AN INVESTMENT FRAMEWORK FOR NUTRITION IN AFGHANISTAN:

Estimating the Costs, Impacts, and Cost-Effectiveness of Expanding High-Impact Nutrition Interventions to Reduce Stunting and Invest in the Early Years

DISCUSSION PAPER **April 2018**

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Health, Nutrition & Population

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Health, Nutrition and Population (HNP) Discussion Paper

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Health, Nutrition and Population (HNP) Discussion Paper

An Investment Framework for Nutrition in Afghanistan: *Estimating the Costs, Impacts, and Cost-Effectiveness of Expanding High-Impact Nutrition Interventions to Reduce Stunting*

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Abstract: This paper examines the costs, impacts, and cost-effectiveness of scaling up over five years the nutrition interventions included in Afghanistan's Basic Package of Health Services (BPHS) as a first step in investing in the early years to build human capital. The total public investment required for the scale up to government-set program coverage levels is estimated to be $44 million per year over five years, or $1.49 per capita per year. Each dollar invested would yield at least $13 in economic returns and even under conservative assumptions regarding future economic growth, the economic benefits exceed the cost by six times: $815 million over the productive lives of the beneficiaries. This scale up would prevent almost 25,000 child deaths and over 4,000 cases of stunting and avert a loss of 640,000 disability-adjusted life years (DALYs) and almost 90,000 cases years of anemia. Almost 100,000 more children would be exclusively breastfed. However, this scale-up would only have a marginal effect – a decrease of less than one-half percentage point – on stunting prevalence because the current government-set target program coverage rates are very low for the preventive interventions that affect stunting. A substantially greater impact could be achieved if preventive interventions could be scaled to full program coverage levels, which would require less than $5 million more a year. This would triple the number of DALYs averted, double the number of deaths averted and avert almost eight times as many cases of stunting, resulting in a 2.6 percentage point decline in stunting over the five-year period (from 41% to 38%). The prevalence of anemia in pregnant women could be reduced by 12 percentage points and the prevalence of exclusive breastfeeding could be increased by 18 percentage points. In addition, this investment is projected to generate economic benefits of $815 million over the productive lives of the beneficiaries. Each dollar invested would yield more than $13 in economic returns. Sensitivity analysis was conducted for the total cost, cost-effectiveness, and economic returns on investing in the BPHS nutrition interventions.

Keywords: nutrition, cost-effectiveness, cost-benefit analysis, nutrition financing, Afghanistan

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ABBREVIATIONS AND ACRONYMS

ADHS	Afghanistan Demographic and Health Survey
BPHS	Basic Package of Health Services
CAF	Care of Afghan Families
CoD	cause of death
CSO	Central Statistics Organization
DALYs	disability-adjusted life years
g/dL	grams per deciliter
DHS	Demographic and Health Survey
EU	European Union
FAO	Food and Agriculture Organization (UN)
GAIN	Global Alliance for Improved Nutrition
GDP	gross domestic product
GNI	gross national income
HAZ	height-for-age Z-score
HEFD	Health Economics and Financing Division, Ministry of Public Health
HDI	Human Development Index
HNP	Health, Nutrition and Population
IHME	Institute for Health Metrics and Evaluation
LiST	Lives Saved Tool
MAM	moderate acute malnutrition
MPI	Multidimensional Poverty Index
MSH	Management Sciences for Health
M&E	monitoring and evaluation
MICS	Multiple Indicator Cluster Survey
MOPH	Ministry of Public Health
n.a.	not applicable
NNS	National Nutrition Survey
NRVA	National Risk and Vulnerability Assessment
ODA	Official Development Assistance
PAF	population attributable fraction
PND	Public Nutrition Directorate, Ministry of Public Health
PPP	purchasing power parity
SAM	severe acute malnutrition
SC	Save the Children
SD	standard deviation
SUN	Scaling Up Nutrition
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WAZ	weight-for-age Z-score
WDI	World Development Indicators
WHO	World Health Organization
WHO-CHOICE	Choosing Interventions that are Cost-Effective
WHZ	weight-for-height Z-score
WFP	World Food Programmed (UN)
YLD	years of life lived with disability (from a disease)
YLL	years of life lost (from a disease)

All dollar amounts are U.S. dollars unless noted otherwise.

GLOSSARY OF TECHNICAL TERMS

Anemia is defined as the condition of having a low concentration of hemoglobin in the blood or a low red-blood cell (also called erythrocyte) count. In this condition, red blood cells in the body are not able to deliver oxygen to tissues. This leads to a higher risk of infections and to impaired cognitive function and physical work capacity.

A **benefit-cost ratio** summarizes the overall value of a project or proposal. It is the ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. The benefit-cost ratio takes into account the amount of monetary gain realized by implementing a project versus the amount it costs to execute the project. The higher the ratio, the better the investment. A general rule is that if the benefit from a project is greater than its cost, the project is a good investment.

Cost-benefit analysis is an approach to economic analysis that weighs the cost of an intervention against its benefits. The approach involves assigning a monetary value to the benefits of an intervention and estimating the expected present value of the net benefits, known as the *net present value*. Net benefits are the difference between the cost and monetary value of benefits of the intervention. The net present value is defined mathematically as:

$$Net\ present\ value = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0$$

where C_t is net cash inflows, C_0 is the initial investment, the index t is the time period, and r is the discount rate. A positive net present value, when discounted at appropriate rates, indicates that the present value of cash inflows (benefits) exceeds the present value of cash outflows (cost of financing). Interventions with net present values that are at least as high as alternative interventions provide greater benefits than interventions with net present values equal to or lower than alternatives. The results of cost-benefit analysis can also be expressed in terms of the benefit-cost ratio. The intervention with the lowest cost per benefit is considered to be the most cost-effective intervention among the alternatives.

Cost-effectiveness analysis is an approach to economic analysis that is intended to identify interventions that produce the desired results at the lowest cost. Cost-effectiveness analysis requires two components: the total cost of the intervention and an estimate of the intervention's impact, such as the number of lives saved. The cost-effectiveness ratio can be defined as:

$$Cost\text{-}effectiveness\ ratio = \frac{total\ cost\ of\ implementing\ the\ intervention}{impact\ of\ the\ intervention\ on\ a\ specific\ outcome}$$

The analysis involves comparing the cost-effectiveness ratios among alternative interventions with the same outcomes. The intervention with the lowest cost per benefit is considered to be the most cost-effective intervention among the alternatives.

A **DALY** is a **disability-adjusted life year**, which is equivalent to a year of healthy life lost due to a health condition. The DALY, developed in 1993 by the World Bank, combines the years of life lost from a disease (YLL) and the years of life lived with disability from the disease (YLD). DALYs

count the gains from both mortality (how many more years of life lost due to premature death are prevented) and morbidity (how many years or parts of years of life lost due to disability are prevented). An advantage of the DALY is that it is a metric that is recognized and understood by external audiences such as the World Health Organization (WHO) and the National Institutes of Health (NIH). It helps to gauge the contribution of individual diseases relative to the overall burden of disease by geographic region or health area. Combined with cost data, DALYs allow for estimating and comparing the cost-effectiveness of scaling up nutrition interventions in different countries.

A **discount rate** refers to a rate of interest used to determine the current value of future cash flows. The concept of the time value of money suggests that income earned in the present is worth more than the same amount of income earned in the future because of its earning potential. A higher discount rate reflects higher losses to potential benefits from alternative investments in capital. A higher discount rate may also reflect a greater risk premium of the intervention.

The **internal rate of return** is the discount rate that produces a net present value of cash flows equal to zero. An intervention has a non-negative net present value when the internal rate of return equals or exceeds the appropriate discount rate. Interventions yielding higher internal rates of return than alternatives tend to be considered more desirable than the alternatives.

The **Lives Saved Tool (LiST)** is an estimation tool that translates measured coverage changes into estimates of mortality reduction, cases of childhood stunting averted, cases of anemia in women, and changes in breastfeeding practices. LiST is used to project how increasing intervention coverage would impact child and maternal survival. It is part of an integrated set of tools that comprise the Spectrum policy modeling system.

Nutrition-sensitive interventions are those that have an indirect impact on nutrition and are delivered through sectors other than health such as the agriculture, education, and water, sanitation, and hygiene sectors. Examples include biofortification of food crops, conditional cash transfers, and water and sanitation infrastructure improvements.

Nutrition-specific interventions are those that address the immediate determinants of child nutrition, such as adequate food and nutrition intake, feeding and caregiving practices, and treating disease. Examples include community nutrition programs (e.g., protection, promotion and support of breastfeeding and complementary feeding, micronutrient supplementation, and treatment of acute malnutrition), micronutrient supplementation, and deworming.

Program costs are health or nutrition system costs that are not linked to a particular intervention but are necessary to ensure system capacity to deliver all interventions. The program costs cover national-level nutrition program staffing (not including frontline personnel); training frontline health and nutrition workers; training the trainer; training development, supervision, and transport (new vehicles and operating costs); monitoring and evaluation; surveillance surveys; equipment; and policy and communications advocacy.

Sensitivity analysis is a technique that evaluates the robustness of findings when key variables change. It helps to identify the variables with the greatest and least influence on the outcomes of the intervention, and it may involve adjusting the values of a variable to observe the impact of the variable on the outcome.

Stunting is an anthropometric measure of low height-for-age. It is an indicator of chronic undernutrition and is the result of prolonged food deprivation and/or disease or illness. It is

measured in terms of Z-score (or standard deviation score; see definition below); a child is considered stunted with a height-for-age Z-score of −2 standard deviations (SD) or lower.

Underweight is an anthropometric measure of low weight-for-age. It is a composite measure of wasting and stunting that result from either acute or chronic undernutrition, or both. It is measured in terms of Z-score (or standard deviation score; see definition below); a child is considered underweight with a weight-for-age Z-score of −2 standard deviations (SD) or lower.

A **unit cost** is the cost of all inputs divided by the number of units per output (person treated, group sensitized, report produced, and so on) in one given intervention.

Wasting is an anthropometric indicator of low weight-for-height. It is an indicator of acute undernutrition and the result of more recent food deprivation or illness. It is measured in terms of Z-score (or standard deviation score; see definition below). A child with a weight-for-height Z-score of −2 standard deviations (SD) or lower is considered wasted.

A **Z-score** is a calculation used to explain deviations from an established norm. It is calculated with the following formula:

$$Z\text{-}score = \frac{(observed\ value) - (median\ reference\ value)}{standard\ deviation\ of\ reference\ population}$$

EXECUTIVE SUMMARY

Key Findings

- The total public investment required to scale up nutrition interventions (a first step towards investing in the early years) in the Basic Package of Health Services (BPHS) is estimated to be $44 million a year for 5 years, or $1.49 per capita per year. Each dollar invested would yield at least $13 in economic returns and even under conservative assumptions regarding future economic growth, the economic benefits exceed the cost by six times.

- This scale up would prevent almost 25,000 child deaths and over 4,000 cases of stunting and avert a loss of 640,000 disability-adjusted life years (DALYs) and almost 90,000 cases years of anemia. Almost 100,000 more children would be exclusively breastfed.

- However, this scale-up would only have a marginal effect – a decrease of less than one-half percentage point – on stunting prevalence because the current government-set target program coverage rates are very low for the preventive interventions that affect stunting.

- A substantially greater impact could be achieved if preventive interventions could be scaled to full program coverage levels, which would require less than $5 million more a year. This would triple the number of DALYs averted, double the number of deaths averted and avert almost eight times as many cases of stunting, resulting in a 2.6 percentage point decline in stunting over the five-year period (from 41% to 38%). The prevalence of anemia in pregnant women could be reduced by 12 percentage points and the prevalence of exclusive breastfeeding could be increased by 18 percentage points.

This report was prepared in response to the Government of Afghanistan's request for technical assistance from the World Bank and the United Nations Children's Fund (UNICEF) to estimate the costs of implementing nutrition interventions within the country's existing BPHS and to assist with the prioritization of scaling up nutrition actions over the next five years. It is also intended to help the government formulate an investment case to support the mobilization and allocation of resources necessary for improving nutrition in Afghanistan, which is the first step towards investing in the early years to build human capital in Afghanistan. The specific objectives are as follows:

- To estimate the total costs and impacts of the current BPHS nutrition package, which consists of 12 nutrition-specific interventions delivered through the public sector (either by government programs and facilities or by those run by NGOs).
- To inform prioritization of interventions and geographic areas by examine relative costs, benefits and cost-effectiveness by (i) individual intervention, (ii) category of interventions (preventive and curative) and (iii) province of Afghanistan.
- To estimate the overall return on investment of scaling up the BPHS nutrition package of interventions.

COUNTRY CONTEXT

Afghanistan is faced with a difficult social, economic, and political situation after three decades of conflict, civil unrest, and recurring natural disasters. The fact that armed conflict has been underway for so long severely undermines development efforts and presents challenges unique to the country. In 2016, Afghanistan ranked 171 out of 188 countries in the United Nations' Human Development Index (HDI), even lower than many other fragile, low-income countries and lower than other countries in the South Asia region. The infant mortality rate in Afghanistan decreased from 83.6 per 1,000 live births in 2003 to 54.0 in 2015 and the under-five mortality rate decreased from 118.3 to 73.2 deaths per 1,000 live births (World Development Indicators). However, limited access to health facilities, coupled with high fertility rates, results in high risks of maternal mortality during pregnancy, labor, and postnatal recovery (MICS 2003; IRA CSO 2014).

Per capita gross domestic product (GDP) was estimated at $630 in 2015 (World Bank 2016b), and growth averaged 9.4 percent per year between 2003 and 2012, but fell sharply between 2013 and 2015. Over 75 percent of the country's 32.5 million inhabitants live in rural areas (World Bank 2016a) and 36 percent live below the national poverty line (World Bank 2016a).

Levels of malnutrition in Afghanistan—as measured by the prevalence of stunting (height-for-age) and underweight (weight-for-age)—have improved substantially over time but still remain very high. In 2013, 41 percent of children under five were stunted (a form of chronic undernutrition), 10 percent were wasted (acutely malnourished), and 25 percent were underweight (NNS 2013). Many factors affect levels of malnutrition in Afghanistan, including poverty, the protracted political conflict and insecurity, the burden of disease, lack of access to adequate sanitation, poor dietary diversity, and suboptimal infant and young child feeding and caregiving practices.

The prevalence of stunting in Afghanistan is above the regional average, and Afghanistan has the second-highest prevalence of stunting in the region (second only to Pakistan) (see Figure 4 in main report). When compared with countries with similar income levels, countries such as Guinea and Haiti have significantly lower rates of stunting the potential to achieve better nutrition outcomes despite a low per capita income (see Figure 5 in main report).

Combating acute and chronic malnutrition through multisectoral action, improved monitoring, and increased resource allocation is a priority for the Ministry of Public Health (MOPH) in the National Nutrition Strategy (NNS 2013). Specifically, the ministry aims to address inadequate infant and young child feeding practices and to prevent and control micronutrient deficiencies among adolescent girls to reduce the intergenerational impact of undernutrition (IRA MOPH 2015a). The BPHS, implemented by the MOPH and contracted implementing agencies, includes interventions for the prevention, treatment, and surveillance of nutritional disorders (IRA MOPH 2015a). Recent System of Health Accounts (SHA) data show that in 2014, Afghanistan spent about US$ 97 million or about US$ 2 dollars per capita on nutritional disorders. This included only about US$ 820,000 (2 cents per capita) from the public budget. The remainder came from overseas assistance (US$ 56 million; about US$ 1.62 per capita) and from out of pocket expenditure (US$ 39.9 million or about US 1.15 per capita)

METHODS

The analysis includes 12 nutrition-specific interventions included the current BPHS package (listed in Table ES1). The main scenario (Scenario 1) considers the scale up of the nutrition

package to target program coverage levels set by the MOPH. The analysis also estimates the costs and impacts of scaling up the interventions to full (90%) program coverage (Scenario 2).

Table ES.1: List of Nutrition-specific Interventions and Target Populations

Intervention	Target population
PREVENTIVE INTERVENTIONS	
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding b) Complementary feeding education c) Community food preparation demonstration	 Pregnant women Caregivers of children 6–23 months Caregivers of children 6–59 months
2. Vitamin A supplementation for children	Children 6–59 months
3. Control and prevention of diarrheal disease and parasitic infections a) Deworming in children b) Deworming in adolescent girls c) Therapeutic zinc and oral rehydration solution for diarrhea in children	Children 12–59 months Females 10–19 years Children 6–59 months
4. Promotion of balanced micronutrient-rich foods	Children 6–23 months
5. Iron and folic acid supplementation for pregnant women	Pregnant women
6. Promotion of iodized salt	General population
7. Growth monitoring	Children 6–23 months
8. Vitamin A supplementation for pregnant women	Pregnant women
CURATIVE INTERVENTIONS	
9. Treatment of severe acute malnutrition (with and without complications)	Children 6–59 months suffering from severe acute malnutrition (WHZ<−3 SD)
10. Management of moderate acute malnutrition	Children 6–59 months (WHZ< −2 and > −3 SD)
11. Clinic-based nutrition surveillance	Children 0–59 months
12. Screening for acute malnutrition and micronutrient deficiencies	Children 0–59 months

Note: SD = standard deviation; WHZ = weight-for-height Z-score.

The estimated costs for 2016–20 are based on unit cost data collected from the MOPH and two nongovernmental organizations (NGOs): the Aga Khan Development Network – Afghanistan (AKDN) and the Care of Afghan Families (CAF). The estimates represent the costs borne by the public sector, which includes primarily the government but also other organizations (NGOs and UN agencies) involved in the provision of nutrition services. The estimates do not capture the full social resource requirements, such as the opportunity costs of the time committed by beneficiaries accessing the services. For salt iodization, the analysis reports private sector costs and, separately, the costs to be borne by households that purchase the food and salt.

TOTAL RESOURCES REQUIRED (2016–2020) AND IMPACT

The total public investment required to deliver the BPHS nutrition package (Scenario 1) is estimated to be an average of $44 million per year or $219 million total from 2016 through 2020 (box ES.1 and Table ES.1).[1] The total includes the cost of maintaining the interventions at current

[1] The analysis was performed in 2016.

coverage levels ($105.1 million), the additional cost of scaling up interventions to target coverage levels by 2020 ($54.5 million), and program overhead costs of $59.2 million. This translates to a total cost of $10.69 per child under the age of five per year, or $1.49 per capita per year. The estimated per capita annual cost is $0.78 for preventive and $0.71 for curative interventions and varies by province, from a low of $1.09 in Faryab to a high of $2.44 in Takhar. A little over half of this total investment (52%) would be allocated to preventive interventions, with the remainder allocated to curative interventions to treat acute malnutrition.

Scaling up the BPHS nutrition package from baseline to government-set target coverage levels across Afghanistan over five years is projected to avert a loss of over 639,530 disability-adjusted life years (DALYs) and to prevent 24,083 child deaths and 4,296 cases of stunting among children under five (Table ES.2). In addition, the scale-up would also avert 87,227 case-years of anemia in women and add 96,614 children who are exclusively breastfed.[2]

If target program coverage levels were more ambitious and set at full (90%) coverage, the costs to scale up all interventions would increase by about 20% percent to $261 million. The benefits of the scale up to full coverage levels are enormous—almost triple the number of DALYs averted, double the number of deaths averted **and avert almost eight times as many cases of stunting (**Box ES.1). These additional benefits are almost entirely a result of the additional scale-up of the preventive interventions.

When considering cost-effectiveness, both scale up scenario are very cost-effective according WHO-CHOICE criteria (WHO 2014) but scaling up to full coverage levels would be almost twice as cost effective (cost per DALY averted is $112 for scenario 1 and $69 for scenario 2) while only costing about 20% more. (If only preventive interventions were scaled up, this would require less than $5 million more per year.) This is because scaling up preventive interventions is generally more cost effective than scaling up curative interventions.

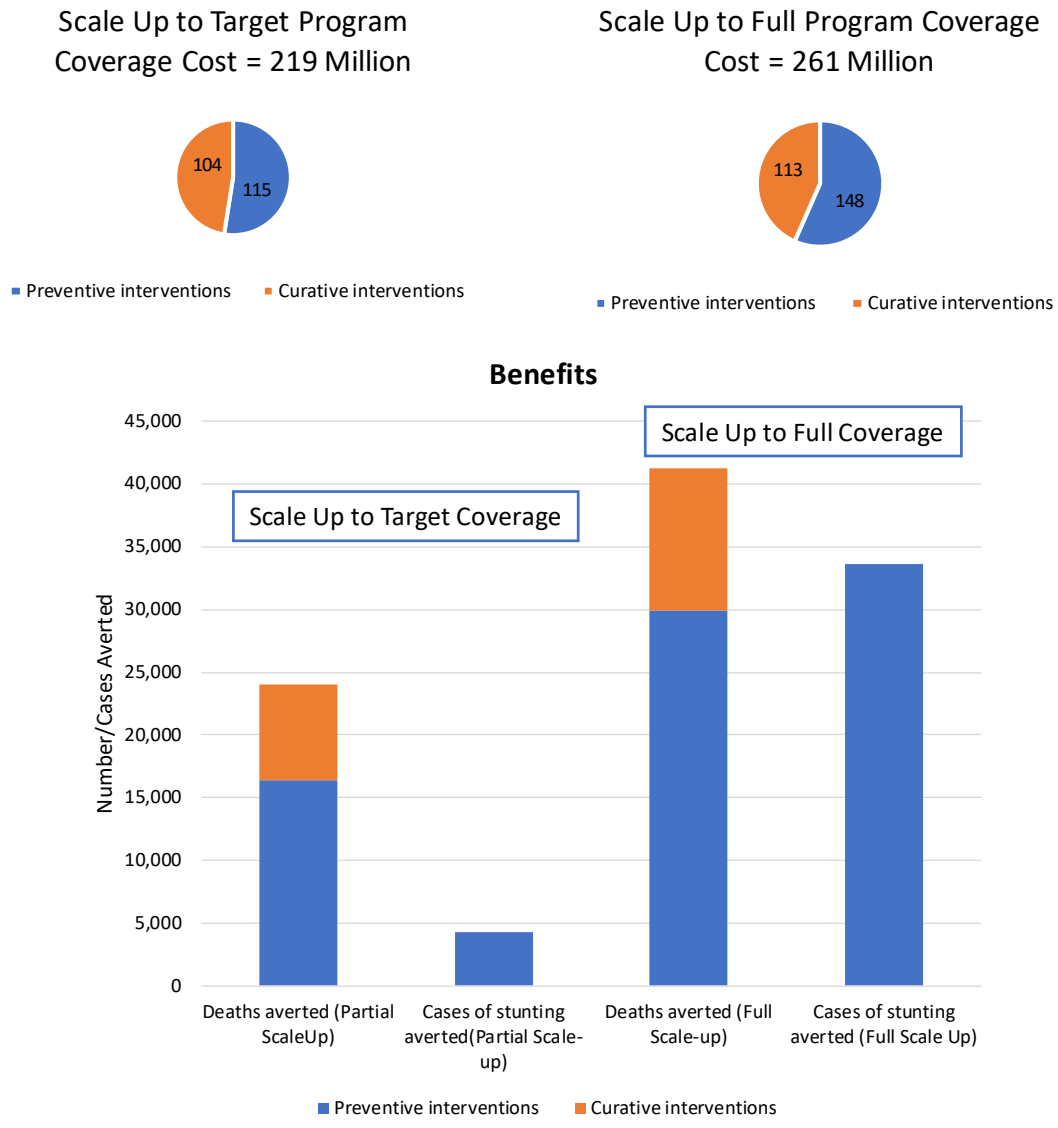
Table ES 2: BPHS Nutrition Package Scaled Up Over 5 years to Target Program Coverage Levels (Scenario 1) and Scaled Up to Full Program Coverage (Scenario 2), US$

Scale Up Scenario	Per capita cost	Total cost (millions)	DALYs averted	Cost per DALY averted	Cost per case of stunting averted
Scenario 1: BPHS scaled up to target* program coverage levels					
a. All interventions	1.49	219	639,530	112	16,611
b. Preventive interventions	0.78	115	455,428	70	7,462
c. Curative interventions	0.71	104	184,101	213	n.a.
Scenario 2: BPHS scaled up to full program coverage					
d. All interventions	1.78	261	1,733,513	69	3,534
e. Preventive interventions	1.01	148	1,465,452	46	2,007
f. Curative interventions	0.77	113	268,061	192	n.a.

