actively engaged in finding solutions to undernutrition, particularly in relation to fortifying foods with micronutrients. The private sector can also help by applying its marketing skills to "social marketing" of positive nutrition messages.
6. New initiatives in the closely related areas of food security, social protection, and health systems offer opportunities to raise the profile of nutrition in these areas, as well as to obtain financing for nutrition through them.

Today's context for scaling up nutrition in Tajikistan is a new and far more favorable one than in the past. It is characterized by demonstrable and increasing proof of interventions with high development and health returns; increased recognition of the need to scale up such interventions; increased potential for public-private partnerships; and increased will by the international nutrition community to agree on a common framework for action.

Table 2. Estimated benefits from scaling up nutrition interventions

<i>Intervention</i>	<i>Estimated benefit: cost savings or cost effectiveness</i>	<i>Source</i>
Behavior change (through community nutrition programs for behavior change)	US\$53-153 per disability-adjusted life-year saved	Ho (1985: Tamil Nadu) Waters et al. (2006: Peru)
Vitamin A supplements	US\$3-16 per disability-adjusted life-year saved	Ching et al. (2000); Fiedler (2000); Horton and Ross (2003)
Therapeutic zinc supplements	US\$73 per disability-adjusted life-year saved (zinc)	Robberstad et al. (2004)
Micronutrient powders	US\$12.20 per disability-adjusted life-year saved (zinc) 37:1 benefit:cost ratio	Sharieff et al. (2006)
Deworming	6:1 benefit:cost ratio	Horton et al. (2008)
Iron-folic acid supplements	US\$66-115 per disability-adjusted life-year saved (iron; no estimates known for folic acid)	Baltussen et al. (2004)
Iron fortification of staples	8:1 benefit:cost ratio	Horton and Ross (2003, 2006)
Salt iodization	30:1 benefit:cost ratio	Horton et al. (2008)
Complementary foods	US\$500-1,000 per disability-adjusted life-year saved	Authors' rough estimates ^a
Community-based management of acute malnutrition	US\$41 per disability-adjusted life-year saved	Bachmann (2009)

Source: Horton and others, 2010.

^a. Based on Caulfield et al's (1999) estimate that increased intake of 71-164 kcal per day for children younger than one year of age, as a result of complementary feeding, could decrease deaths due to malnutrition by 2-13 percent, depending on underlying presence of malnutrition in the community.

Table 3. Rankings of top 10 priorities from the Copenhagen Consensus, 2008

Solution	Challenge
Micronutrient supplements for children (vitamin A and zinc)	Malnutrition
The Doha development agenda	Trade
Micronutrient fortification (iron and salt iodization)	Malnutrition
Expanded immunization coverage for children	Diseases
Biofortification	Malnutrition
Deworming and other nutrition programs at school	Malnutrition & Education
Lowering the price of schooling	Education
Increase and improve girls' schooling	Women
Community-based nutrition promotion	Malnutrition
Provide support for women's reproductive role	Women

Source: Copenhagen Consensus. <http://www.copenhagenconsensus.com/Default.aspx?ID=1318>. Accessed June 3, 2010.

2.6 Nutrition: A Priority for The World Bank and UNICEF

Nutrition is a priority for both the World Bank and UNICEF. Each institution is committed to working collaboratively with other donors to support governments' efforts to reduce undernutrition and achieve the MDGs. The World Bank is striving to position nutrition in the mainstream of development initiatives. The Bank was instrumental in bringing global partners together to build the consensus that enabled the SUN Framework to be developed.

UNICEF's Medium-Term Strategic Plan's (2006–2013) focus area of “Young Child Survival and Development” includes scaling up high-impact, cost-effective nutrition interventions to reduce the number of neonatal and young child deaths. UNICEF's nutrition programs in Central and Eastern Europe and Central Asia have resulted in some major achievements, including increasing household use of adequately iodized salt from 18 percent in 1990 to 56 percent in 2007 and 61.9 percent in 2009. This has substantially improved iodine nutrition, which directly benefits improved growth and cognitive development of children, and hence efficiency of schooling and economic productivity. UNICEF's long-term support of the Multiple Indicator Cluster Surveys (MICS) has enabled countries throughout the world to continually monitor the status of nutrition, particularly among vulnerable groups, “through statistically sound, internationally comparable estimates of socioeconomic and health indicators.”

This report describes the joint effort of the World Bank and UNICEF's situational analysis for Tajikistan. This information is intended to inform the further development and scaling up of policies and programs. The report describes (1) the epidemiology of undernutrition; (2) the health consequences of undernutrition in terms of mortality and DALYs, and the economic losses due to lost workforce and lost productivity; (3) the health, social protection, and agriculture and food intervention systems relevant to delivering interventions for improving nutrition; (4) the current coverage of nutrition interventions; and finally, (5) the potential economic gains of scaling up evidence-based nutrition interventions, and the appropriate and effective nutrition interventions to scale up.

The results of this report makes a strong case for immediately scaling up proven interventions to reduce the direct causes of undernutrition, and, where opportunities exist, initiate multisectoral interventions that address the underlying and basic causes of undernutrition.

References

- Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E. and others (2008). “Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences.” *The Lancet* 371: 243–60.
- Bhutta, Z. A., and others. (2008). “What Works? Interventions for Maternal and Child Undernutrition and Survival.” *The Lancet*. Published online January 17.
http://www.who.int/nutrition/topics/Lancetseries_Undernutrition3.pdf.
- DFID (Department for International Development, UK). 2008. *DFID and Nutrition: An Action Plan*, London: DFID, 6.
- Ergo, A., D., Gwatkin, R., and Shekar. M. (2009). “What Difference Do the New WHO Growth Standards Make for the Prevalence and Socioeconomic Distribution of Malnutrition?” *Food Nutrition Bulletin* 30 (1): 3–15.
- Haddad, L., Alderman, A., Appleton, S., Song, L., and Yohannes, Y.(2003). “Reducing Child Malnutrition: How Far Does Income Growth Take Us?” *The World Bank Economic Review* 17 (1): 107–31.
- Hawkes, C., and others. (2008). *From Agriculture to Nutrition: Pathways, Synergies and Outcomes*. Washington, DC: World Bank.
<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:21608903~pagePK:148956~piPK:216618~theSitePK:336682,00.htm> (accessed February 14, 2010).
- Hoddinott, J., and others. (2008). “Effect of Nutrition Interventions During Early Childhood on Economic Productivity in Guatemalan Adults.” *The Lancet* 371: 411–16.
- Horton, S., and others. (2010). *Scaling Up Nutrition: What Will It Cost?* Washington, DC: World Bank.
- The Lancet*(2008), “Maternal and Child Undernutrition,” Special Series, January.
- United Nations. (2010). “Scaling Up Nutrition: A Framework for Action.” Policy Brief. April.
<http://siteresources.worldbank.org/NUTRITION/Resources/281846-1131636806329/PolicyBriefNutrition.pdf>.
- UNICEF. (1990). *Strategy for Improved Nutrition of Children and Women in Developing Countries*, UNICEF.
- World Bank. (2006). *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action*. Washington, DC: World Bank.

3. Methods

3.1 Assessing the Nutrition Situation and Its Context

The structure used to describe the nutrition situation and context in Tajikistan follows the structure proposed by Menon and others (2011). Our structure builds on the UNICEF conceptual framework explaining the three levels of causes of undernutrition, and includes the influence of factors in the policy context, as well as factors at the community, household, and child levels. Menon's structure was developed based on the experiences of scaling up nutrition interventions in several countries, which participated in the World Bank-funded Mainstreaming Nutrition Initiative from 2006 to 2009. This report uses the following three domains in our assessment structure:

- 1) *Epidemiological*, pertaining to the current nutritional situation in the country (e.g., prevalence and causes of key nutrition problems), and the current body of evidence about the efficacy and effectiveness of nutrition interventions;
- 2) *Operational*, pertaining to coverage, quality, and utilization of nutrition-related interventions and programs, as well as the capacities, opportunities, and constraints to improving these; and
- 3) *Economic and sociopolitical*, pertaining to economic and sociopolitical factors, from community to national and international levels, that may enhance or inhibit efforts to create positive changes in policies and programs.

This assessment describes the first domain comprehensively and components of the second and third domains. Detailed information about the quality of program delivery or capacities of institutions to scale up programs, although critical to the second operational domain, was unavailable to assess. Detailed information is presented on the third domain, the economic burden of undernutrition and the benefits of implementing programs. The report briefly describes aspects of the health, social protection, and agricultural sectors that will be key to delivering interventions. Key sociopolitical issues, pivotal to building the political commitment required to mobilize the resources essential to scale up nutrition interventions, need to be examined. These issues include how resources are allocated to curative or preventive health programs, the relative priorities assigned to programs designed to build human capital; and the extent to which donors are aligned in direction and process to promote favored development objectives.

Understanding these sociopolitical issues is critical to realize the full potential that improving nutrition will contribute to achieving the MDGs in Tajikistan. To understand the issues in-depth, interviews and discussions are required with key policy makers and program managers. These discussions should take place as an immediate next step to further develop the recommendations made in this report.

The primary source of data for this assessment was the most recent MICS. Additional sources are indicated where they were used. They include Demographic and Health Surveys (DHSs); Nutrition Landscape Information System of the World Health Organization (WHO);⁴ country-specific national or subnational surveys of the food security, nutrition, and micronutrient situation; routine Ministry of Health

⁴ WHO. Nutrition Landscape Information System. <http://apps.who.int/nutrition/landscape/report.aspx>. Accessed February 15, 2010.

(MoH) data; and information from national nutrition plans and programs. Published and unpublished reports were collected from the country offices of UNICEF, the World Bank (WB), WHO, nongovernmental organizations (NGOs), and government ministries. Documentation available on websites was also used.

3.2 Estimating the Health and Economic Consequences of Undernutrition

The consequences of undernutrition in terms of DALYs and mortality in children less than five years of age were estimated with the methods used in the WHO Global Burden of Disease, 2004 (Murray and others, 2001) and in *The Lancet* series on Maternal and Child Undernutrition, 2008. A DALY is a health gap measure and provides a comprehensive summation of information that includes the impact of premature death, disability, and other non-fatal health outcomes. This indicator was used to count the nonfatal but important adverse consequences of iron and iodine deficiencies, for example. One DALY can be thought of as one lost year of healthy life. It measures the gap between the current health status of the target population and an ideal situation where everyone lives into old age free of disease and disability.

Mortality resulting from undernutrition was calculated with measures of attributable mortality and relative risk (These epidemiological concepts are explained in annex 1). The number of annual deaths attributable to malnutrition was calculated based on these risk coefficients, as well as the UNICEF statistics for prevalence of undernutrition and demographic and mortality statistics.. Using standard statistical methods, joint attributable fractions were calculated to avoid the double counting of deaths that occurs when cause-specific mortality attributed to individual risk factors is simply added up. Methods and formulas used are described in annex 1.

Economic productivity is lost through both mortality and the reduced cognitive and physical development caused by undernutrition. Tajikistan's net economic deficits as a consequence of undernutrition, including micronutrient deficiencies, was assessed by measuring workforce losses (based on premature mortality attributable to undernutrition) and future productivity losses among survivors (based on deficits in education and lower labor productivity). Similar methods to those used in the calculations made for *The Lancet* (2008) series on undernutrition and in the Uzbekistan National Investment Plan (NIP)⁵ were applied. Economic losses due to six types of undernutrition that are widely prevalent were calculated. These were LBW, stunting, severe wasting, anemia, vitamin A deficiency, and iodine deficiency in children under five years of age. The net present values of losses from undernutrition due to lost workforce (mortality) and child productivity (reduced cognitive and physical development) were calculated using the algorithms developed for the Uzbekistan NIP, which are also applicable to Tajikistan.

3.3 Estimating the Health and Economic Benefits of Scaling Up Nutrition Programs

Information on existing nutrition interventions and their coverage levels were used to investigate potential options to reduce undernutrition. The goal of this exercise was to determine the efficacy of selected maternal and child interventions in reducing undernutrition, using as a reference the recent *Lancet* undernutrition and primary care series.

⁵ The Uzbekistan Nutrition Investment Plan (NIP) was a multisectoral consultation conducted in 2007 and involved key stakeholders from government and private sectors. The NIP process included participation of experts from the Ministry of Health, Ministry of Public Education, Ministry of Economy, Ministry of Finance, and Tax Committee as well as representation from food industries, national media, and NGOs. Representatives of UNICEF, the World Bank, and the WHO participated and provided technical assistance.

Field site visits to Tajikistan were carried out in April–May 2009 and included a number of meetings with stakeholders to discuss and gather information on the epidemiology of nutrition and operational details of programs, including activities, beneficiaries, durations, coverage rates, and where possible, budgets.

Based upon evidence on efficacy and effectiveness presented in *The Lancet* series, nutrition interventions were categorized as *Universal Interventions* that have sufficient evidence to warrant implementation, *Situational Interventions* that have evidence supporting their implementation in specific situational contexts, and *Other Supportive Strategies* for which the current evidence is insufficient or the effectiveness varies.

The impact of *The Lancet*-recommended nutrition interventions on reducing mortality and improving nutrition outcomes for women, newborns, and children was assessed by using a previously described and validated sequential model (Bhutta and others, 2008). The expected reductions were estimated in prevalence of undernutrition and mortality from each intervention that would result from increasing coverage by 20 percent, a “pragmatic” increase, and universal coverage (100 percent).

Cumulative economic gains—achieved by investing in particular nutrition interventions—were calculated by comparing the national economy’s annual loss due to undernutrition with the effectiveness of existing nutrition interventions. The gains obtained after addition of new interventions and scaling up existing interventions are reflected as a percentage of the losses offset by the interventions.

3.4 Analyzing Cost-Effectiveness of Nutrition Programs

The analysis of the cost-effectiveness of current nutritional interventions in Tajikistan is based upon data from the Copenhagen Consensus,⁶ the Disease Control Priority Project,⁷ and *The Lancet* (2008) nutrition series.

These calculations are complex and were carried out by the team that developed the methods and undertook many of the calculations for *The Lancet* series on undernutrition. Details of the estimates of cost effectiveness from the literature are presented in annex 6.

3.5 Summarizing Analyses and Assigning Program Priorities

Rankings for interventions were developed by considering three criteria: (1) expected impact on mortality; (2) expected economic returns on investments (benefits/cost effectiveness); and (3) feasibility of implementation at scale. Two ranking systems were developed: numbers suggesting operational priority and letters “grading” evidence for interventions. Both rankings took into account the first two of the three criteria, and the number ranking assigned more weight to operational feasibility. The letter ranking assigned greater weight to the “evidence base” as set out in *The Lancet* series, and placed less emphasis on pragmatic operational details. Importantly, the two sets of rankings are intended as a basis for discussion with local stakeholders who can provide a clearer understanding of the operational contexts of the interventions, and whose buy-in to the priorities set of interventions will ultimately determine the success and sustainability of their implementation.

⁶ Copenhagen Consensus. <http://www.copenhagenconsensus.com/Home.aspx>. Accessed November 10, 2009.

⁷ WHO-Choice: Choosing Interventions That Are Cost-Effective. <http://www.who.int/choice/en/>. Accessed April 1, 2010.

References

Bhutta, Z. A., Ali, S. , Cousens, T. M., Ali, B. A., Haider, A., Rizvi, P., Okong, S. Bhutta, Z., and Black R. E. (2008). Alma-Ata: Rebirth and Revision 6 Interventions to Address Maternal, Newborn, and Child Survival: What Difference Can Integrated Primary Health Care Strategies Make?” *The Lancet* 372 (Sep 13): 972–89.

The Lancet. (2008), “Maternal and Child Undernutrition,” Special Series, January.

Menon P., Pelletier, D.L., Frongillo, E. A., Stoltzfus, R.J., Ahmed, A.M.S., Ahmed, T. (2011). “Assessment of epidemiologic, operational, and sociopolitical domains for mainstreaming nutrition.” *Food and Nutrition Bulletin* 32 (2 Suppl):S105-S114.

Murray, C. J. L., Lopez, A. D., Mathers, C. D., and Stein, C. (2001). “The Global Burden of Disease 2000 Project: Aims, Methods and Data Sources.” Global Program on Evidence for Health Policy Discussion Paper No. 36. World Health Organization.

4. Addressing Challenges and Seizing Opportunities

This chapter describes Tajikistan's nutrition context, including the biological, epidemiological, and operational aspects of sectors, through which interventions could be delivered. It also discusses the economic burden of undernutrition and the possible estimated health and economic gains achievable by scaling up priority interventions to address the immediate causes of undernutrition. Finally, it makes initial suggestions for recommended actions as a basis for discussions to determine the country's next steps.

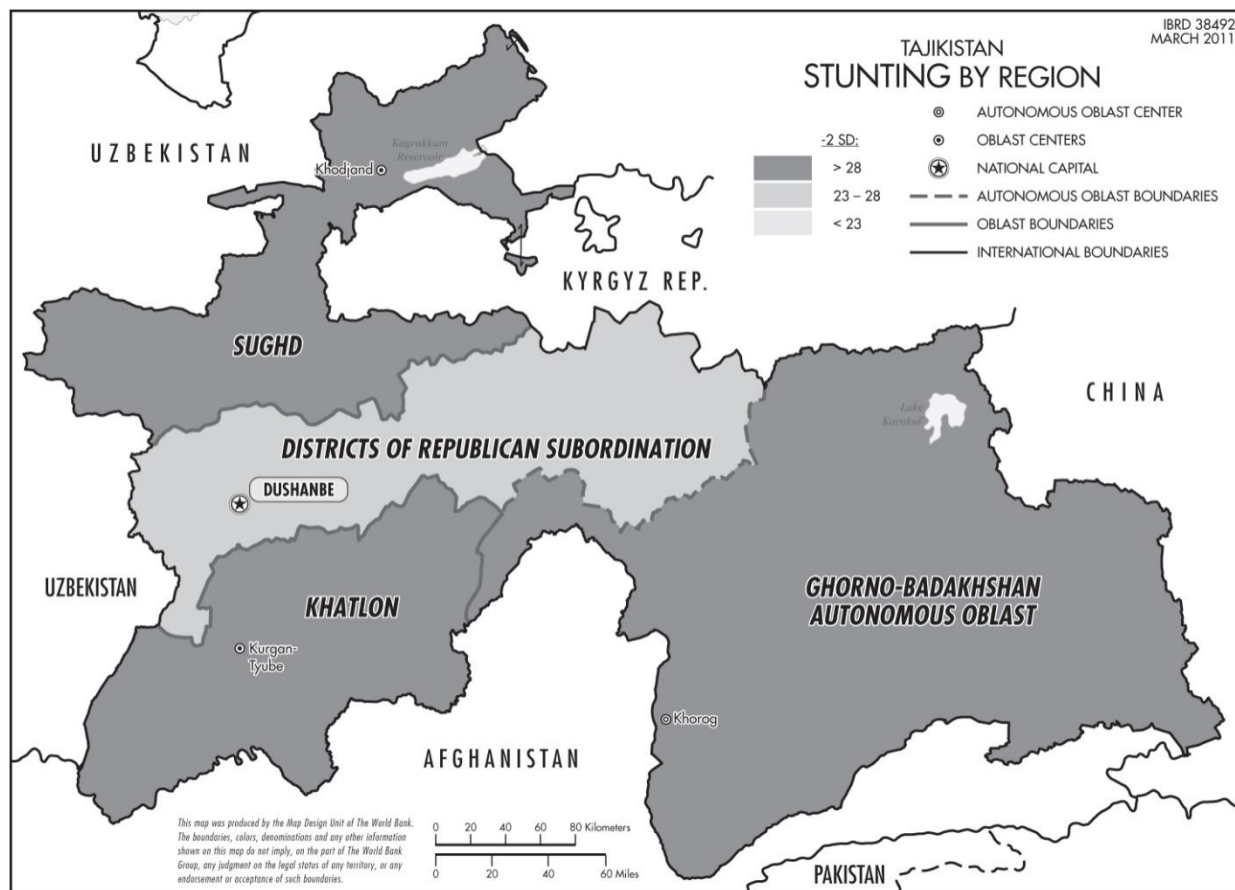
4.1 Epidemiology and Health Consequences of Undernutrition

High levels of childhood undernutrition in Tajikistan persisted in 2009. Stunting, iodine deficiency, and maternal and child anemia represent the largest burden of undernutrition in Tajikistan (see table 4). They are also significant contributors to both morbidity and elevated infant and under-five mortality. Every third child under five (29 percent) was stunted—the highest prevalence in the Central and Eastern Europe/Commonwealth of Independent States (CEE/CIS) region (Cattaneo and others 2007). More than 20 percent of children in all regions of the country were stunted, an alarming statistic. The prevalence of acute undernutrition (wasting), at 4 percent, was also high. The prevalence of stunting and underweight children were highest in the Khatlon, Sogd, and Ghorno-Badakhshan Autonomous Province (GBAO) regions. In Dushanbe and the region (around Dushanbe) under Direct Republic subordination (Directly Ruled Districts, or DRD), the rates were lower, but still higher than 20 percent (stunting). Unsurprisingly, children whose mothers had higher educational levels and income status were less likely to be underweight or stunted than children whose mothers had little or no primary or secondary education. Undernutrition rates are higher in rural areas than in urban areas. The data presented in table 4 are from the 2005 MICS and National Nutrition Survey in December 2009.