*The MOPH set targets for program coverage expansion for each of the 12 interventions, many of which fall short of full program coverage. These targets are shown in Figure 7 of the full report.

[2] *Anemia in women* refers to all women of reproductive age, including non-pregnant women 15-49 years and all pregnant women.

Box ES.1.Total Costs and Selected Benefits of Two BPHS Scale-Up Scenarios



Prioritization and Cost-Effectiveness by Intervention and Geographic Region

If not all interventions can be scaled up in all provinces of Afghanistan in the five years considered in this analysis, results from the cost-effectiveness analysis can guide policy makers in selecting interventions or provinces to prioritize in the scale-up.

The previous section has already shown that preventive interventions are estimated to be more cost-effective than curative interventions. The most cost-effective intervention in terms of DALYs averted is **the support and promotion of exclusive breastfeeding ($23 per DALY averted), followed by complementary feeding education ($31 per DALY averted), the control and prevention of diarrheal and parasitic diseases ($57 per DALY averted), and vitamin A supplementation for children ($95 per DALY averted).**

The cost per DALY averted by province ranges from $76 per DALY averted in Faryab to $193 in Takhar. If it is not possible to scale up all interventions everywhere, geographic targeting in the short and medium term could lead to increased efficiency of investments. In terms of DALYs averted, **the most cost-effective provinces for scaling up the BPHS nutrition package are Faryab, Farah, Bamyan, Herat, Balkh, Daykundi, Ghor, Kabul, and Jawzan.** The cost per DALY averted in each of these nine provinces is below $93—very cost-effective, based on the WHO-CHOICE criteria. These provinces roughly correspond to the Northern and Northeastern regions, which have some of the highest rates of poverty and prevalence of severe acute malnutrition and moderate acute malnutrition in children in the country.

Economic Benefits

The economic benefits of investing in scaling up nutrition-specific interventions in the BPHS nutrition package are enormous. The investment in scaling up to target program coverage levels (scenario 1) is projected to generate economic benefits of $815 million over the productive lives of the beneficiaries and scaling up to full program coverage is expected to generate $1.18 million. Each dollar invested in scenario 1 would yield at least $13 in economic returns ($11 for scenario 2). Even under conservative assumptions regarding future economic growth, the economic benefits exceed the cost by six times.

Limitations

The analyses presented here have several important limitations. The unit costs used for the analyses (from the MOPH, the Aga Kahn Development Network (AKDN), and Care of Afghan Families) may not be representative of costs across the entire country. To address this uncertainty, the sensitivity analysis includes high and low total cost estimates from the range of available unit costs. In addition, the estimated program delivery costs —which are equivalent to 33 percent of the total BPHS package costs—are extrapolated from one source to all provinces, and may not accurately reflect the on-the-ground realities in all provinces. The analysis assumes a constant relationship between costs and program coverage rates—in other words, it assumes that reaching the last beneficiary costs the same as the reaching the first ones. Although this may not reflect reality, not enough information is available to determine whether marginal costs increase or decrease as program coverage expands. The impact modeling relies on accepted global evidence for intervention effectiveness (LiST visualizer, 2018), although it is unclear whether these effectiveness rates reflect the realities in fragile and conflict-affected countries such as Afghanistan. Finally, these analyses focus only on nutrition-specific interventions whose impact

has been demonstrated. Although there is emerging evidence of the impact of nutrition-sensitive interventions on stunting reduction, it is too weak to estimate costs and impacts.

CONCLUSIONS

Implementing the BPHS nutrition interventions as planned by the Afghan MOPH is estimated to cost $219 million from 2016 through 2020, which is equivalent to $10.69 per child under the age of five per year (or $1.49 per capita per year). This is a modest investment to kick-start the investments in the early years to build human capital in Afghanistan. Scaling up the package from current coverage levels to reach the government-set coverage targets by 2020 would generate substantial benefits. It would prevent 24,083 child deaths, 4,296 cases of stunting, and 87,227 case-years of anemia in women, and would avert 639,530 DALYs. The estimated cost per DALY averted of $112 suggests that this package would be very cost-effective based on the WHO-CHOICE criteria. In addition, this investment is projected to generate economic benefits of $815 million over the productive lives of the beneficiaries. Each dollar invested would yield more than $13 in economic returns. This estimated total cost of scaling up the BPHS nutrition package is consistent with other estimates of nutrition costs in Afghanistan.

Although the BPHS nutrition package is very cost-effective, it is not likely to substantially reduce the prevalence of stunting in children. The scale-up of this set of interventions to the program coverage levels set by the MOPH would achieve only a very modest decrease—of less than one-half of a percentage point over five years—in the national stunting prevalence in Afghanistan. This is largely because of the relatively low coverage targets set for some of the key interventions aimed at stunting reduction (e.g., complementary feeding education).

A substantially greater impact could be achieved if all the prevention interventions included in the BPHS package could be scaled to full program coverage levels, rather than the targets currently set by the government. Such scale up would cost about $5 million per year in addition to the cost of scaling up the BPHS package to the target level set currently. This more ambitious program expansion would result in almost triple the number of DALYs averted, double the number of deaths averted and avert almost eight times as many cases of stunting. This increase in the number of cases of stunting averted would result in a 2.6 percentage point decline in stunting (from 41% to 38%). The prevalence of anemia in pregnant women could be reduced by 12 percentage points and the prevalence of exclusive breastfeeding could be increased by 18 percentage points. This investment is projected to generate economic benefits of $1.18 billion over the productive lives of the beneficiaries. If a full scale up of all preventive interventions is not initially possible, it will be important to increase program coverage of the most cost-effective interventions first, starting with the support and promotion of exclusive breastfeeding, complementary feeding education, the control and prevention of diarrheal and parasitic diseases, and vitamin A supplementation for children.

This analysis demonstrates that the BPHS nutrition package is a very cost-effective approach for reducing maternal and child malnutrition and saving lives in Afghanistan. This strategy would also contribute to the economic development of Afghanistan by increasing productivity in women in the labor force and ensuring higher cognitive development of children, leading to higher intelligence, human capital accumulation, and higher earnings in adulthood. To maximize the impact of the BPHS package, the expansion of prevention interventions (in particular the support and promotion of breastfeeding and complementary feeding education) should be prioritized in the scale-up. These recommendations are consistent with government plans to expand community-based delivery of infant and young child nutrition and maternal nutrition packages and a stated focus on making key investments in the early years of life, which have the potential to

break the cycle of poverty, address inequality, and boost the productivity of the next generation of Afghanis.

PART I – BACKGROUND

OBJECTIVES AND STUDY RATIONALE

The overall objective of this report is to provide policy support to the Government of Afghanistan for reducing malnutrition. This analysis will be used to inform planning and decision making related to the implementation of the next edition of the Basic Package of Health Services (BPHS) from 2016 through 2020. It is also intended to help the government to formulate an investment case to support the mobilization and allocation of resources necessary for improving nutrition in Afghanistan. Within this context, the objectives of this analysis are as follows:

- To estimate the total and incremental costs and impacts of the current BPHS nutrition package, which consists of 12 nutrition-specific interventions delivered through the public sector (either by government programs and facilities or those run by NGOs).
- To inform prioritization of interventions and geographic areas by examine relative costs, benefits and cost-effectiveness by (i) individual intervention, (ii) categories of interventions (preventive and curative) and (iii) province of Afghanistan.
- To estimate the overall return on investment of scaling up the BPHS nutrition package of interventions.

The analytical framework is based on *An Investment Framework for Nutrition* (Shekar et al. 2017), which presented global costs, impacts, and returns on investment from achieving the World Health Assembly global nutrition targets. The *Investment Framework* reported global financing needs of $70 billion over the next 10 years to reach the targets for stunting, anemia, and breastfeeding, and to mitigate the impacts of wasting. In all, this would prevent 3.7 million child deaths, avert 65 million cases of stunting in children under five, and avert 265 million cases of anemia in women in 2025.[3] Furthermore, this investment is estimated to generate large economic benefits and a positive return on investment from each of the intervention packages necessary to reach the global nutrition targets, ranging from $4 to $35 for every dollar invested. These global estimates, however, did not capture the nuances and context in each country, and did not contextualize the estimates to every individual country's policy and capacity setting or its fiscal constraints. This report extends the previous analytic work by placing it within the context of Afghanistan.

Although reducing malnutrition will probably require both nutrition-specific and nutrition-sensitive interventions that can be delivered through other sectors, because of the focus on health sector, this report emphasizes the nutrition-specific interventions for the next phase of the roll out of the BPHS planned for 2016–20. This report consists of five parts. Part I presents background context and an overview of nutritional status of the population of Afghanistan, with a focus on pregnant women and children under age five. Part II describes the methodology used; Part III presents an analysis of the costs, impacts, and cost-effectiveness of the BPHS nutrition package. Part IV estimates the costs and impacts of scaling up the BPHS nutrition package of interventions to full program coverage levels and compares them to the more modest program coverage targets (set

[3] *Anemia in women* refers to all women of reproductive age, including non-pregnant women 15-49 years and all pregnant women.

by the MOPH) reported in in Part III. Part V of the report summarizes the main implications, limitations, and conclusions of the analyses.

COUNTRY CONTEXT

Afghanistan is faced with a difficult social, economic, and political situation after three decades of conflict, civil unrest, and recurring natural disasters. In 2016, Afghanistan ranked 171 out of 188 countries in the United Nations' Human Development Index (HDI), even lower than many other fragile, low-income countries and lower than other countries in the South Asia region. Furthermore, Afghanistan ranks last of all countries assessed through the United Nations Development Programme's (UNDP) Gender Development Index, a composite measure of gender gaps in human development outcomes (UNDP 2016).

Per capita gross domestic product (GDP) was estimated at $630 in 2015 (World Bank 2016a). Economic growth in terms of GPD per capita over the past decade varied form 17.9% in 2009 to -1.6% in 2015, with negative growth rated reported from 2014 through 2016. The World Bank forecasts that the overall economy (total GDP) will grow by only 0.8 percent in 2016 and by 3.6 percent in 2019 (World Bank 2016a).

Roughly 70 percent of the country's 34.7 million inhabitants live in rural areas (World Bank 2016a). The population growth rate is 3 percent, and almost half of the population is under the age of 15. Thirty-six percent live below the national poverty line (World Bank 2016a). National poverty rates mask differences between urban and rural areas and among different provinces. The proportion of urban households living in poverty is 29 percent, compared with 38 percent of rural residents and 54 percent of pastoral nomads (IRA CSO 2014). The poverty rate exceeds 60 percent in seven provinces, all located in the northeast part of Afghanistan (Figure 1).

Agriculture has been one of the largest contributors to economic growth in Afghanistan, but the sector is highly vulnerable to climate variability and this partly accounts for the volatility in growth. At the same time, the many years of war, fueled by the Taliban insurgency, have weakened state institutions and led to the internal displacement of over 1 million people.

Afghanistan spends a relatively large share—8.2 percent—of its GDP on health. This is comparable to health spending in Pakistan but far exceeds spending in other countries in South Asia (2.8 percent in Bangladesh, 3.5 percent in Sri Lanka, 4.7 percent in India, and 5.8 percent in Nepal) (World Bank 2016a). Total health expenditure equals approximately $55 per capita per year; government expenditure accounts for about 4 to 6 percent of this amount, 20 to 25 percent is provided by the development partners, and the remaining 70 percent is out of pocket for individuals and households (IRA MOPH 2012; WHO 2016; World Bank 2016a). Recent System of Health Accounts (SHA) data show that in 2014, Afghanistan spent about US$ 97 million or about US$ 2 dollars per capita on nutritional disorders. This included only about US$ 820,000 (2 cents per capita) from the public budget. The remainder came from overseas assistance (US$ 56 million; about US$ 1.62 per capita) and from out of pocket expenditure (US$ 39.9 million or about US 1.15 per capita)

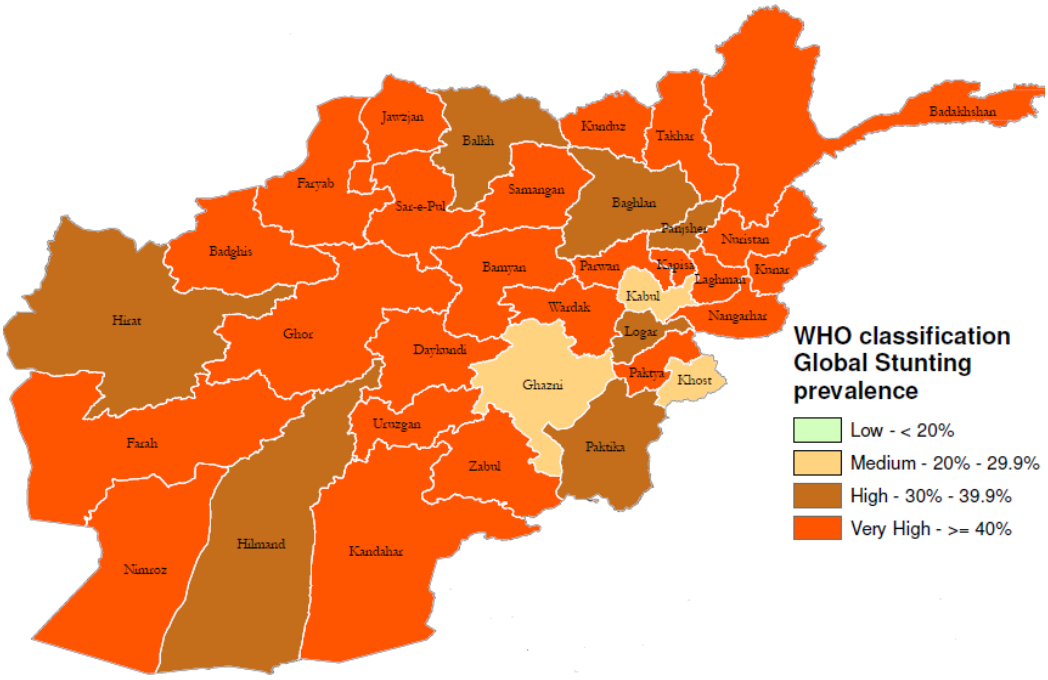
Together, the BPHS and the Essential Package of Hospital Services constitute the minimum package of health services provided to the population. However, health services are severely lacking in security-compromised areas—approximately 30 percent of the country. Since 2003, the

Ministry of Public Health (MOPH) has implemented several contracting rounds of the BPHS, which includes a wide range of public health interventions and nutrition interventions. The package implementation is contracted by the MOPH to local and international nongovernmental organizations (NGOs) in the majority of provinces. Since 2013, the World Bank has financed the Systems Enhancement for Health Action in Transition (SEHAT) project to sustain and improve implementation of the BPHS and the Essential Package of Hospital Services. The World Bank and Government of Afghanistan are working on designing a new project for 2018–21.

Figure 1. Poverty Rates in Afghanistan, by Province

Source: OCHA 2012.

Figure 2. Prevalence of Stunting, by Province



Source: NNS 2013.

HEALTH AND NUTRITION STATUS

Despite recent progress, the people of Afghanistan are challenged by a high prevalence of malnutrition; noncommunicable diseases such as cardiovascular disease, cancer, and diabetes; and communicable diseases such as tuberculosis and malaria.

The infant mortality rate decreased from 83.6 live births in 2003 to 53.2 in 2016 and the under-five mortality rate decreased from 118.3 to 70.4 deaths per 1,000 live births (World Bank 2017). Basic vaccination coverage for children 12–23 months is approximately 40 percent, but varies widely between provinces (ADHS 2015). The prevalence of symptoms of acute respiratory illness and diarrhea in children is high; these are major contributors to child mortality (ADHS 2015). Only slightly more than half of children who experience acute respiratory illness or diarrhea are taken to see a health provider.

The maternal mortality rate for women has declined from 1,600 deaths per 100,000 live births in 2002 to 1,291 deaths per 100,000 live births in 2015, although Afghanistan still ranks high in maternal mortality compared with other countries in the region (World Bank 2017). Limited access to health facilities, coupled with high fertility rates, implies high risks for maternal mortality during pregnancy, labor, and postnatal recovery (MICS 2003; IRA CSO 2014). Nearly 4 out of 10 pregnant women in the last five years did not have access to antenatal care from a skilled provider. Overall, Afghanistan ranks among the 30 bottom-ranked countries for the health and well-being of mothers and children (Save the Children 2015).

Box 1. The Importance of Investing in Nutrition

Every year, malnutrition claims the lives of 3 million children under age five and costs the global economy billions of dollars in lost productivity and health care costs. Yet these losses are almost entirely preventable. A large body of scientific evidence shows that investments in early childhood nutrition programs has the potential to save lives, help millions of children develop fully and thrive, and deliver greater economic prosperity.

SCHOOLING: Early nutrition programs can increase school completion by one year

EARNINGS: Early nutrition programs can raise adult wages by 5-50%

POVERTY: Children who escape stunting are 33% more likely to escape poverty as adults

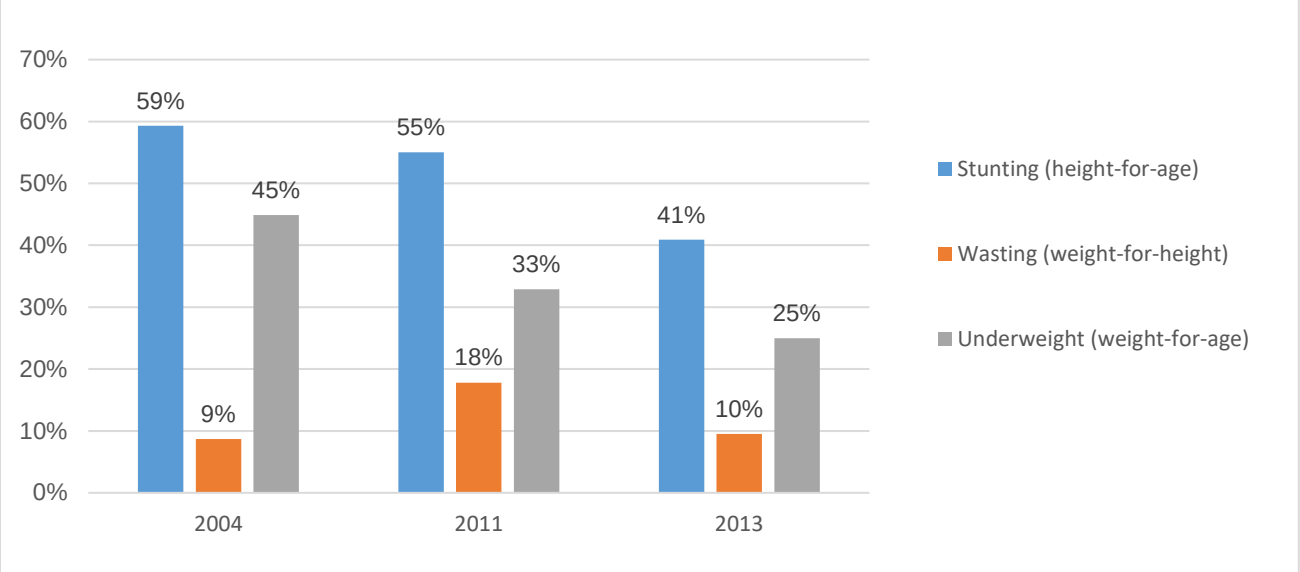
ECONOMY: Reductions in stunting can increase GDP by 4-11% in Asia & Africa

Because the detrimental effects of malnutrition that occur in the 1,000 day window from a woman's pregnancy to her child's second birthday are essentially irreversible, it is critical to focus nutrition interventions on pregnant mothers and children under two (Black et al. 2008, 2013; World Bank 2006). The rates of return from nutrition investments are highest for programs targeting the earliest years of life (Heckman and Masterov 2004).

Sources: Shekar et al. 2017, with data from Martorell et al. 2010 for schooling; Hoddinott et al. 2011 for earnings; Hoddinott et al. 2008 for poverty; and Horton and Steckel 2013 for economy.

Levels of malnutrition in Afghanistan—as measured by the prevalence of stunting and underweight—have decreased over time but remain unacceptably high (Figure 3). In 2013, 41 percent of children under five suffered from chronic undernutrition (stunting or low height-for-age), 10 percent were acutely malnourished (wasted or low weight-for-height), and 25 percent were underweight (low weight-for-age) (NNS 2013). The prevalence of stunting (2 or more standard deviations below the median height-for-age of the reference population) and underweight (2 or more standard deviations below median weight-for-age of reference population) declined from 59 percent in 2004 to 41 percent in 2013, but commensurate progress has not been consistently observed for wasting (2 or more standard deviations below median weight-for-height of reference population) (Figure 3).

Figure 3. Trends in Prevalence of Undernutrition among Children under Age Five, 2004–13



Sources: 2004 data are from the National Nutrition Survey 2004 (NNS 2004); 2011 data are from the 2010–2011 MICS Survey; and 2013 data are from the National Nutrition Survey 2013 (NNS 2013).
Note: Stunting, wasting, and underweight are calculated as more than 2 standard deviations below the median values for height-for age, weight-for-height, and weight-for-age, respectively.

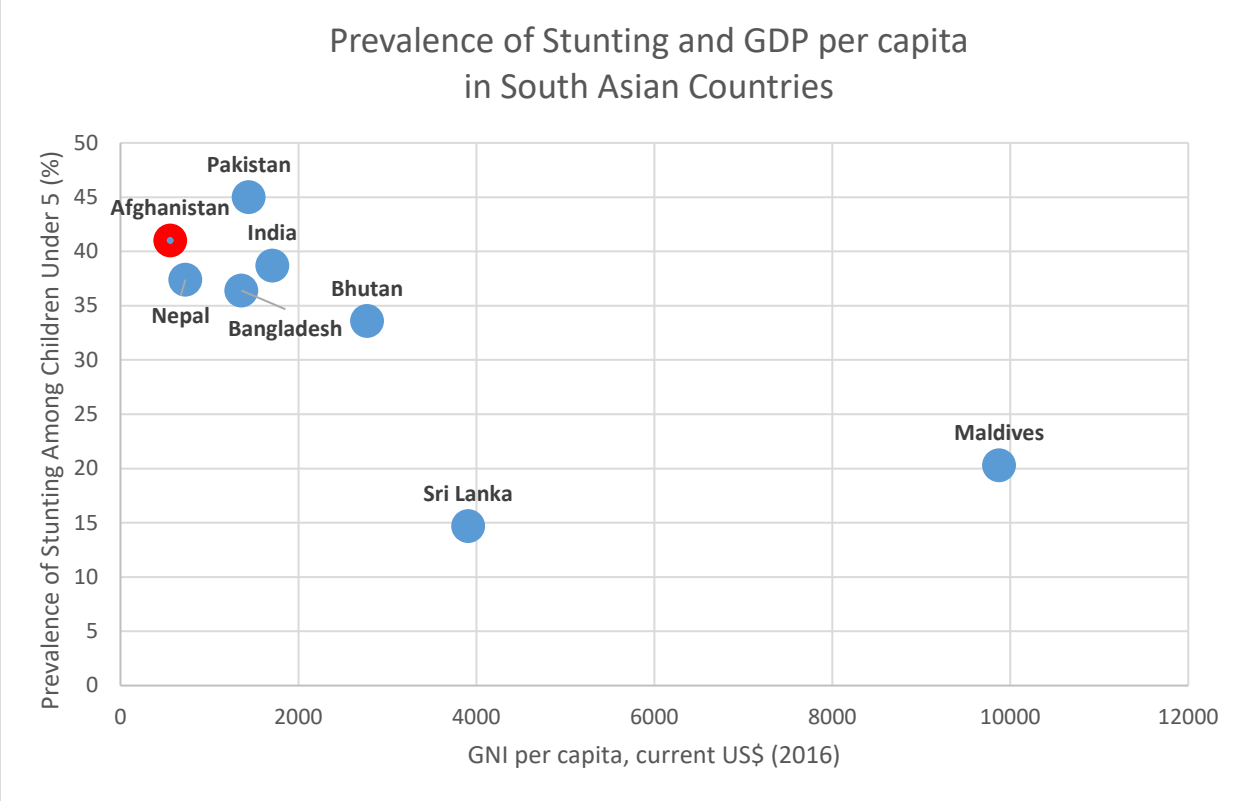
Stunting is a key measure of chronic nutritional deficiencies in children. Not only does it constitute a failure to achieve a child's genetic potential for height, but it is also a predictor of many other developmental constraints, including cognitive deficits and loss of future economic productivity. Preventing stunting can therefore boost long-term human capital development and economic productivity (see Box 1).

Afghanistan's national stunting prevalence of 41 percent is considered "very high" by the World Health Organization (WHO) classification (NNS 2013). The prevalence is greater than 30 percent across most provinces (Figure 2). The exceptions are Kabul, Ghazni, and Khost in the Central and Southeastern regions, which have a prevalence of 29.8 percent, 28.9 percent, and 24.3 percent respectively. Stunting prevalence was slightly higher among boys than among girls (42.3% and 39.4%, respectively).The stunting prevalence remains high across wealth quintiles, but the poorest were more likely to be stunted (49.4 percent), with stunting prevalence of 48.5

percent in the second poorest quintile, 44.7 percent in the middle quintile, 39.1 percent in the fourth quintile, and 31.1 percent in the richest quintile (NNS 2013). Poverty is probably a major factor in child malnutrition in Afghanistan, although other factors—such as the burden of disease, lack of access to adequate sanitation, insufficient food diversity, and less than optimal feeding and caregiving practices—also contribute to stunting and malnutrition (Smith and Haddad 2015).

The prevalence of stunting in Afghanistan is above the regional average for South Asia. As illustrated in Figure 4, Afghanistan has the second-highest prevalence of stunting in the region (second only to Pakistan). The prevalence of childhood stunting in Afghanistan is comparable to that of several countries with similar income levels (Figure 5). Nevertheless, some countries with lower per capita incomes, such as Guinea and Haiti, exhibit significantly lower rates of stunting. This demonstrates the potential to achieve better nutrition outcomes despite a low per capita income.

Figure 4. Prevalence of Stunting and GDP per Capita: Afghanistan and South Asia

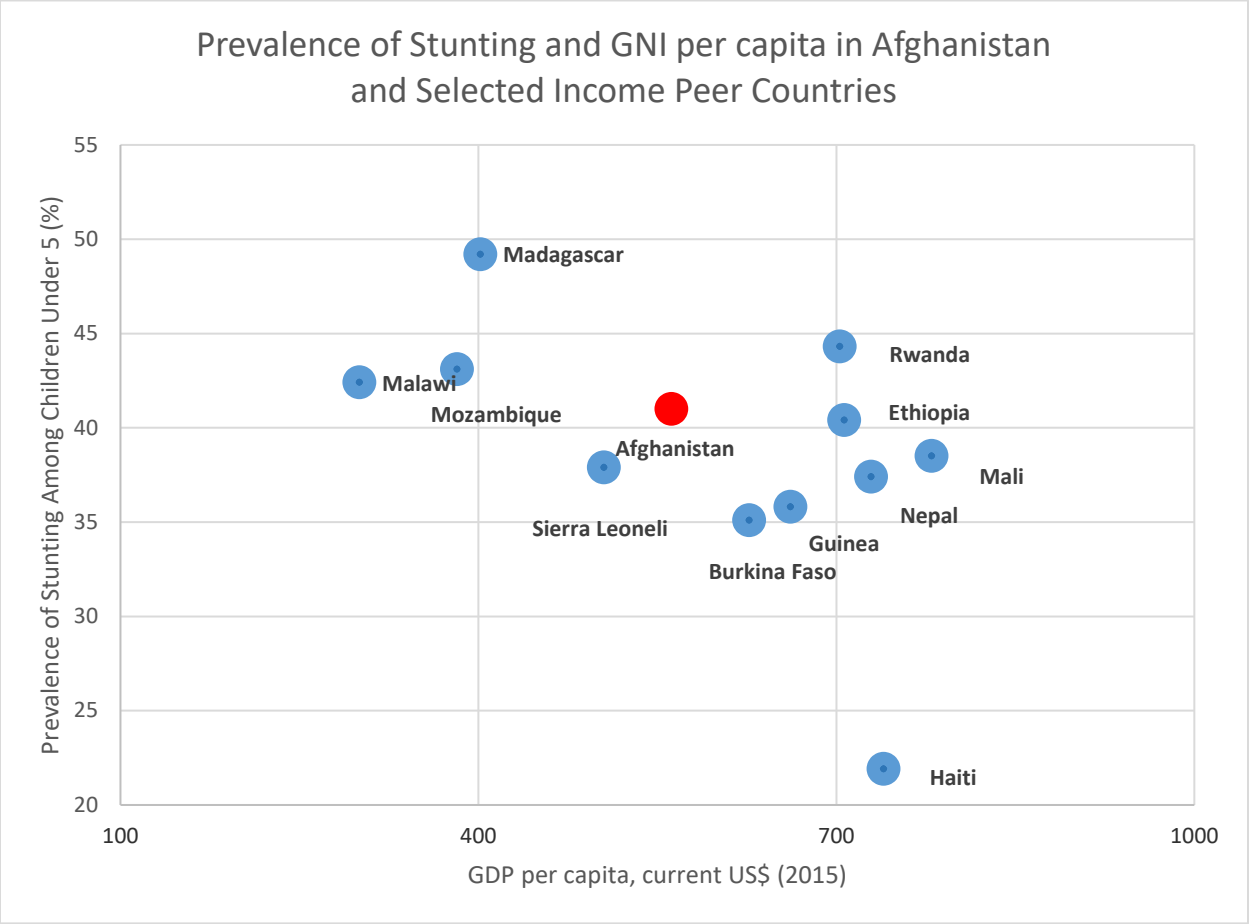


Sources: UNICEF, WHO, and World Bank 2016; World Bank 2016a.

Infant and young child feeding practices in Afghanistan are suboptimal, despite strong evidence of the benefits of early and exclusive breastfeeding on survival, growth, and development (Figure 6). In 2015, only 43 percent of all mothers of infants under six months of age reported practicing exclusive breastfeeding in Afghanistan (ADHS 2015). This represents a 15 percentage point decline from the exclusive breastfeeding estimate of the National Nutrition Survey in 2013 (NNS

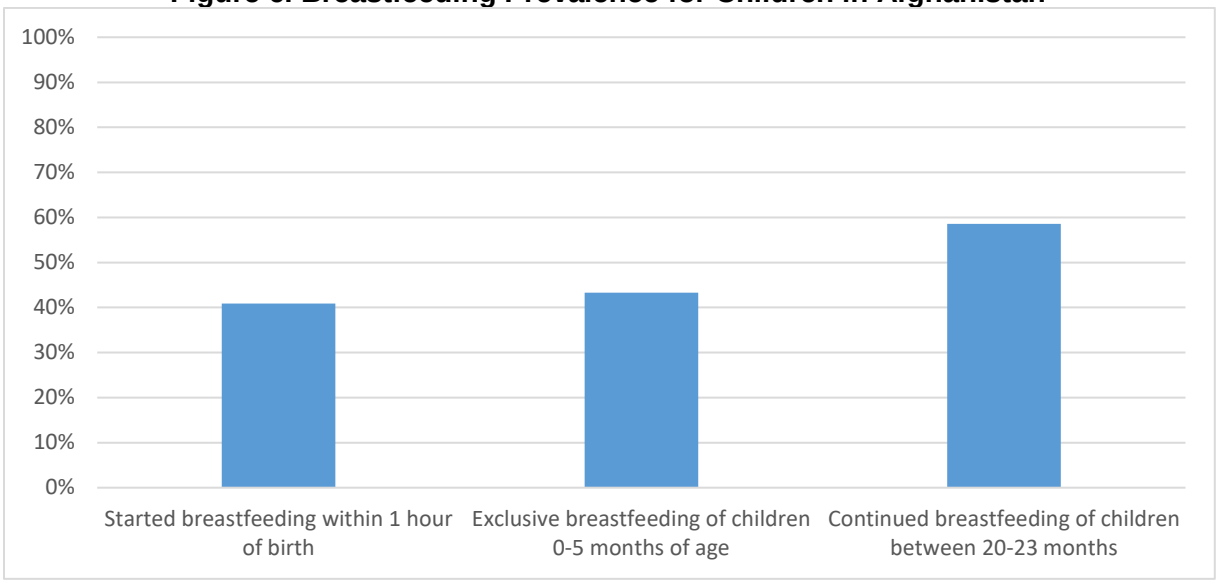
2013), and further investigation is needed to understand the causes of the rapid decline in breastfeeding. Furthermore, only 33 percent of mothers continue to breastfeed exclusively until their children are four to five months of age, which falls short of the WHO/UNICEF guideline of exclusive breastfeeding until six months. Regional variations in breastfeeding practices are evident. The median duration of any breastfeeding ranges from a low of 17.1 months in the province of Panjsher to a high of 24.6 months in the province of Ghor. The Afghanistan DHS report does not disaggregate breastfeeding data by sex. Therefore, it is not possible to assess whethe breastfeeding rates were different for boys and girls. However, in the 2013 National Nutrition Survey did not vary substantially by sext with 56.9% of boys and 60.2% of girls exclusively breastfed.

Figure 5. Prevalence of Stunting and GDP per Capita: Afghanistan and Peer Income Countries



Sources: UNICEF, WHO, and World Bank 2016; World Bank 2016a.

Figure 6. Breastfeeding Prevalence for Children in Afghanistan



Source: ADHS 2015.

Complementary feeding practices in Afghanistan are suboptimal as well, with only 16 percent of children aged 6–23 months consuming a minimum acceptable diet—that is, a minimum meal frequency (a proxy for energy intake) with minimum dietary diversity (foods from at least four food groups) in addition to continued breastfeeding or alternative milk feeds (NNS 2013). According to the National Nutrition Survey, slightly more girls (18.0%) than boys (14.5%) consume minimum acceptable diet. Ten percent of children in the poorest households and 25 percent of children in the wealthiest households receive a minimum acceptable diet (NNS 2013), which suggests severe disparities in dietary intake across households' income levels.

Micronutrient deficiencies, a form of malnutrition that relates to a deficiency in essential vitamins and minerals needed for body functions and is sometimes referred to as *hidden hunger,* are pervasive in Afghanistan and increase the population's vulnerability to preventable illness and death. Collectively, micronutrient deficiencies add up to an estimated loss of over $235 million in GDP in Afghanistan every year (World Bank 2010). The most recent National Nutrition Survey shows that anemia among children under age five (45 percent) and women of reproductive age (40 percent) is a severe public health concern (NNS 2013). The WHO estimates that approximately half of all cases of anemia are caused by inadequate dietary intake of iron, although the cause can vary greatly by setting. Other potential causes include other "micronutrient deficiencies (e.g., folate, riboflavin, vitamins A and B12), or acute and chronic infections [and illnesses] (e.g., malaria, cancer, tuberculosis, and HIV) and inherited or acquired disorders that affect haemoglobin synthesis, red blood cell production or red blood cell survival" (WHO 2015, p. 1). Anemia resulting from iron deficiency adversely affects child development and birth outcomes as well as increasing the risk of perinatal and maternal mortality (WHO 2015). Because of the high rates of child and maternal mortality in Afghanistan, addressing anemia deficiency can have a significant impact on health outcomes. Micronutrient deficiencies are further compounded since fewer than one in five households use adequately iodized salt, leaving many unprotected from iodine deficiency disorders (MICS 2010–2011).

Afghanistan has made great strides in reducing vitamin A deficiency in children since 2000. Severe and prolonged vitamin A deficiency increases the risk of child mortality, increases vulnerability to infectious diseases such as measles, and leads to blindness among children under five. The most recently available estimates show that nearly all children under age five (95 percent) receive two high-dose vitamin A supplements (UNICEF 2016b). Current coverage rates are a strong improvement from 1995–2005, when nearly 46 percent of preschool-age children and 23 percent of pregnant women in Afghanistan were deficient in vitamin A (NNS 2013). It is likely that this high coverage has contributed substantially to the declines in child mortality.

DETERMINANTS OF MALNUTRITION

The National Nutrition Survey ascertained that the key determinants of undernutrition in women and children in Afghanistan are likely to be lack of awareness of optimal feeding practices for infants and young children, lack of affordability and availability of diverse food items, low socioeconomic status, and other cultural determinants (NNS 2013).

Lack of knowledge about optimal infant and young child feeding practices is common globally. In Afghanistan, it is usual for mothers to believe, for example, that breastmilk does not provide sufficient nutrition for newborns, and few women have a strong grasp of the recommendations of quantity and quality of foods needed by either children or adults (NNS 2013).

The Afghan diet is cereal based, and many families struggle to ensure that meals contain an adequate and frequent balance of high-quality, nutrient-rich foods (WFP 2013). Afghanistan experienced a sharp surge in the price of wheat flour and related foods a decade ago. Between July 2007 and July 2008, the cost of wheat flour surged by 325 percent—from 14.30 to 43.75 Afghanis per kilogram (FAO 2017). Although wheat flour, wheat, and bread prices have stabilized, this surge may have had lasting effects. Food security is further affected by both recurring drought and flooding in surplus-producing regions of the country and limited storage and processing capacity (MDG AF 2013). The latest National Risk and Vulnerability Assessment found that the proportion of the population experiencing very severe to moderate food insecurity increased from 28.2 percent in 2008 to 30.1 percent in 2012. In relative terms, urban households are more food insecure (34.4 percent) than households in rural areas (29.1 percent) or pastoral nomadic populations (25.6 percent) (IRA CSO 2014). In addition, food insecurity was found to increase with household size and to follow seasonal trends, with the incidence of acute malnutrition peaking during the agricultural lean season (MDG AF 2013).

High levels of household poverty translate into food insecurity and poor childhood nutrition in Afghanistan. Populations residing in the Northeastern regions experience the highest levels of food insecurity nationwide as well as the highest rates of poverty. The World Food Programme (WFP) estimated that hunger in Afghanistan incurs an economic loss of about 10.5 percent of the national GDP and about $2.1 billion per year (WFP 2013).

Efforts to Address Malnutrition

The MOPH aims to reduce morbidity and mortality from preventable causes for all Afghans; it emphasizes improving health outcomes for children, women, and vulnerable populations. Combating acute and chronic malnutrition through multisectoral action, improved monitoring, and increased resource allocation is highlighted as a priority in the National Nutrition Strategy (2015). Specifically, the ministry aims to address inadequate infant and young child feeding practices and to prevent and control micronutrient deficiencies among adolescent girls as a means to reduce the intergenerational impact of undernutrition (IRA MOPH 2015a).

The UN Joint Programme (UNJP), under the Millennium Development Goals Achievement Fund, has similarly prioritized efforts to reduce chronic malnutrition and food insecurity in Afghanistan. The UNJP, along with government partners, aims to strengthen integrated interventions related to nutrition and agriculture. These efforts are reflected in the objectives and targets within the National Health and Nutrition Policy (2012–20), the Nutrition Action Framework (NAF), and the Afghanistan Food Security and Nutrition Agenda (AFSANA), among other institutional frameworks. This effort is supported by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Children's Fund (UNICEF), the United Nations Industrial

Development Organization (UNIDO), the WFP, and the WHO, and is implemented at national and subnational levels under Afghan leadership (MDG AF 2013).

Through this partnership, the UNJP, government representatives, and community organizations have established a coordination mechanism to identify, track, and respond to province-specific nutrition and food security concerns. Particular attention has been given to increasing nutrition education, diet diversification, and the capacity of health service providers to counsel on breastfeeding and complementary feeding (MDG AF 2013).

In 2013, the World Bank financed efforts to strengthen and expand health sector delivery, and the BPHS in particular, through the 2013 the Afghanistan System Enhancement for Health Action in Transition Project (SEHAT), which also included a multi-donor grant. Currently planning for the the Health Sector Support Program (Sehatmandi) is underway. It proposes to have an enhanced focus on nutrition by supporting the operationalization of the nutrition interventions under the BPHS package, through the Community Based Nutrition Program and health facilities. The program will also closely collaborate with community programs, such as the Women's Economic Empowerment Rural Development Project and Citizens' Charter Afghanistan Program, to integrate nutrition actions for enhanced early years/nutrition outcomes.

A number of food fortification initiatives have been established in Afghanistan to address widespread micronutrient deficiencies. The Global Alliance for Improved Nutrition (GAIN) has provided technical assistance to the Afghan National Standards Authority to establish standards for fortification and importation standards of food staples, including wheat flour, vegetable oil, and ghee. Similarly, GAIN has partnered with the MOPH to oversee the development of micronutrient powders for children age 6 to 24 months (GAIN 2016). However, the coverage of these interventions remains low.

PART II – METHODOLOGY

SCOPE OF THE ANALYSIS AND DESCRIPTION OF THE INTERVENTIONS

The analyses contained in this report focus on two potential scale-up scenarios:

1. **Scenario 1**: Scale up 12 nutrition-specific interventions in the BPHS package to target program coverage levels set by the government.

2. **Scenario 2:** Scale up 12 nutrition-specific interventions in the BPHS package to full program coverage levels of 90% coverage.

The 12 nutrition-specific interventions in Afghanistan's BPHS from 2010 to 2015 are delivered primarily through the health sector. Many of those interventions have been included in the 2008 and 2013 Maternal and Child Nutrition Lancet Series (Bhutta et al. 2008; Bhutta et al. 2013) and the global *Investment Framework for Nutrition* (Shekar et al. 2017). They are included in the 2016–2020 iteration of the BHPS, which is currently being rolled out.

The interventions, delivery platforms, and associated target populations are described in Table 1. This analysis does not address nutrition-sensitive interventions because of a lack of data and evidence of their direct impact on maternal and child nutrition, but their importance for the long-term sustainable development of the country is acknowledged.