Table 4. Nutrition indicators in children under five years of age, Tajikistan, 2005-2009

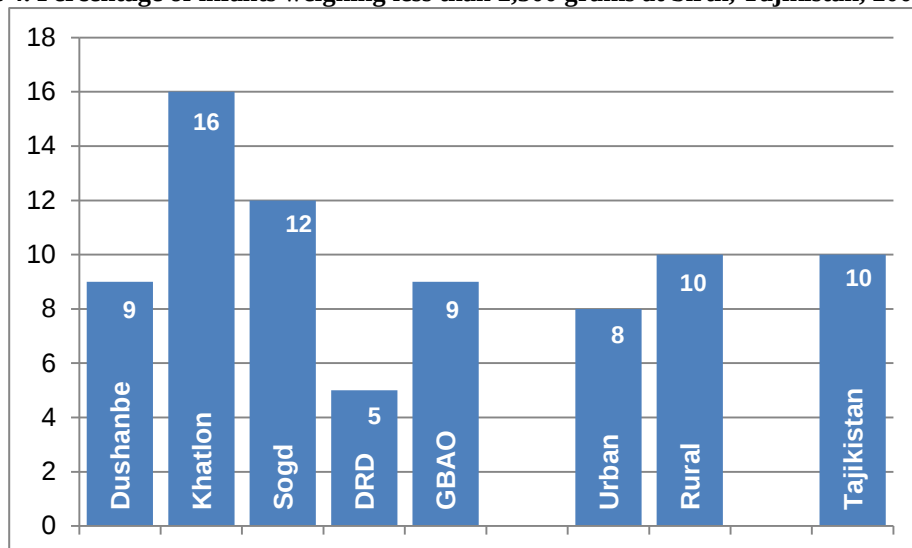
Location	Stunting		Wasting		Underweight		LBW
	2005	2009	2005	2009	2005	2009	2005
Dushanbe	20.6	21.8	6.8	4.0	13.3	7.7	7.3
Khatlon	29.0	36.9	9.3	4.9	20.2	10.5	11.4
Sogd	28.9	27.9	4.0	2.3	15.3	5.9	8.0
DRD	22.9	22.8	7.8	7.2	16.2	8.6	9.3
GBAO	29.7	25.4	5.2	4.0	20	8.5	12.8
Urban	26.1	23.6	7.4	4.5	17.2	n/a	7.8
Rural	27.3	28.3	7.1	4.4	17.4	n/a	10.3
Country-wide	27	28.9	7.2	4.5	17.4	8.8	9.7

Map 1. Stunting by Region in Tajikistan, 2005-2009



The proportion of babies born with LBW in 2005 (below 2,500 grams) was about 10 percent, an important reduction from the 13 percent LBW reported in the 2000 MICS. An additional improvement related to the birthing process noted in 2005 was that the proportion of babies weighed at birth increased from 47 percent in 2000 to 66 percent. Rates of LBW were highest in the regions of Khatlon (16 percent) and Sogd (12 percent) (see figure 4).

Figure 4. Percentage of infants weighing less than 2,500 grams at birth, Tajikistan, 2005



Source: UNICEF. MICS 2005.

Nationally representative data on micronutrient deficiencies in Tajikistan are from a 2009 survey. This survey focused on describing the prevalence of anemia, iron deficiency, and iodine deficiency among women of childbearing age and children six months to five years of age. The national prevalence of anemia in children was 28.8 percent. The prevalence was lower in Khatlon and Dushanbe (24.9 and 28.4 percent) than in GBAO (39.8 percent) and DRD (31.9 percent). The prevalence of anemia was highest (56 percent) among children 6 to 23 months. Iron deficiency, globally the most common cause of anemia, was present nationally in 31 percent of the children with moderate and severe anemia and in 5.4 percent of the children with mild anemia or with normal hemoglobin levels. The highest frequencies of iron deficiency were observed in DRD and GBAO.

The results of the 2009 survey confirmed that iodine deficiency is an extremely important public health problem in Tajikistan (see table 5). Low urinary iodine excretion, indicating inadequate iodine nutrition, was observed in 52.9 percent of children and in 58.6 percent of women. These findings indicate that Tajikistan in 2009 had the highest prevalence of iodine deficiency in the CEE/CIS region. The differences in prevalence of iodine deficiency among children noted among regions were much less than were noted with anemia, but still higher in Khatlon and DRD (73 percent each) than in Sogd and GBAO (18.9 percent and 57.4 percent, respectively). But at prevalence of above 50 percent in many regions, iodine deficiency can be considered a national and pressing public health concern. The distribution of iodine deficiency among women was similar to that of children. During pregnancy and infancy, iodine deficiency impairs growth and the child's neurodevelopment, as well as increasing infant mortality. Iodine deficiency during childhood reduces somatic growth and cognitive and motor function (Zimmerman, 2009). The simultaneous presence of iron and iodine deficiency in the same children may seriously hamper their cognitive development.

Table 5. Anemia and iodine deficiency of young children and women, Tajikistan, 2009, %

		Children < 5 years		Women 15–49 years	
		Anemia	ID	Anemia	ID
Region	Dushanbe	28.4	41.8	26.7	46
	Khatlon	24.9	73.2	24.9	85
	Sogd	29.2	18.9	19	20
	DRD	31.9	73.3	28.1	74
	GBAO	39.8	57.4	29.8	55
Countrywide		28.8*	52.9*	24.2*	58.6*

* UNICEF Micronutrient Survey Tajikistan, 2009.

In the 2009 MNSS, 61.9 percent of households were using salt containing 15 mg/kg or more of iodine. This is substantially higher than the proportion of households using adequately iodized salt reported in 2003 and 2005 (28 and 46 percent accordingly). Use of iodized salt was lowest in DRD and GBAO, at 27.3 percent and 42.3 percent, respectively. The highest usage of iodized salt was 93.8 percent in Sogd. The 2009 results on household use of iodized salt are fully consistent with the prevalence of iodine deficiency. About 20 percent of urban households were using adequately iodized salt, compared to only 32.7 percent in rural areas.

Childhood infections interact with nutritional status. Together with the quantity and quality of food and child care practices, infections are a major cause of undernutrition. Managing and preventing them contributes enormously to reducing undernutrition. This section describes the infections with the greatest negative impact on nutrition.

According to 2009 MNSS, the overall prevalence of diarrhea reported in the four weeks prior to the surveys was 37.2 percent. The GBAO region had the highest proportion of children with diarrhea (45.1 percent). Around 72.6 percent of under-five children with diarrhea were reported to be taking fluids from ORS packets. In a finding confirming the unsanitary environment and poor hygiene practices, a national survey of intestinal parasites carried out in 2004 reported a high prevalence of pinworm.⁸

After a substantial resurgence in Tajikistan in the 1990s, the number of reported cases of malaria is decreasing; nevertheless, the situation remains critical, especially in the areas neighboring Afghanistan.⁹ Where malaria remains a public health problem, it has important implications for nutrition, particularly as a cause of anemia in both young children and pregnant women. Khatlon region has the highest prevalence of malaria, which is consistent with the findings related to iron deficiency and anemia mentioned above. Control of malaria is complicated by population movements between neighboring Uzbekistan and Kyrgyz Republic. According to USAID, Tajikistan has the highest TB incidence in the WHO's European Region. Although the political commitment to control TB is considered high in Tajikistan, capacity to implement TB control activities at a national level is low.

Feeding behaviors are a major determinant of nutritional status. A common factor in child undernutrition is poor infant and young child feeding (IYCF) practices. While part of the problem is the lack of access to nutritious foods for children, another significant factor is that mothers lack a general awareness of what constitutes proper nutrition for young children. The core of IYCF practices is in

⁸ <http://www.schoolsandhealth.org/Documents/Save%20the%20Childrens%20Schools%20and%20Health%20Newsletter%20November%202006.pdf>.

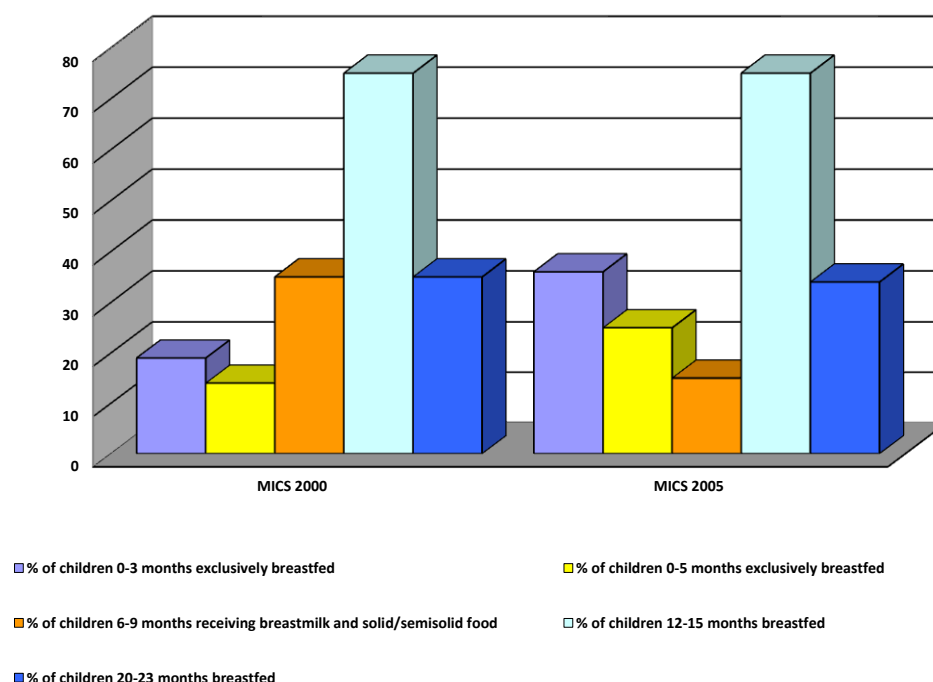
⁹ http://whqlibdoc.who.int/publications/2008/9789241563697_eng.pdf.

breastfeeding behaviors and timely, appropriate complementary feeding. Breastfeeding can be further categorized as early initiation, exclusive breastfeeding for the first six months, and continued breastfeeding from 6 to 24 months, with complementary foods.

Both MICS 2005 and MNSS 2009 surveys reported poor IYCF practices as a major probable cause of undernutrition. In 2009, initiation of breastfeeding within the first hour after birth was reported by 56 percent of women who had given birth and within the first six hours by one third. This initiation of breastfeeding within one day of birth was highest in Sogd (91.2 percent) and similar across urban–rural settlements.

Exclusive breastfeeding started to decrease between month five (with 64.8 percent of mothers reporting as still breastfeeding) and month six (23.8 percent of mothers reporting as still breastfeeding). In 2003 two thirds (64 percent) of infants under four months of age and 50 percent of infants under six months of age were exclusively breastfed. Breastfeeding rates reported in MICS 2005 showed that 36 percent of the sampled infants under the age of four months were exclusively breastfed and the percentage of children under six months of age who were exclusively breastfed was even lower (25 percent) (see figure 5). In 2009, in the majority of cases, complementary feeding was first offered to infants at age six months and older (44.3 percent). Almost half of mothers started with complementary food when her child was between four and six months (48.5 percent), and 11.9 percent of the mothers within the first three months. In 2003 the proportion of children receiving complementary food at the age of six to nine months was 66 percent. Details of the variation in IYCF behaviors across geographic and demographic factors reported from the MICS 2005 are presented in annex 8. More detailed information about IYCF behaviors is necessary to design effective interventions.

Figure 5. Breastfeeding indicators, Tajikistan



Health consequences. Subsequent to Tajikistan's civil war and other economic and social disruption following independence, the nation has progressed in reducing infant and child mortality rates. These key indicators of health and nutrition improved substantially between 1990 and 2007 (falling from 91 to 57, and from 117 to 67 per 1,000 live births, respectively). Yet both rates remain very high—twice as high as the average rates for the CEE/CIS region. Tajikistan is off track to achieving the MDG 4 target of 40 for child mortality. Undernutrition of children is the largest independent cause of this mortality. The neonatal mortality rate is also very high, at 52 deaths per 1,000 live births. Many of the leading causes of neonatal deaths are associated with maternal undernutrition and the LBW it causes.

The contribution of LBW and stunting to the burden of disease expressed as disability-adjusted life years (DALYs) is presented in table 6. Nationwide, LBW accounted for about 10 percent of DALYs for children under five, the largest contribution of these forms of undernutrition.

Table 6. Burden of disease (DALYs) caused by five types of undernutrition, Tajikistan, 2005

	Children 0–4.9 years			Females 15–44 years
	Male	Female	Total	
All causes DALYs	466,856	440,692	907,548	201,642
Growth deficiencies				
Low birth weight	47,234	43,788	91,022 (10.0%)	--
Stunting	9,667	9,302	18,969 (2.09%)	--
Micronutrient deficiencies				
Iron-deficiency anemia	2,274	2,125	4,399 (0.5%)	5,709 (2.8%)
Iodine deficiency	1,686	1,748	3,434 (0.4%)	4 (0.0%)
Vitamin A deficiency	21	20	41 (0.0%)	--

Deaths caused by undernutrition in Tajikistan constitute 34.9 percent of the total number of child deaths (n = 7,676). Stunting, both severe and moderate, is the major type of undernutrition causing child deaths and is responsible for more than half of them (see table 7). The second and third major causes of malnutrition attributable deaths in Tajikistan are LBW and wasting (both 19.7 percent).

Table 7. Deaths resulting from undernutrition, Tajikistan, 2005-2009

Form of undernutrition	Prevalence	Relative risk	Estimated annual deaths
Low birth weight			
1,500–1,999 g	1.2	8.1	552
2,000–2,499 g	8.8	2.8	961
Vitamin A deficiency			
< 5 months	18.0*	1.25	303
6–59 months	26.8**	1.47 (DD) & 1.35 (ARI)	530
Stunting			
<-3 SD	9	4.1	2,704
<-2 SD	19.9	1.6	1,322
Wasting			
<-3 SD	1.4	9.4	1,304
Total			7,676

Note: DD = diarrheal disease; ARI = acute respiratory infection.

* Estimated % of children under 6 with sub-clinical vitamin A deficiency - Food and Nutrition Communication November 2008

** WHO Global Database on Vitamin A Deficiency. Ref 5718. Avgonov ZT, Gaibov AG, Tazhibaev ShS, Khairov KhS.

[Prevalence of vitamin deficiency in Tajik children. Voprosy Pitaniia, 2005, 74 :14-16

4.2 Economic Consequences of Undernutrition

The economic costs of undernutrition result from both the workforce losses because of nutrition-related mortality and the productivity losses from reduced cognitive and physical capacities of the surviving workforce.

Cost of lost workforce due to mortality from undernutrition. The economic costs of undernutrition caused by deaths attributable to undernutrition and the value of the subsequent lost workforce are shown in table 8. The models used were based on the Uzbekistan NIP. A detailed description of the methods used can be found in annex 1. Net present values (NPVs) estimate, in today's economic terms, the value of future losses caused by undernutrition. All calculations are NPVs expressed in millions of U.S. dollars.

Table 8. Annual NPV of lost workforce as a consequence of undernutrition, Tajikistan, 2009

Form of malnutrition	Number of deaths	Lifetime discounting factor (LDF)	Value (US\$ millions)
Low birth weight	1,513	From birth: 14.9	2.76
Vitamin A deficiency	833	From 5 years: 17.42	1.78
Stunting	4,026	From 5 years: 16.9	5.86
Wasting	1,304	From 5 years: 16.9	1.9
Total	7,676		12.30

Cost of future workforce productivity losses due to undernutrition. Table 9 shows the economic costs of future productivity losses among survivors. These losses are due to childhood undernutrition and deficiencies which caused deficits in educational abilities and therefore lost labor productivity. Annual productivity losses were estimated at both a 3 percent and 10 percent discount rate (two values commonly employed in health project analysis).

Table 9. Estimated annual NPV of future productivity losses due to cognitive and physical growth deficits in children caused by undernutrition, Tajikistan, 2009

Form of malnutrition	NPV at 3% discount rate (US\$ million/year)	NPV at 10% discount rate (US\$ million/year)
Iodine deficiency disorders	17.8	2.7
Stunting (< 5 years)	6.23	1.09
Low birth weight	2.32	0.36
Childhood anemia	2.26	0.45
Total	28.61	4.60

The cost of undernutrition and micronutrient deficiency in lost lives and economic losses is staggering. Financial losses in Tajikistan from mortality due to undernutrition are US\$ 12.30 million (table 8), and productivity losses due to undernutrition at a 3 percent discount rate are US\$ 28.61 million (table 9). **The total loss is approximately US\$ 41 million with iodine deficiency responsible for more than 40 percent of these losses. Most of these losses are preventable by investing in programs to reduce undernutrition.** In the next section, the economic and human development benefits of scaling up national nutrition interventions will be presented. The nutrition programs that are the most cost-effective and efficacious will be discussed from a public health viewpoint.

4.3 The Operational Context for Nutrition Policies and Programs

The policy and program recommendations that are developed later in the report are based on considerations of the context in which they might be implemented. This context is described below for the health, social protection, and agriculture sectors.

4.3.1 Health sector

Health Sector Delivered Interventions. The interventions directly addressing the immediate causes of undernutrition, and those with the most compelling evidence of efficacy and effectiveness, are best delivered through the health system. The following brief description of the health sector is presented to further discussion on how to best deliver these interventions. Tajikistan is in transition from a relief to a development stage. The health system faces many problems that range from operational issues related to service delivery to strategic issues such as formulating an explicit privatization policy, reducing fragmentation of external aid, and aligning it. These issues were described recently by Mirzoev and others (2007).

Health Reforms. Compared to other countries in the ECA region, Tajikistan is least likely to achieve most of its MDGs (World Bank, 2005a). The Tajik health sector is characterized by severe underfunding, insufficient quality of care, high informal payments charged by underpaid health workers, and relatively low utilization rates. Indicators of health outcomes such as infant mortality, maternal mortality ratio, and child undernutrition, which had begun to improve, are again at risk of declining.

In the decade following the dissolution of the Soviet Union, the health sector in Tajikistan suffered a sharp deterioration and poor health outcomes. A large number of health care facilities were either completely damaged or abandoned due to lack of public infrastructure such as running water and electricity. The number of hospital beds was sharply reduced from 104 to 63 per 100,000 population. Furthermore, a great many health care professionals emigrated from the country, and the burden of health care expenditures shifted dramatically from the state to individuals.¹⁰

Expenditure on the health sector fell from 4.5 percent of GDP in 1991 to less than 1 percent in 2002.¹¹ In 2003, total private spending on health services was US\$ 12 per capita, one of the lowest levels of health spending in the world (World Bank, 2005b). Private payments comprised 70 percent of expenditures, compared with 16 percent from the government and 13 percent from international sources. Households reported that as much as 30 percent of household expenditures went toward covering health expenses (World Bank 2003), a rate generally considered unsustainable.

In 2005, with a period of political stability and economic growth in the country, the government, with the support of donors, started to introduce health reforms and to increase investments in the health sector to increase the availability of services and to improve sector performance. The reforms were aimed at increasing access to, utilization of, and patient satisfaction with health services. Their goal was also to build capacity and efficiency at national, *oblast*, and *rayon* levels to administer a basic package of health benefits as well as reform the financing system in primary health care. The health sector strategy envisions reforming health financing and provider payment that include results-based incentives. The strategy is also focused on substantial investments to increase the availability and quality of health care services and to improve the information system.

¹⁰ <http://www3.interscience.wiley.com/cgi-bin/fulltext/123233898/PDFSTART>.

¹¹ Tajikistan MDG Needs Assessment 2005.

Maternal and child health services. Maternal and child health services are critically important for the delivery of nutrition interventions. Mothers and children are the target groups most vulnerable to the adverse effects of undernutrition as well as the population that will most benefit from the interventions. Delivery of these services suffers from well-known deficiencies, including the lack of well-trained staff, low salaries and insufficient funds to pay for other operational costs, and informal payments charged by health staff.