Table 1. Nutrition-Specific Interventions Included in the Analyses

Interventions and their subcomponents	Description	Delivery platforms	Target populations	Expected area of impact
Preventative				
1. Promotion of good infant and young child nutrition and hygiene practices	Multi-visit package for infant and young child nutrition			Child and maternal mortality and morbidity; stunting
a) Support and promotion of exclusive breastfeeding	Behavior change communication focusing on promotion of exclusive breastfeeding	Home/Community-level and health system delivery	Pregnant women; mothers with infants <6 months[a]	
b) Complementary feeding education	Promotion of complementary feeding; promotion of safe water, hygiene, and sanitation; and growth promotion	Home/Community-level and health system delivery	Caregivers of children 6–23 months	Child and mortality and morbidity; stunting

Interventions and their subcomponents	Description	Delivery platforms	Target populations	Expected area of impact
c) Community food preparation demonstration	Community food preparation demonstration in Afghanistan for groups of up to 12 caregivers	Community-level delivery in groups of up to 12 mothers	Caregivers of children 6–59 months	Child and mortality and morbidity; stunting
2. Vitamin A supplementation	Provision of 100,000 international units (IU) of vitamin A for infants 6–11 months of age, and 200,000 IU of vitamin A every four to six months for children age 12–59 months	Semi-annual mass campaign	Children 6–59 months	Micronutrient deficiency; child and mortality and morbidity; stunting
3. Control and prevention of diarrheal diseases and parasitic infections				
a) Deworming in children	Twice-annual deworming in children	Mass campaign	Children 12–59 months	Child morbidity
b) Deworming in adolescent girls	Twice-annual deworming in girls	School-based delivery	Females 10–19 years	Adolescent morbidity
c) Zinc treatment and oral rehydration solution for diarrhea in children	Zinc (20 mg/day) provided together with oral rehydration solution for the treatment of severe diarrhea	Clinics and health centers	Children 6–59 months	Child morbidity and morality
4. Promotion of balanced micronutrient-rich foods	Home fortification of complementary foods with micronutrients powders. In-home fortification of complementary food is assumed to cover at least 50% of iron needs, hence a pack of 30 sachets is provided every other month	Community-level health posts	Children 6–23 months of age	Child and morbidity; micronutrient deficiency; anemia
5. Iron and folic acid supplementation for pregnant women	Iron and folic acid supplementation during pregnancy. This intervention is called “maternal nutrition” in BPHS documentation	Home/Community-level and health system delivery as part of antenatal and postnatal care	Pregnant women	Anemia

Interventions and their subcomponents	Description	Delivery platforms	Target populations	Expected area of impact
6. Promotion of iodized salt	Iodization of salt for the prevention of iodine deficiency at a level of 45–50 parts per million (or 90 mg potassium iodate (KIO3) fortificant per 1 kg of salt)	Marketplace	General population	Iodine deficiency; child cognitive development; morbidity
7. Growth monitoring	Consultation sessions with health workers to monitor growth	Home/Community-level and health system delivery as part of integrated management of childhood illnesses	Children 6–23 months	
8. Vitamin A supplementation for pregnant women	Daily or weekly supplementation to all pregnant women	Clinic and health centers via antenatal care	Pregnant women	Micronutrient deficiency
Curative				
9. Treatment of severe acute malnutrition (with and without complications)	Outpatient treatment for severely wasted children including supplementation with ready-to-use therapeutic foods and provision of maternal education	Outpatient in health facility or community-level for uncomplicated cases Complicated cases through clinics and health centers	Children 6–59 months suffering from severe acute malnutrition (WHZ<−3 SD)	Wasting
10. Management of moderate acute malnutrition	Provision of ready-to-use supplementary foods	Hospitals, clinics health centers, and community-level health posts	Children 6–59 months (WHZ<−2 and > −3 SD)	Wasting
11. Clinic-based nutrition surveillance	Height and weight measured in all children to monitor growth trends and children showing developmental delay are referred to physiotherapy services	Clinic and health centers	Children 0–59 months	n.a.
12. Screening for acute malnutrition and micronutrient deficiencies	Screening and referral of at-risk children using mid-upper-arm circumference or weight/height, or clinical signs of micronutrient deficiency diseases	Clinic and health centers	Children 0–59 months	Wasting

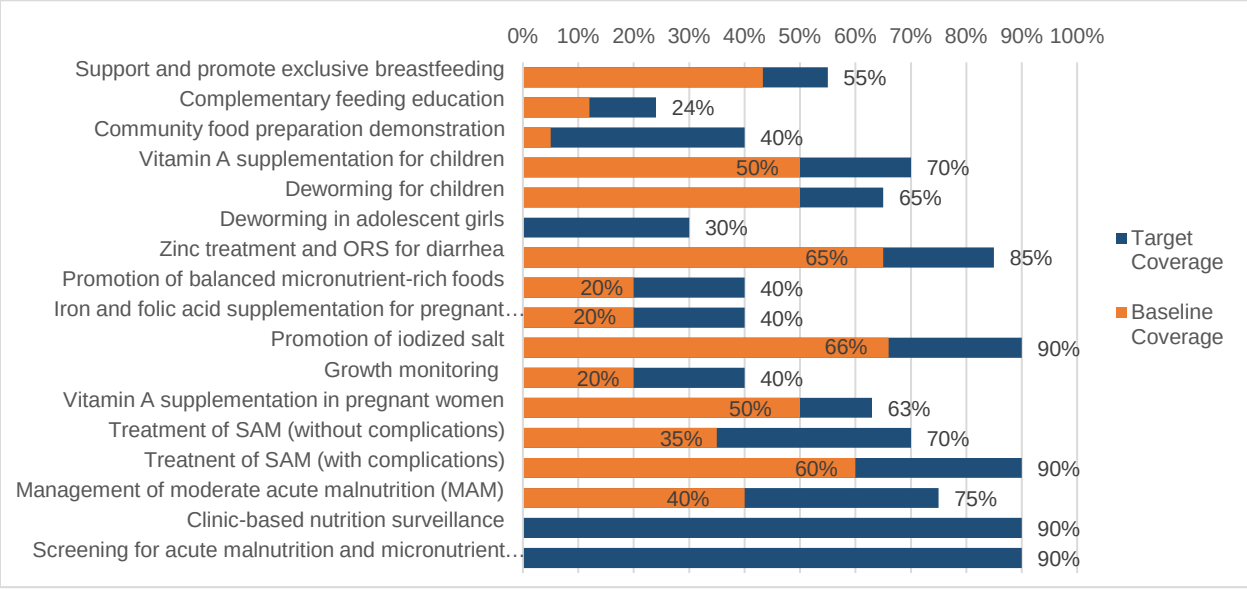
Note: n.a. = not applicable; WHZ = weight-for-height Z-score.
a Although the target population for this intervention includes pregnant women and mothers with infants (children < 6 months), the costs were estimated based on the number of pregnant women only, because the cost or providing breastfeeding counseling to mothers with infants were included under the complementary feeding education intervention.

ESTIMATION OF TARGET POPULATION SIZES AND COVERAGE LEVELS

Target population estimates are based on demographic data obtained from Afghanistan's Central Statistics Organization's (CSO) for the 2016–17 year (IRA CSO 2016). These data do not include a breakdown of population by age, so they are supplemented with age group population proportions from the Lives Saved Tool's DemProj module (LIST 2016). The prevalence of child stunting (height-for-age Z-score less than −2 standard deviations), underweight (weight-for-age Z-score less than −2 standard deviations), and severe wasting (weight-for-height Z-score less than −3 standard deviations) among children under five years of age in each province are from the 2013 National Nutrition Survey (NNS 2013). See Appendix 1 for population totals by province and Appendix 2 for the prevalence of stunting, wasting, and anemia by province.

Data on baseline and target program coverage levels for most interventions have been set by the MOPH and were provided by the ministry's Health Economics and Financing Department (HEFD) and Public Nutrition Directorate (PND). *Target program coverage* refers to the intervention coverage that the government is planning to achieve by the year 2020 and are used to estimate scenario 1 in the analysis. The target coverage levels vary by intervention from 3 percent for edible oil fortification to 90 percent for the promotion of iodized salt, treatment of severe acute malnutrition (with and without complications), clinic based surveillance, and screening. Figure 7 shows baseline and additional coverage needed to reach the target for each intervention (see Appendix 3 for more detail). For this analysis, a gradual, linear scale-up of program coverage from baseline in 2016 to reach the MOPH targets in 2020 is assumed.

Figure 7: Baseline Coverage of All Interventions and Target Coverage by 2020



Sources: ADHS 2015; MICS 2010–2001; NNS 2013; direct communication with MOPH.

ESTIMATION OF UNIT COSTS AND PROGRAM COSTS

The costing analysis employed an ingredients-based costing methodology by adding unit cost data for key subcomponents of each intervention, including human resource personnel, drugs and commodities, other equipment and materials, and transportation (if necessary). For this report, the "unit" is the cost of providing the intervention to one beneficiary for one year. Unit cost data were collected for this analysis in 2016 from three sources: the MOPH, the Aga Khan Development Network (AKDN), and Care of Afghan Families (CAF). This was a convenience sample in that the unit costs from the above sources were applied to all provinces of Afghanistan. Based on National Salary Policy, human resource personnel unit costs were adjusted on a province-by-province basis to reflect the varying level of provincial hardship allowances afforded by the MOPH and a 5 percent annual inflation for salaries (IRA MOPH 2015b).

Where data from the three sources mentioned above were not available, costs from other sources—such as similar costing studies from other countries (Shekar et al. 2014, 2015a, 2015b), the GAIN costing model for fortification (Ghauri et al. 2016), and a similar analysis conducted by Management Sciences for Health on the nutrition programs implemented by Save the Children in Afghanistan (Collins and Newbrander 2016)—were used.

For several interventions, there were differences in the unit cost collected from different sources. If multiple unit cost values were available, the highest unit cost was used. To account for the possibility that the unit cost data collected for BPHS Nutrition interventions may not be representative of costs in other regions and implementing agencies, the analysis uses the highest unit cost collected for each intervention. Sensitivity analyses using the lower unit cost were conducted to show the variability in costs compared to the higher value costs, which are reported in Appendix 4.

It was assumed that most interventions would be publicly financed through the BPHS. For salt iodization and wheat flour and oil fortification, however, the analysis follows the approach in the GAIN costing model for food fortification. In this model, 90 percent of the costs (incremental cost of purchasing fortified foods compared to the cost of purchasing unfortified foods) were assumed to be borne initially by the private sector and then ultimately passed on to consumers. Approximately 10 percent of the total costs for promotion, monitoring and evaluation, and policy development would be financed by the public sector and development partners (Ghauri et al. 2016; World Bank 2016b).

In addition, program costs—that is, the overhead costs of managing the implementation of the BPHS package—are estimated based on MOPH, AKDN, and CAF data. These program costs are not attributed to specific interventions but are necessary to support their implementation. The program costs cover national-level nutrition program staffing (not including frontline personnel); training frontline health and nutrition workers; training the trainer; training development, supervision, and transport (new vehicles and operating costs); monitoring and evaluation; surveillance surveys; equipment; and policy and communications advocacy.

ESTIMATION OF TOTAL COSTS

Total public sector resources required to deliver these interventions are calculated as follows:

$$Y = (x_1 + x_2 + x_3) - x_4 \quad \text{(EQ 1)}$$

where:

Y = public sector cost to deliver interventions to target coverage;
x_1 = total current direct costs to deliver interventions at baseline coverage levels;
x_2 = total additional direct costs to scale up interventions from baseline to target coverage levels (incremental scale-up cost);
x_3 = additional program cost for staffing, training, equipment, policy, monitoring and evaluation, and so on; and
x_4 = private sector cost to deliver interventions ultimately paid for by household expenditure through the marketplace.

Total costs are also broken down into estimated cost per province for all 34 provinces in Afghanistan.

Annual per capita costs at the national and provincial levels are calculated to inform budgeting and contracting for the provision of the BPHS. The per capita cost calculation is:

$$Y_c = \frac{(x_1 + x_2 + x_3) - x_4}{p} \quad \text{(EQ 2)}$$

where:

Y_c = the per capita public sector cost to deliver interventions to target coverage, and
P = the mean total population over the BPHS timeframe (either national or provincial), all age and sex groups.

The cost of scaling up (x_2) the BPHS Nutrition interventions plus a proportional share of the program costs (x_3) are used for the cost-effectiveness and cost-benefit analyses explained later in this section. More detail on how total costs are estimated is presented in Appendix 5.

ESTIMATION OF IMPACT

The expected benefits of the additional scale-up from baseline program coverage to target program coverage levels are calculated in terms of (1) the number of cases of childhood stunting averted,[4] (2) the number of case-years of anemia averted in women of reproductive age,[5] (3) the number of additional children exclusively breastfed, (4) the number of lives saved (deaths

[4] The interventions that prevent stunting are the promotion of good infant and young child nutrition and hygiene practices (breastfeeding promotion and complementary feeding education) and vitamin A supplementation.

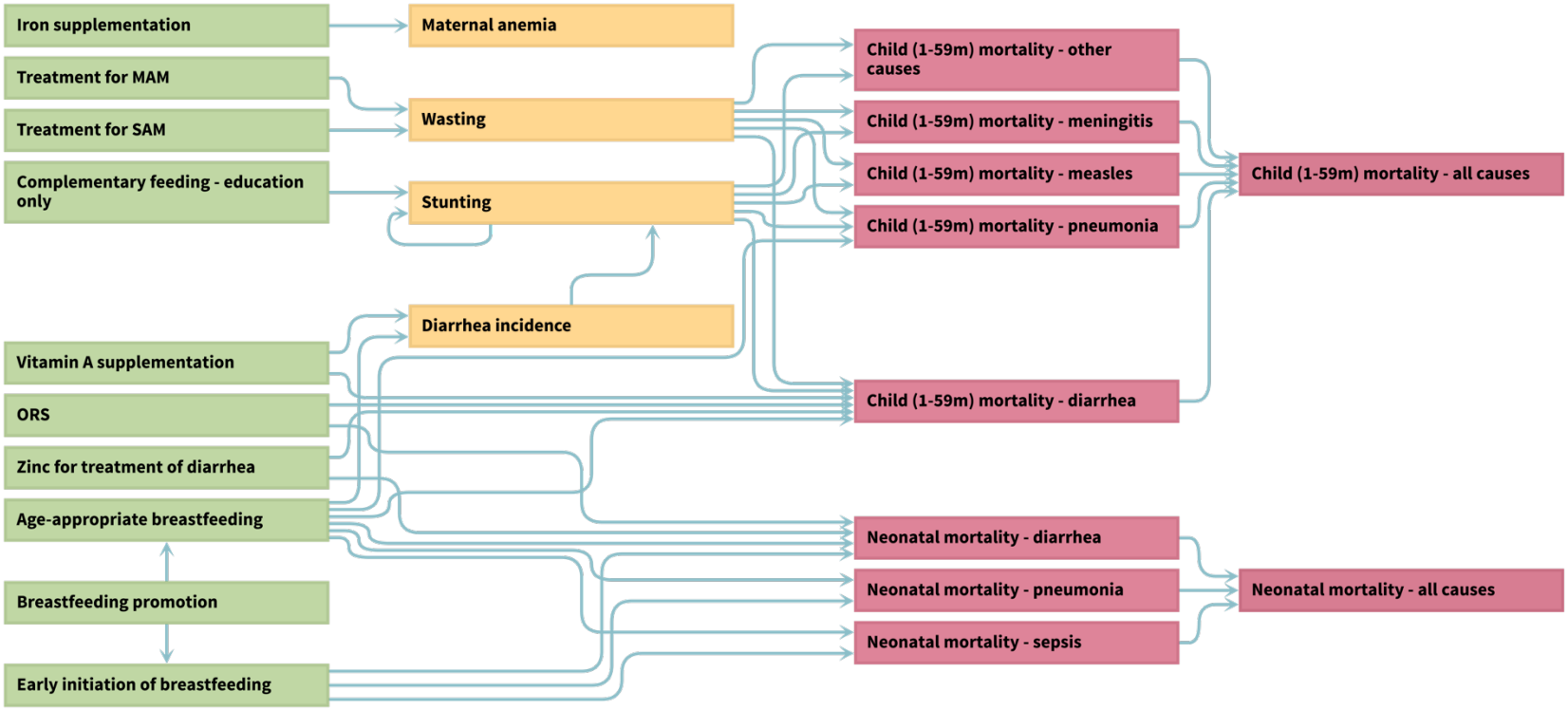
[5] The interventions that prevent anemia in women are iron and folic acid supplementation for pregnant women and staple food fortification (wheat flour) and iron and folic acid supplementation for girls.

averted),[6] and (5) the number of disability-adjusted life years (DALYs) averted.[7] The Lives Saved Tool (LiST), version 5.47, is used for calculating all outcomes except the DALYs averted. These interventions follow the impact pathway shown in Figure 8 (shown on the next page). The intervention effect sizes are derived from meta-analyses and systematic reviews (LiST visualizer, 2018). Growth monitoring, community food preparation demonstration, vitamin A supplementation in pregnancy, promotion of iodized salt, and promotion of micronutrient-rich foods are not included in the LiST impact model. The method for calculating the number of DALYs averted attributable to scaling up interventions is explained in Appendix 7.

[6] The interventions that reduce child mortality are the promotion of good infant and young child nutrition and hygiene practices (breastfeeding promotion and complementary feeding education), vitamin A supplementation, therapeutic zinc and oral rehydration solution for diarrhea in children, and the management of moderate acute malnutrition and the treatment of severe acute malnutrition.

[7] All of the interventions that affect reduce stunting, anemia, or mortality also contribute to averting DALYs.

Figure 8: Impact Pathway for the BPHS nutrition package of Interventions



Source: LiST Visualizer, 2018 https://impactmodeltool.org/
Note: MAM = moderate acute malnutrition; ORS = oral rehydration solution; SAM = severe acute malnutrition.

ESTIMATION OF COST-EFFECTIVENESS

The cost-effectiveness of scaling up each intervention—and the package as a whole—from current to target program coverage levels is calculated, where possible, in terms of the cost per DALY averted, cost per death averted, cost per case of stunting averted, cost per case-year of anemia averted, and cost per additional child exclusively breastfed. To calculate the cost per outcome for each intervention, the incremental scale-up costs are divided by the impact of each applicable intervention in terms of the number of deaths averted, the number of cases of stunting averted, cases of anemia prevented, and DALYs averted. Cost-effectiveness of each different intervention and different packages of interventions is then assessed based on the cost per death averted, cost per case of stunting averted, cost per case of anemia prevented, and cost per DALY averted.

The cost per outcome for each of the 34 provinces for stunting, mortality, and DALY averted is estimated using a similar approach. The cost per case-year of anemia averted was estimated only at the level of the eight United Nations' mission regions for Afghanistan since provincial anemia prevalence data were not available.

According to criteria used by WHO-CHOICE (Choosing Interventions that are Cost-Effective), an intervention is considered to be "very cost-effective" if the range for the cost per DALY averted is less than GDP per capita;[8] "cost-effective" if it is between one and three times GDP per capita; and "not cost-effective" if it exceeds three times GDP per capita (WHO 2014).

ESTIMATION OF ECONOMIC BENEFITS

A high burden of nutritional diseases and attributable mortality can negatively impact a nation's human capital. An investment in improving nutrition outcomes among Afghanistan's women and children is therefore also an investment in the country's economic future. The two main ways that poor nutrition affects economic productivity are by increasing mortality and by increasing morbidity—in other words, lives lost and years lived with a disease or disability. Because each life lost results in one less citizen contributing to the nation's economy, and because children and women affected by nutritional disorders tend to earn and consume less, these impact estimates provide approximations of the return on investment attributable to the scale-up of a particular package of interventions.

Cost-benefit analysis assesses whether the cost of expanding the coverage of the nutrition-specific interventions is offset by the benefits the expansion would generate. The economic benefits are estimated based on mortality, stunting, and micronutrient deficiency reductions (specifically, anemia in women) resulting from expanded intervention coverage. One life year saved is valuated as gross domestic product (GDP) per capita (in current U.S. dollars). To estimate the value of the reduction in stunting, the study follows the methodology used in Hoddinott et al. (2013), and values a year of life lived without stunting based on the assumption that stunted individuals generate, on average, 21 percent less in lifetime earnings. Future benefits are then age-adjusted and discounted at two potential discount rates (3 percent and 5 percent) in order to arrive at their present values. The present value of future benefits is then compared with the present value of the estimated 10-year public investment required, which allows the net present value (NPV) and internal rate of return of the investment to be estimated. Benefits

[8] Afghanistan GDP per capita in current U.S. dollars was $630 in 2015 (World Bank 2016a).

resulting from the prevention of cognitive losses resulting from iodine deficiency are also included. A detailed explanation of the benefit estimation methodology can be found in Appendix 8.

SENSITIVITY ANALYSES

Sensitivity analyses were also conducted to assess the robustness of the estimates because of uncertainty regarding some of the key parameters used in the economic benefit models. Sensitivity analyses included varying unit cost estimates, projected long-term rates of economic growth, and discount rates. The main results of the BPHS nutrition package are reported with the results in Part III and detailed results of the relevant sensitivity analyses are provided in the appendixes.

PART III – RESULTS

UNIT COSTS

Table 2 presents the unit cost values used in the analysis for the BPHS nutrition package.[9] These unit costs do not include program costs.

Table 2. Unit Costs for the BPHS nutrition package

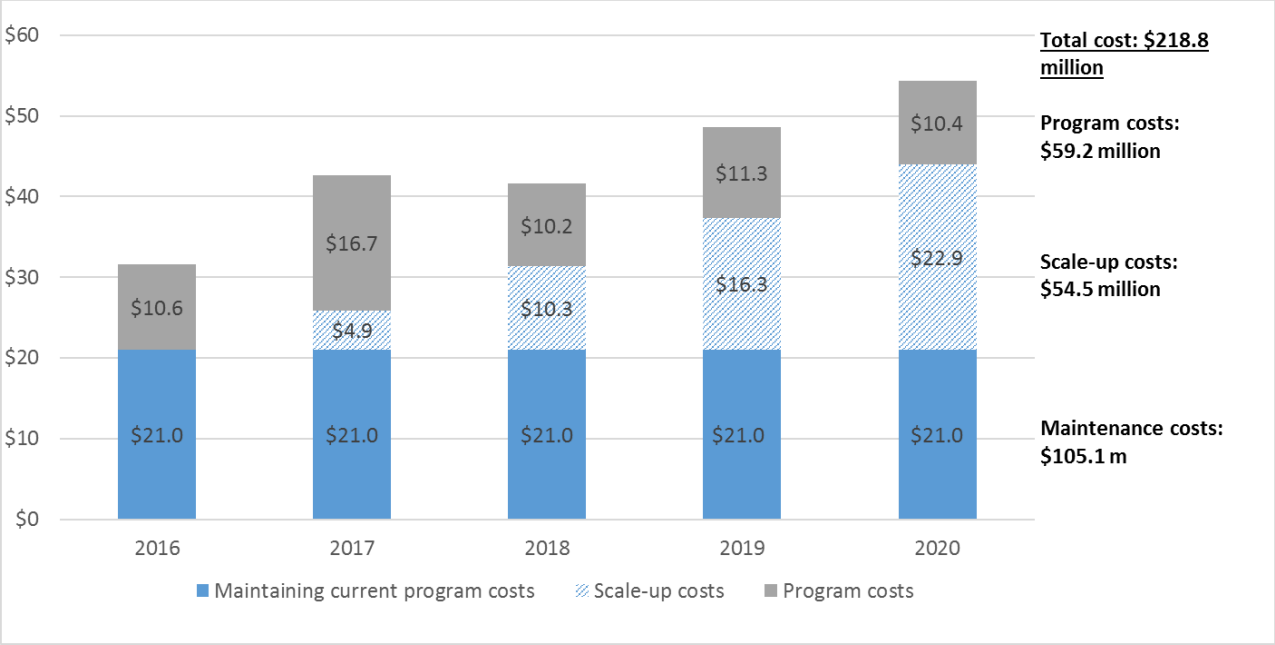
Intervention	Unit cost per beneficiary (US$ / year)	Source
Preventive		
1. Promotion of good infant and young child nutrition and hygiene practices		
a) Support and promotion of exclusive breastfeeding	3.28	AKDN
b) Complementary feeding education	1.39	CAF
c) Community food preparation demonstration	5.29	CAF
2. Vitamin A supplementation for children	0.60	CAF
3. Control and prevention of diarrheal diseases and parasitic infections		
a) Deworming in children	1.08	AKDN
b) Deworming in adolescent girls	1.08	AKDN
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	9.66	CAF
4. Promotion of balanced micronutrient-rich foods	6.05	WBG/MOPH
5. Iron and folic acid supplementation for pregnant women	2.82	MOPH
6. Promotion of iodized salt	0.02	GAIN
7. Growth monitoring	5.15	AKDN
8. Vitamin A supplementation for pregnant women	1.00	CAF
Curative		
9. Treatment of severe acute malnutrition in children		
a) with complications	85.68	SC/MSH
b) without complications	68.05	MOPH
10. Management of moderate acute malnutrition	66.43	LiST/OHT
11. Clinic-based nutrition surveillance	0.96	CAF
12. Screening for acute malnutrition and micronutrient deficiencies	1.11	CAF

[9] Unit cost estimates are based on the high-value unit cost collected for each intervention. Based on a comparison of the high-value and low-value unit costs (see Appendix 5), there appears to be a pattern that the MOPH unit cost estimates for BPHS Nutrition Core package are lower than those collected from NGOs that provided data. It is unknown whether this pattern holds across other NGOs or whether it is correlated with geographic regions of delivery or level of insecurity or other factors.