Child health services. The health sector generally provides good coverage of vaccinations countrywide, however data from recent Living Standards Measurement Surveys point to a decline, most notably related to the third dose of polio and also measles. Other preventive services are not well delivered (Mirzoev and others, 2007). For example, growth monitoring and promotion, health and nutrition education, basic hygiene and sanitation could be more effectively implemented at scale. These and other interventions requiring community involvement and motivation are burdened by the old centralized decision making, which is only slowly changing in the public health system.

The practices of exclusive breastfeeding and appropriate introduction of complementary foods are weak and need to be reinforced. Strengthening implementation of existing policies, particularly in hospitals/health centers, and effective behavior change communication strategies are required to reinforce these important practices. UNICEF is working closely with the MoH in Tajikistan to certify and recertify Baby-Friendly Hospitals (BFH) and to implement a national level “Breastfeeding Promotion” campaign. Thirty out of the 70 maternity hospitals in the country had been certified as BFH by 2008.¹² For effective behavior change communication, outreach services need to build bridges of trust between the health system and communities, among other efforts. As with the delivery of all community-based services, success requires that the community be actively engaged.

Increasing coverage of the WHO-recommended case management of SAM and promoting appropriate complementary feeding for food-secure and -insecure populations would decrease under-five deaths in Tajikistan by almost 2 percent. The effective delivery of these interventions also requires community engagement.

Antenatal and emergency obstetric care services. The 2005 MICS reported that antenatal care at least once during pregnancy was 77 percent, an increase of 6 percent over the 2000 survey results. The lowest level of antenatal care was found in Khatlon at 66 percent, while the highest, in Sogd, was 92 percent. Urban areas had almost 10 percent higher coverage than rural areas, and older, poorer, and less educated women were less likely to attend antenatal clinics. The proportion of women receiving antenatal care from medical doctors increased from 58 percent in 2000 to 68 percent in 2005.

The 2005 MICS also reported Tajikistan had made progress in increasing the number of deliveries attended by skilled personnel. More than four out of five (83 percent) deliveries were attended by medical doctors, nurses, midwives, or auxiliary midwives. However, this progress varied among regions. The most rapid improvement in the provision of these services was demonstrated in GBAO region—from 21 percent in 2000 to 77 percent in 2005.

Trends in infant and child mortality rates and maternal mortality ratio (MMR) in Tajikistan remain somewhat obscure due to discrepancies in data. Official statistics and independent studies report different results in maternal and infant mortality reductions after 1990. Infant and child mortality rates have improved quite quickly over the past 15 to 20 years, as described above. However, the MMR has improved only slowly (WHO 2005). UNICEF reported the MMR in the 2005 MICS as 170 per 100,000 live births. An assessment of reproductive health services in 2000 identified the major causes of maternal

¹² http://www.unicef.org/nutrition/Tajikistan_45114.html.

mortality as obstetrical hemorrhages (37 percent), eclampsia (27 percent), abortion complications and extragenital diseases (12 percent), and complications resulting from infection (11 percent) (UN, 2003). Even though more than 40 percent of women of reproductive age are anemic, the assessment did not include this as one of the causes. Perhaps anemia was included under obstetrical hemorrhages in the assessment. A global study of the causes of maternal mortality reported that anemia, independent of postpartum hemorrhage, was the second most important cause of maternal deaths in the Asia region (Khan and others, 2006).

These health outcomes suggest that the MDG 4 and 5 targets are most likely to be missed in Tajikistan, unless additional actions are taken to improve the availability, quality, and utilization of maternal and child services. The main challenges to providing adequate antenatal and obstetric emergency care for mothers are the lack of qualified obstetric professionals and primary health care workers, especially in rural areas, and the lack of access to quality services.

Quality and access to health services. Compared to other low-income countries, Tajikistan's health services are relatively low quality and inaccessible, particularly in rural areas. Several studies have identified a number of concerns such as lack of qualified medical personnel, especially in rural areas, lack of basic medical equipment and medications, poor infrastructure of the primary health care services, poor infection control standards, inefficacy of treatments provided in hospitals and during long hospital stays, decline in hospital admissions, and the increase in out-of-pocket expenditures.¹³

Community Outreach. One of the weaknesses of the current public health care (PHC) system is the lack of engaged dialogue between PHC providers and the communities they serve. This is problematic in a country where mortality rates are high and where many bottlenecks to service delivery could be relieved with greater attention to the PHC community interface. The current focus of health reform is to strengthen PHC services and outreach. Health workers and communities would be brought together on a regular basis to identify service delivery bottlenecks and prioritize solutions.

Building Capacity in Nutrition. Efforts to increase capacity in nutrition programming have been supported by a number of donors working in Tajikistan. The World Bank supported capacity building activities for child growth monitoring at the primary care level. In fact, under the 2008 Global Food Price Crisis Response Program over 1000 primary health care centers in the country were provided with growth monitoring equipment and over 700 primary health care personnel were trained on growth monitoring practices, and maternal and child nutrition. Following on this, the Bank is currently implementing a community based nutrition project in 10 districts of Khatlon region, which again involves significant capacity building on child and maternal nutrition, management and identification of nutrition problems and common childhood illnesses. A group of community volunteers have also been trained to undertake community growth monitoring and nutrition education and to serve as a liaison between the community and primary health care providers.

4.3.2 Social Protection Sector

Poverty has declined significantly since 2003 in Tajikistan. Estimates from the 2007 Living Standard Survey for Tajikistan suggest that the poverty head count had declined from 72 percent in 2003 to 54 percent in 2007. Extreme poverty, on the other hand, declined from 42 percent in 2003 to 17 percent in 2007. Despite the significant decline in poverty levels during 2003–2007, significant clustering around the poverty line suggests that the slight fluctuation in people purchasing power would push many Tajiks into poverty. World Bank (2009) estimates suggest that a 10 percent decline in purchasing power would

¹³ http://planipolis.iiep.unesco.org/upload/Tajikistan/Tajikistan_MDG_Needs_Assessment.pdf (UN, 2005) ; <http://www3.interscience.wiley.com/cgi-bin/fulltext/123233898/PDFSTART?CRETRY=1&SRETRY=0>.

increase the poverty head count from 53.5 percent to 62.6 percent. Clustering around the poverty line has great implications during difficult times, such as the recent financial crisis. Poverty is widespread in rural areas; 70 percent of the poor live in rural areas. When analyzed, poverty was found to significantly correlate to low levels of education; a high dependency ratio; employment in agriculture; and living in unfavorable geographical locations, such as the ones with high altitude.

When assessing poverty and its prevalence in Tajikistan, the impact of migration must be considered. Emigration began to increase after independence in 1992. By 2007, Tajik migrants were estimated at 350,000, most of them working in the Russian construction sector. Their remittances were estimated at US\$ 1.4 billion, about 40 percent of GDP, the highest in the world. These sizable remittances have a significant impact on household consumption and overall poverty. While remittances raised many households out of poverty, they also increased dependency and vulnerability to external factors. As a result of the financial crises and the slowdown in construction in Russia, many migrants lost their jobs. By 2007, 100,000 migrants had returned to Tajikistan, resulting in huge losses in household income and a great unemployment burden.

In spite of significant poverty, Tajikistan has a very poor social protection system. It is only 0.5 percent of GDP—the lowest percentage among CIS countries—and covers only pensioners and the disabled. The pension segment of social protection covers a third of all households and provides social assistance in the form of electricity and gas support benefits to only 1 percent of all households. The small social protection programs also lack any targeting mechanism and therefore have little impact on poverty alleviation and or mitigation. Sector reforms should aim at improving targeting using a mix of community and means testing. Spending on different social protection programs is illustrated in table 10.

Table 10. Distribution of total social protection spending across programs, Tajikistan, 2003 and 2007, %

	Old Age	Disability	Other
2007	89	10	1
2003	63	20	18

Source: World Bank.

Social Protection Coverage. Table 11 illustrates the coverage of social protection transfers during 2003–2007. While the percentage of households receiving old age pension increased by 2007, households receiving disability pension decreased from 8.8 percent in 2003 to 5.2 percent in 2007. Other programs, such as secondary school stipends, also covered fewer households by 2007.

Table 11. Coverage of social protection transfers, Tajikistan, 2003 and 2007

	2007 - Share of households receiving				2003 - Share of households receiving			
	Old age benefits	Disability benefits	Other benefits	All benefits	Old age benefits	Disability benefits	Other benefits	All benefits
Quintile (pre-transfer)								
1	39.8	8.7	0.9	41.6	31.7	11.6	9.0	44.9
2	35.1	5.7	0.4	36.2	27.9	8.7	8.8	39.7
3	31.2	3.5	0.2	32.0	27.8	8.2	7.5	39.0
4	28.2	3.9	0.2	29.1	25.1	8.2	8.1	36.9
5	20.8	2.3	0.2	21.2	23.4	7.3	5.5	33.2
Location								
Urban	24.8	4.4	0.2	26.1	23.4	9.6	8.6	36.4
Rural	33.9	5.0	0.5	34.8	29.2	8.4	7.3	39.9
Poverty status (pre-transfer)								

<i>Non-poor</i>	25.0	3.2	0.2	25.8	-	-	-	-
<i>Poor</i>	37.2	6.5	0.6	38.4	-	-	-	-
Sex of the household head								
<i>Female</i>	51.0	4.9	0.3	51.9	41.2	8.3	17.4	60.9
<i>Male</i>	29.2	5.3	0.5	30.4	23.8	8.9	5.4	33.3
All households	33.3	5.2	0.4	34.4	27.2	8.8	7.8	38.7

Source: World Bank.

The small size of the social protection system is inadequate to the degree of poverty in Tajikistan, especially during crises. The government and international donors both found it difficult to protect the poorest of the poor during the recent financial crisis by employing the existing small and inefficient social protection system. While many countries have responded to the food and financial crisis by scaling up existing social protection programs, in Tajikistan, responding effectively to the food crisis was even more challenging because an emergency food response had to be set up before distributing food due to a lack of preexisting social protection and targeting systems.

4.3.3 Agriculture and Food Interventions

Tajikistan's chronic food insecurity was exacerbated by the global food and financial crises. The 2009 IFPRI Global Hunger Index for Tajikistan was 18.5, the highest of the Central Asian countries. In 2008, a joint WFP, Food and Agriculture Organization (FAO), UNICEF Emergency Food Security Assessment estimated the number of food-insecure individuals at about 1.7 million (almost one in four), 600,000 of whom were severely food insecure (UN 2008). Food expenditures were about US\$ 23 per month, 81 percent of all basic expenditures for the majority of households. By January 2009, the number of food insecure had declined to about 1.5 million (one in five) and 400,000 severely food insecure. Access to food, either because of food shortages or poverty, remains the key factor affecting food security in Tajikistan. Food security is integrally linked with nutrition security.

Prior to the 2008 global food crisis, long-term food security trends in Tajikistan were improving—although data still portray a severely food-insecure population. Using FAO estimates, the prevalence of undernourishment (i.e., persons whose dietary energy consumption is below a minimum dietary energy requirement) had fallen from 42 percent during the late 1990s to 34 percent by 2003. Undernourishment in urban areas at 62 percent was significantly higher than the 38 percent in rural regions, where more than 70 percent of the population live. The kilocalorie deficit per person/day also slightly decreased during the same period. In 2005, 43 percent of the population's food consumption was below the minimum dietary energy requirement of the average Tajik (1,880 kcal per person per day). While limited dietary information exists, the traditional diet is high in fatty meat and refined carbohydrates (many foods are fried). Fruits and vegetables are not a major part of the usual Tajik diet.

Poverty and food insecurity are intricately linked. In 2008, the FAO estimated the prevalence of critical food poverty¹⁴ at 19 percent nationally (table 12). Critical food poverty estimates differed at sub-national levels. Dushanbe (43 percent) had the highest levels of critical food poverty, while Sogd (13 percent) had the lowest. The prevalence of undernourishment was greater than the prevalence of critical food poverty at national and sub-national levels.

¹⁴ The proportion of population below the *critical* level of income (or proxy total expenditure) that represents the monetary value of the *minimum* dietary energy requirement of the population provided by a balanced energy-yielding nutrients food basket using energy-yielding nutrient prices of low-income population groups.

Table 12. Regional prevalence of food deprivation and food poverty (FAO), 2008

	Prevalence of food deprivation	Prevalence of food poverty
Nationwide	43	19
Dushanbe	69	43
Khatlon	37	14
Sogd	36	13
DRD	NA	NA
GBAO	NA	NA
Urban	62	24
Rural	38	18

The global food crisis compounded the adverse effects of climatic and other agricultural stresses causing major food insecurity in Tajikistan. Sharply rising food prices exacerbated the difficulties of the poor. The government of Tajikistan made an urgent plea to donors for support in dealing with this situation.

Food Security Program. In February 2009, the Food Security Program of the Republic of Tajikistan was launched (Tajikistan 2009). This program was positioned within the framework of National Development Strategy, and the Ministry of Economic Development and Trade was made responsible for its implementation. The initial phase of the program was planned through 2015. The ministry is required to provide annual progress reports each February. While identifying the need to increase food production as central to enhancing food security, the program presents a comprehensive plan that also recognizes the need for inputs and adjustments of current policy by several sectors. In particular, it identifies the need to enhance financial accessibility to food through both pricing and income strategies. Broader nutrition issues such as maternal nutrition, IYCF behaviors, micronutrient deficiencies, and sanitation and hygiene were highlighted as being vital to sustainable food and nutrition security.

The food security program planning document described the geographical distribution of insecurity and noted the extent to which food consumption fell below requirements. For example, consumption of meat and meat products, eggs, milk, and dairy products among the population was assessed as being less than 25 percent of recommended rates. The document identified the constraints to agricultural production as “existing problems with cotton debts, limited access to credit resources, technologies and product markets, including local consumer markets, weakly developed agricultural infrastructure, high production cost of vegetables and fruits processing. Low level of awareness of the land reform conducted and lack of knowledge for arranging up-to-date agricultural production should also be mentioned” (Tajikistan 2009). The imbalance between food imports and exports was also mentioned.

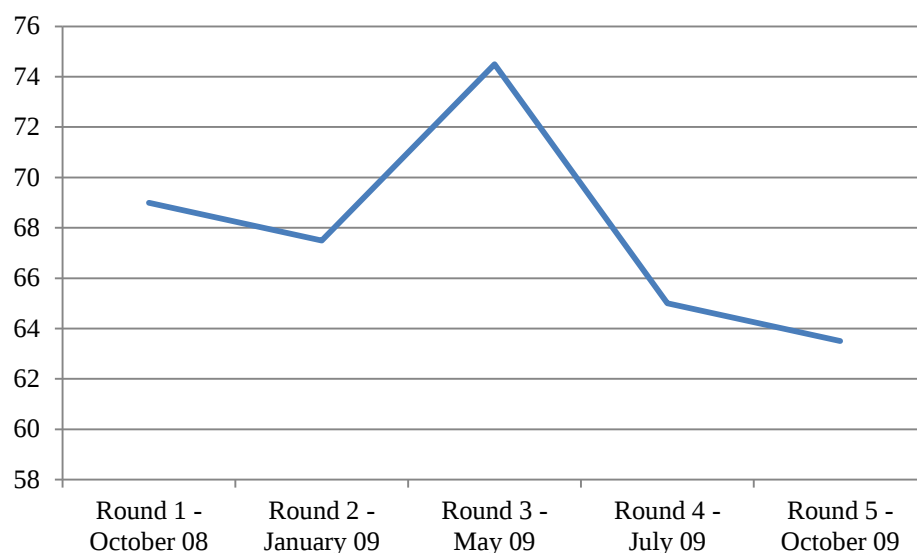
The food security planning document recognized the multisectoral nature of interventions required to ensure food and nutrition security. Besides addressing the agricultural sector, it identified the need for action in policies and resource allocation concerning macroeconomic policy (currency, financial and budgetary, monetary and credit); food market and prices; trade; infrastructure; social development; health and education; demographic; and regional development.

The WFP has set up a quarterly surveillance monitoring system to monitor and report on key indicators providing a “seasonal snapshot” of the food security situation and some of the key factors underlying it. For example, the December 2009 issue¹⁵ reported food security remaining poor, but improving from the

¹⁵ World Food Program. Food Security Monitoring System.
http://www.untj.org/files/FSMS/documents/FSMS_bulletin5.pdf.

situation in May 2009 (see figure 6). Such information gathering, analysis, and sharing is very helpful to both increasing understanding of the situation and raising awareness of it.

Figure 6. Median percentages of expenditures on food out of total expenditure



Fortification. Fortification in Tajikistan has focused on iodization of salt and adding selected B vitamins, including folic acid, iron, and zinc, to wheat flour. Joint efforts of the government and donor community to address IDD were formulated in the National Program for Elimination of IDD, developed in 1997. The program stipulates that all salt must be iodized to 45 mg/kg (Law No. 344 on Salt Iodization). The law was adopted in 2002 and regulates the production, distribution, and consumption of iodized salt. Substantial efforts, often led by UNICEF, have been made to increase awareness of the rationale for iodizing salt among policy makers and industry stakeholders, as well as the general population. The MICS provides the main tool for monitoring progress in implementation of the program. The most recent MICS indicated that less than half the population was consuming salt with adequate iodine content, thus identifying the urgent need for increased focus on this program.

Wheat flour and products made from it, such as bread, are ideal vehicles for delivering key vitamins and minerals to people in Tajikistan, since flour is relatively simple to fortify and consumed by many in fairly high amounts. Initial interest in wheat flour fortification was generated by ADB through its project Improve Nutrition for Poor Mothers and Children in Asian Countries in Transition. By 2004, standards had been developed, codified, and operational; six mills were fortifying flour in a pilot mode, with donors providing most of the components required for the process. The operational issues associated with the intervention were succinctly described in a 2004 paper commissioned by ADB (Ranum, 2004). Identified challenges facing fortification in Tajikistan included the old Soviet mills being in disrepair, the remote location of some mills making logistics very difficult, and an unreliable supply of wheat upon which the mills could rely. In 2004, these challenges led to expression of some caution about expectations of achieving the original project goal of fortifying one-third of the country's flour.

A major challenge in Tajikistan is that large mills meet less than 40 percent of all demand for wheat flour. Therefore, the vast majority of the more vulnerable population relies on flour milled in small mills, with capacity of less—often much less—than 10 metric tonnes per day. Fortification is more challenging in small mills because the costs are inherently greater, and it is more difficult to ensure quality in numerous and scattered operations. Global Alliance for Improved Nutrition (GAIN) responded to this challenge with a regional grant facilitating the exploration of practical solutions to these issues in Tajikistan.

Activities funded under the grant made encouraging progress in addressing these challenges, such as establishing both the potential of the toll milling system¹⁶ to provide a sustainable funding mechanism for fortification where consumers were prepared to pay more for the fortified product, and feasible mechanisms for ensuring quality of the processes.¹⁷

The lack of a laboratory in the country with the capacity to analyze flour for the six nutrients being added is a hindrance to fortification. The Kazakh Academy of Nutrition does have the capacity, and it has established itself as an outstanding regional resource to support the program.

4.4 Current Coverage and Potential Benefits of Scaled Up Nutrition Interventions

In this section, information on the coverage of nutrition programs in Tajikistan will be presented. Further, the estimates of current coverage of nutrition interventions that were recommended in the 2008 *Lancet* series are provided. It shows the potential to reduce the prevalence of undernutrition and neonatal and child mortality by scaling up these interventions by 20 percent, considered a pragmatic increase, and to 100 percent, or universal coverage. Estimates also are presented of potential economic gains from an increased workforce (by mortality reduction) and workforce productivity by scaling up nutrition interventions at both pragmatic and universal coverage.

4.4.1 Current Coverage

The available information about nutrition program coverage in 2009 is presented in table 13. The absence of data for many programs clearly indicates the need to strengthen investments in systems and capacity to monitor programs.

Table 13. Proportion of target populations covered by selected nutrition interventions, Tajikistan, 2009

Universal interventions	Coverage
Breastfeeding promotion strategies (individual and group counseling)	60
Maternal iodine through iodization of salt	59
Maternal iron folic acid supplementation	21
Maternal calcium supplementation	
Zinc fortification/ supplementation	E
Zinc in management of diarrhea	E
Vitamin A supplementation	98
Universal salt iodization	46
Treatment of severe acute malnutrition	E
Behavior change communication for improved complementary feeding	60
Delayed cord clamping	
Maternal multiple micronutrient supplementation	E
Handwashing / Hygiene interventions	E
Situational interventions	
Maternal balanced energy protein supplementation	E
Maternal iodine supplements	
Iron fortification/supplementation programs	E
Provision of complementary foods	38

¹⁶ Consumer pays to have his/her wheat milled with a quantity of the wheat (a toll)

¹⁷ Johnson, Q. Personal communication, February 2010.