TOTAL COSTS

The total public investment required to deliver the BPHS nutrition package of interventions in Afghanistan is estimated to be $218.8 million from 2016 through 2020 (Table 3), or $43.8 million per year on average. This translates to $10.69 per child under the age of five per year, and $1.49 per capita. The total includes the cost of maintaining the interventions at current coverage levels ($105.1 million), the additional cost of scaling up interventions to target coverage levels by 2020 ($54.5 million), and program overhead costs of $59.2 million.[10] An additional $0.3 million would be borne by the private sector and households for the purchase of iodized salt. Annual costs for the package would increase from $31.6 million in 2016 to $54.4 million in 2020. Costs by year are presented in Appendix 9.

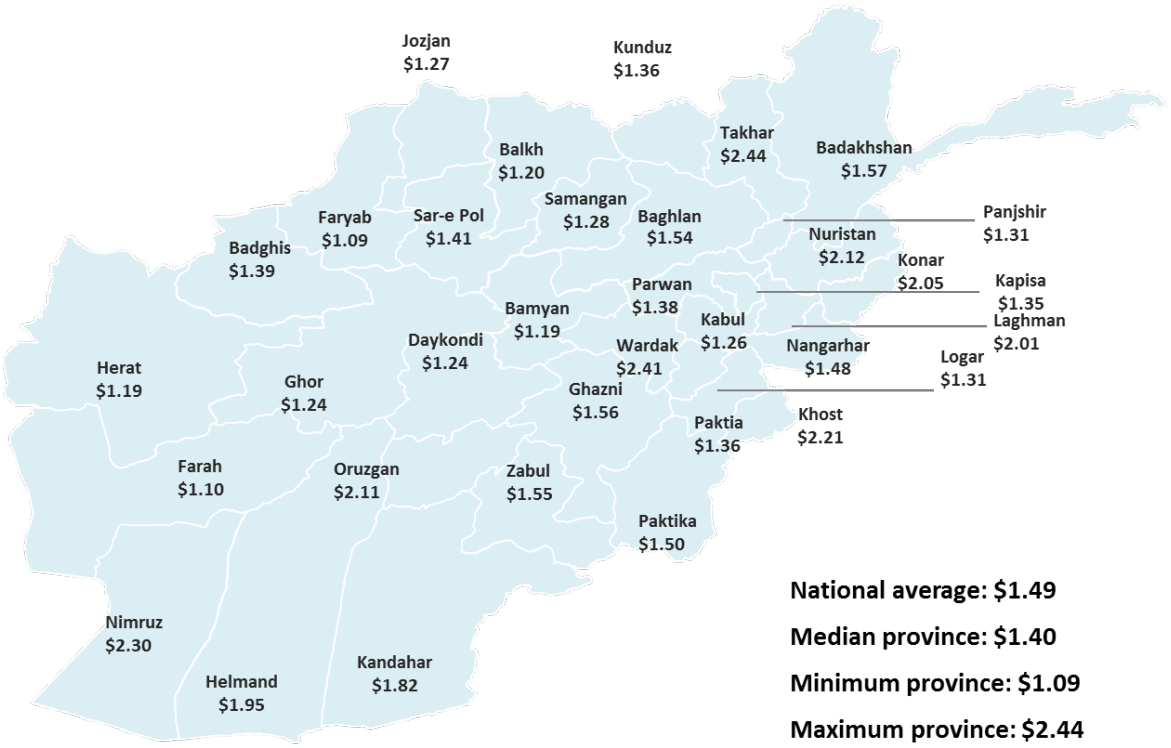
Figure 9. Comparison of Costs for Maintaining Current Coverage of the BPHS Nutrition Core Interventions, Scaling Up to Target Coverage, and Program Costs



The total cost per province (including program and scale-up costs) ranges from $1.1 million in the province of Panjsher to $30.1 million in Kabul. The five provinces (out of 34) with the highest costs together account for 36 percent of the total national cost: Kabul, Takhar, Nanghar, Kandahar, Herat (see Appendixes 10 and 11a for costs by province). Overall, these cost estimates The average annual per capita cost varies by province from $1.09 in Faryab to $2.44 per capita in Takhar. Per capita cost results for each province are shown in Figure 10 and Appendix 11b.

[10] Program costs are highest in 2017 due to a planned one-time procurement of equipment in that year.

Figure 10. Estimated Annual per Capita Cost of BPHS Nutrition Core Interventions by Province



Prevention interventions account for just over half (52%) of required resources and the treatment of acute malnutrition accounts for the rest (45%) (Figure 11 and Table 3).

Figure 11. Total Costs of BPHS Nutrition package for 2016–20, by preventive and curative Intervention

US$, millions

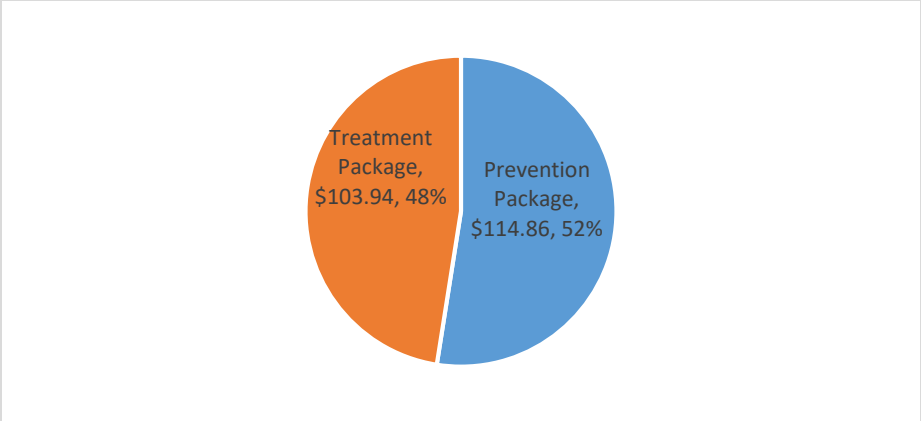


Table 3. Estimated Total Costs of BPHS Nutrition Core Interventions, 2016–20

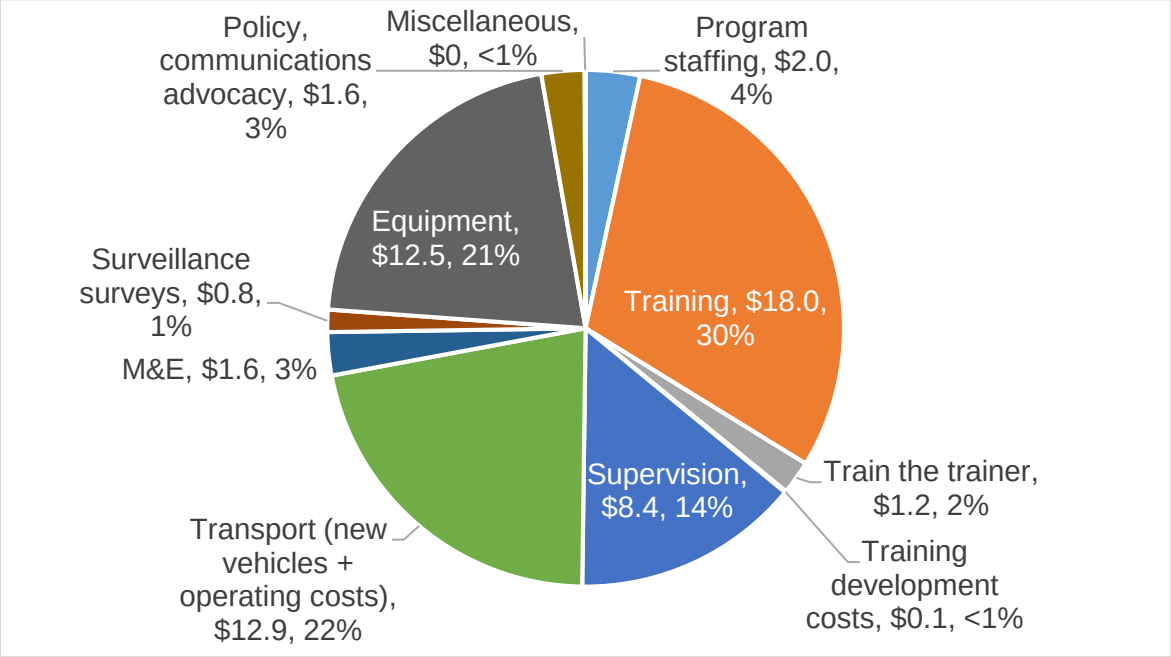
Interventions and their components	Total cost by intervention (US$, millions)	Share of total cost (%)
Prevention		
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	9.85	
b) Complementary feeding education	1.71	
c) Community food preparation demonstration	0.78	5.6
2. Vitamin A supplementation for children	7.33	3.4
3. Control and prevention of diarrheal diseases and parasitic infections a) Deworming in children	10.78	
b) Deworming in adolescent girls	1.01	20.5
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	32.95	
4. Promotion of balanced micronutrient-rich foods	12.80	5.9
5. Iron and folic acid supplementation for pregnant women[a]	2.48	1.1
6. Promotion of iodized salt	0.20	0.1
7. Growth monitoring	1.17	0.5
8. Vitamin A supplementation for pregnant women	2.66	1.2
Program costs for prevention interventions	31.07	14.2
Subtotal for preventive interventions (intervention + program costs)	**114.86**	**52.4**
Treatment		
9. Treatment of severe acute malnutrition (with and without complications)	33.52	15.3
10. Management of moderate acute malnutrition	41.88	19.1
11. Clinic-based nutrition surveillance	0.35	0.2
12. Screening for acute malnutrition and micronutrient deficiencies	0.07	0.0
Program costs for treatment interventions	28.12	12.9
Subtotal for treatment interventions (intervention + program costs)	**103.94**	**47.5**
Total costs for prevention and treatment (intervention + program costs)	**218.80**	**100**
Additional costs borne by private sector/households	**0.34**	n.a.

Note: n.a. = not applicable.
a This intervention is called “maternal nutrition” in BPHS documentation.

General program management costs are estimated to be $59.2 million over five years, or 27 percent of total costs. The three largest categories of program costs are training ($17.98 million), transport ($12.94 million), and equipment ($12.48 million), which together account for 73 percent of the program costs (Figure 12). A spike in program costs early in the five-year plan is projected as a result of up front lump sum costs for the acquisition of equipment, delivery of training programs, and implementation of a large-scale national nutrition survey. A more detailed breakdown of general program cost estimates is presented in Appendix 12.

Figure 12. Program Costs by Category for the BPHS nutrition package

US$, millions



Note: M&E = monitoring and evaluation.

IMPACTS

Scaling up the BPHS Nutrition interventions from baseline to target coverage levels set by the MOPH over five years (2016–20) (Scenario 1) is projected to result in over 706,678 DALYs averted, 23,064 child deaths averted, and 4,807 cases of stunting among children under five averted (Table 4). The scale-up would also result in 87,227 case-years of anemia averted in adolescent girls and women and 96,614 additional children being exclusively breastfed.

Table 4. Impacts of Scaling Up BPHS nutrition package to Target Coverage

Outcome	Total
Deaths averted	24,083
Cases of stunting averted (children who are not stunted at age five)	4,296
Percentage point reduction in stunting prevalence	0.4%
Case-years of anemia in adolescent girls and women prevented	87,227
Percentage point reduction in anemia in pregnant women	3.35%
Additional children exclusively breastfed	96,614
Percentage point increase in rate of exclusive breastfeeding of infants	4.5%
Total DALYs averted	639,530

Most of these benefits are thanks to the planned scale-up of preventive interventions, and this is despite the fact that only about half of the required resources are directed at preventive intervention due to the modest/low targets for program target expansion as compared to the targets for curative interventions. Preventive interventions contribute to 71% of all DALYs averted,

with 62% of all DALYs averted thanks to two interventions (Table 5): control and prevention of diarrheal diseases and parasitic infections (254,460 DALYs averted) and the promotion of good infant and young child nutrition and hygiene practices (141,177 DALYs averted). Preventive interventions are estimated to account for 68% of all death averted, with one intervention, the control and prevention of diarrheal diseases and parasitic infections, accounting for over 50 percent of all child deaths averted.

Complementary feeding education is the most important intervention for averting cases of stunting, accounting for about 60 percent (4,678 cases) of all stunting cases averted. Vitamin A supplementation for children (*N* = 2,883) and the support and promotion of exclusive breastfeeding (*N* = 193) contribute the remaining number of cases of stunting averted. It should be noted that the scale-up of the BPHS nutrition package will have only a marginal impact on stunting prevalence. After five years, the projected stunting prevalence will have declined only by about 0.4 percentage points. This is largely due to the relatively low coverage targets set for some of the key interventions aimed at stunting reduction (e.g., complementary feeding education; see the Discussion in Part V).

Promoting maternal nutrition through iron and folic acid supplementation is the only intervention that contributes to the reduction of anemia in women. This intervention is projected to reduce the prevalence of anemia in women of reproductive age by about 3 percentage points, to just under 22 percent

Scaling up the promotion of good infant and young child nutrition and hygiene practices is projected to increase the prevalence of exclusive breastfeeding by 4.5 percentage points. Achieving the target coverage rates for the iodization of salt would result in an additional 9.6 million people consuming iodized salt and contribute to reduced iodine deficiency.

Table 5. Impact of Scaling Up the BPHS nutrition package to Target Coverage

BPHS nutrition package	DALYs averted	Deaths averted	Cases of stunting averted	Case-years of anemia averted	Additional infants exclusively breastfed
Preventive Interventions					
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	141,177	1,710	193	n.a.	96,614
b) Complementary feeding education	29,966	361	4,678	n.a.	n.a.
c) Community food preparation demonstration	n.a.	n.a.	n.a.	n.a.	n.a.
2. Vitamin A supplementation for children	26,436	2,883	2,883	n.a.	n.a.
3. Control and prevention of diarrheal diseases and parasitic infections a) Deworming in children	n.a.	n.a.	n.a.	n.a.	n.a.

b) Deworming in adolescent girls	n.a.	n.a.	n.a.	n.a.	n.a.
c) Therapeutic zinc treatment and oral rehydration solution for diarrhea in children	254,460	12,925	n.a.	n.a.	n.a.
4. Promotion of balanced micronutrient-rich foods	n.a.	n.a.	n.a.	n.a.	n.a.
5. Iron and folic acid supplementation for pregnant women[a]	3,389	n.a.	n.a.	87,227	n.a.
6. Promotion of iodized salt	n.a.	n.a.	n.a.	n.a.	n.a.
7. Growth monitoring	n.a.	n.a.	n.a.	n.a.	n.a.
8. Vitamin A supplementation for pregnant women	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal – impact of all preventive interventions	**455,428**	**16,382**	**4,286**	**87,227**	**96,614**
Curative Interventions					
9. Treatment of severe acute malnutrition (with and without complications)	130,728	6,079	n.a.	n.a.	n.a.
10. Management of moderate acute malnutrition	53,373	1,622	n.a.	n.a.	n.a.
11. Clinic-based surveillance	n.a.	n.a.	n.a.	n.a.	n.a.
12. Screening	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal – impact of all curative interventions	**184,101**	**7,701**	n.a.	n.a.	n.a.
Total combined impact	**639,530**	**24,083**	**4,286**	**87,227**	**96,614**

Note: n.a. = not applicable.
a This intervention is called “maternal nutrition” in BPHS documentation.

THE COST-EFFECTIVENESS OF THE BPHS NUTRITION PACKAGE AS A WHOLE AND BY INTERVENTION

For the whole package, the cost per life saved is estimated to be $2,963, the cost per case of stunting averted is $16,611, and the cost per DALY averted is $112 (Table 6).[11] The cost per case of stunting averted is significantly higher than the $1,063 global average estimated in the *Global Investment Framework* (Shekar et al. 2017; see the Discussion in Part V for further details). Scaling up this set of nutrition interventions would be very cost-effective based on WHO-CHOICE

[11] For the total cost per benefit unit, the total annual program cost for all 12 interventions (including monitoring and evaluation and capacity development costs, but before subtracting household contributions) is divided by the benefits estimates available. Because of limitations of LiST, DALYs averted estimates are available for only seven interventions, lives saved estimates are available for six interventions, and stunting reduction estimates are available for three interventions.

criteria because the cost per DALY averted of $112 is below the Afghanistan GDP per capita of $630 (WHO 2014).

Each individual interventions is also very cost-effective according to WHO-CHOICE criteria, although the cost-effectiveness varies greatly across intervention $23 for the support and promotion of exclusive breastfeeding to $426 for the iron and folic acid supplementation for pregnant women. The support and promotion of exclusive breastfeeding is the most cost-effective intervention in terms of DALYs averted ($23 per DALY averted), followed by complementary feeding education ($31 per DALY averted), the control and prevention of diarrheal diseases and parasitic infections ($57 per DALY averted), and vitamin A supplementation for children ($95 per DALY averted).

The control and prevention diarrheal diseases and parasitic infections has the lowest cost per child death averted ($1,130), followed by vitamin A supplementation for children ($1,818), and complementary feeding education ($3,173).and the support and promotion of exclusive breastfeeding ($1,929)

Complementary feeding education has the lowest cost per case of stunting prevented ($199), followed by vitamin A supplementation for children ($874) and the support and promotion of exclusive breastfeeding ($17,099).

Iron and folic acid supplementation for pregnant women appears to be cost-effective for the reduction of anemia in women at $17 per case-year of anemia averted. Similarly, the cost per additional child exclusively breastfed through supporting and promoting exclusive breastfeeding is $26.

Under this scenario, the incremental cost effectiveness ratio (ICER) of adding the curative interventions to the preventative interventions is $213 per DALY averted. Using any reasonable willingness-to-pay threshold, adding curative interventions to the preventative ones would be cost-effective.

Table 6. Total Scale-Up Cost and Cost per Benefit Unit, by Intervention

Intervention	Total additional scale-up cost (US$ millions)	Cost per benefit unit				
		Cost per DALY averted	Cost per life saved	Cost per case of stunting averted	Cost per case-year of anemia averted	Cost per child exclusively breastfed
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	3.30	23	1,282	8,424	n.a.	26
b) Complementary feeding education	0.93	31	3,193	354	n.a.	n.a.
c) Community food preparation demonstration	0.83	n.a.	n.a.	n.a.	n.a.	n.a.

2. Vitamin A supplementation	2.52	95	2,584	1,416	n.a.	n.a.
3. Control and prevent diarrheal disease and parasitic infections a) Deworming in children	3.23	57	1,207	n.a.	n.a.	n.a.
b) Deworming in adolescent girls	1.39				n.a.	n.a.
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	9.99				n.a.	n.a.
4. Promotion of balanced micronutrient rich foods	6.96	n.a.	n.a.	n.a.	n.a	n.a.
5. Iron and folic acid supplementation for pregnant women[a]	1.45	426	n.a.	n.a.	17	n.a.
6. Promotion of iodized salt	0.08	n.a.	n.a	n.a	n.a	n.a.
7. Growth monitoring	0.63	n.a.	n.a	n.a	n.a	n.a.
8. Vitamin A supplementation for pregnant women	0.75	n.a.	n.a	n.a	n.a	n.a.
Subtotal –preventive interventions	**32,06**	**70**	**1,957**	**7,462**	**368**	**331**
9. Treatment of severe acute malnutrition (with and without complications)	17.42	133	3,173	n.a.	n.a.	n.a.
10. Management of moderate acute malnutrition	21.33	400	13,044	n.a.	n.a.	n.a.
11. Clinic-based nutrition surveillance:	0.46	n.a.	n.a.	n.a.	n.a.	n.a.
12. Screening for acute malnutrition and micronutrient deficiencies	0.10	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal –curative interventions	**39.30**	**213**	**5,103**	**n.a**	**n.a**	**n.a**
Total for BPHS Nutrition package	**71.36**	**112**	**2,963**	**16,611**	**818**	**739**

Note: n.a. = not applicable; the model cannot be applied because of a lack of evidence of intervention effect size and it is not included in the LiST impact model.
a This intervention is called “maternal nutrition” in BPHS documentation.

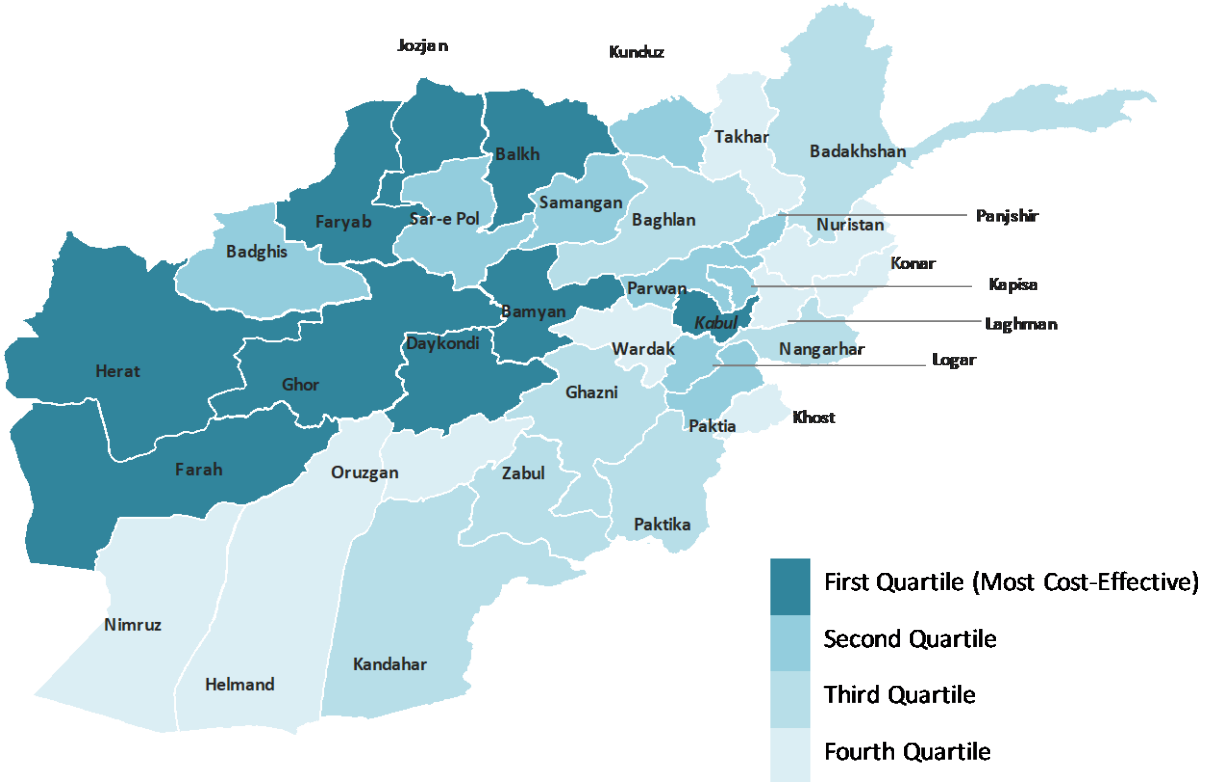
PRIORITIZATION BY PROVINCE

The cost-effectiveness of package of interventions also varies by geographic area. Policy makers may consider prioritizing the investment of resources in provinces with the highest intervention

cost-effectiveness to achieve policy goals and, importantly, to maximize the impact of investments on the prevention of malnutrition and related mortality (refer to Appendix 13 for all details of impact and cost-effectiveness of interventions by province).