Neonatal vitamin A supplementation	95
Maternal deworming in pregnancy	
Deworming in children	E
Multiple micronutrient supplements	5
Other supportive strategies	
Conditional cash transfers (unspecified)	
Unconditional cash transfers and microcredit programs	
Conditional cash transfer programs (with nutrition education)	
Maternal mental health interventions	
Family planning interventions to promote birth spacing	
Handwashing / Hygiene interventions	
Mass media strategies for breastfeeding promotion, dietary diversification, etc.	70
Baby Friendly Hospital initiatives	53
Food for work programs and generalized food subsidies	
Dietary diversification strategies, small animal husbandry and home gardening	E

Note: E = existing program but no available coverage data.

4.4.2 Reductions in Undernutrition from Scaling Up Nutrition Interventions

Burdened with the highest prevalences of different types of undernutrition in Central Asia, Tajikistan also has the opportunity to achieve the greatest improvements in its nutrition status and concomitantly reap the highest economic benefits.

The greatest reduction in undernutrition can be achieved by reducing maternal anemia. Pragmatic coverage and universal coverage with multiple micronutrient supplements would result in reductions in undernutrition of 8 percent and 39 percent, respectively. Similar reductions in maternal anemia would be expected with maternal iron folic acid supplementation, but these were not calculated because of data limitations. Reductions in maternal anemia also yield important reductions in LBW. For child interventions, universal coverage of iodized salt offers the largest reductions in deficiency at universal coverage (27 percent). Our results indicate that complementary feeding promotion and micronutrient powders would bring the largest reductions in prevalence in stunting and anemia, respectively.

Table 14 shows the potential relative reductions in prevalence of undernutrition if nutrition program coverage is increased by pragmatic levels (20 percent) and to universal coverage (100 percent). The estimates were derived from methods described in annex 1.

Table 14. Relative reduction in prevalence (%) of undernutrition outcomes from maternal and child interventions through Pragmatic Coverage (PC) and Universal Coverage (UC), Tajikistan

Interventions	LBW		Stunting		IDD		Maternal anemia		Childhood anemia	
	PC*	UC	PC*	UC	PC*	UC	PC*	UC	PC*	UC
Maternal interventions										
Maternal micronutrient supplementation	2.8	6.4					7.8	38.6		
Maternal balanced energy protein supplementation	6.4	31.7								
Maternal iron folic acid supplementation							NA**	NA		
Use of IPT/ITN during pregnancy **	8.0	31.6					2.5	9.7		
Child interventions										

Complementary feeding promotion through community education (food secure population)			1.8	8.2						
Complementary feeding promotion through community education and support (food insecure population)			3.4	15.7						
Zinc fortification			3.0	14.9						
Iodization of salt					10.1	26.8				
Micronutrient supplementation with sprinkles									4.5	15.3
Deworming of child τ									2.0	9.9

* Assumed 20 percent increase from existing coverage per year.

τ Only in children with intestinal helminths.

** For areas with endemic malaria (subnational).

Note: IPT/ITN = intermittent preventive treatment/insecticide-treated nets.

4.4.3 Reductions in Neonatal and Child Mortality by Scaling Up Nutrition Interventions

In this section, the potential neonatal and child deaths averted per year if the coverage of maternal and childhood interventions listed in table 15 were increased by 20 percent (pragmatic coverage) or by 100 percent (universal coverage) is estimated.

Table 15. Estimated impact of core nutrition interventions on neonatal and child mortality, Tajikistan

Maternal interventions	Pragmatic Coverage* Annual number of deaths prevented (%)	Universal Coverage Annual number of deaths prevented (%)
Maternal balanced energy protein supplementation	28 (0.4)	139 (2.0)
Maternal iron folic acid and multiple micronutrient supplementation [¶]	14 (0.3)	68 (1.0)
Periconceptual folic acid supplementation	12 (0.2)	61 (0.9)
Immediate breastfeeding	71 (1.0)	136 (2.0)
Exclusive breastfeeding	67 (1.0)	233 (3.5)
Child interventions		
Exclusive breastfeeding < 6 months	130 (2.4)	481 (9.0)
Continued breastfeeding beyond 6 months	64 (1.2)	166 (3.1)
Appropriate complementary feeding in food secure and insecure populations	103 (1.9)	433 (8.1)
Vitamin A supplementation	43 (0.8)	43 (0.8)
Promotion of WASH strategies	47 (1.9)	47 (0.9)
Zinc fortification [†]	2 (0.03)	9 (0.2)
Zinc for diarrhea treatment	0 (0.0)	0 (0.0)
WHO-recommended case management of SAM	70 (1.3)	286 (5.3)

* Assumed 20 percent increase from existing coverage per year.

[†] Estimates will improve after comparative risk assessment.

[¶] Maternal iron folic acid supplementation will also impact maternal mortality (estimated 4.7 percent reduction in anemia deaths at universal coverage).

Note: WASH = water sanitation and hygiene; SAM = severe acute malnutrition.

The greatest numbers of neonatal and child deaths averted with pragmatic increases (20 percent) in coverage are from breastfeeding interventions—early initiation, exclusive to six months, and continuing to two years. These simple, cost-effective interventions would save 332 deaths—138 neonatal and 194 child. At universal coverage, these breastfeeding interventions would result in 1,066 deaths averted: 369 neonatal, 647 child.

After breastfeeding, the interventions with the largest impact on reducing infant and child mortality result from promoting appropriate complementary feeding in children 6–23 months in food-insecure areas, and case management of SAM.

Even though an estimate of the reduction in maternal mortality by addressing anemia was not done, such interventions are known to be of enormous public health significance.

4.4.4 Future Economic Gains from Scaling Up Nutrition Interventions

In this section, Tajikistan’s future economic gains in productivity and increased workforce using our analysis findings will be approximated. Our estimates are based on the reductions in the prevalence of undernutrition and mortality as a result of scaling up nutrition intervention packages at universal coverage (see tables 16 and 17). From among the possible interventions, the outstanding productivity benefit is derived from implementing universal salt iodization, owing to its reduction of iodine deficiency disorders and their associated problems. The next most beneficial interventions are those reducing stunting, including complementary feeding, and treatment of diarrhea with zinc supplements. Reducing mortality increases both workforce and productivity. Interventions with the greatest impact on reducing mortality include complementary feeding interventions for food-secure and -insecure areas, as well as introducing zinc for the treatment of diarrhea.

Table 16. Future gain in productivity by nutrition intervention package at universal coverage, Tajikistan, US\$ million

Intervention	LBW	Stunting	IDD	Childhood anemia
Maternal multiple micronutrient or iron folic acid supplementation	0.14			
Maternal balanced energy protein supplementation	0.75			
Use of IPT/ITN during pregnancy	0.75			
Complementary feeding promotion through community education (for food-secure pop.)		0.45		
Complementary feeding promotion through community education (for food-insecure pop.)		0.85		
Zinc for diarrhea treatment		0.81		
Iodized salt			4.69	
Micronutrient supplementation with Sprinkles				0.35
Deworming of child				0.22
Package	1.40	1.11	4.69	0.53

Table 17. Future gain in workforce by nutrition intervention package at universal coverage, Tajikistan, US\$ million

Intervention	Low birth weight	Stunting
Maternal multiple micronutrient or iron folic acid supplementation	0.15	
Maternal balanced energy protein supplementation	0.81	
Use of IPT/ITN during pregnancy	0.81	
Complementary feeding promotion through community education (for food-secure pop.)		0.19
Complementary feeding promotion through community education (for food-insecure pop.)		0.37
Zinc for diarrhea treatment		0.35
Package	1.57	0.48

4.5 Summary

This section described the epidemiological situation of nutrition, the operational context of scaling up selected nutrition interventions, and the health and economic benefits that can be expected if the selected interventions are scaled up. In addition to the analysis on relative reduction in risk, deaths averted, losses in productivity averted, and cost-benefit comparison, the authors evaluated the cost-effectiveness of interventions based upon global, not Tajikistan-specific evidence (see annex 7). Lack of data constrained this analyses. However, the nutrition situation in Central Asia is quite fluid, and updated data on prevalence of conditions, coverage, and costs of the interventions described may soon be available and used to update these analyses and the conclusions drawn from them.

The authors developed two ranking systems. First, a numerical ranking (1–11) presents our recommended priorities for policy and program action. These priorities were developed by combining the results of the analyses with our judgments and understanding of the feasibility of scaling up the selected interventions in Tajikistan at this time. In this ranking, highest weighting was assigned to the feasibility of program implementation. The highest priorities were therefore assigned to a set of direct public health interventions to be delivered through the health system.

Second, the letter ranking was developed by combining the analyses presented in this report with the recent work undertaken by global nutrition partners who are moving toward consensus on the interventions to recommend at a global level. This consensus builds upon the evidence presented in *The Lancet* maternal and child undernutrition series and also seeks to balance two complementary sets of interventions that address the immediate and underlying causes of undernutrition. The immediate causes are addressed through public health interventions focusing on the minus 9 to 24-month target group—the so-called “window of opportunity” for nutrition interventions. The underlying causes will be addressed with a broader set of longer-route interventions, primarily delivered through social protection and agriculture sectors.

Table 18 presents a summary of our findings for the types of undernutrition reviewed: low birth weight, stunting, severe wasting, vitamin A deficiency, iodine deficiency, childhood anemia, and maternal anemia. The prevalence and attributable deaths for each (the absolute number of deaths from the condition), including the proportion it contributes to the number of deaths in children under five years of age was reported. An evaluation of potential interventions with a high impact on child survival recommended by *The Lancet* nutrition series and the more recent *Framework for Global Action* was

carried out. This evaluation considered the coverage rates for each of the recommended interventions, if already ongoing in the country, and the relative risk reduction achievable with universal coverage. The number of avertable deaths with full-scale implementation of the intervention was also estimated and the economic benefit in millions of U.S. dollars per year calculated for future gains in productivity and work force. The table also incorporates the cost-effectiveness for each of the interventions and categorizes each as a core minimum cost-effective intervention or a country-specific recommendation. The intervention categories are listed below:

- 1–11 = Overall priority assigned on basis of expected impact on health and economy, heavily weighted to consider feasibility of delivery; interventions using same delivery platform assigned same priority; presented solely as a foundation for discussion with local stakeholders
- A = Recommended core of direct interventions from the *Framework for Global Action*
- A* = Priority multisectoral interventions addressing the underlying determinants for undernutrition, important to initiate programs for long-term sustainable impacts
- B = Situational recommendations depending upon prevalence rates of deficiencies or disease (e.g., malaria, parasitic worms), and availability of delivery mechanisms
- C = Optional second-level interventions depending upon burden (prevalence of maternal low BMI) and experience of successful delivery

Interventions using the same delivery platform (e.g., complementary feeding promotion and micronutrient powders for children; vitamin A and deworming preschool children) were assigned the same numerical priority because interventions are delivered most efficiently this way (i.e., operational considerations outweigh “the evidence”).

There are no compelling data on impact to support investments in large-scale nutrition interventions for agriculture, and the evidence supporting interventions in social protection interventions is growing, but it remains limited. But it is abundantly clear that elements in these sectors are the underlying causes of undernutrition and that developing effective interventions to address these elements is critically important to establishing sustainable national programs to reduce undernutrition. In addition, agricultural and social protection interventions are presented in table 18 as addressing only stunting. In fact, because these interventions address the underlying causes of undernutrition, they will have an impact on all forms of undernutrition. Therefore, their impact is more important than the table demonstrates, and these interventions should be strengthened.

Table 18. Summary of findings on the consequences of undernutrition, the costs and benefits of scaling up program, and priorities recommended, Tajikistan

Form of undernutrition	Prevalence %	Attributable < 5 deaths (%)	Interventions				Economic benefit (US\$ mil/year)	Cost Effectiveness (US\$)		Priority assigned/ intervention grade
			Potential interventions	Coverage*	Relative risk reduction at UC	Deaths averted		Cost per death averted	Cost per DALY averted	
LBW	10.0	1513 (6.8)	Maternal balanced energy protein	E	31.7	139 (9.2)	1.56	NA	NA	11/B
			Maternal iron folic acid or maternal multiple micronutrient supplements	E	6.4	68 (4.5)	0.29	100-300	3-11	3/A
			IPT/ITN during pregnancy	20	NA	NA	1.56	NA	5-17	3/A
Stunting	28.9	4026 (36.8)	Early initiation and exclusive breastfeeding until 6 months	26	NA	850 (19.1)	NA	NA	NA	1/A
			Complementary feeding promotion for food-secure population	10	8.2	NA	4.1	NA	NA	1/A
			Complementary feeding promotion for food-insecure population	8	15.7	NA	4.85	NA	NA	1/A
			Complementary feeding promotion (overall)	E	NA	433 (9.7)	NA	NA	NA	1/A
			Zinc fortification/supplementation	25	14.9	9 (0.2)	NA	NA	12.20	6/A//11/B
			Zinc for diarrhea treatment	99	NA	0 (0.0)	4.77	2100	73	7/A
			handwashing and hygiene promotion	90	NA	47 (1.1)	NA	NA	NA	10/A
			Agriculture/food security	NA	NA	NA	NA	NA	NA	9/A*
			Social protection	NA	NA	NA	NA	NA	NA	8/A*
Severe wasting	1.4	1304 (6.0)	WHO-recommended case management of SAM	5	NA	286 (5.3)	NA	NA	NA	4/A
VAD	44.8	530(2.4)	Vitamin A supplementation	92	NA	43 (8.1)	NA	19-193	NA	5/A
Maternal IDD	58.6	-	Universal iodization of salt	46	26.8	NA	5.77	NA	34-36	2/A
Child IDD	52.9									
Childhood anemia	Moderate 18.6	-	Micronutrient supplementation with Sprinkles fortification for children	31	15.3	NA	0.74	248-273	8-97	1/A
	Severe 10.2		Deworming during childhood							
Maternal anemia	24.2	-	Maternal iron folic acid supplements	99	NA	-	NA	NA	66-115	3/A
			Maternal multiple micronutrient supplementation	E	38.6	-	NA	NA	NA	3/A
			Fortification of wheat flour	E	NA	NA	NA	NA	NA	6/A

Form of undernutrition	Prevalence %	Attributable < 5 deaths (%)	Interventions				Economic benefit (US\$ mil/year)	Cost Effectiveness (US\$)		Priority assigned/ intervention grade
			Potential interventions	Coverage*	Relative risk reduction at UC	Deaths averted		Cost per death averted	Cost per DALY averted	
			IPT/ITN during pregnancy	20	NA	-	NA	NA	13-24	3/A

* E = Existing program but no available coverage data; N = No existing program;

Note: UC = universal coverage.

References

- Black, R.E., Allen, L.H., Bhutta, Z.A., Caulfield, L.E. and others. (2008). "Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences." *The Lancet* 371: 243–60.
- Cattaneo, A., and others. (2007). *Child Nutrition in Central and Eastern Europe and Commonwealth of Independent States: Report of a Situation Analysis*. UNICEF.
- Franca, F., and others. (2003). *Micronutrient Status Survey, Tajikistan*. <http://www.idpas.org/SCNReportSite/supplements/Tajikistan%20-%20Micronutrient%20Status%20Survey.pdf>.
- Khan, K.S., and others. (2006). "WHO Analysis of Causes of Maternal Death: A Systematic Review." *The Lancet* 367: 1066–74.
- Mirzoev, T.N., and others. (2007). "Progress Towards Health Reform in Tajikistan." *Journal of Health Organization and Management* 21 (6): 495–505.
- Ranum, P. (2004). "Issues Paper on Flour Fortification." <http://www.adb.org/Projects/sustainable-food-fortification/Wheat-Flour-Fortification.pdf>.
- Tajikistan (Government of the Republic of Tajikistan). (2009). *Resolution: February 2, 2009 #72. On the Approval of Food Security Program of the Republic of Tajikistan for the Period up to 2015*.
- United Nations. (2003). *Progress Towards Millennium Development Goals*. United Nations. <http://planipolis.iiep.unesco.org/upload/Tajikistan/Tajikistan%20MDG.pdf>.
- United Nations. (2008). *UN World Food Program Emergency Food Security Assessment in Rural Areas of Tajikistan*. <http://home.wfp.org/stellent/groups/public/documents/ena/wfp187141.pdf>.
- WHO (World Health Organization). (2005). <http://www.euro.who.int/document/e88393.pdf>.
- WHO, WFP, UNSCN, and UNICEF. (2007). *Community- Based Management of Severe Acute Malnutrition*. Geneva: World Health Organization. http://www.who.int/nutrition/topics/statement_commbased_malnutrition/en/index.html. Accessed February 10, 2010.
- World Bank. (2003). *WB TLSS*. Washington, DC: World Bank.
- World Bank. (2005a). *Millennium Development Goals: Progress and Prospects in Europe and Central Asia Region*. Washington, DC: World Bank.
- World Bank. (2005b). *Tajikistan Health Sector Note*. Washington, DC: World Bank.
- World Bank. (2009). *Republic of Tajikistan. Poverty Assessment*. Washington, DC: World Bank.
- Zimmermann, M. B. (2009). "Iodine Deficiency." *Endocrine Reviews* 30: 376–408.

5. Nutrition Intervention Priorities for Tajikistan

Economic losses caused by early death (US\$ 13.2 12.3 million) and lost productivity (US\$ 28.6) due to undernutrition cost Tajikistan almost US\$ 40 million per year. Improving the population's nutrition through evidence-based, preventive, and therapeutic nutrition interventions at scale could save approximately US\$ 15.45 million annually.

Two complementary sets of interventions are proposed to address the immediate and underlying causes of undernutrition. The immediate causes should be addressed through a set of direct public health interventions that focus on the minus 9 to 24-month “window of opportunity”; these are described below. Efforts should be initiated to address the underlying causes through a broader set of longer-route interventions, primarily delivered through the social protection and agriculture sectors. Action to reduce undernutrition in a sustainable way will require a comprehensive, multisectoral approach involving coordination across sectors that are not currently involved in nutrition. Such an approach has been defined for Tajikistan in the Food Security Program described above. The economic rationale for multisectoral nutrition interventions presented in this report support the government's efforts. These multisector approaches were described in the Food Security Program officially sanctioned by the government in February 2009.

Achieving measurable success in reducing undernutrition by rapidly scaling up the recommended direct public health nutrition interventions will help to catalyze the longer-term effort required. To achieve rapid success, the highest priority should be assigned to the three groups of interventions described below.

Targeting interventions to the geographic areas with greatest nutrition problems may yield the greatest potential for benefits and is justified on the grounds of equity. In Tajikistan, the highest rates of stunting have been reported in GBAO, Khatlon, and Sogd. The existing capacity to deliver interventions is a further important consideration in targeting nutrition interventions. In discussions with stakeholders concerning targeting and resource allocation, it will be useful to identify and map the capacity of both government and NGOs to deliver services in the areas being considered.

Priority 1. Promoting Good Nutritional Practices

Stunting causes 20 percent of under-five deaths in Tajikistan. Almost 30 percent of these can be prevented with universal coverage of breastfeeding and complementary feeding interventions. Changes in behavior that will reduce and treat undernutrition include breastfeeding, complementary feeding for infants after six months of age (preferably using locally available and affordable foods and multiple micronutrient powders where needed), and improved hygiene. Changing family behaviors is crucial; the most important short-run determinants of nutrition status are choices that families make in markets, as consumers and in many cases producers, and in household practices.

Infant and young child feeding. The most cost-effective and high-impact interventions to prevent stunting and save young lives are promoting early initiation of breastfeeding (within the first hour after birth), exclusive breastfeeding for infants under six months, and timely and appropriate complementary feeding. For the second and third interventions, it is estimated that at full coverage, they will reduce cause-specific under-five deaths by 19.1 percent and 9.7 percent, respectively. The current low rates of exclusive breastfeeding to six months (25 percent) should be urgently addressed. Promoting breastfeeding is recommended as a top priority for nutrition programming and policy.

Improving complementary feeding in both food-insecure and food-secure settings. Providing appropriate complementary foods and education strategies in food-insecure households will reduce stunting and result in an estimated US\$ 4.85 million benefit per year in Tajikistan. In food-secure households, the annual benefit of this intervention is estimated to be US\$ 4.1 million. Opportunities to provide even greater cost efficiencies exist by linking these interventions with existing food distributions. Operational guidance on how to build these linkages has been recently disseminated by USAID's FANta project (Food and Nutrition Technical Assistance).¹⁸

Current interventions need to be strengthened or modified. These include the Baby-Friendly Hospital Initiative, nutrition education in group settings, and individual counseling. As with all interventions requiring behavior change, and particularly those that are culturally ingrained, such as feeding and food, delivery of IYCF interventions requires real community participation. The mobilization required for these interventions is a long-term investment. Evidence shows that mass media efforts to promote breastfeeding in Tajikistan have had little or no impact.

Detailed data on the determinants of IYCF behaviors is a key information gap that needs to be filled to design effective interventions. For example, in relation to breastfeeding, it will be important to understand the main barriers to early initiation, exclusive, and continuing breastfeeding and the major determinants of the timing, frequency, and quality of complementary feeding.

Multiple micronutrient powders for children. The WHO and UNICEF have a pilot study in two regions of Tajikistan to implement an integrated food-based strategy to improve complementary feeding, and an in-home fortification (SprinklesTM) targeting children under two. Although this project currently has limited coverage, it is estimated that universal coverage of Sprinkles will result in US\$ 740,000 in increased productivity benefits. (The benefits of promoting complementary feeding were discussed above.) This study will provide valuable evidence for scaling up the program to a national level.

Priority 2. Universal Salt Iodization

Our analyses indicate that strengthening the universal salt iodization program in Tajikistan will provide the highest annual economic returns of any intervention. This technology and the mechanisms to deliver it are probably the best understood in international nutrition. The 2005 MICS estimated that fewer than half the households in Tajikistan were consuming salt that was adequately iodized (i.e., 15 parts per million). The prevalence of iodine deficiency among young children and women of reproductive age is very high and carries a substantial economic loss from lower productivity. The economic returns from investing to expand adequate salt iodization to universal coverage are extremely attractive at over US\$ 5 million per year from increased productivity and cognitive function. Existing efforts to strengthen capacity of government to monitor iodine levels in both domestically produced and imported salt and then enforce compliance should be supported. It is also important to continue to build the partnership with the salt industry to strengthen its capacity in quality assurance.

Priority 3. Management of Severe Acute Malnutrition

Almost 400 deaths would be prevented each year with universal implementation of the WHO recommendations for case management of SAM. Severe wasting causes 6 percent of under-five mortality in Tajikistan. In 2009, the WHO, UNICEF, the WFP, and the MoH agreed to implement the WHO case management of SAM in two therapeutic feeding centers and open an additional center in Dushanbe. The economic and mortality benefits of full-scale implementation of this program were previously discussed. More than one in four (27 percent) of the deaths caused by severe wasting could be prevented with this

¹⁸ FANta/USAID. Preventing Malnutrition in Children Under Two Approach (PM2A): A Food-Assisted Approach. http://www.fantaproject.org/pm2a/PM2A_v1.1_Mar2010.pdf. Accessed April 9, 2010.

protocol. But achieving universal coverage of SAM will be challenging because cases are widely dispersed and accessing remote mountainous regions is difficult. Implementing community-level growth monitoring in 2009 may help to identify moderately acute malnourished children before they become severely wasted. Growth monitoring alone is of little use without immediate action to remedy growth faltering, together with the ability to refer severely malnourished children to facilities for therapeutic treatment.

New evidence indicates that many children with SAM can be treated in their communities without being admitted to a health facility or a therapeutic feeding center (WHO and others 2007).

Priorities 4–7. Increasing Vitamin and Mineral Intake, Other than Iodine

Most of the interventions recommended are already in place but need to be strengthened and scaled up. The only new intervention to introduce is zinc supplementation for diarrhea.

Maternal supplementation with either iron folic acid or multiple micronutrients. Pregnant women need daily supplements of vitamins and minerals to meet their substantially increased requirements. Reducing anemia in pregnancy through supplementation with micronutrients is probably the most feasible way to reduce LBW. The delivery mechanism for both IFA and multiple micronutrients is the same; therefore the issues in scaling up these interventions are the same. Our inability to determine the coverage of the iron folic acid supplementation component of antenatal care restricted our analysis of the benefits of this intervention. The reductions in maternal mortality through reducing anemia are substantial (Black and others, 2008). Malaria control (IPT/ITN) is also assigned priority 4 together with other interventions to reduce maternal anemia because it is delivered through the same ANC mechanism as the supplements.

Twice-yearly vitamin A. The vitamin A supplementation program achieves impressive coverage and should be maintained. The MoH should establish permanent mechanisms to oversee the VAS program to ensure sustained high coverage. Declines in coverage should prompt an immediate investigation to determine the strength of logistics supply, supervision, and the mechanics of community mobilization. Vitamin A supplementation should also be provided according to WHO recommendations in the management of common childhood illnesses.

Deworming in children. Deworming receives the same priority as vitamin A supplementation because it is delivered together with vitamin A. UNICEF distributed deworming medication together with vitamin A for the first time in 2009. This program would yield US\$ 480,000 in economic benefits by reducing childhood anemia, resulting in increased productivity. Deworming is also a *Lancet*-recommended core cost-effective intervention. According to global estimates, deworming has a cost-effectiveness of US\$ 33–36 per DALY averted.

Flour fortification. Efforts to fortify flour are in progress and should be supported as providing an additional source of key B vitamins including folic acid and the minerals iron and zinc. Careful analysis and advocacy are required to ensure that the types of fortification being promoted will be effective in the context in which they are proposed. Investments by GAIN are providing useful lessons about how best to reach those target groups who do not access flour milled in large central mills; these lessons should be acted upon. However, flour fortification is but one component of a comprehensive strategy required to reduce deficiencies of vitamins and minerals in Tajikistan. Analysis is needed to identify the situations where fortification is unlikely to be effective, such as with children under two years who do not eat sufficient amounts of the fortified flour to meet their relatively high requirements, and populations living in more remote areas. To reach children under two, interventions specifically for children, such as micronutrient powders, need to be expanded concurrently with flour fortification.

Zinc for the management of diarrhea. The 2004 revised WHO/UNICEF guidelines for the standard management of diarrhea were introduced in Tajikistan in 2007, one of the first countries in the region to do so. Our analyses estimate that further scaling up and maintaining this intervention would result in US\$ 2.28 million in economic benefits per year.

Priorities 8–10. Interventions Addressing the Underlying Determinants of Undernutrition

These interventions particularly related to the availability and affordability of food, and poverty reduction strategies are important to initiate. These multisector approaches are described in the description of the Food Security Program officially sanctioned by the government in January 2009. In addition to food security, hygiene (including handwashing), and sanitation need to be also considered as part of the multisectoral approaches to address stunting. Children living in conditions of poor sanitation and hygiene are at high risk of contracting tropical enteropathy¹⁹ – a subclinical infection which damages the small intestine affecting its digestive and absorptive capacity – and therefore are more likely to become undernourished as a result (Humphrey 2009).

References

Shrimpton, R., and others. 2009. “Multiple Micronutrient Supplementation During Pregnancy in Developing Country Settings: Policy and Program Implications of the Results of a Meta-Analysis.” *Food and Nutrition Bulletin* 4: S556–73.

WHO, WFP, UNSCN, and UNICEF. 2007. *Community- Based Management of Severe Acute Malnutrition*. Geneva: World Health Organization.

http://www.who.int/nutrition/topics/statement_commbased_malnutrition/en/index.html. Accessed February 10, 2010.

Humphrey, Jean H. *Child undernutrition, tropical enteropathy, toilets, and handwashing*. *Lancet* 2009;374:1032-35.

¹⁹ Tropical enteropathy is caused by fecal bacteria ingested in large quantities by young children living in conditions of poor sanitation and hygiene. It is a subclinical condition of the small intestine characterized by villous atrophy, increased permeability, and inflammatory cell infiltrate, causing malabsorption of nutrients

6. Putting it All Together

6.1 Interpreting the Results

The evidence from this report offers national policy makers tools to identify the most appropriate and effective interventions to combat undernutrition in a cost-effective manner. In some cases, the evidence supports existing programs, and in others, it lends support to advocate for and attract additional funding for expanding effective programs.

This report calculates the specific estimated health and economic costs of undernutrition and also the economic benefits and cost effectiveness of scaling up a selected set of direct nutrition interventions to be delivered through the health sector (“*The Lancet* interventions”). In addition, it has attempted to present this information in the context of the SUN framework (UN 2010), a consensus developed by global nutrition partners in 2010. This consensus framework seeks to provide guidance to countries in how to address both the immediate and underlying causes of undernutrition through a multisectoral strategy, by striking the locally appropriate balance between direct short-term public health interventions and the indirect or longer-term strategies of agriculture and social protection.

The interpretation of the results presented in this report, and hence the recommendations, have important caveats. First, the analyses and subsequent development of recommendations would further benefit from the insights of local stakeholders, who: (a) have detailed understanding of both the operational context of nutrition programs and the sociopolitical factors determining policy decisions and resource allocation (i.e., the third domain of the Menon and others (2011) structure used in this report²⁰); and (b) will be responsible for the implementation of these programs. The first recommended next step seeks to include input from local stakeholders.

Second, while the best available information was used for the analyses, and despite our best efforts, some key data are missing due to a variety of reasons. Some of the data are outdated, consequently, it is strongly recommended that new data be obtained and used, as they become available, to update these analyses. Some of the information on the current coverage of programs was either missing or of uncertain quality. This detracted from our ability to provide more precise estimates of the potential impacts resulting from scaling up programs, as well as the potential positive health and economic benefits of scaling up interventions.

Because of issues with data quality resulting from the limited scope of the project (i.e., an initial contribution to the discussions required to develop momentum for scaling up nutrition), more detailed economic analysis has not been presented. It is acknowledged that linking the presented cost estimates of not intervening with the costs and benefits of intervening would be of great interest to Ministries of Finance and overall would provide more compelling support for allocating more resources for nutrition.

Our findings closely indicate the reality of the undernutrition situation in Tajikistan in spite of the caveats. They provide significant evidence in quantifying the significant human and economic benefits achievable by scaling up the nutrition interventions recommended.

²⁰ See Chapter 2.

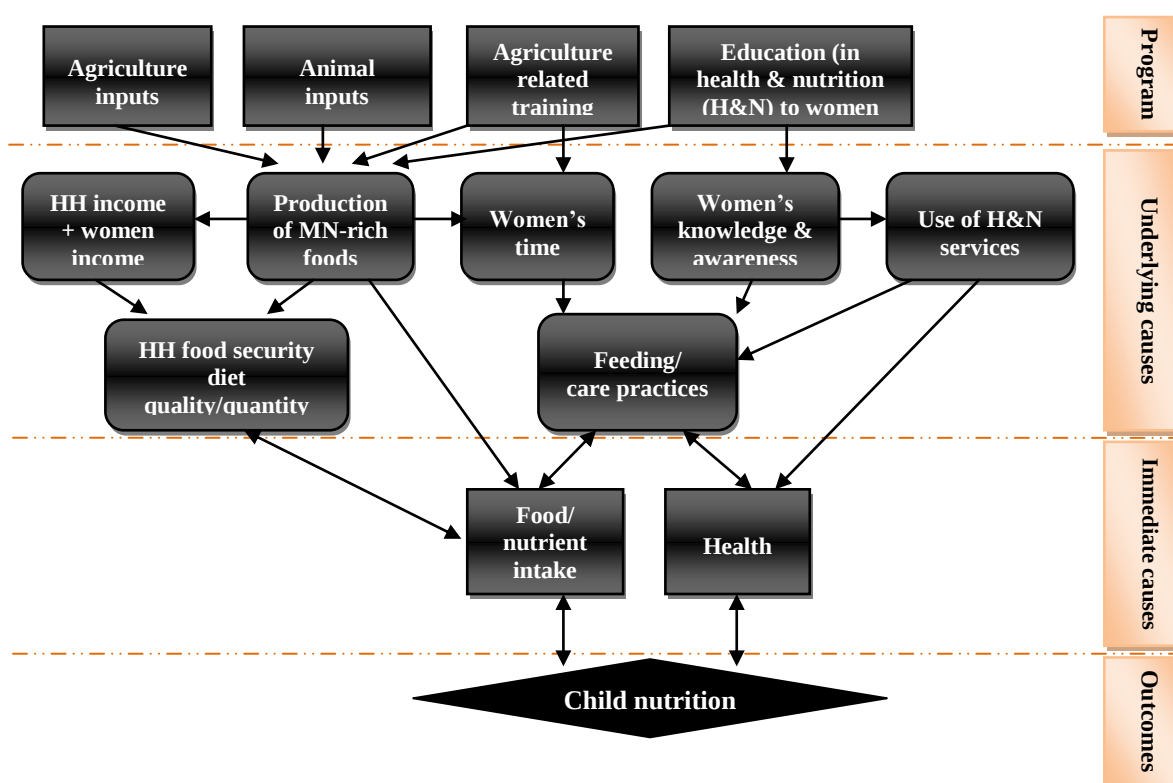
6.2 Addressing the Underlying Causes of Undernutrition

The underlying causes of undernutrition are mitigated with a broader set of longer-route interventions, primarily delivered through social protection sectors and agriculture. Poverty has always been a primary factor contributing to undernutrition. Although, as with food production, the relationships between poverty and nutritional status are complex, a number of interventions have attempted to improve household economics specifically to improve nutrition. These include conditional or non-conditional cash transfers (the former noted as effective in certain contexts in *The Lancet* series), and microcredit programs, among others. Save the Children UK (2009) describe social cash transfers and safety nets as short-term emergency or seasonal safety nets to ensure household food security and to prevent the sale of vital livelihood assets. These programs are usually delivered by governments on a permanent basis to reduce poverty and vulnerability. A clear distinction needs to be drawn between conditional and non-conditional cash transfer. The former have a double aim: reducing vulnerability in the short run and building human capital to break the intergenerational cycle of poverty in the longer term. Unconditional transfers, on the other hand, are focused only on the short-term impacts.

Five pathways link the food supply chain from food production to food consumption and nutrition (Hawkes and others 2008). Through these pathways, interventions in agriculture will reduce undernutrition. These pathways are: (1) subsistence-oriented production for households' own consumption; (2) income-oriented production for sale in markets; (3) reduction in food prices associated with increased production; (4) empowerment of women as agents instrumental to household food security; and (5) the indirect relationship between the contribution of agricultural production to increased national income and economic growth and improved nutrition outcomes. The first four of the pathways are illustrated in figure 7.²¹ Agricultural policies and programs may impact directly on all these pathways. Therefore agriculture holds enormous potential to impact, either positively or negatively, on the nutritional well-being of populations. These critical linkages between agriculture and nutrition are often under-recognized by those responsible for developing policies in both health and agriculture.

²¹ Modified from LeRoy and others. *The micronutrient impact of multisectoral programs focusing on nutrition*. http://www.micronutrientforum.org/Innocenti/Leroy%20et%20al%20MNF%20Indirect%20Selected%20Review_FI_NAL.pdf, p. 62. Accessed February 14, 2010.

Figure 7. Mechanisms by which agriculture programs might improve nutrition



In the context of emergency relief, new approaches are being developed to strengthen the impact that food distributions might have on strengthening nutrition. An example is the recently developed “Preventing Malnutrition in Children Under Two Approach (PM2A): A food-assisted approach” of USAID’s FANta Project.²² The three core PM2A services provided to participants are: (1) conditional food rations²³ for the individual woman or child and for the household; (2) preventive and curative health and nutrition services for children and women, according to national protocols; and (3) behavior-change communication targeting priority context-specific nutrition actions.

6.3 Recommended Actions

Increase investments in nutrition. The results of this report definitively reveals that undernutrition is a tremendous burden of mortality and morbidity, as well as an enormous cause of economic losses. The findings also demonstrate that averting significant financial loss by scaling up high-impact cost-effective nutrition interventions is a strategic economic investment returning high benefits. It shows that “good nutrition equals good fiscal policy” is a message that needs to reach policy makers. By raising their

²² FANta/USAID. Preventing malnutrition in children under two approach (PM2A): A food-assisted approach. http://www.fantaproject.org/pm2a/PM2A_v1.1_Mar2010.pdf. Accessed April 9, 2010.

²³ “Conditional” ration indicates that beneficiaries must participate in behavior change interventions and attend and receive a minimum package of preventive health services to receive the ration. The specific behavior change and health service requirements for participation are determined on a case-by-case basis based on each program’s context.

awareness to the national undernutrition problem and its interconnectedness to their country's economic health, the recommendations for expanding funding for scaled up nutrition programs will be appreciated, examined, and adopted.

Prioritizing interventions to scale up. Discussion with country stakeholders, led to the recommendation to update the country's nutrition plan by priority stages. Based on the authors' analysis, stage one priority interventions should focus on deaths averted, economic gains, relative reduction in prevalence, and cost effectiveness. Although the analysis identifies key evidence-based interventions to reduce IDD, stunting, and anemia, the degree and pace of program expansion will likely be dictated by the level of capacity, commitment, and funding. To plan successful interventions, planners must ensure that available local technical and managerial capacity exists to implement interventions and to fund monitoring and evaluation to gauge the interventions' impact. In many rural areas, technical and managerial capacity is limited. Therefore, incremental expansion and extensive capacity building may be necessary before expanding nutrition interventions.

Filling gaps in information. Important gaps in information need to be filled in the process of designing interventions. This is particularly true for interventions to address infant and young child feeding. Effective communication strategies will require detailed knowledge on the social, economic, environmental, and cultural determinants of current feeding behaviors.

Addressing the causes of undernutrition. Two complementary sets of interventions are available to address the immediate and underlying and basic causes of undernutrition. The immediate causes can be most effectively addressed through a set of direct public health interventions that focus on the minus 9 to 24-month "window of opportunity." The strong evidence base for these interventions was presented in the 2008 *The Lancet* series on undernutrition, as previously mentioned. The impact these interventions will have on reducing undernutrition in Tajikistan was determined in this report by using the same analytical methods as the authors of *The Lancet* series. It is strongly recommended that highest priority be assigned to the set of direct interventions that address undernutrition during the narrow window of opportunity from pre-pregnancy through 24 months of age. Measurable success in reducing undernutrition with these direct interventions will establish the confidence among decision makers to pledge their commitment, which is required to overcome the bureaucratic challenges inherent in any multisectoral coordination.

Facilitating Multisectoral Action. A high-level coordinating group should be established to which line ministries report. Line ministries must be made responsible for nutrition outcomes, for example, the prevalence of underweight. This coordinating group will also increase "policy coherence" by enabling government-wide attention to unintended negative nutrition consequences by other sectors' policies. Well-known examples are subsidies for biofuels and food exports. What is required is both better and timelier analysis of nutritional consequences and inclusion of nutritional consequences in "all government" mechanisms for policy coordination.

Successfully incorporating concern for nutrition across multiple sectors will require substantial effort, as previous attempts to do this have had little success. Positive incentive levers for governments to encourage harmonized multisectoral attention to nutrition are available and include: (1) sustained political visibility coupled with progress reporting; (2) financial levers (mandated budgetary earmarks and pools of funding to attract competition/ innovation); (3) organizational mandates with resources and staff; and (4) relevant laws/regulations to support nutrition actions. These incentives require structures, leadership, and resources.

6.4 Moving to Action

This situational analysis of undernutrition in Tajikistan has provided valuable information on the immediate and root causes of undernutrition. It has also examined what interventions work, and the economic benefits and cost effectiveness of these interventions where possible. The SUN Framework for scaling up nutrition at the global level describes nine steps in moving to action (UN, 2010). These steps have been modified into five broader categories to guide and support national-level efforts where this is determined to be appropriate.

- i. **Build Political Commitment.** Strong political commitment to reduce undernutrition is needed to mobilize the political will and the financial resources necessary to implement the policies and programs required for success. Direct nutrition interventions should be sharply scaled up immediately (see step iii below), and the necessary support mobilized to build the human capacity to design, manage, and evaluate the policies and programs (see step ii below). This will require key stakeholders' galvanizing behind an inclusive approach to build country ownership. To the extent possible, leaders should draw on support from related international initiatives such as the International Health Partnership. Strategic advocacy will be required and the development partners should provide the means to design and implement this.
- ii. **Build Capacity to Design, Manage, and Evaluate Nutrition Policies and Programs.** Sustaining effective national nutrition programs requires leadership from national stakeholders. Development partners should provide for the stewardship of these national leaders as they acquire the necessary skills that these complex tasks demand. Opportunities for these leaders to learn-by-doing should be created and supported. Understanding and using epidemiological and program data are the fundamental skills that are needed. Discussions resulting from the presentation of the findings and recommendations of this report will provide important opportunities to highlight both information gaps and the availability of local stakeholders with the skills needed to fill these gaps.
- iii. **Strengthen Policies and Operational Strategies.** The analysis presented in this report is designed to support and invigorate ongoing activities related to further development of the national plan of action for nutrition. It is hoped that these findings can be incorporated into the national plan and strategies in ways consistent with the Paris-Accra principles of aid effectiveness. Using the “three ones approach” has proven effective in the effort to combat HIV/AIDS, and may be highly applicable to nutrition: one agreed framework provides the basis for coordinating the work of all partners; one national coordinating authority with a broad multisectoral mandate is designated to lead; and one national monitoring and evaluation system is developed.²⁴
- iv. **Strengthen Program Implementation.** Scale up a set of direct evidence-based interventions that address the immediate causes of undernutrition in the window of opportunity from the start of pregnancy to two years of age. These include maternal supplementation with vitamins and minerals, early initiation of breastfeeding, exclusive breastfeeding for six months, timely and appropriate complementary feeding, increasing intakes of vitamins and minerals in children through micronutrient powders with food, medicinal supplements (vitamin A and zinc for diarrhea), or fortification (iron, zinc, folic acid, and other B vitamins), therapeutic feeding for malnourished children with special foods.