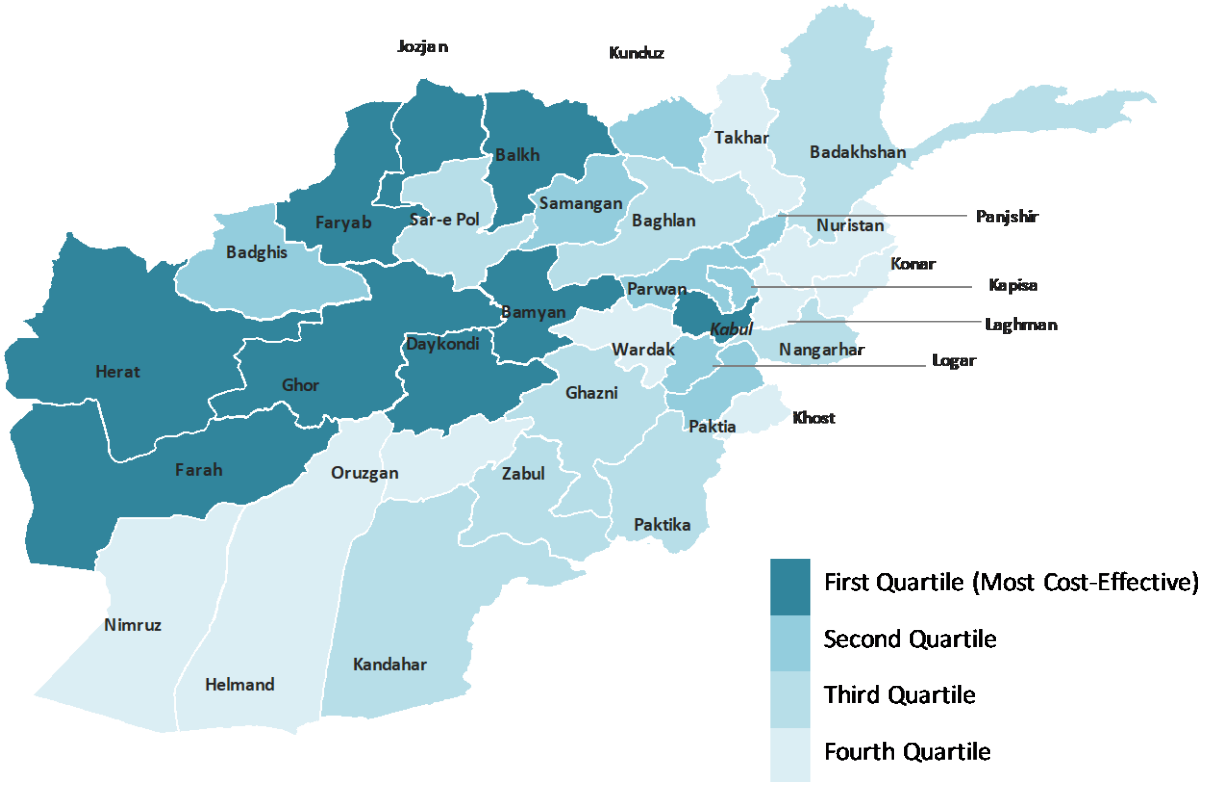
As indicated in the previous section, the cost per DALY averted for a nationwide scale-up to government targets of the interventions was $112. The cost of per DALY averted per province, however, ranges from $76 in Faryab to $193 in Takhar. The most cost-effective provinces for scaling up the BPHS nutrition package in terms of cost per DALY averted are Faryab, Farah, Bamyan, Herat, Balkh, Daykundi, Ghor, Kabul, and Jawzan (Figure 13). The cost per DALY averted in each of these nine provinces is below $93. The total cost of implementing the BPHS Nutrition interventions in these nine provinces is $73.93 million: about $50.6 million is needed to maintain current intervention coverage and a further $23.33 for the scale-up. The least cost-effective provinces in terms of cost per DALY averted are Takhar, Wardak, Nimroz, Khost, Nooristan, Urozgan, Kunarha, Laghman, and Helmand. The cost per DALY averted for these nine provinces ranges from $149 to $175. Nevertheless, even in those provinces, the cost per DALY averted is still significantly below the WHO CHOICE threshold of one times GDP per capita, which indicates that even in those provinces the scale-up would be very cost-effective.

Figure 13. Cost-Effectiveness by Region: DALYs Averted



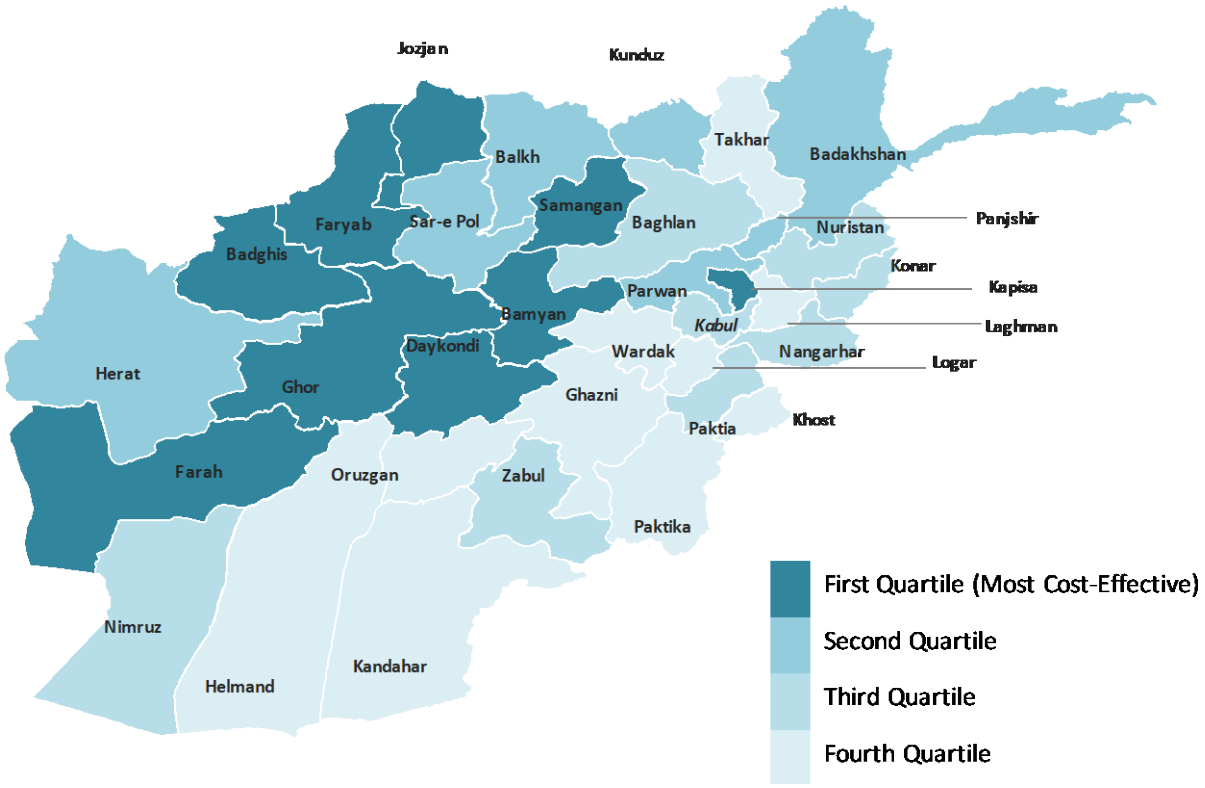
The national average cost per child death averted is $2,963. By province, this cost ranges from $2,028 in Faryab to $5,127 in Takhar. The most cost-effective provinces in terms of cost per child death averted are Faryab, Farah, Bamyan, Herat, Balkh, Daykundi, Ghor, Kabul, and Jawzjan (Figure 14). These nine provinces all have a cost per death averted of less than $2,446. The least cost-effective provinces in terms of cost per death averted are estimated to be Takhar, Wardak, Nimroz, Khost, Nooristan, Urozgan, Kunarha, and Laghman. The cost per death averted for these eight provinces are all above $4,145 and below $5,127.

Figure 14. Cost-Effectiveness by Province: Child Deaths Averted



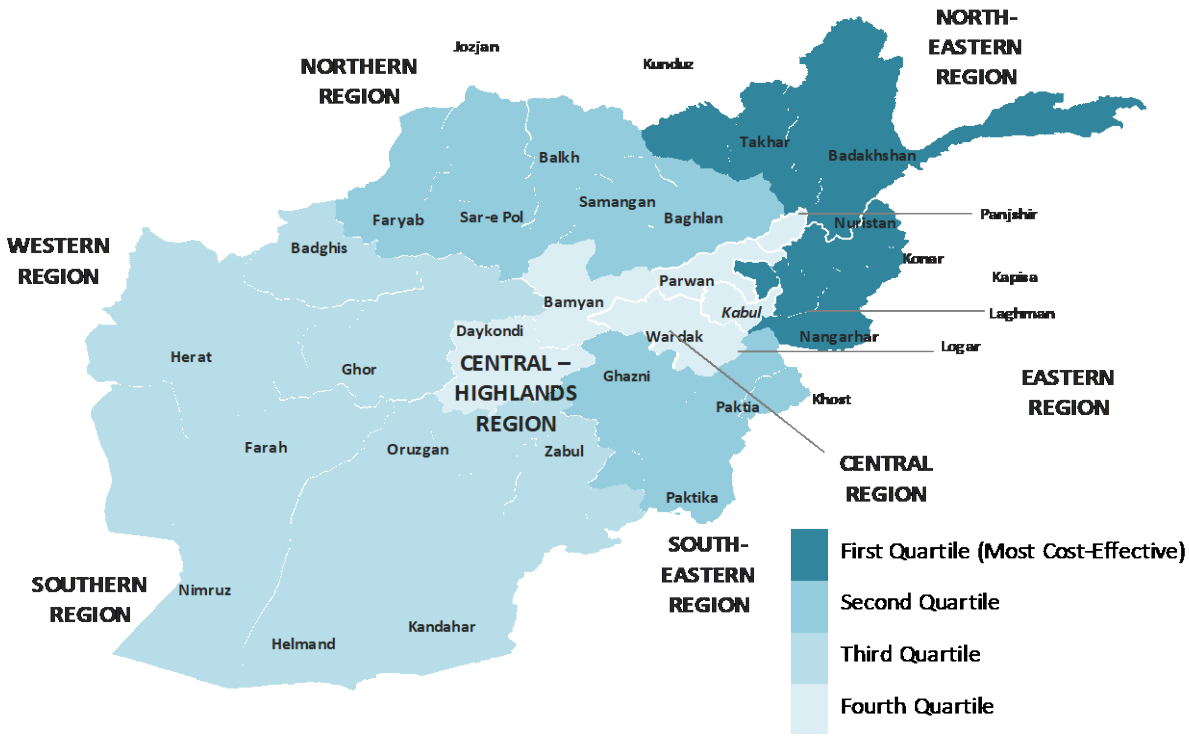
The national average of the cost per case of stunting averted is $16,611. By province, the cost per case of stunting averted ranges from $6,511 in Farah to $35,412 in Khost. The most cost-effective provinces in terms of cost per case of stunting averted are Farah, Faryab, Bamyan, Ghor Samangan, Jawzjan, Badghis, Kapisa, , and Daykundi. These nine provinces all have a cost per case of stunting averted under $12,403 (Figure 15). The least cost-effective provinces in terms of cost per case of stunting averted are projected to be Khost, Helmand, Ghazni, Takhar, Urozgan, Laghman, Wardak, Paktika, and Kandahar. The cost per case of stunting averted for these nine provinces are all above $19,006 and below $35,412.

Figure 15. Cost-Effectiveness by Province: Stunting Averted



Since data on the prevalence of anemia in pregnant women are not available at the provincial level, the geographic cost-effectiveness of investing in interventions to prevent anemia in women is presented by the larger UN mission region. The cost per case-year of anemia averted ranges from $7.81 in the Eastern region to $33.29 in the Central region. The most cost-effective regions for the reduction of case-years of anemia are the Eastern, Northeastern, Northern, and Southeastern regions (Figure 16).

Figure 16. Cost-Effectiveness by Region: Anemia in Women Averted



It needs to be noted that the analyses presented above are based on the assumption that the unit costs are constant across the regions. Therefore the differences in cost-effectiveness across regions are driven primarily by the differences in the coverage and the prevalence of malnutrition in terms of stunting, wasting, and anemia. Collecting data and estimating the unit cost for each of the regions was not possible. However, even the data obtained from the MOPH and the two NGOs indicate substantial differences in the unit cost for delivering the same intervention (see above). This suggests that differences in the cost of delivering interventions may also vary substantially across regions. Therefore, further more detailed analysis of differences in cost and cost-effectiveness may be needed (see the Discussion in Part V for more details).

ECONOMIC BENEFITS

Scaling up the package nationwide to target coverage levels set by the MOPH is estimated to produce net benefits of $815 million (Table 7) over the productive lives of the children benefiting from the interventions (assuming 3 percent discount rate on benefits and costs). In turn, this level of benefits would result in a return on investment of at least 12.9 dollars for each dollar invested and yield an internal rate of return of 10 percent per year. In the scenario with a 5 percent discount rate on cost and benefits, the package would yield a net present value of economic benefits would be $369 million and the return investment of 6.3 dollars for each dollar invested.

Table 7. Net Benefits of the BPHS nutrition package, 2016–20

Cost-benefit analysis	Discount rate			
	3%		5%	
	Net present value of benefits (US$, millions)	Benefit-cost ratio	Net present value of benefits (US$, millions)	Benefit-cost ratio
BPHS nutrition package (at 3.6% GDP growth)	$815.5	**12.9**	$369.3	**6.3**

The benefits resulting from the prevention of iodine deficiency disorders thanks to salt iodization are the largest contributor to the total economic benefits of investing in the BPHS nutrition package. Separately, investing in the support and promotion of exclusive breastfeeding is also projected to generate a return on investment of $12.6 for every dollar invested at a 3 percent discount rate and $6.0 at a 5 percent discount rate.

These estimates of economic benefits are based on a conservative methodology that does not necessarily account for all potential benefits associated with improving nutrition outcomes for Afghanistan's women and children. Potential savings that would result from lower health system utilization because of the improved health and nutritional status of mothers and children who received interventions, savings from reduced indirect costs borne by households seeking treatment for childhood diseases such as diarrhea and pneumonia, and savings from the prevention of productivity losses incurred by caregivers while seeking treatment for children are not captured in these estimates. Moreover, the benefits linked to cognitive gains from increased breastfeeding are excluded from the total estimates since they may be duplicated with the benefits of pregnant women and children consuming iodized salt. Because these estimates assume a constant long-term annual GDP growth rate of 3.6 percent, economic benefits may be higher if Afghanistan emerges from its fragile and conflict-affected status toward a period of economic stability and growth. For these reasons, the projected economic benefits and return on investment figures may be underestimates.

SENSITIVITY ANALYSIS

Assumptions about unit costs and expected GDP growth rates have large effects on the analysis. As noted above, the BPHS Nutrition Core analyses used the highest unit cost for each intervention. The sensitivity analysis shows that using the lowest values would result in a total cost that would be 33 percent lower than the estimate based on the high unit cost values. For the BPHS nutrition package, the total cost in the lowest-value scenario would be $145.62 million over five years with an average annual national per capita cost of $0.99 per person per year, with a range of $0.68 in Faryab to 1.72 per capita in Takhar. The key drivers of the variation in cost per DALY averted by province are predominantly the prevalence of moderate acute malnutrition and severe acute malnutrition in children in each province. The range in cost per DALY averted between the low of $52 in Faryab and the high of $140 per capita in Takhar can be explained by these two factors. Similarity, the high prevalence of anemia in pregnant women is the key driver of cost-effectiveness for anemia reduction. The results of the cost-benefit analysis are not only sensitive to assumptions about future discount rates, as already reported, but also to the unit costs selected and long-term GDP growth rate. If a low-value unit cost is used, the benefit-cost ratio in the base-case scenario increases from 13 to 18. The estimated benefit-cost ratio reaches

31 if both the low-value unit cost and a 5 percent long-term GDP growth rate are assumed. See Appendix 14 for detailed results of the sensitivity analysis.

PART IV – SCALING UP THE BPHS NUTRITION PACKAGE TO FULL PROGRAM COVERAGE

The section of the report estimates of the costs, impacts and cost-effectiveness of scaling up the BPHS nutrition package of interventions to full (90%) program coverage levels (scenario 2) and compares them to the more modest scale up (scenario 1) reported in the previous section.

To scale all interventions to full coverage is estimated to require $261 million over 5 years, or about 20% more than scaling up to government-set program coverage levels (Tables 8 and results by intervention in Appendix 15). If only prevention interventions were scaled up, the additional cost would be $33 million over 5 years, or less than $5 million a year, above initial scale up of prevention interventions in scenario 1. Under full scale up of the whole package of interventions, per capita cost is estimated at $1.78 and the per child under 5 at $12.74.

Table 8. Summary of Required Investment Over 5 years to Scale Up BPHS Nutrition Package to Target Program Coverage Levels (Scenario 1) and to Full Program Coverage (Scenario 2)

Scale Up Scenario	Total cost (US$, millions)	Per capita cost	Cost Per Child Under 5
Scenario 1: BPHS scaled up to target* program coverage levels			
All interventions	218.80	1.49	10.69
Preventive interventions	114.86	0.78	5.61
Curative interventions	103.94	0.71	5.08
Scenario 2: BPHS scaled up to full program coverage			
All interventions	260.68	1.78	12.74
Preventive interventions	147.53	1.01	7.21
Curative interventions	113.15	0.77	5.53

*The MOPH set targets for program coverage expansion for each of the 12 interventions, many of which fall short of full program coverage. These targets are shown in Figure 7 of the full report.

The benefits of the additional scale-up would be very substantial. They include almost triple the number of DALYs averted, double the number of deaths averted and avert almost eight times as many cases of stunting, as compared with scaling up to more modest program coverage targets (Table 9). In addition, an almost four-fold increase in the number of case-years of anemia averted and additional infants exclusively breastfed is estimated. These additional benefits are almost entirely a result of the additional scale-up of the preventive interventions.

When considering cost-effectiveness within the full program coverage scenario, the ICER of adding curative interventions to the preventative interventions is $191 per DALY averted. Using any reasonable willingness-to-pay threshold, this suggests that the addition of curative interventions would be very cost-effective. When considering cost-effectiveness between scale-up scenarios, scaling up to full coverage levels (scenario 2) would be almost twice as cost-effective as scaling up to more modest government-set target program coverage levels set in scenario 1: the cost per DALY averted is $69 for scenario 2 and $112 for scenario 1. This is because this scenario mostly includes expanding program coverage of preventive interventions as curative interventions were scaled up to high program coverage levels under scenario 1.

Table 9. Summary of Benefits of Scaling Up BPHS Nutrition Package Over 5 years to Target Program Coverage Levels (Scenario 1) and Full Program Coverage (Scenario 2)

Scale Up Scenario	DALYs averted	Cost per DALY averted	Cases of stunting averted	Cost per case of stunting averted	Deaths averted	Case-years of anemia averted	Additional infants exclusively breastfed
Scenario 1: BPHS scaled up to target* program coverage levels							
All interventions	639,530	112	4,286	16,611	24,083	87,227	96,614
Preventive	455,428	70	4,286	7,462	16,382	87,227	96,614
Curative	184,101	213	n.a.	n.a.	7,701	n.a.	n.a.
Scenario 2: BPHS scaled up to full program coverage							
All interventions	1,733,513	69	33,644	3,534	41,212	305,291	385,630
Preventive	1,465,452	46	33,644	2,007	29,952	305,291	385,630
Curative	268,061	192	n.a.	n.a.	11,260	n.a.	n.a.

*The MOPH set targets for program coverage expansion for each of the 12 interventions, many of which fall short of full program coverage. These targets are shown in Figure 7 of the full report.

Scaling up the preventive interventions within the BPHS nutrition package generates nearly all the economic benefits from investing in nutrition compared to the curative interventions. The preventive interventions alone are estimated to produce a return on investment of at least 28 dollars for each dollar invested (Table 10). In the scenario with a 5 percent discount rate on cost and benefits, the preventive intervention package would yield a return on investment of $14.50 for each dollar invested. If Afghanistan achieves a higher long-term mean GDP growth rate of 5 percent, this investment is estimated to generate over $2 billion dollars in economic benefits and a return on investment of 33 dollars for each dollar invested (Appendix Table A14.3) Since the curative interventions within the BPHS nutrition package are not associated with cognitive benefits, their economic benefits are minimal. However, investing in curative interventions may be important to achieve goals for the reduction of under-five child mortality.

Table 10. Net Benefits of the BPHS nutrition package scaled up partially (scenario 1) and to full program coverage levels (scenario), 2016–20

Cost-benefit analysis (at 3.6 % GDP growth rate)	Discount rate			
	3%		5%	
	Net present value of benefits (US$, millions)	Benefit-cost ratio	Net present value of benefits (US$, millions)	Benefit-cost ratio
Scenario 1: BPHS scaled up to target* program coverage levels				
All interventions	$815.5	**12.9**	$369.3	**6.3**
Preventive	$814.4	**28.6**	$384.1	**14.5**
Curative	$18.0	**0.5**	($6.6)	**-0.2**
Scenario 2: BPHS scaled up to full program coverage				
All interventions	$1,179.2	**11.2**	$528.0	**5.4**
Preventive	$1,169.0	**19.5**	$543.1	**9.8**
Curative	$33.7	**0.74**	($3.7)	**-0.1**

PART V – LIMITATIONS

The analyses presented above have several important limitations. First, it is unknown how representative the unit cost values collected from the MOPH, the Aga Kahn Development Network (AKDN), and Care of Afghan Families (CAF) are for all the implementers of BPHS contracts across the countries. Another limitation of the costing analysis is that the unit costs do not explicitly account for the potential integrated delivery of multiple interventions, which may lower human resource costs. To account for this uncertainty, as part of the sensitivity analysis, high and low total cost estimates based on the range of available unit costs were used. The fact that the MOPH is the primary source of low-value unit cost data may be an indication of the total cost if efficiency gains in the delivery of nutrition interventions can be achieved over the long term. However, given the complexity of implementing nutrition interventions in Afghanistan, it may be best to adopt the more conservative high-value unit cost scenario for budgeting and policy making purposes to ensure that contractors have sufficient resources to deliver high-quality interventions.

Second, the only variation in unit cost values of interventions by region is related to the inclusion of a varying government hardship allowance for personnel costs. Collecting data and estimating the commodities, supplies, equipment and transport for the unit cost estimation for each of the regions was not possible. The estimated program delivery costs—which are equivalent to 33 percent of the total BPHS package costs—are extrapolated from one source to all provinces, and may not accurately reflect the on-the-ground realities in all provinces. The analyses presented here are based on the assumption that the program costs are constant across the regions. Therefore, the differences in the cost-effectiveness across regions are driven primarily by the differences in the coverage, the prevalence of different types of malnutrition (stunting, wasting, and anemia), and variation in personnel costs. More detailed analysis of differences in cost and cost-effectiveness is needed to further inform geographic prioritization in the expansion of nutrition interventions in Afghanistan.

Third, the analysis assumes a constant relationship between costs and program coverage rates—in other words, it assumes that reaching the last beneficiary costs the same as the reaching the first ones. Although this may not be the case in reality, it is unclear whether marginal costs either decrease as the program expands because of economies of scales or, on the other hand, increase once all the easy-to-reach beneficiaries are covered and the program needs to expand to hard-to-reach populations and locations. This analysis also assumes that all people in Afghanistan will use public health services and not private services if available or choose not to seek care at all. Modelling health service utilization by sector and an estimation of future trends was outside of the scope of this report.

Fourth, impact modeling in this report uses the accepted global evidence for intervention effectiveness, but it is unclear whether these effectiveness rates reflect the realities in fragile and conflict-affected countries such as Afghanistan. It is conceivable that security challenges in Afghanistan may hinder the ability of families and health and nutrition workers to deliver the quality of nutrition interventions necessary to achieve effect sizes comparable to those from research studies in more stable low- and middle-income countries. A probabilistic sensitivity analysis of the impact and cost-effectiveness would be very valuable addition to the sensitivity analysis, but this was not possible using the impact modelling tools used for this analysis.

Last, these analyses focus only on nutrition-specific interventions whose impact has been demonstrated. Although there is emerging evidence of the impact of nutrition-sensitive interventions on stunting reduction, but it is too weak to estimate costs and impacts.

PART VI – DISCUSSION AND POLICY IMPLICATIONS

Implementing the Basic Package of Health Services (BPHS) nutrition package as planned by the Afghan Ministry of Public Health (MOPH) is estimated to cost an average of $44 million per year, or $219 million over five years in public sector funds, which is equivalent to $1.49 per capita per year or $10.69 per child under the age of five per year. The System of Health Accounts estimate indicate that, in 2014, Afghanistan spent about $97 million on nutrition disorders. The analysis presented above indicates that this annual expenditure needs to increase by about 45% on average, in order to reach the intervention coverage targets set by the MOPH.

While such an increase in nutrition expenditure in ambitious, the intervention scale-up would have substantial benefits: it would prevent 24,083 child deaths, 4,296 cases of stunting, and 87,227 case-years of anemia in women, and avert the loss of 639,530 DALYs. The total estimated cost per DALY averted of $112 suggests that this package would be very cost-effective according to World Health Organization (WHO) criteria. This investment is projected to generate economic benefits of $815 million over the productive lives of the beneficiaries. Each dollar invested would yield at least $13 in economic returns.

The estimated total cost of the nutrition package is consistent with other estimates of nutrition costs in Afghanistan. Collins and Newbrander (2016) found that the total direct cost of a community-nutrition project implemented by Save the Children across six provinces in Afghanistan was $1.10 per capita, which fits within the range of the per capita costs estimated for the BPHS nutrition interventions in this report. In 2012, the Health Economics and Financing Division (HEFD) estimated the cost of the entire BPHS package, including non-nutrition interventions, at $4.17 per capita (IRA MOPH 2012b); and Newbrander et al. (2003) estimated the cost at between $4.30 and $5.12. If these costs are adjusted with a 5 percent annual inflation rate to present-day cost, the cost estimate for the BPHS nutrition package as presented in these analyses represents 21 percent of the total costs of the BPHS package as estimated by the HEFD.

The preventive interventions in the package are the most cost-effective. Scaling up only the preventive interventions within the BPHS nutrition package to target coverage rates would lower the to cost $115 million and yield a higher estimated return for each dollar invested ($29 dollars vs. $13 for the whole package). Furthermore, the total estimated cost per DALY averted would decrease to $70 and the cost per case of stunting averted would decrease to $7,486. The promotion of salt iodization was the only intervention included in the BPHS nutrition package that had a private sector/household cost component, which totaled only $0.34 m over five years. Other Additional analysis included in the report on the fortification of wheat flour and edible oil also states that there would be private sector/household costs related to the production and purchase of these fortified food products.

Furthermore, although the BPHS nutrition package is very cost-effective, the scale-up of these interventions over the five-year period is estimated to have only a modest decrease—of less than half a percentage point – in Afghanistan's stunting prevalence. This is because only modest expansions in program coverage are planned for the interventions that most affect stunting. For example, for the support and promotion of exclusive breastfeeding, the most cost-effective intervention in this package, coverage is expected to increase from 43 percent to 55 percent by 2020. On the other hand, the MOPH plans to expand treatment interventions to almost full program coverage levels.

A substantially greater impact could be achieved if the modest target coverage rates for prevention interventions set by the MOPH were increased. Scaling up the full set of prevention interventions would multiply the impact by tripling the number of DALYs averted, doubling the number of deaths averted and avert almost eight times as many cases of stunting as compared with scaling up to more modest program coverage targets. The prevalence of anemia in pregnant women would be reduced by 11.7 percentage points and the prevalence of exclusive breastfeeding would be increased by 18 percentage points. This scale-up to full program coverage rates would cost $12.74 per child under the age of five per year and would be projected to generate economic benefits of $1.18 billion over the productive lives of the beneficiaries.

If full scale up is not possible, it is recommended to start with the most cost-effective interventions: the support and promotion of exclusive breastfeeding, complementary feeding education, the control and prevention of diarrheal diseases and parasitic infections, and vitamin A supplementation for children. Furthermore, scaling up preventive interventions is consistent with government plans to expand coverage of the infant and young child nutrition and maternal nutrition packages the focus on making investments in the early years which have the potential to break the cycle of poverty, address inequality, and boost productivity later in life.

Several interventions that are not currently included in the BPHS nutrition package should be considered for future inclusion due to their high-effectiveness and low relative costs. The implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes is expected to be an important policy intervention that will help foster a culture that is protective of breastfeeding. It is expected that fortification of oil with vitamin A can help reduce the burden of vitamin A deficiency in children and women of reproductive age. The delivery of weekly iron folic acid supplements to adolescent girls or women of reproductive age, if feasible, as well as wheat flour fortification would be very cost-effective in reducing the high prevalence of anemia across the country. (See sensitivity analysis in Appendix 14 for costs and cost-effectiveness of these interventions.) The majority of the costs of fortification interventions may also be borne largely by private sector enterprises in the agriculture sector.

Faryab, Farah, Bamyan, Herat, Balkh, Daykundi, Ghor, Kabul, and Jawzan are the nine provinces in which the BPHS nutrition package is most cost-effective. The total costs of scaling up to the target coverage set by the MOPH in only these nine provinces would be $73.9 million over five years. These provinces roughly correspond to the Northern and Northeastern regions, which have some of the country's highest rates of poverty and prevalence of severe acute malnutrition and moderate acute malnutrition in children. Under budget constraints, synergies and efficiencies in intervention implementation may also be achieved, and it is recommended that scarce resources be focused on increasing the target program coverage rates of the most cost-effective interventions in the most cost-effective regions.

This list of the most cost-effective provinces differs from the Akseer et al. (2018) list of provinces with the highest burden provinces in Afghanistan for two main reasons. First, Akseer et al. (2018) defined the highest burden provinces as those having a higher number districts with a high prevalence of malnutrition, based on district-level analysis from the National Nutrition Survey (2013), whereas this study reported provincial-level prevalence reported by the National Nutrition Survey. Akseer et al. (2018) concluded that that childhood stunting, underweight, and combined stunting and wasting were consistently highest in the districts of the Farah, Nangarhar, Nuristan, Kunar, Paktia and Badakhshan provinces. Using province-level prevalence rates from the National Nutrition Survey (2013) leads to a different conclusion. Second, the costing analysis in this report includes some variation in the unit cost of interventions due to the MOPH's policy on provide a sliding scale of hardship cost for health workers delivering interventions in provinces

with security concerns. As Figure 10 shows, the total cost of the BPHS nutrition package per capita in each of Nangarhar, Nuristan, Kunar, and Badakhshan were well above the median total cost per capita among provinces. The total cost per capita in Farah and Paktia were among the lowest. Therefore, since Farrah had among the highest provincial level burden of malnutrition and the lowest cost per capita for the delivery of interventions, it makes sense that it is ranked as one of the most cost-effective regions to implement the BPHS nutrition package. The differences in the provincial priorities listed by Akseer et al. (2018) and this report demonstrate the added-value (and a policy dilemma) of incorporating cost-effectiveness analysis into the nutrition policy and program planning. There is potential that future analysis with new modelling tools may be go beyond the comparison of the preventive and the curative packages by determining the optimal allocations for investments into specific interventions and regions with the BPHS, which may include raising or lower coverage levels of certain interventions.

It is unclear to what extent there exists fiscal space for expanding nutrition interventions in Afghanistan. In low-income and fragile settings even a single additional dollar of spending has many competing demands: both from within the health and outside the health sector. Although investments in nutrition are repeated identified as one of the best value-for-money investments in development, future analysis should investigate the fiscal space further.

CONCLUSIONS

This analysis demonstrates that the BPHS nutrition package is a very cost-effective approach to reducing maternal and child malnutrition and saving lives and, importantly, to strengthening human capital in Afghanistan. Implementing the BPHS nutrition package is expected to contribute to the economic development of Afghanistan by increasing the productivity of women in the labor force and generating higher earnings for child beneficiaries later in adulthood. However, the scale-up of this set of interventions to the program coverage levels set by the MOPH would achieve only a very modest decrease—of less than half a percentage point—in the national stunting prevalence in Afghanistan. A substantially greater impact – in term of lives saved, DALYs averted and important reductions in stunting and anemia rates – could be achieved by prioritizing the scale-up of the preventive interventions beyond the current target levels to full program coverage. This would be consistent with government plans to expand coverage of the infant and young child nutrition and maternal nutrition packages and a stated focus on making key investments in the early years which have the potential to break the cycle of poverty, address inequality, and boost the productivity of the next generation of Afghanis.

APPENDIXES

APPENDIX 1: TARGET POPULATION BY PROVINCE

Province	Total population (1)	Children 0–23 months (2)	Children 6–59 months (3)	Children 6–23 months (4)	Pregnant women (5)	Girls 10–19 years (6)
Badakhshan	966,789	57,952	126,612	43,266	37,828	83,596
Badghis	504,185	30,222	66,029	22,563	19,661	43,448
Baghlan	926,969	55,565	121,397	41,484	36,047	79,661
Balkh	1,353,626	81,141	177,273	60,578	52,743	116,558
Bamyan	454,633	27,252	59,539	20,346	17,885	39,524
Daykundi	468,178	28,064	61,313	20,952	18,167	40,147
Farah	515,973	30,929	67,572	23,091	20,050	44,309
Faryab	1,015,335	60,862	132,970	45,438	39,658	87,641
Ghazni	1,249,376	74,892	163,620	55,912	48,738	107,706
Ghor	701,653	42,059	91,889	31,400	27,382	60,511
Helmand	940,237	56,361	123,135	42,078	36,496	80,653
Herat	1,928,327	115,590	252,536	86,297	75,897	167,726
Jawzjan	549,900	32,963	72,016	24,609	21,542	47,606
Kabul	4,523,718	271,166	592,432	202,446	174,423	385,458
Kandahar	1,252,786	75,096	164,066	56,065	48,671	107,559
Kapisa	448,245	26,869	58,703	20,060	17,712	39,142
Khost	584,075	35,011	76,491	26,139	22,735	50,243
Kunarha	458,130	27,462	59,997	20,502	17,838	39,420
Kunduz	1,029,473	61,710	134,821	46,071	40,324	89,112
Laghman	452,922	27,150	59,315	20,269	17,616	38,931
Logar	398,535	23,889	52,193	17,835	15,618	34,514
Maidan Wardak	606,077	36,330	79,373	27,123	23,672	52,314
Nangarhar	1,545,448	92,639	202,394	69,162	60,178	132,987
Nimroz	167,863	10,062	21,984	7,512	6,543	14,459
Nooristan	150,391	9,015	19,695	6,730	5,877	12,987
Paktika	441,883	26,488	57,870	19,775	17,162	37,925
Paktya	561,200	33,640	73,495	25,115	21,881	48,354
Panjsher	156,001	9,351	20,430	6,981	6,081	13,439
Parwan	675,795	40,509	88,503	30,243	26,641	58,874
Samangan	394,487	23,647	51,663	17,654	15,360	33,943
Sar-e-Pul	569,043	34,110	74,523	25,466	22,152	48,953
Takhar	1,000,336	59,963	131,005	44,767	39,099	86,405
Urozgan	356,364	21,362	46,670	15,948	13,790	30,474
Zabul	309,192	18,534	40,492	13,837	12,015	26,551
Total	27,657,145	1,657,856	3,622,014	1,237,715	1,077,482	2,381,128

Sources: Column (1): IRA CSO (Islamic Republic of Afghanistan Central Statistics Organization). 2016. Demographic and Social Statistics (database), http://www.cso.gov.af/en/page/demography-and-socile-statistics/demograph-statistics/3897111 ; Columns (2), (3), (4), and (6): IRA CSO & LiST 2016; Column (5): IRA CSO, LiST, & National Nutrition Survey 2013.

APPENDIX 2: PREVALENCE OF STUNTING, WASTING, AND ANEMIA IN WOMEN

Region (UN)	Province	Prevalence of stunting (%)	Prevalence of wasting (%)	Prevalence of anemia in pregnant women (%)	Prevalence of anemia in non-pregnant women (%)
Central	Maidan Wardak	52.3	21.2	5.0	9.6
	Kabul	29.8	6.5		
	Panjsher	35.0	6.9		
	Parwan	41.1	7.8		
	Kapisa	48.1	7.4		
	Logar	30.4	6.8		
Central Highlands	Bamyan	51.7	5.0	7.7	5.0
	Daykundi	42.3	5.3		
Eastern	Kunarha	56.3	16.2	21.4	22.2
	Laghman	40.2	16.0		
	Nangarhar	40.9	9.4		
	Nooristan	63.3	16.7		
Northern	Balkh	34.6	5.7	18.7	27.0
	Faryab	48.4	3.7		
	Jawzjan	48.7	6.3		
	Samangan	47.1	6.2		
	Sar-e-Pul	49.8	7.9		
Northeastern	Badakhshan	49.8	9.3	21.3	37.8
	Baghlan	37.3	9.8		
	Kunduz	45.1	7.5		
	Takhar	46.9	21.6		
Southern	Helmand	30.8	14.5	8.7	16.4
	Kandahar	43.6	13.5		
	Nimroz	40.0	19.4		
	Urozgan	45.3	16.6		
	Zabul	40.4	9.4		
Southeastern	Paktya	34.0	7.2	19.5	20.3
	Khost	28.9	18.2		
	Ghazni	24.3	9.8		
	Paktika	54.9	8.7		
Western	Badghis	52.1	7.3	13.4	16.8
	Farah	70.8	3.9		
	Ghor	53.5	5.3		
	Herat	31.0	5.6		
NATIONAL	Total	40.9	9.5	16.3	21.4

Source: For stunting and wasting prevalence: NNS 2013; for anemia: MICS 2010–2011.

APPENDIX 3: CURRENT COVERAGE AND ADDITIONAL COVERAGE NEEDED TO REACH FULL COVERAGE

Intervention	Current coverage (% of total target population)	Coverage increases planned (percentage points)	Target coverage (% of total target population)
BPHS nutrition package			
Prevention			
1. Promotion of good infant and young child nutrition and hygiene practices			
a) Support and promotion of exclusive breastfeeding	43	12	55
b) Complementary feeding education	12	12	24
c) Community food preparation demonstration	5	35	40
2. Vitamin A supplementation for children	50	20	70
3. Control and prevention of diarrheal disease and parasitic infections			
a) Deworming in children	50	15	65
b) Deworming in adolescent girls	0	30	30
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	65	20	85
4. Promotion of balanced micronutrient-rich foods	20	20	40
5. Iron and folic acid supplementation for pregnant women	20	20	40

6. Promotion of iodized salt	66	24	90
7. Growth monitoring	20	20	40
8. Vitamin A supplementation for pregnant women	50	13	63
Treatment			
9. Treatment of severe acute malnutrition treatment a) with complications b) without complications	40 35	35 35	75 70
10. Management of moderate acute malnutrition	60	30	90
Surveillance and Referral			
11. Clinic-based nutrition surveillance	0	90	90
12. Screening for acute malnutrition and micronutrient deficiencies	0	90	90
Additional interventions included in the BPHS Nutrition Plus Package			
13. Iron and folic acid supplementation for adolescent girls	0	45	50
14. Fortification of wheat flour	5	45	50
15. Fortification of edible oil	3	47	50
16. Implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes	35	15	50

APPENDIX 4: DATA SOURCES AND RELEVANT ASSUMPTIONS FOR UNIT COSTS IN AFGHANISTAN

Intervention	High value (US$ / year)	Source	Assumption	Low value (US$ / year)	Source	Assumption
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	3.28	AKDN	Based on personnel salary for only three visits of 20 minutes each with a midwife and one visit of 20 minutes with a nutrition nurse	0.54	MOPH	Based solely on personnel salary for two visits of 10 minutes each with a midwife
b) Complementary feeding education	1.39	CAF	Based on personnel costs for one 10-minute visit with a midwife for counselling plus a CHW and an FHAG during a family home visit	—	—	—
c) Community food preparation demonstration	5.29	CAF	Based on personnel costs of 120 minutes for a CHW and an FHAG, plus cost of materials for demonstration (dishes, food items, gas, poster); 12 women participants per demonstration	2.53	MOPH	Based on 120 minutes of personnel time for a CHW and 30 for a CHW supervisor; 12 women participants per demonstration
2. Vitamin A supplementation for children	0.60	CAF	Based on 5 minutes of personnel cost for vaccinator during a vaccination campaign, plus the cost of vitamin A supplement	0.34	MOPH	Based on 5 minutes of personnel time for physician, plus the cost of vitamin A supplement
3. Control and prevention of diarrheal diseases and parasitic infections a) Deworming in children	1.04	AKDN	Based on 20 minutes of personnel cost for a doctor and a nurse plus 10 minutes with a CHW, plus the cost of mebendazol	0.34	MOPH	Based on 5 minutes of personnel cost for a doctor, plus cost of mebendazol
b) Deworming in adolescent girls	1.04	AKDN	Based on 20 minutes of personnel cost for a doctor and a nurse plus 10 minutes with a CHW, plus the cost of albendazole	0.28	MOPH	Based on 3 minutes of personnel cost for a doctor, plus the cost of albendazole

Intervention	High value (US$ / year)	Source	Assumption	Low value (US$ / year)	Source	Assumption
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	9.66	CAF	Based on 6 minutes of personnel cost for a nurse, 5 minutes for a doctor, and 2.5 minutes for a pharmacist, plus the cost of cotrimoxazole, ORS, and zinc	3.31	MOPH	Based on 49 minutes of personnel cost for a doctor and 21 minutes with a CHW over 14 visits, plus the cost of zinc
4. Promotion of balanced micronutrient-rich foods	5.64	WBG/ MOPH	Based on the cost of micronutrient powders sachet for children	—	—	—
5. Iron and folic acid supplementation for pregnant women[a]	2.82	MOPH	Based on the personnel cost of 5 minutes for a midwife, plus the cost of micronutrient tablets	—	—	—
6. Promotion of iodized salt	0.02	GAIN	—	—	—	—
7. Growth monitoring	5.15	AKDN	Based on personnel costs of 230 minutes with nurse, 115 minutes with a CHW supervisor, and 10 minutes with a midwife, plus the cost of a growth monitoring card	—	—	—
8. Vitamin A supplementation for pregnant women	1.00	CAF	Based on personnel costs of 1 minute with a midwife and 0.5 minutes with a pharmacist, plus the cost of vitamin A supplement and a brochure	0.15	MOPH	Based on personnel cost of 2 minutes with a midwife plus the cost of vitamin A supplement

Intervention	High value (US$ / year)	Source	Assumption	Low value (US$ / year)	Source	Assumption
9. Treatment of severe acute malnutrition a) with complications	85.68	SC	Based on the cost of inpatient care, which is comprised of food and food transport, and the cost of staffing and medicines; also the cost of follow-on outpatient care, which is comprised of food (ready-to-use therapeutic foods or RUTF), food transport, staffing, and medicines	43.57	MOPH	Based on personnel costs of 210 minutes with a doctor, 168 minutes with a nurse, plus the cost of F-75, F-100, resomal, ampicillin, amoxicillin, gentamycin, ceftriaxone, paracetomol, zinc oxide, and vitamin A
b) without complications	68.05	MOPH	Based on personnel costs of 120 minutes with doctor, 120 minutes with a nurse, plus the cost of RUTF, amoxicillin, mebendazole, and a treatment card	58.02	SC	Based on Collins and Newbrander 2016, unpublished report
10. Management of moderate acute malnutrition	69.20	OHT/ MOPH	Based on personnel costs of 54 minutes with a doctor and 54 minutes with a nurse, plus cost of Super Cereal	33.12	MOPH	Based on personnel costs of 54 minutes with a doctor and 54 minutes with a nurse, plus the cost of RUSF, amoxicillin, and mebendazole
11. Clinic-based nutrition surveillance	0.96	CAF	Based on personnel costs of 1 minute with a doctor, 1 minute with a nurse, plus the overhead cost of height measuring boards, weighing scales, growth monitoring charts, and registers	—	—	—
12. Screening for acute malnutrition and micronutrient deficiencies	1.11	CAF	Based on personnel costs of 2 minutes with a doctor, 2 minutes with a nurse, and 2.5 minutes with a CHW, plus the cost of a height measuring board, weigh scale, GM chart, and register	—	—	—

Intervention	High value (US$ / year)	Source	Assumption	Low value (US$ / year)	Source	Assumption
13. Iron and folic acid supplementation for adolescent girls a) School-based delivery	0.46	WBG	Based on Walters et al. 2016a estimated of cost of delivery of weekly iron and folic acid supplementation (WIFS) in Pakistan	—	—	—
b) Community-based delivery	3.31	MOPH	Based on personnel cost of 40 minutes with teachers and 40 minutes with a CHW, plus the cost of iron and folic acid supplement and albendazole	—	—	—
14. Fortification of wheat flour	0.36	GAIN	Based on Ghauri et al. 2016 estimate for cost of fortifying wheat with iron and folic acid.	—	—	—
15. Fortification of edible oil	0.04	GAIN	Based on Ghauri et al. 2016 estimate for cost of fortifying oil with micronutrients	—	—	—
16. Implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes	600,000	Shekar et al. 2016; Walters et al. 2016b	Estimated national cost of $600,000 annually, calculated as 20 percent of the cost of $3 million for policy and media extrapolated for an area the size of Afghanistan and modified based on coverage from the MOPH on implementation, and distributed across regions proportional to the population.	—	—	—

Note: AKDN = Aga Khan Development Network; CAF = Care of Afghan Families; CHW = community health worker; FHAG = family health action group; GAIN = Global Alliance for Improved Nutrition; GM = growth monitoring; MOPH = Ministry of Public Health; OHT = One Health Tool; ORS = oral rehydration solution; RUTF = ready-to-use therapeutic foods; RUTS = ready-to-use supplementary foods; SC = Save the Children; WBG = World Bank Group; WIFS = weekly iron and folic acid supplementation; — = not available.
a This intervention is called “maternal nutrition” in BPHS documentation.