Initiate interventions to address the underlying and basic causes of undernutrition through sectors other than health. A potential starting point for this is to build links with high-priority global initiatives recently launched by the international development community to include specific pro-

²⁴ http://data.unaids.org/UNA-docs/Three-Ones_KeyPrinciples_en.pdf.

nutrition actions in other sectors, such as agriculture and social protection. Examples are investments in agriculture and social protection to enhance food security. Good nutrition is essential to the success of these initiatives. Persons suffering from undernutrition are by definition food insecure, unhealthy, and lacking adequate social protection. So it is essential to include an indicator of undernutrition in the results frameworks for each of these sectors, both as part of a broader effort to hold the sectors to account for nutrition results, and as a measure of their progress in meeting their overall objectives.

- v. **Use Monitoring and Evaluation to Design and Manage Programs.** Increase the use of data in designing, monitoring, managing, and evaluating nutrition policies and programs. Linking with point two above, building capacity in these skills is critical at all levels of implementation and coordination. This will not only improve program quality but will also further strengthen the evidence base for them. Operational research is important to develop delivery platforms for existing and new interventions. Regional workshops are recommended as platforms for building capacity in these complex skills. These would also serve as means of disseminating findings and sharing lessons learned.

6.5 Immediate Next Steps

To move to the next level, both the Government of Tajikistan and the development partners could benefit from adopting the following immediate next steps.

Development partners could:

- i. Engage partners. Present these findings and recommendations as a means of engaging key stakeholders within the country including government, UN, and NGO stakeholders. This might be done in conjunction with disseminating the SUN Framework. The active participation of key stakeholders is required to discuss findings, elicit feedback, determine analysis shortcomings, modify conclusions and recommendations where needed, and identify priorities for the way forward. The purpose is to build commitment to nutrition, which is likely the single biggest determinant of success in scaling up activities at the national level.
- ii. Identify and exploit opportunities for building capacity of the national staff and institutions. Allow additional time in the plans being developed to enable the learning-by-doing that is central to building capacity. In this step, the institutions providing leadership to promoting global action for nutrition have an opportunity, perhaps an obligation, to provide the technical and strategic stewardship that will be required to make this a reality.
- iii. Work closely with government to mobilize resources to scale up the highest-priority interventions. Direct nutrition interventions that will reduce the immediate causes of undernutrition include: breastfeeding, complementary feeding, universal salt iodization, maternal supplementation with vitamins and minerals, and other approaches to increasing vitamin and mineral intakes, such as fortification.

The Government of Tajikistan could:

- i. Incorporate recommendations from the report into nutrition strategies and plans. In particular, strengthen the design and implementation of the monitoring and evaluation components within each of these plans. Where possible, update the analyses presented in the report using more rigorous program coverage data and the latest prevalence data.
- ii. Prioritize the direct interventions to be scaled up and assign responsibilities for key tasks to the staff of government units, donors, and where appropriate, to NGOs.

- iii. Develop mechanisms to engage the social protection and agricultural sectors to address the underlying and basic causes of undernutrition. Identifying effective approaches will require additional research, evidence-based advocacy, and the institutional capacity to coordinate the design and implementation of multisectoral nutrition interventions in these sectors. Donors should provide financial support to facilitate the discussions and development of strategic investments necessary for national stakeholders to create the coordinating mechanisms required to ensure that intersectoral coordination addressing the basic causes of undernutrition will be both feasible and efficient.
- iv. Develop a national log frame with key steps and a realistic timetable to guide a set of short- and medium-term objectives emerging from the above recommendations for stakeholders to adopt.

References

Hawkes, C., and others. (2008). *From Agriculture to Nutrition: Pathways, Synergies and Outcomes*. Washington, DC: World Bank.

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/0,,contentMDK:21608903~pagePK:148956~piPK:216618~theSitePK:336682,00.htm>. Accessed February 14, 2010.

Save the Children UK. (2009). *Hungry For Change: An Eight-Step, Costed Plan of Action to Tackle Global Child Hunger*. Save the Children UK.

<http://www.savethechildren.net/alliance/media/newsdesk/2009-11-16.html>. Accessed February 11, 2010.

United Nations. (2010). "Scaling Up Nutrition: A Framework for Action." Policy Brief. April.

<http://siteresources.worldbank.org/NUTRITION/Resources/281846-1131636806329/PolicyBriefNutrition.pdf>.

Annex 1. Details of Methods Used in the Analyses

A1.1 Prevalence Data

Indicators were grouped into two categories: (1) *nutrition indicators in children under five* and (2) *risk factors* associated with women of reproductive age—factors that may increase the risk of childhood malnutrition. The categories were then stratified by region, locality, maternal education, and wealth quintile.

The explanatory (independent) variables used for this analysis included: *region*, *locality*, (defined as either urban or rural), and *maternal education* (defined as none, primary or secondary, and beyond). *Wealth quintile* is a composite measure of the cumulative living standard of a household based on asset ownership. The households were classified as either poorest, second, middle, fourth, or richest. All data is from the 2005 MICS unless otherwise specified.

A1.2 Estimates of DALYs Lost Due to Malnutrition

The effects of adverse health outcomes have traditionally been measured by estimating excess mortality. But mortality rate alone does not adequately measure the adverse impacts of certain conditions on the quality of life. Some conditions adversely affect long-term outcomes without causing death. For example, conditions such as iron and iodine deficiencies in children have very low mortality rates, but cause moderate to severe disability by impairing cognitive physical activity and/or mental development. To quantify the burden of such diseases, the WHO introduced the Global Burden of Disease project in 2000 and a new metric: disability-adjusted life years (DALY).

DALY is a “health gap measure.” It is a more comprehensive summation of information that includes the impact of premature death, disability, and other non-fatal health outcomes. One DALY can be thought of as “one lost year of healthy life.” It measures the gap between current health status of the target population and an ideal situation where everyone lives into old age free of disease and disability (Murray and others, 2001).

A1.3 Estimating Mortality Attributable to Malnutrition

Population Attributable Fraction (PAF). The PAF is defined as the proportional reduction in disease or death that would occur if exposure to the risk factor were reduced to zero (Cole and MacMahon 1971; Eide and Heuch 2001; Greenland 1984; Levin 1953; Rockhill, Newman, and Weinberg 1998; Uter and Pfahlberg 2001). The attributable mortality, here denoted as *AB*, is the incidence or burden of disease due to a particular risk factor and is calculated as $AB = PAF \times B$, where *B* is the total burden of disease from a specific cause or group of causes affected by the risk factor with a relative risk of *RR* (see table 1 for *RR*).

The overall attributable fraction of under-five mortality due to the above defined risk factors can be computed according to formula:

$$PAF = \frac{P(RR-1)}{P(RR-1)+1}$$

Where *P* is the prevalence of the risk factor and *RR* is the associated risk ratio.

Based on risk coefficients, the prevalence of malnutrition indicators, and demographic and mortality statistics from UNICEF, the number of annual deaths attributable to malnutrition was calculated. Because many diseases are caused by the interaction of multiple risk factors (Rothman, 1976; Rothman and Greenland, 1998; Walter, 1976; Walter, 1980; Yerushalmy and Palmer, 1959), double counting the number of deaths may occur if the cause-specific mortality attributed to individual risk factors is simply added up. To calculate the joint PAF for multiple risk factors, the following formula is used (Walter 1980):

$$\text{Joint PAF} = 1 - \prod_{i=1}^n (1 - \text{PAF}_i)$$

We estimated the crude PAF for various micronutrient deficiencies and key undernutrition indicators by using the approximate distribution of PAF as per the comparative risk assessment and the overall DALYs envelope from the WHO Global Burden of Disease, 2004. While these estimates were useful for this report, future research needs to include more in-depth analysis with primary data.

Relative Risk (RR)

Relative risk is an epidemiological term describing the likelihood of a consequence arising from a particular risk factor, compared to the risk of the same consequence occurring without the presence of the risk factor. The global relative risks used in our computations of adverse outcomes caused by undernutrition are based on *The Lancet* series on maternal and child undernutrition and are shown in table 2.

Table A1: Key Types of Undernutrition Evaluated, Relative Risks of Mortality and Potential Interventions

Forms of undernutrition	Impact on mortality in terms of RR	Potential interventions
Low birth weight	Infants born at term weighing 1500–1999 g were <u>8.1</u> (95% CI 3.3–19.3) times more likely to die from all causes during the neonatal period, and those weighing 2000–2499 g were <u>2.8</u> (95% CI 1.8–4.4) times more likely to die, than were those weighing more than 2499 g at birth.	1. Maternal balance energy protein 2. MMN supplementation 3. IPT/ITN during pregnancy
Stunting	Odds of mortality when HAZ(<-3 sd) is <u>4.1</u> (95% CI 2.6-6.4) and HAZ (<-2 sd) is <u>1.6</u> (95% CI 1.3-2.2)	1. Complementary feeding education for food secure population 2. Complementary feeding education and support of food insecure population 3. Zinc fortification 4. Exclusive breastfeeding till six months and continued breast feeding beyond six months 5. Complementary feeding promotion 6. Zinc for diarrhea treatment 7. Promotion of handwashing and hygiene strategies
Severe Wasting	Odds of mortality for severe wasting (WHZ<-3 sd) is 9.4 (95 percent CI 15.3-16.8) as above for stunting.	1. WHO-recommended case management of SAM

Vitamin A deficiency	Relative risk of diarrhea mortality is 1.47 (95% CI 1.25–1.75) and 1.35 (0.96–1.89) for measles mortality related to vitamin A deficiency.	1. Vitamin A supplementation
Iodine deficiency	Iodine deficiency impairs child motor, mental, and cognitive development and negatively effects future productivity.	1. Iodization of salt 2. Maternal iodization of salt
Maternal and child hood anemia	Anemia impairs infant mental and motor skills development, and causes fatigue impairing physical work in adults and therefore has negative consequences on future productivity.	1. Maternal iron folic acid supplementation 2. Maternal micronutrient supplementation 3. IPT/ITN during pregnancy 4. Micronutrient supplementation with Sprinkles fortification for children 5. Deworming during childhood (for children with intestinal helminthes)

Source: Black and others 2008.

Note: HAZ = Height-for-Age Z Score; WAZ = Weight-for-Age Z Score; CI = Confidence Interval.

Table A2: Relative Risks of Mortality Due to Undernutrition

Nutrition indicator	Relative risk
LBW	
Low birth weight (1500-1999 gm)	8.1
Low birth weight (2000-2499 gm)	2.8
Breastfeeding (BF)	
Relative risks among predominant BF (0-5 months)	1.48
Relative risks among partially BF (0-5 months)	2.85
Relative risks among not BF (0-5 months)	14.40
Relative risks among not BF (6-23 months)	3.68
Vitamin A Deficiency (VAD)	
Relative risks among vitamin A deficient(< 5 m)	1.25
Relative risks among vitamin A deficient (6-59 m)	1.47 (diarrhea), 1.35 (ARI)
Stunting	
Relative risk among stunted (<-3 SD)	4.1
Relative risk among stunted (<-2 SD)	1.6
Underweight	
Relative risk among underweight (<-3 SD)	9.7
Relative risk among underweight (<-2 SD)	2.5
Wasting	
Relative risk among wasted (<-3 SD)	9.4
Relative risk among wasted (<-2 SD)	3

Source: Black and others 2008.

We also estimated the adverse effects of undernutrition by estimating DALYs as described below.

A1.4 Estimation of Economic Cost of Malnutrition

To evaluate net economic deficits as a consequence of undernutrition, including micronutrient deficiencies, lost workforce resulting from premature mortality attributable to undernutrition was measured. This analysis also included future productivity losses among survivors because of deficits in cognitive and physical development caused by undernutrition. Our approach was similar to the one used for the NIP.²⁵ The same set of calculations used for the NIP (see below) was used to estimate economic losses and updated information on the impacts of interventions where these were available from *The Lancet* series on undernutrition.

A calculation of the economic losses due to the six types of undernutrition that are most prevalent was done. These are LBW in infants, and in children under-five years, stunting, severe wasting, anemia, vitamin A deficiency, and iodine deficiency. Severe wasting and stunting are mutually exclusive; using these two markers does not lead to double counting.

The following algorithms²⁶ was used to calculate value of lost workforce and future child productivity losses, respectively:

- (child deaths attributed to malnutrition) x (average wage) x (labor force participation rate) x (lifetime discounting factor (LDF)) = (net present value (NPV) of losses)
- (# of children affected by indicator) x (coefficient of deficit) x (average wage) x (labor force participation rate) x (manual labor share) x (lifetime discounting factor) = (NPV of losses)

Where:

- Data on child deaths attributed to malnutrition are from annex 3.
- Average wage is calculated by 60 percent of wage share of per capita GDP, based on World Bank data.
- Effective employment is based on the labor force participation rate, from the UN International Labor Organization, for ages 15-64 years.
- We use estimates of LDF similar to that used in the NIP analysis. LDF is derived from a discount rate (Phillips 1996), age of entry and exit into workforce, and other factors.²⁷ The LDF essentially represents the years of earnings that are “counted” in the calculation.
- Manual labor share is defined as employment in manual labor (agriculture + construction). Manual labor share is calculated by multiplying economic activity rate with percent share of GDP obtained from agriculture and construction. Economic activity rate is defined as percent of labor force in age group 25-54 years.

²⁵ The Uzbekistan Nutrition Investment Plan (NIP) is based on a multisectoral consultation conducted in 2007, involving key stakeholders from government and private sectors. The NIP process included participation of experts from the Ministry Health, Ministry of Public Education, Ministry of Economy, Ministry of Finance, and Tax Committee as well as representation from food industries, national media and NGOs. Representatives of UNICEF, World Bank, and the WHO participated and provided technical assistance.

²⁶ Uzbekistan NIP. 2008.

²⁷ For mortality at birth, the discount rate is 14.9. For mortality through age five years from vitamin A deficiency or stunting, a higher LDF of 17.42 is used to reflect the shorter period from mortality to entering the work force. Other conditions such as breastfeeding are discounted from ages 1-2 years. An alternative scenario based on a 10 percent discount rate derives LDFs of 2.65 to 3.93 as opposed to the 14.9 – 17.42 used at 3 percent. Discount rate estimates are based on the World Bank’s *The Economic Analysis of Nutrition Projects: Guiding Principles and Examples* (Phillips, 1996).

A1.5 Interventions, Current Coverage, and Potential Benefits

A1.5.1 Evaluating the interventions that may reduce undernutrition

Findings of this analysis is based on the results of evaluated existing data and potential nutrition interventions that may reduce undernutrition based on recent reviews of the *The Lancet* 2008 undernutrition series, as well as the 2008 primary care series. Table 3 summarizes the interventions evaluated as part of this exercise. Detailed impact estimates for these interventions across various age bands are summarized in annex 4.

Table A3: Potential Maternal and Child Interventions Targeting Undernutrition

Interventions for which there is sufficient evidence for inclusion in all programs (Universal)	Interventions for which there is evidence for inclusion in specific contexts (Situational)	Other supportive strategies
Breastfeeding promotion strategies (individual & group counseling)*	Maternal balanced energy protein supplementation	Conditional cash transfers (unspecified)
Maternal iodine through iodization of salt*	Maternal iodine supplements	Unconditional cash transfers and micro-credit programs
Maternal iron folic acid supplementation*	Iron fortification/supplementation programs	Conditional cash transfer programs (with nutrition education)
Maternal calcium supplementation	Maternal multiple micronutrient supplements	Maternal mental health interventions
Zinc fortification/ supplementation	Behavior change communication for improved complementary feeding	Family planning interventions to promote birth spacing
Zinc in management of diarrhea	Provision of complementary foods	Handwashing/Hygiene interventions
Vitamin A fortification/supplementation	Neonatal vitamin A supplementation	Mass media strategies for breastfeeding promotion, dietary diversification, etc.
Universal salt iodization	Maternal deworming in pregnancy	Baby-Friendly Hospital Initiatives
Treatment of severe acute malnutrition	Deworming in children	Food-for-work programs and generalized food subsidies
Delayed cord clamping		Dietary diversification strategies, small animal husbandry, and home gardening
		Agricultural subsidies and land reform

Source: Bhutta and others 2008a.

*Includes interventions that also affect neonatal outcomes.

A1.5.2 Inventory of Existing Nutrition Interventions and Coverage

The authors collected all available information on existing nutrition interventions and their coverage levels wherever possible to investigate the interventions' potential to reduce undernutrition. The goal of this analysis was to determine the efficacy of select maternal and child interventions (listed in table 3) in reducing undernutrition in reference to the recent *The Lancet* undernutrition and primary care series. When programs covered only select regions, coverage rates were estimated using the region's population or best estimates. Programs are classified, according to evidence from *The Lancet* maternal and child

undernutrition series, as *Universal Interventions* (sufficient evidence exists to implement them in any program); *Situational Interventions* (evidence exists to implement the programs in specific situational contexts); and *Other Supportive Strategies* (evidence is insufficient or the effectiveness varies).

A1.5.3 Assessing the Impact of Nutrition Interventions on Mortality and Malnutrition

The report assessed the impact of major nutrition interventions on reducing mortality and improving nutrition outcomes for women, newborns, and children by using the same sequential model employed in the Uzbekistan NIP. The effects of the interventions are correlated to estimates of current deaths associated with each cause of death (see annex 3). An assumption that the positive effect of the intervention on the population would increase linearly with expanded coverage was adopted. The estimate of the intervention's impact on mortality and malnutrition used the following equation and employs a previously described and validated sequential application model (Bhutta and others, 2008b).

$$\text{Deaths prevented} = N \times I \times (P_1 - P_0) (1 - I \times P_0)$$

Where:

N= number of deaths prior to intervention

I= percentage by which intervention reduces deaths

P₀= existing coverage of intervention

P₁= target coverage for intervention

The effects of nutrition interventions (by percent) on newborn and maternal mortality and nutritional status are shown in annex 5. The impacts were modeled at two levels of coverage:

1. A pragmatic increase in intervention coverage by 20 percent per annum over baseline; and
2. Universal coverage (at 100 percent) assuming rapid and comprehensive scale up.

The results for the relative reduction in prevalence of undernutrition outcomes and neonatal and child mortality are presented.

A1.5.4 Estimating Economic Gains from Interventions

Once the lives and productivity lost due to undernutrition was estimated, we were able to assess the country's potential economic gains achieved by averting the burden of mortality and undernutrition from high-impact nutrition interventions implemented at universal coverage. Economic gains assume improvement in the population's nutrition status and survival through nutrition programming, thereby increasing the size and productivity of the workforce. The economic costs of malnutrition to a country can be reduced by the economic gains achieved by an intervention's positive impact on reducing the prevalence of mortality and malnutrition at universal coverage.

We calculated the cumulative economic gains achieved by investing in particular nutrition interventions by comparing the national economy's annual loss due to undernutrition with the effectiveness of the existing nutrition programs and interventions. The additional gains obtained after adding new interventions and scaling up existing interventions are reflected as a percentage of the deficits offset by the interventions.

A1.5.5 Assessment of Cost Effectiveness

A detailed cost-effectiveness analysis was impossible because country-specific costs for nutrition interventions are limited. This gap was overcome by conducting a detailed review of existing global

evidence of the various nutrition interventions and their cost effectiveness from the Disease Control Priority Project, *The Lancet* series on primary health care, and the Copenhagen Consensus project on malnutrition and hunger. The results of the global effectiveness of various intervention are expressed in (US\$) cost per DALY averted or cost per life saved (see annex 6 for the cost effectiveness of various nutrition interventions.) Evidence from global cost effectiveness to further evaluate the appropriateness of nutrition interventions was used.

Disability Life Years Calculation

The DALYs measure the total burden of disease by summing up the “years of life lost” (YLL), due to cause-specific mortality, and “years lived with disability” (YLD), that is,

1. Burden of disease = DALYs lost = YLL + YLD, where
2. YLL = f (size of target group, mortality rate of disease, discount rate), and
3. YLD = f (size of target population, incidence rate, disability weight, discount rate).

Taking account of potentially different incidence rates and levels of severity of a disease between different groups within a population, the complete formula can be represented more formally as follows:

$$DALY_{S_{lost}} = \sum_j T_j M_{ij} \left[\frac{1 - e^{-rL_j}}{r} \right] + \sum_i \sum_j T_j I_{ij} D_{ij} \left[\frac{1 - e^{-rd_{ij}}}{r} \right]$$

where T_j is the number of people in the target group j and M_{ij} is the mortality rate associated with the given disease i . I_{ij} is the incidence rate of disease i that is of interest, D_{ij} is the corresponding disability weight, and d_{ij} is the duration of the disease. Future life is discounted at the rate of r^{2-3} .

References

- Bhutta, Z. A., Ahmed, T., Black, R. E., Cousens, S., Dewey, K., Giugliani, E., Haider, B. A., Kirkwood, B. Morris, S. S. Sachdev, H. P., and Shekar, M. (2008a). “What Works? Interventions for Maternal and Child Undernutrition and Survival. *The Lancet* 371: 417–40.
- Bhutta, Z. A., Ali, S., Cousens, S., Ali, T. M., Haider, B. A., Rizvi, A., Okong, P., Bhutta, S. Z., and Black, R. E., (2008b). Alma-Ata: Rebirth and Revision 6 Interventions to Address Maternal, Newborn, and Child Survival: What Difference Can Integrated Primary Health Care Strategies Make?” *The Lancet* 372 (Sep 13): 972–89.
- Black, R. E., Allen, L. H., Bhutta, Z. A., Caulfield, L. E., and others. (2008). “Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences.” *The Lancet* 371: 243–60.
- Cole P., and MacMahon, B. (1971). “Attributable Risk Percent in Case-Control Studies.” *British Journal of Preventive and Social Medicine*. 25: 242–44.
- Eide, G. E., and Heuch, I.. (2001). “Attributable Fractions: Fundamental Concepts and Their Visualization.” *Statistical Methods in Medical Research* 10: 159–93.
- Greenland, S. (1984). “Bias in Methods for Deriving Standardized Morbidity Ratio and Attributable Fraction Estimates.” *Statistics in Medicine* 3: 131–41.
- Levin, M. L. (1953). “The Occurrence of Lung Cancer in Man.” *Acta Unio Internationalis Contra Cancrum* 9: 531–41.

Murray, C. J. L., Lopez, A. D., Mathers, C. D., and Stein, C. (2001). "The Global Burden of Disease 2000 Project: Aims, Methods and Data Sources." Global Program on Evidence for Health Policy Discussion Paper No. 36. World Health Organization.

Phillips, M. (1996). *The Economic Analysis of Nutrition Projects Guiding Principles and Examples*. Washington, DC: World Bank, Human Development Department. (May) 57–63.

Rockhill, B., Newman, B., and Weinberg, C. (1998). "Use and Misuse of Population Attributable Fractions." *American Journal of Public Health* 88: 15–19.

Rothman, K. J. (1976). "Causes." *American Journal of Epidemiology* 104: 587–92.

Rothman, K. J., and Greenland, S. (1998). *Modern Epidemiology*. Philadelphia: Lippincott-Raven.

Uter, W., and Pfahlberg, A. (2001). "The Application of Methods to Quantify Attributable Risk in Medical Practice." *Statistical Methods in Medical Research* 10: 231–37.

Walter, S. D. (1976). The Estimation and Interpretation of Attributable Risk in Health Research. *Biometrics* 32: 829–49.

Walter, S. D. (1980). "Prevention of Multifactorial Disease." *American Journal of Epidemiology* 112: 409–16.

Yerushalmy, J., and Palmer, C. E. (1959). "On the Methodology of Investigations of Etiologic Factors in Chronic Diseases." *Journal of Chronic Diseases* 108: 27–40.

Annex 2. Attributable Fractions, Joint Attributable Fractions, and Pathways Due to Malnutrition for Under-Five Mortality

Table A2.1: Attributable Fractions of Under-Five Mortality, %

	Neonatal	ARI	Diarrhea	Malaria	Measles	All causes
Maternal iron deficiency anemia						3.0
VAD			0.23	0.15	0.17	
Zinc deficiency		6.00	3.00	7.00		2.0
Under weight		20.00	26.00	22.00	15.00	11.0
LBW/IUGR	11.50					
Low maternal BMI	1.60					
<i>Age 15-29</i>	1.90					
<i>Age 30-44</i>	1.20					
Joint PAF	12.9	24.8	2.4	5.6	15.1	4.7

Note: IUGR = Intrauterine growth retardation.

Table A2.2: Under-Five Mortality Pathways Due to Undernutrition

	Neonatal	Pneumonia	Diarrhea	Malaria	Measles	All cause
Maternal iron deficiency anemia						668
VAD			12	0	0	
Zinc deficiency		360	155	0		445
Under weight		1,201	1,347	0	0	2,448
LBW/IUGR	814					
Low maternal BMI	219					
<i>Age 15-29</i>	134					
<i>Age 30-44</i>	85					
Total using individual PAFs	1,033	1561	1,515	0	0	3,561
Total using joint PAFs	914	1489	127	0	0	1,052

Annex 3. Causes of Death in Children and Neonates

Causes of Death in Children Under Five and Neonates (GBD 2004)

Under-five death	Deaths	Percentage of total under five	Neonatal death	Deaths	Percentage of total neonatal deaths
0 days to 28 days (neonatal)	7075	31.8	Prematurity and low birth weight	2515.29	35.6
28 days to 5 years	15,178	68.2	Birth asphyxia and birth trauma	1672.86	23.6
Pneumonia	6004	27.0	Neonatal infections ¹	1416.49	20.0
Diarrheal diseases	5181	23.3	Other non-infectious perinatal causes ²	404.69	5.7
Malaria	0.40	0.0	Diarrheal diseases	174.07	2.5
Measles	0.19	0.0	Neonatal tetanus	0.00	0.0
HIV/AIDS	9.96	0.0	Congenital ³	785.91	11.1
Other infectious, parasitic, and nutritional deficiencies	2919	13.1	Other non-communicable and injury	105.89	1.5
Non-communicable diseases	527	2.4			
Injuries	534	2.4			
Total under five	22,253		Total neonatal	7075.19	

Source: WHO GBD Project. 2004 (unpublished data courtesy Mathers et al).

1. Includes all neonatal infections except diarrheal diseases and neonatal tetanus.

2. Other non-infectious causes arising in the perinatal period.

3. ICD-10 codes Q00-Q99.

Annex 4. Evidence-Based Nutrition Interventions and Target Age Groups

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
A. Interventions to increase general nutrient intake (including food supplements)					
Balanced energy protein supplementation in pregnancy	Systematic review of RCTs (Kramer and Kakuma 2003)	32% reduction in term IUGR births (RR= 0.68; 95% CI= 0.56, 0.84) 45% reduction in the risk of stillbirths (RR= 0.55; 95% CI= 0.31,0.97)	-	-	-
Breastfeeding education/promotion strategies	Effect on breastfeeding patterns from RCTs and one systematic review (Britton and others 2007) Effect of BF on mortality from observational studies	-	-EBF in the neonatal period Group counseling increased odds of EBF in the neonatal period by a factor of 3.88 as compared to routine care (OR=3.88; 95% CI=2.09, 7.22, p<0.0001 (random effects). Individual counseling increased odds of EBF in the neonatal period by a factor of 3.45 as compared to routine care	Impacts on growth negligible -BF at 6 months of age Group counseling increased odds of BF by a factor of 5.19 as compared to routine care (OR=5.19; 95%CI=1.90, 14.15, p<0.00001 (random effects). Individual counseling increased odds of BF by a factor of 1.93 at 6 months of age as compared to routine	Impacts on growth negligible No evidence of impact of BF promotion on BF rates beyond 12 months

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
			(OR=3.45, 95% CI=2.20 to 5.42, p<0.00001) (random effect). An evaluation of national mass media campaign of Honduras reported that EBF increased from 48% to 70% at one month.	care (OR=1.93; 95% CI=1.18, 3.15, p<0.00001) (random effect). An evaluation of national mass media campaign of Honduras reported that BF increased from 24% to 31% at 4 months and from 7% to 12% at 6 months of age.	
Complementary feeding support and education strategies without provision of food supplements or conditional cash transfers (CCTs)	Systematic review of RCTs			Reduced stunting (in food-secure populations), educational intervention vs control: HAZ WMD= 0.25 (95% CI= 0.01, 0.49) (random effects)	Reduced stunting (in food-secure populations), educational intervention vs control: HAZ WMD= 0.25 (95% CI= 0.01, 0.49) (random effects)
Complementary feeding support including education plus provision of food supplements or CCTs	Systematic review of RCTs			Reduced stunting (in food-secure populations), provision of complementary food with or without education: HAZ WMD= 0.41 (95% CI= 0.05, 0.76) (random effects)	Reduced stunting (in food-secure populations), provision of complementary food with or without education: HAZ WMD= 0.41 (95% CI= 0.05, 0.76) (random effects)
WHO-recommended case management of	RCTs and observational studies			Reduced mortality (Case fatality rate	Reduced mortality (Case fatality rate

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
severe acute malnutrition				RR= 0.45; 95% CI 0.32-0.62, random effects)	RR= 0.45; 95% CI 0.32-0.62, random effects)
B. Vitamin and mineral interventions					
Food fortification strategies and programs (including iodized salt, iodization of water, vitamin A fortification, and iron fortification strategies)	Limited number of RCTs; largely observational studies	Improved MN status (in women of childbearing age Hb conc g/L WMD=5.70; 95% CI=0.02, 11.38). In pregnant women Hb conc 6.90 g/L higher as compared to no fortification (WMD=6.90, 95% CI 2.74-11.06). USI programs decreased goiter prevalence by 19%-64%. Rate of goiter reduced by 51%-89% by iodization of water.	Neonatal mortality reduced by 65.7% after iodization of water.	Improved MN status (Hb conc g/L WMD=7.36; 95% CI= 2.88, 11.84) Infant mortality decreased 56.5% after iodization of water.	Improved MN status (Hb conc g/L WMD=7.36; 95% CI= 2.88, 11.84) Beyond 24 months of age the use of general fortified foods including milk has shown benefits on micronutrient status (WMD 10.33 from a meta-analysis of studies). Additional reduction in diarrhea morbidity noted in one recent study. The fortified milk reduced the odds for days with severe illnesses by 15% (95% CI=5% to 24%), the incidence of diarrhea by 18% (7% to 27%), and the incidence of acute lower

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
					respiratory illness by 26% (3% to 43%)
Antenatal iron-folate/iron supplementation	Systematic review of RCTs (Pena-Rosas and Viteri 2006; Gera and others 2007)	Improved MN status (Hb conc g/L WMD= 12.00; 95% CI=2.93, 21.07)	Improved MN status (Hb conc g/dL WMD = 0.74; 95% CI= 0.61, 0.87)	Improved MN status (Hb conc g/dL WMD = 0.74; 95% CI= 0.61, 0.87)	Improved MN status (Hb conc g/dL WMD = 0.74; 95% CI= 0.61, 0.87). Potential increased risk of death in malaria areas so only recommended for non-malaria areas as a treatment strategy.
Multiple micronutrient (MMN) supplements in pregnancy	Systematic review and recent studies of MMN supplementation in pregnancy (altogether nine RCTs) were reviewed	MMN supplementation (defined as supplementation with three or more micronutrients) was associated with 39% reduction in maternal anemia compared to placebo or two or less micronutrients (RR=0.61; 95% CI=0.52, 0.71)	Pooling these recent studies of MMN with the results of the Cochrane review now indicate a significant reduction in the risk of LBW births (RR=0.84 ;95% CI=0.74-0.95)	A recent study from Indonesia using these MMN in comparison with iron-folate tablets in over 31,000 women was also associated with a 22% reduction in infant mortality (RR=0.78; 95% CI=0.64-0.95)	
Sprinkles for home fortification	Systematic review of RCTs and observational studies			Use of Sprinkles for home fortification in anemic children results in a significant impact on Hb level (WMD=5.68, 95% CI=1.78, 9.57) and iron deficiency anemia (RR=0.54; 95% CI= 0.42, 0.70) (random effects as	

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
				compared to placebo).	
Vitamin A supplementation	Three systematic reviews of RCTs	No impact on LBW in HIV-negative populations, some impact in HIV-positive populations	Reduced mortality between 0- 6 months (RR=0.80; 95% CI= 0.66, 0.96)	-Reduced disease burden (reduction in persistent diarrhea rate ratio=0.45; 95% CI=0.21, 0.94) -Reduced mortality (RR=0.76; 95% CI= 0.69, 0.84) Impact usually between 6 and 11 months of age	Reduced disease burden (reduction in persistent diarrhea rate ratio=0.45; 95% CI= 0.21, 0.94) Reduced mortality (RR= 0.76; 95% CI= 0.69, 0.84)
Zinc supplementation (preventive and therapeutic)	Four systematic reviews (Aggarwal, Sentz, and Miller 2007; Bhutta and others 1999; Brown and others 2002; Mahomed, Bhutta, and Middleton 2007)	No evidence of benefit except for small reduction in prematurity rates	No evidence of benefit	No evidence of benefit of therapeutic zinc supplementation under 6 months of age Fewer episodes of diarrhea (rate ratio 0.86; 95% CI=0.79-0.93), severe diarrhea or dysentery (0.85, 0.75-0.95), persistent diarrhea (0.75, 0.57-0.98) Reduced stunting (weighted average effect size for change in height =0.35; 95% CI= 0.19, 0.51)	Fewer episodes of diarrhea (rate ratio 0.86; 95% CI=0.79-0.93), severe diarrhea or dysentery (0.85, 0.75-0.95), persistent diarrhea (0.75, 0.57-0.98) Reduced stunting (weighted average effect size for change height =0.35; 95% CI= 0.19, 0.51) Reduced mortality

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
				Reduced mortality (9%)	
Maternal calcium supplementation	One systematic review (Hofmeyr, Atallah, and Duley 2006)	Reduced risk of pre-eclampsia (12 trials, 15,206 women: RR=0.48; 95% CI=0.33 to 0.69). The effect was greatest for high-risk women (5 trials, 587 women: RR=0.22; 95% CI=0.12 to 0.42), and those with low baseline calcium intake (7 trials, 10,154 women: RR=0.36; 95% CI=0.18 to 0.70). The composite outcome maternal death or serious morbidity was reduced (4 trials, 9732 women; RR=0.80, 0.65 to 0.97).			
Delayed cord clamping	Three systematic reviews (Hutton and Hassan and 2007; Van Rheen and Brabin 2004; Villabona and others 2005)	-	Improved MN status (mean neonatal hematocrite at 24 to 48 hours, WMD= 10.01%; 95% CI, 4.10-15.92%)		-
Cooking in iron pots	Three RCTs and one systematic review (Adish and others 1999; Borigato and Martinez 1998; Geerligs and others 2002; Geerligs, Brabin, and Omari 2003; Geerligs and others 2002)				Iron pot group (after 8-12 months) showed a significantly higher Hb (1.3 g/dL) vs non-iron pot use group (p<0.05)

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
C. Disease prevention strategies					
Malaria prophylaxis and intermittent preventive treatment for malaria IPT in pregnancy and children	A systematic review of RCTs (ter Kuile, van Eijk, and Filler 2007)	In women in their first or second pregnancy, IPT reduced severe antenatal anemia (RR=0.62; 95% CI=0.50-0.78; 2809 participants, 1 prophylaxis and 2 IPT trials) and perinatal deaths (RR=0.73; 95% CI=0.53 - 0.99; 2 prophylaxis and 1 IPT trial) Pooled data from five studies showed reduction in LBW (RR= 0.55; 95% CI= 0.43, 0.70)		IPT results in 46% reduction in the risk of severe anemia (RR= 0.54; 95% CI= 0.42, 0.68) IPT results in 48% reduction in the risk of Clinical malaria, from the age of 2 months (RR= 0.52; 95% CI= 0.35, 0.77) (random effects)	
Insecticide treated bed nets	A systematic review of RCTs (Gamble, Ekwaru, and ter Kuile 2006)	Pooled estimates indicated a 23% reduction in the risk of delivering a LBW infant (RR= 0.77; 95% CI= 0.61-0.98, equivalent to a reduction in odds of term LBW of 43%)			
Hygiene interventions (handwashing, water quality treatment, sanitation, and hygiene)	Three systematic reviews (Curtis and Cairncross 2003; Fewtrell and others 2005; Zwane and Kremer 2007)			Significant decrease in diarrhea (handwashing vs control: RR= 0.70; 95% CI= 0.56, 0.89 random-effects model). Multiple interventions also had similar effects on severe diarrhea and dysentery (pooled	Significant decrease in diarrhea (handwashing vs control: RR= 0.70; 95% CI= 0.56, 0.89 random-effects model). Multiple interventions also had similar effects on severe diarrhea and dysentery (pooled estimate of relative

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
				estimate of relative risk 0.68, 0.62–0.74).	risk 0.68, 0.62–0.74).
Deworming in pregnancy and childhood	Three studies and a systematic review of RCTs (Dickson and others 2000)	Improved MN status (mean decline in Hb between first and third trimester was 6.6 g/L less as compared to the placebo)		Improved MN status (Hb g/l WMD=0.93; 95% CI=0.10, 1.77) Increase in height with a single dose was 0.14 cm (95% CI=0.04 to 0.23) A single dose was associated with an average 0.24 kg increase in weight (95% CI=0.15 kg to 0.32 kg). For multiple doses, the increase was 0.10 kg (0.04 kg to 0.17 kg) for up to one year of follow-up.	Improved MN status (Hb g/l WMD=0.93; 95% CI=0.10, 1.77) Increase in height with a single dose was 0.14 cm (95% CI 0.04 to 0.23) A single dose was associated with an average 0.24 kg increase in weight (95% CI=0.15 kg to 0.32 kg). For multiple doses, the increase was 0.10 kg (0.04 kg to 0.17 kg) for up to one year of follow-up. 5%-10% reduction in rates of anemia in populations with high rates of intestinal helminthiasis
D. General Nutrition Support Strategies					
CCTs	Six case studies, mostly observational data were reviewed	No maternal impact estimates available	No neonatal impact estimates available	Reduced stunting Increase in height on average 0.44 cm for children ages 0- 12	Reduced stunting Increase in height on average 0.44 cm for

Interventions	Evidence reviewed	Age groups affected and impact			
		Prenatal and antenatal [∞]	Newborn (0-1 month)*	Infants (1-12 months)	Child (12-59 months)
				months (PFA in Colombia) An increase of 16 % in mean growth rate per year corresponding to 1 cm increase in height per year. Reduced prevalence of stunting by 10% in 12-36 months age group (PROGRESA in Mexico) Decline in stunting from 41.9% to 37.1% over 2 years (RPS in Nicaragua)	children ages 0- 12 months (PFA in Colombia) An increase of 16 % in mean growth rate per year corresponding to 1 cm increase in height per year. Reduced prevalence of stunting by 10% in 12-36 months age group (PROGRESA in Mexico) Decline in stunting from 41.9% to 37.1% over 2 years (RPS in Nicaragua)
Dietary diversification strategies including home gardening, livestock, and dietary modifications	Twenty-nine studies and one systematic review were included	No impact estimates available	No impact estimates available	Improved hemoglobin concentration (107 vs. 102 g/L; p < 0.01) Improved serum retinol WMD=0.12 (95% CI= 0.07, 0.17)	Improved hemoglobin concentration (107 vs. 102 g/L; p < 0.01) Improved serum retinol WMD=0.12 (95% CI= 0.07,0.17)

[∞] Includes interventions focusing on mothers and the impacts on maternal and child health.

*Includes interventions in the neonatal period of life.

Note: RCT = randomized controlled trial; WMD = weighted mean difference; Hb conc = hemoglobin concentration.

References

- Adish, A. A., Esrey, S. A., Gyorkos, T. W., Jean-Baptiste, J., and Rojhani, A. (1999). "Effect of Consumption of Food Cooked in Iron Pots on Iron Status and Growth of Young Children: A Randomized Trial." *The Lancet* 353: 712–16.
- Aggarwal, R., Sentz, J. and Miller, M. A. (2007). "Role of Zinc Administration in Prevention of Childhood Diarrhea and Respiratory Illnesses: A Meta-Analysis." *Pediatrics* 119: 1120–30.
- Bhutta, Z. A., Black, R. E., and Brown, K. H. and others. (1999). "Prevention of Diarrhea and Pneumonia by Zinc Supplementation in Children in Developing Countries: Pooled Analysis of Randomized Controlled Trials. Zinc Investigators' Collaborative Group." *Journal of Pediatrics* 135: 689–97.
- Borigato, E. V. M., and Martinez, F. E. (1998). "Iron Nutritional Status Is Improved in Brazilian Preterm Infants Fed Food Cooked in Iron Pots." *J Nutr* 128: 855–57.
- Britton, C., McCormick, F. M., Renfrew, M. J., Wade, A., and King, S. E. (2007). "Support for Breastfeeding Mothers." *Cochrane Database Syst Rev* 2007; 1: CD001141. DOI: 10.1002/14651858.CD001141.pub3.
- Brown, K. H., Pearson, J. M., Rivera, J., and Allen, L. H. (2002). "Effect of Supplemental Zinc on the Growth and Serum Zinc Concentrations of Prepubertal Children: A Meta-Analysis of Randomized Controlled Trials." *American Journal of Clinical Nutrition* 75: 1062–71.
- Curtis, V., and Cairncross, S. (2003). "Effect of Washing Hands with Soap on Diarrhoea Risk in the Community: A Systematic Review." *Lancet Infect Dis* 3: 275–81.
- Dickson, R., Awasthi, S., Williamson, P., Demellweek, C., and Paul, G. (2000). "Effects of Treatment for Intestinal Helminth Infection on Growth and Cognitive Performance in Children: Systematic Review of Randomized Trials." *BMJ* 320: 1697–701.
- Fewtrell, L., Kaufmann, R. B., Kay, D., Enanoria, W., Haller, L., and Colford, Jr. J. M. (2005). "Water, Sanitation, and Hygiene Interventions to Reduce Diarrhea in Less Developed Countries: A Systematic Review and Meta-Analysis." *Lancet Infect Dis* 5: 42–52.
- Gamble, C., Ekwaru, J. P., and ter Kuile, F. O. (2006). "Insecticide-Treated Nets for Preventing Malaria in Pregnancy." *Cochrane Database Syst Rev* 2006; 2: CD003755.pub2. DOI: 10.1002/14651858.
- Geerligs, P. D. P., Brabin, B. J., and Omari, A. A. A. (2003). "Food Prepared in Iron Cooking Pots as an Intervention for Reducing Iron Deficiency Anaemia in Developing Countries: A Systematic Review." *J Hum Nutr Dietet* 16: 275–81.
- Geerligs, P. D. P., Brabin, B. J., Mkumbwa, A., Broadhead, R., and Cuevas, L. E. (2002). "Acceptability of the Use of Iron Cooking Pots to Reduce Anaemia in Developing Countries." *Public Health Nutr* 5: 619–24.

Geerligs, P. D. P., Brabin, B. J., Mkumbwa, A., Broadhead, R., and Cuevas, L. E. (2002). "The Effect on Haemoglobin of the Use of Iron Cooking Pots in Rural Malawian Households in an Area with High Malaria Prevalence: A Randomized Trial." *Trop Med Int Health* 8: 310–15.

Gera, T., Sachdev, H. P. S., Nestel, P., and Sachdev, S. S. (2007). "Effect of Iron Supplementation on Hemoglobin Response in Children: Systematic Review of Randomized Controlled Trials." *Journal of Pediatric Gastroenterol Nutri* 44: 468–86.

Hofmeyr, G. J., Atallah, A. N., and Duley, L. (2006). "Calcium Supplementation During Pregnancy for Preventing Hypertensive Disorders and Related Problems." *Cochrane Database Syst Rev* 2006; 3: CD001059.

Hutton, E. K., and Hassan, E. S. (2007). "Late vs Early Clamping of the Umbilical Cord in Full-Term Neonates: Systematic Review and Meta-Analysis of Controlled Trials." *Journal of the American Medical Association* 297: 1257–58.

Kramer, M. S., and Kakuma, R. (2003). "Energy and Protein Intake in Pregnancy." *Cochrane Database Syst Rev* 2003; 4: CD000032. DOI: 10.1002/14651858.

Mahomed, K., Bhutta, Z., and Middleton, P. (2007). "Zinc Supplementation for Improving Pregnancy and Infant Outcome." *Cochrane Database Syst Rev* 2007; 2: CD000230.

Pena-Rosas, J. P., and Viteri, F. E. (2006). "Effects of Routine Oral Iron Supplementation with or Without Folic Acid for Women During Pregnancy." *Cochrane Database Syst Rev* 2006; 3: CD004736.

ter Kuile, F. O., van Eijk, A. M., and Filler, S. J. (2007). "Effect of Sulfadoxine-Pyrimethamine Resistance on the Efficacy of Intermittent Preventive Therapy for Malaria Control During Pregnancy: A Systematic Review." *Journal of the American Medical Association* 297: 2603–16.

Van Rheenen, P., and Brabin, B. J. (2004). "Late Umbilical Cord-Clamping as an Intervention for Reducing Iron Deficiency Anaemia in Term Infants in Developing and Industrialised Countries: A Systematic Review." *Ann Trop Paediatr* 24: 3–16.

Villabona, B. L., Ayllon, E. B., Thompson, M. L. C., and Chiesa, J. M. B. (2005). "Early or Late Umbilical Cord Clamping? A Systematic Review of the Literature." *Ann Pediatr (Barc)* 63: 14–21.

Zwane, A. P., and Kremer, M.. 2007. "What Works in Fighting Diarrheal Diseases in Developing Countries? A Critical Review." CID Working Paper No. 140 (March).

Annex 5. Effects of Newborn and Maternal Nutrition Interventions on Mortality and Nutritional Status

Table A5.1: Effects of Newborn and Maternal Nutrition Interventions (Percentage) on Neonatal and Child Mortality

	Severe infections	Diarrhea	Congenital disorders	All cause mortality
Maternal Interventions*				
Maternal balance energy protein supplementation**				2%
Maternal micronutrient supplementation***				1%
Periconceptual folic acid supplementation			8%	
Newborn Interventions*				
Early initiation of breastfeeding	22%			
Exclusive breastfeeding	19%	36%		
	Diarrhea	Pneumonia	Measles	SAM and other nutritional deficiencies
Child Interventions*				
Exclusive breastfeeding < 6 months	19%	14%		
Continued breastfeeding beyond 6 months	11%	6%		
Complementary feeding promotion (for both food-secure and -insecure population)	8%	10%		20%
Vitamin A supplementation	33%		66%	
Preventive zinc supplementation****				9%
Zinc for management of diarrhea	20%			
Promotion of handwashing and hygiene strategies	30%			
WHO-recommended case management of SAM				55%

*Bhutta and others 2008.

**Maternal balance energy protein supplementation reduced risk of LBW by 32 percent and LBW contributes around 7.4 percent of neonatal deaths therefore it translates to 2 percent reduction in overall neonatal mortality.

*** Similarly maternal micronutrient supplementation reduced risk of LBW by 14 percent therefore it translates to 1 percent reduction in overall neonatal mortality.

****Aggarawal, Sentz, and Miller 2007; Mahomed, Bhutta, and Middleton 2007.

Table 2: Effects of Newborn and Maternal Interventions (Percentage) on Nutrition Status

	LBW	Stunting	Iodine deficiency	Maternal anemia	Child anemia
Maternal balance energy protein*	32%				
Maternal IFA supplementation**				73%	
Maternal micronutrient supplementation	14%***			39%****	
IPT/ITN during pregnancy*****	37%			12%	
Complementary feeding*****		26%			
Food secure		17%			
Food insecure		9%			
Iodization of salt			41%		
Zinc fortification*****		15%			
Micronutrient supplementation with Sprinkles					21%
Deworming during childhood*****					10%

*Kramer and Kakuma 2003.

**Pena-Rosas and Viteri 2006.

***Brent and others 1995.

****Haider and Bhutta 2006.

*****ter Kuile, van Eijk, and Filler 2007; Gamble, Ekwaru, and ter Kuile 2006.

*****Victora 2005; Sempertegui and others, n.d.

*****Kramer and Kakuma 2003; Britton and others 2007.

*****Dickson and others 2008.

References

- Bhutta, Z. A., Ali, S. , Cousens, T. M., Ali, B. A., Haider, A., Rizvi, P., Okong, S. Bhutta, Z., and Black R. E. (2008). Alma-Ata: Rebirth and Revision 6 Interventions to Address Maternal, Newborn, and Child Survival: What Difference Can Integrated Primary Health Care Strategies Make?" *The Lancet* 372 (Sep 13): 972–89.
- Brent, N. B., Redd, B., Dworetz, A., D'Amico, F. D., and Greenberg, J. (1995). "Breastfeeding in a Low-Income Population." *Arch Pediatr Adolesc Med* 149: 798–803.
- Britton, C., McCormick, F. M., Renfrew, M. J., Wade, A., and King, S. E. (2007). "Support for Breastfeeding Mothers." *Cochrane Database Syst Rev* 2007; 1: CD001141. DOI: 10.1002/14651858.CD001141.pub3.
- Curtis, V., and Cairncross, S. (2003). "Effect of Washing Hands with Soap on Diarrhoea Risk in the Community: A Systematic Review." *Lancet Infect Dis* 3: 275–81.
- Gamble, C., Ekwaru, J. P., and ter Kuile, F. O. (2006). "Insecticide-Treated Nets for Preventing Malaria in Pregnancy." *Cochrane Database Syst Rev* 2006; 2: CD003755.pub2. DOI: 10.1002/14651858.
- Haider, B. A., and Bhutta, Z. A. (2006). "Multiple-Micronutrient Supplementation for Women During Pregnancy." *Cochrane Database Syst Rev* 2006; 4: CD004905.
- Kramer, M. S., and Kakuma, R. (2003). "Energy and Protein Intake in Pregnancy." *Cochrane Database Syst Rev* 2003; 4: CD000032. DOI: 10.1002/14651858.
- Mahomed, K., Bhutta, Z., and Middleton, P. (2007). "Zinc Supplementation for Improving Pregnancy and Infant Outcome." *Cochrane Database Syst Rev* 2007; 2: CD000230.
- Pena-Rosas, J. P., and Viteri, F. E. (2006). "Effects of Routine Oral Iron Supplementation with or Without Folic Acid for Women During Pregnancy." *Cochrane Database Syst Rev* 2006; 3: CD004736.
- Sempertegui, F., Estrella, B., Egas, J., and others. n.d. "Pneumonia Adversely Affects Growth in Children." 55th Annual Meeting of the American Society of Tropical Medicine and Hygiene. Atlanta, Georgia, Abstract 771.
- ter Kuile, F. O., van Eijk, A. M., and Filler, S. J. (2007). "Effect of Sulfadoxine-Pyrimethamine Resistance on the Efficacy of Intermittent Preventive Therapy for Malaria Control During Pregnancy: A Systematic Review." *Journal of the American Medical Association* 297: 2603–16.
- Victora, C. G., Fenn, B., Bryce, J., and Kirkwood, B. R. (2005). "Co-Coverage Of Preventive Interventions And Implications For Child-Survival Strategies: Evidence From National Surveys." *The Lancet* 366: 1460–66.

Annex 6. Cost Effectiveness Estimates for Various Nutrition Interventions

Interventions	Cost effectiveness estimates (DCPP)	Lancet PHC cost effectiveness	Copenhagen Consensus
Maternal			
Iron folic acid supplementation	N/A	N/A	US\$ 66-115 per DALY*
Maternal calcium supplementation	N/A	N/A	N/A
Maternal balanced energy protein supplementation	N/A	N/A	N/A
Maternal iodine supplements	US\$ 1.80–18/ infant-early child death avoided*	N/A	N/A
Vitamin A supplementation	US\$ 19–193/maternal death averted**	N/A	N/A
Maternal deworming in pregnancy	N/A	N/A	N/A
Insecticide-treated bednets (for family)	US\$ 5-17 per DALY averted	N/A	N/A
Intermittent preventive treatment for malaria (pregnancy)	US\$ 13-24 per DALY averted	N/A	N/A
Family planning interventions to promote birth spacing	N/A	N/A	N/A
Maternal mental health interventions	N/A	N/A	N/A
Support for breastfeeding mothers (50% coverage)***	8 mil. DALY averted/year (ACER=6)		
Support for breastfeeding mothers (80% coverage)***	14 mil. DALY averted/year (ACER=6)		
Support for breastfeeding mothers (95% coverage)***	16 mil. DALY averted/year (ACER=6)		
Neonatal			
Breastfeeding promotion strategies (individual and group counseling)	N/A	N/A	N/A

Interventions	Cost effectiveness estimates (DCPP)	Lancet PHC cost effectiveness	Copenhagen Consensus
Breastfeeding promotion (Baby-Friendly Hospitals)	N/A	N/A	US\$ 2-4/DALY to US\$ 12-19/DALY****
Delayed cord clamping	N/A	N/A	N/A
Growth monitoring and counseling	US\$ 8-11 per DALY averted	N/A	N/A
Infants and Children			
Behavior change communication for improved complementary feeding	N/A	N/A	N/A
Multiple micronutrient supplementation	N/A	N/A	US\$ 8-97/ DALY gained, US\$ 273-248/ death averted*****
Vitamin A supplementation	US\$ 6-12 per DALY averted	N/A	US\$ 64-294 /death-averted***** US\$ 3-16/DALY*****
Vitamin A fortification	US\$ 33-35 per DALY averted	N/A	N/A
Zinc supplementation in diarrheal management	N/A	N/A	US\$ 73/DALY US\$ 2,100 / death-averted*****
Zinc fortification	N/A	N/A	US\$ 12.20/DALY*****
Improved diarrhea management	US\$ 527-2,001 per DALY averted	US\$ 132-2570 per DALY averted	N/A
Iodine fortification	US\$ 34-36 per DALY	N/A	N/A
Treatment of severe acute malnutrition	N/A	N/A	N/A
Iron fortification/supplementation programs	US\$ 66-70 per DALY averted	US\$ 66-70 per DALY averted	N/A
Provision of complementary foods	N/A	N/A	N/A
Neonatal vitamin A supplementation	N/A	N/A	N/A
Multiple micronutrient (breastfeeding programs)	US\$ 3-11 per DALY averted US\$ 100-300 per death averted	N/A	N/A
Deworming in children	US\$ 2-9 per DALY averted	N/A	N/A
Strategies			
Conditional cash transfer	N/A	N/A	N/A
Unconditional cash transfers and micro-credit programs	N/A	N/A	N/A

Interventions	Cost effectiveness estimates (DCPP)	Lancet PHC cost effectiveness	Copenhagen Consensus
Handwashing/hygiene interventions	N/A	N/A	N/A
Mass media strategies for breastfeeding promotion, dietary diversification, etc.	N/A	N/A	N/A
Food for work programs & generalized food subsidies	N/A	N/A	N/A
Dietary diversification strategies, small animal husbandry, and home gardening	N/A	N/A	N/A
Agricultural subsidies and land reform	N/A	N/A	N/A

Note: ACER= average cost effectiveness ratio; DCPP= Disease Control Priorities Project.

*Baltussen, Knai, and Sharan 2004.

**Rouse 2003.

***Adam and others 2005.

****Horton and others 1996.

*****Robberstad and others 2004.

*****Ching and others 2000.

*****Ching and others 2000; Fiedler 2000; Horton 1999.

*****Sharieff, Horton, and Zlotkin 2006.

References

Adam, T., and others. (2005). Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries. *BMJ*, 2005. 331: 1107.

Baltussen, R., Knai, C., and Sharan, M. (2004). Iron Fortification and Iron Supplementation are Cost-Effective Interventions to Reduce Iron Deficiency in Four Subregions of the World J. *Nutr.*, 134: 2678–2684.

Ching, P., Birmingham, M., Goodman, T., Sutter, R., and Loevinsohn, B. (2000). Childhood mortality impact and costs of integrating vitamin A supplementation into immunization campaigns. *Am J Pub Health* 90, 1526–1529.

Fiedler, J. L. (2000). The Nepal national vitamin A program: prototype to emulate or donor enclave? *Health Policy and Planning* 15, 145–156.

Horton, S. (1999). Opportunities for investments in nutrition in low-income Asia. *Asian Development Review*, 17, 246–273.

Horton, S., Sanghvi, T., Phillips, M., Fiedler, J., Perez-Escamilla, R., Lutter, C., Rivera, A., and Segall-Correa, A.M. (1996). Breastfeeding promotion and priority setting in health. *Health Policy and Planning*, 11, 156–168.

Robberstad, B., Strand, T., Black, R. E., Sommerfelt, H., (2004). Cost-effectiveness of zinc as adjunct therapy for acute childhood diarrhea in developing countries. *Bull WHO* 82: 523–31.
Rouse, D. Potential Cost-Effectiveness of Nutrition Interventions to Prevent Adverse Pregnancy Outcomes in the Developing World. *J. Nutr.*, May 2003; 133: 1640S–1644S.

Sharieff, W., Horton, S., and Zlotkin, S. (2006). Economic Gains of a home fortification program: evaluation of “Sprinkles” from provider’s perspective. *Canadian Journal of Public Health*, 97, 20–23.

Annex 7. Summary and Key Messages of the Lancet Nutrition Series

The Lancet's series on maternal and child undernutrition provide new insight into the global prevalence and impact of maternal and child undernutrition. The series follow a number of earlier important series from *The Lancet*—such as those on child survival and newborn health—which have shaped policy and action. The authors of the series examined evidence-based interventions that, if implemented at scale, could significantly reduce the effects of maternal and child undernutrition. This reduction requires improved coordination between national agencies and international organizations, as well as efficient management of resources and a dedicated effort to strengthen global capabilities.

The first two papers of the series quantify the prevalence of maternal and child undernutrition and consider the short-term consequences in terms of deaths and disease burden, as measured by DALYs. They also quantify the long-term educational and economic effects and associations with adult chronic diseases, particularly as countries go through the demographic, epidemiological, and nutritional transitions. The third paper reviews the evidence base for interventions that impact maternal and child undernutrition and survival, and estimates the potential benefits of implementing effective and relevant evidence-based health and nutrition interventions in low- and middle-income countries. The final papers in the series consider the current state of such interventions, and how they could be implemented at scale through actions at national and global levels.

Key messages

- In low-income countries, maternal and child undernutrition is the underlying cause of more than one-third (3.5 million) of all child deaths under five years of age, many of which are preventable through effective nutrition interventions operating at scale.
- Pregnancy to age 24 months is the critical window of opportunity for the delivery of nutrition interventions. If proper nutrition interventions are not delivered to children before the age of 24 months, they could suffer irreversible damage into their adult life and through subsequent generations.
- Effective interventions are available to reduce underweight, stunting, micronutrient deficiencies, and child deaths. Among the currently available interventions reviewed, breastfeeding counseling, appropriate complementary feeding, and vitamin A and zinc have the greatest potential for reducing child deaths and future disease burden related to undernutrition. Interventions to reduce iron and iodine deficiencies are important for maternal survival and for children's cognitive development, educability, and future economic productivity.
- Ninety percent of the world's undernourished children live in just 36 countries. Intensified nutrition action in these countries can lead to the achievement of the MDGs' goals of halving severe hunger by 2015 (MDG 1) and greatly increase the chances of achieving the goals for child and maternal mortality (MDGs 4 and 5).
- Nutrition should be a priority at all levels—subnational, national, and global—because it is a central component for human, social, and economic development. Undernutrition is a key factor in reducing child development, maternal health, and productivity. The prevention of maternal and child undernutrition is a long-term investment that will benefit the current generation and their children.
- Reducing maternal and child undernutrition will require improved coordination between national governments and international organizations. Additionally, the international nutrition effort requires significant reform in order to be effective. Although undernutrition and poverty are often intertwined and long-term solutions to eradicate poverty and undernutrition must be linked, proven steps can be taken now to alleviate the immediate effects of maternal and child undernutrition.

Annex 8. Infant and Young Child Feeding Behaviors

Percentage of Infants Being Fed According to
WHO Age Recommendations, 2005

		Age in months		
		0-3	0-6	6-9
Region	Dushanbe		17	
	Khatlon		20	
	Sogt		45	
	DRD		13	
	GBAO		51	
Locality	Urban	33	24	24
	Rural	37	26	13
Maternal education	None	--	--	--
	Primary	37	27	13
	Secondary or higher	(28)	24	(32)
Wealth quintiles	Poorest	(34)	24	(14)
	Second	(24)	24	(14)
	Middle	50	33	(13)
	Fourth	29	19	16
	Richest	37	25	22
Total		36	25	15