APPENDIX 5: METHODOLOGY FOR ESTIMATING TOTAL COSTS FOR AFGHANISTAN

The following steps lay out the methodology used to estimate costs for each intervention:

1. Describe each intervention.
2. Define target populations for each intervention.
3. Estimate the size of the target populations for each intervention in each province using the most current demographic data from the Afghanistan Census Survey Organization 2016 and World Population Prospects 2015.
4. Specify the delivery platform or channel(s) for each intervention, based on the province context and the accepted delivery modes.
5. Identify data on the current coverage and target coverage levels for each intervention in each province or nationally.
6. Estimate the unit cost per beneficiary for each intervention from program experience in Afghanistan using data from the MOPH, AKDN, CAF, or other organizations. Calculate additional costs of scaling up to target coverage by multiplying the unit cost for each intervention with the size of the "uncovered" target population for each intervention by province. The formula for calculation is:

$$x_1 = z_1(z_2 - z_3)$$

where:

x_1 = additional costs of scaling up to target coverage
z_1 = unit cost per beneficiary
z_2 = target coverage level (percentage)
z_3 = current coverage level (percentage)

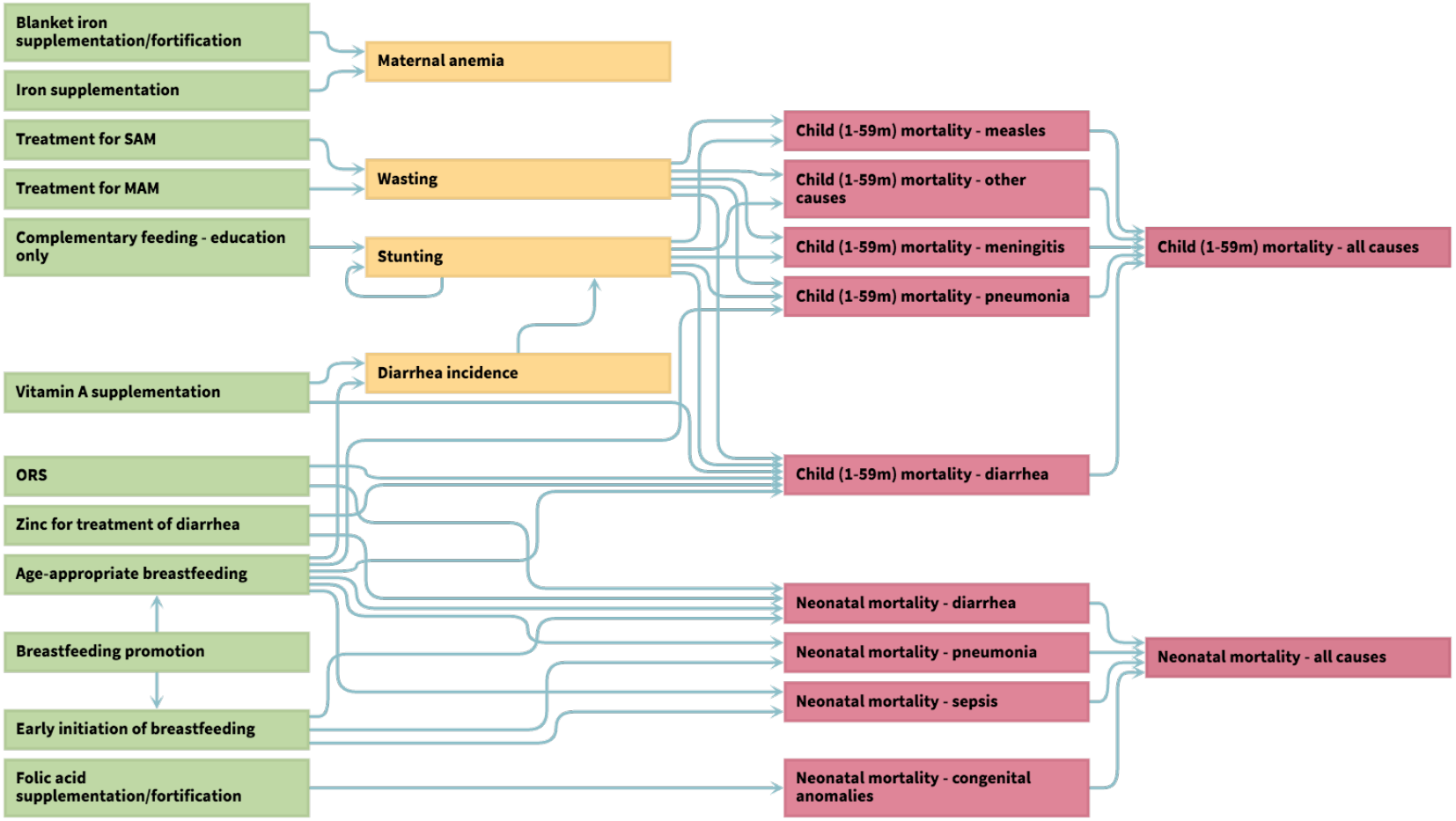
7. Estimate additional resources for general programs' costs for program staffing, training, training the trainer, training development costs, supervision, transportation, monitoring and evaluation, surveillance surveys, equipment and policy, communications and advocacy.
8. Estimate a portion of the total cost that can be covered by private household resources. It is assumed that households above the poverty line could cover their own cost of iron fortification, multiple micronutrient powders, salt iodization, and complementary food from private resources.
9. Calculate the annual public and donor investment required to scale up these interventions to full coverage using the following formula:

$$Y = (x_1 + x_2) - x_3$$

where:

Y = annual public and donor investment required to scale up to target coverage
x_1= additional total cost to scale up to target coverage
x_2= additional cost for general program costs
x_3= cost covered by households living above poverty line for selected interventions

APPENDIX 6: IMPACT PATHWAY FOR BPHS NUTRITION PLUS PACKAGE OF INTERVENTIONS



Source: LiST Visualizer, https://impactmodeltool.org/
Note: MAM = moderate acute malnutrition; ORS = oral rehydration solution; SAM = severe acute malnutrition.

APPENDIX 7: METHODOLOGY FOR ESTIMATING DALYS AVERTED, LIVES SAVED, CASES OF STUNTING AVERTED, AND CASE-YEARS OF ANEMIA AVERTED

Estimating DALYs Averted

To estimate the disability-adjusted life years (DALYs) averted from each intervention, the lives saved, stunting cases averted, and anemia case-years averted are first modeled using LiST (v5.47). LiST is part of an integrated set of tools that comprise the Spectrum policy modeling system. Once the demographic and health data have been updated, the coverage and scale-up plan for each intervention is introduced into LiST. Table 7.1 presents data sources.

Table 7.1: Data Sources for LiST Estimates, Afghanistan

Variable	Source
Demographic and socioeconomic data	
Provincial and national population data	IRA CSO 2016
Age group population data	LiST v. 5.47
Life expectancy	World Bank 2016a
Secondary Enrollment, Female	World Bank 2016a
Poverty rate, <US$1.90 / day	World Bank 2016a
GNI US$	World Bank 2016a
GDP growth projections	World Bank 2016b
Female Share of Labour Force	ILOSTAT 2015
Health, mortality, economic status	
Diarrhea incidence	Fischer Walker et al. 2012
Stunting distribution	LiST default; data have been calculated using DHS data sets
Wasting distribution	LiST default; data have been calculated using DHS data sets
Neonatal mortality	UNICEF 2014 (estimates developed by the UN Inter-agency Group for Child Mortality Estimation)
Infant mortality	UNICEF 2014 (estimates developed by the UN Inter-agency Group for Child Mortality Estimation)
Child mortality	UNICEF 2014 (estimates developed by the UN Inter-agency Group for Child Mortality Estimation)
Breastfeeding prevalence	National Nutrition Survey 2013
Anemia in women prevalence	National Nutrition Survey 2013; MICS 2010–2011
Total deaths, years of life lost, and years of life lived with disability	IHME 2013

Note: DHS = Demographic and Health Survey; IHME = Institute for Health Metrics and Evaluation; IRA CSO = Islamic Republic of Afghanistan Central Statistics Organization; MICS = Multiple Indicator Cluster Survey.

LiST can estimate the impact of each intervention in isolation from other implemented interventions or can calculate the simultaneous impact of a set of interventions implemented at

the same time. The second, simultaneous method is likely to yield slightly lower estimates because interventions may have overlapping benefits. In this analysis we present both the individual/isolated results of the individual interventions with totals calculated using the simultaneous method.

For each intervention, deaths averted are disaggregated by cause of death. To estimate the impact of interventions in terms of disability adjusted life years (DALYs), years of life lost (YLLs), and years lived with disability (YLDs) are estimated separately:

$$(\text{YLL averted})_{CoD} = (\text{Deaths averted})_{CoD} * (\text{Life expectancy at average age of death})_{CoD}$$

$$(\text{Total YLL averted})_{intervention} = \sum(\text{YLL averted})_{CoD}$$

$$(\text{YLD averted})_{CoD} = (\text{YLL averted})_{CoD} * [(\text{Total annual YLD})_{CoD} / (\text{Total annual YLL})_{CoD}]$$

$$(\text{Total YLD averted})_{intervention} = \sum(\text{YLD averted})_{CoD}$$

where

CoD = cause of death

For each cause of death impacted by an intervention, YLL averted are calculated as a product of the number of deaths averted and the average age at death from that cause (Yang et al. 2013). Results from the 2013 update of Global Burden of Disease (IHME 2013) are used to create a ratio of age-specific total YLDs and total YLLs for each cause of death in a country (see Table 7.2 for ratios). This ratio is then used as a multiplier for YLLs averted to estimate the YLDs averted for each cause (Montagu et al. 2013; Weinberger, Fry, and Hopkins 2015). For curative interventions, it is assumed that there will be some disability prior to the provision of the intervention and the intervention will avert only half of the YLDs.

DALYs averted by each intervention are estimated as the sum of YLLs averted and YLDs averted across all causes of death impacted by a given intervention:

$$(\text{DALYs averted})_{intervention} = (\text{total YLLs averted})_{intervention} + (\text{total YLDs averted})_{intervention}$$

Table 7.2: YLD-to-YLL Ratios Calculated from Afghanistan GBD data

Cause of death	YLD-to-YLL ratio
Neonatal diarrhea	0.011787084
Diarrhea (post-neonatal period to 59 months)	0.04971288
Neonatal pneumonia (upper/lower respiratory tract infection)	0.000558916
Pneumonia	0.002830039
Neonatal sepsis	0.001053267
Measles	0.000490504
Other (other neonatal disorders, nutritional deficiencies and infectious diseases)	0.021350347
Neonatal asphyxia (encephalopathy)	0.000426711
Neonatal prematurity (preterm birth due to complications)	0.00477274
Neonatal congenital anomalies (neural tube defects)	0.004043064

Source: IHME 2013.

A different approach is required for the interventions that reduce anemia in women. The LiST output for the number of case-years averted of anemia in women is multiplied by the disability weights for mild, moderate, and severe anemia (IHME 2013) and the best estimates available for the distribution of mild, moderate, and severe anemia within the population of women. It is assumed that the duration of a case of anemia would be one entire year if it was not averted.

Estimating Lives Saved

The projected number of lives saved is also calculated using LiST, which translates measured coverage changes into estimates of reductions in mortality. Because of limitations in LiST, the calculation for the number of lives saved is based on only six of the 12 interventions;[12] thus our estimates are likely to underestimate the actual number of lives saved.

Estimating Cases of Stunting Averted

In order to estimate the number of cases of under-five stunting averted attributable to the annual investment in the scaling up of nutrition interventions, we use LiST to model changes in the prevalence of stunting over five years, during which the interventions are projected to have reached the target coverage percent of the target population. Next, we model changes in the prevalence of stunting over five years with no scale-up of the interventions. We then take the difference between the estimated stunting prevalence in Year 5 with the scale-up and the prevalence in Year 5 absent the scale-up, and multiply this percentage point difference by the total population of children under five years of age.

Our reason for using stunting prevalence in Year 5 relates to the assumptions built into the LiST model, which assumes that stunting is itself a risk factor for becoming stunted in the next time period. As a result, stunting prevalence remains flat during the first two years of the scale-up, before dropping precipitously until Year 5, after which the prevalence begins to level out. We assume that continuing investments in maintaining scale after Year 5 will serve to maintain the gains in stunting prevalence reduction, and therefore we present this reduction as a benefit attributable to a one-year investment in scaling up nutrition.

On the other hand, when estimating stunting reduction (and lives saved) attributable to a five-year scale-up plan, we model this scale-up directly in LiST and use the annual results over five years in our cost-benefit analysis. Using annual results over five years provides a more accurate portrayal of the direct benefits attributable to a five-year scale up plan, and it does not assume that the scale will necessarily be maintained following the end of the period covered in the plan.

The estimate of cases of childhood stunting averted is based on four of the 12 interventions, because of limitations in the LiST model. As such, our estimates are likely to underestimate the number of cases of childhood stunting averted.

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[12] The six interventions are community nutrition programs for growth promotion, vitamin A supplementation, therapeutic zinc supplementation with oral rehydration solution, iron-folic acid supplementation, the public provision of complementary food for the prevention of moderate acute malnutrition, and community-based treatment of severe acute malnutrition.

Estimating Case-Years of Anemia Averted

LiST (v5.47) includes a module for the estimation of the number of cases of anemia averted in pregnant women and women of reproductive age. To prevent a case of anemia in a woman, the intervention—either iron and folic acid supplementation for pregnant women or iron supplementation or fortification for women of reproductive age—must be delivered in each year. Thus summing up the cases averted of all years of a scale-up plan will include redundant cases of anemia in women. Therefore it is best to refer the total number of "case-years" of anemia in women averted or use only the number of cases averted in the final year of the plan.

APPENDIX 8: METHODOLOGY FOR ESTIMATING ECONOMIC BENEFITS

There is considerable debate in the literature regarding the best methodology for monetizing the value of a life saved. In this analysis, we focus solely on the economic value of a life year, which we measure as equal to GNI per capita. Other studies attempt to estimate the social value of a life year as well as its economic value; because we do not, we acknowledge that our results underestimate the true value of a life year saved.

Benefits were calculated based on estimates of lives saved and cases of stunting averted obtained from the LiST model (see Appendix 7). In the base-case scenario, one life saved at age five was valuated as one times GDP per capita. One case of stunting averted was valuated at 21 percent of GDP per capita based on estimates of the impact of childhood stunting on adult wages (Hoddinott et al. 2013) and further adjusted to account for the proportion of income from wages (52 percent) (based on Lübker 2007). Benefits resulting from the prevention of cognitive losses resulting from iodine deficiency were also included.

The following equation summarizes the approach to the valuation of health outcomes and calculation of monetary benefits:

$$B = LS * (1 - P) * GDPpc + LS * P * GDPpc * (1 - S) * L + CS * GDPpc * S * L + IS * GDPpc * I$$

where:

B = monetary benefits
LS = unique lives saved
CS = unique cases of stunting prevented
IS = additional children who benefited from salt iodization
P = prevalence of stunting
GDPpc = GDP per capita
S = percent of wage income gained as a result of the child not being stunted
I = percent of wage income gained as a result of the child not suffering from iodine deficiency
L = proportion of income from labor

The benefits were calculated over the lifetimes of children benefitting from the interventions. Conservatively, it was assumed that the children would start earning wages at the age of 18 and earn until the age of 61 (the life expectancy at birth in Afghanistan).

LiST is a cohort model that produces annual estimates of prevalence and mortality in a cohort of children 0–59 months of age. Over five years, the same child would contribute to stunting prevalence and mortality averted five times as he or she ages through the cohort (once at 0–11 months, then again at 12–23 months, and so forth). Consequently, the same child could be saved from being stunted or from dying multiple times during that time period (for example, a child could be at risk of dying from diarrhea at age 1, then again at age 2, then again at age 3, and so forth).

To avoid counting and assigning a monetary value multiple times to stunting or mortality averted in the same child, based on the LiST output, estimates were made of unique lives saved and unique cases of stunting averted. More specifically, every year, the number of cases of stunting averted and lives saved in children 48–59 months old who would be aging out of the LiST cohort in that year were estimated. Consistent with the extant literature, it was assumed that after

children reach five years of age, their stunting status is irreversible and that children who are not stunted at age five would remain not stunted and vice versa.

Net present value (NPV) was calculated using the following formula:

$$NPV = \sum_{t=0}^{n} \frac{(Benefits - Costs)_t}{(1+r)^t}$$

where:

r = discount rate
t = year
n = analytic horizon (in years)

The baseline GDP per capita of $630 was used for the first year of benefits (World Bank 2016a). The World Bank forecasts GDP growth rate of 0.8 percent in 2016, 1.9 percent in 2017, 2.75 percent in 2018, and 3.6 percent in 2019 for Afghanistan (World Bank 2016a). Beyond 2018, the long-term average GDP growth rate was assumed to be of a constant 3.6 percent. A 5 percent higher long-term GDP growth rate was used in sensitivity analysis. This rate is roughly equivalent to the historical average GDP growth rate for all low- and middle-income countries over the last decade (World Bank 2016a) and average for oil-importing countries within the Middle East, North Africa, Afghanistan, and Pakistan group of countries. Future benefits are discounted at 3 percent and 5 percent discount rates. The present value of future benefits is then compared with the annual public resource requirement, which allows us to estimate the NPV of benefits, internal rate of return, and benefit-cost ratio of the investment.

APPENDIX 9: ANNUAL COSTS BY INTERVENTION BY YEAR, ASSUMING SCALE UP TO MOPH PROGRAM COVERAGE TARGETS

Intervention	2016 (US$, millions)	2017 (US$, millions)	2018 (US$, millions)	2019 (US$, millions)	2020 (US$, millions)	Total cost (US$, millions)
Prevention						
1. Promotion of good infant and young child nutrition and hygiene practices	1.70	2.04	2.43	2.85	3.33	12.35
2. Vitamin A supplementation for children	1.08	1.25	1.45	1.66	1.89	7.33
3. Control and prevention of diarrheal disease and parasitic infections (deworming in children and adolescent girls, and therapeutic zinc and oral rehydration solution for diarrhea in children)	6.73	7.73	8.84	10.08	11.42	44.80
4. Promotion of balanced micronutrient-rich foods	1.50	1.97	2.50	3.09	3.74	12.80
5. Iron and folic acid supplementation for pregnant women	0.27	0.37	0.48	0.60	0.75	2.48
6. Promotion of iodized salt	0.03	0.03	0.04	0.05	0.05	0.20
7. Growth monitoring	0.14	0.18	0.23	0.28	0.34	1.17
8. Vitamin A supplementation for pregnant women	0.42	0.47	0.53	0.59	0.66	2.66
Treatment						
9. Treatment of severe acute malnutrition with and without complications	4.04	5.24	6.56	8.03	9.64	33.52
10. Management of moderate acute malnutrition	5.12	6.58	8.20	10.00	11.97	41.88
Surveillance and Referral						
11. Clinic-based nutrition surveillance	0.00	0.03	0.07	0.11	0.15	0.35
12. Screening for acute malnutrition and micronutrient deficiencies	0.00	0.01	0.01	0.02	0.03	0.07
Subtotal intervention costs	21.02	25.90	31.34	37.37	43.97	159.61
Program costs	10.55	16.74	10.24	11.27	10.40	59.19
Total costs (intervention + program costs)	31.58	42.64	41.58	48.64	54.36	218.80
Additional costs borne by private sector/households	0.00	0.03	0.07	0.10	0.14	0.34

APPENDIX 10: COSTS OF BPHS NUTRITION INTERVENTIONS BY PROVINCE, *US$, THOUSANDS*

Province	Promotion of good infant and young child nutrition and hygiene practices (children 0–23 months)	Vitamin A supplementa-tion (children 6–59 months)	Control and prevention of diarrheal disease and parasitic infections (children 6–59 months and adolescent girls)	Promotion of balanced micronutrient-rich foods (children 6–23 months)	Iron and folic acid supplementa-tion for pregnant women	Promotion of iodized salt	Growth monitoring	Vitamin A supplementa-tion for pregnant women	Treatment of severe acute malnutrition	Management of moderate acute malnutrition (children 6–23 months)	Clinic-based nutrition surveillance	Screening for acute malnutrition and micronutrient deficiencies	Program cost	Total cost BPHS Nutrition package including program cost
Badakhshan	493,639	262,368	1,638,664	447,490	87,543	7,159	40,813	95,877	1,201,078	1,550,930	30,318	6,556	2,174,170	8,036,605
Badghis	256,728	136,826	854,496	233,368	45,500	3,734	21,284	50,000	491,665	605,839	6,485	1,101	1,003,940	3,710,965
Baghlan	405,768	245,000	1,492,500	429,059	82,750	6,864	39,132	88,676	1,196,139	1,495,327	11,065	2,475	2,037,810	7,532,565
Balkh	545,792	352,976	2,122,290	626,543	120,585	10,024	57,144	127,117	1,008,548	1,270,043	15,532	1,999	2,321,091	8,579,683
Bamyan	217,002	121,769	751,444	210,433	41,223	3,367	19,192	44,289	301,485	374,176	5,637	650	775,354	2,866,022
Daykundi	237,446	127,054	793,369	216,702	42,043	3,467	19,764	46,429	331,469	408,443	6,022	742	828,123	3,061,074
Farah	243,859	138,199	852,571	238,825	46,214	3,821	21,782	50,264	266,886	331,235	6,398	575	816,135	3,016,764
Faryab	481,855	271,949	1,677,908	469,960	91,409	7,519	42,863	98,910	498,248	618,381	12,589	1,073	1,584,580	5,857,245
Ghazni	592,319	334,634	2,064,610	578,289	112,336	9,252	52,743	121,710	1,623,880	2,015,413	15,491	3,499	2,790,451	10,314,628
Ghor	357,499	190,415	1,189,189	324,769	63,368	5,196	29,620	69,583	496,769	612,129	9,024	1,112	1,241,905	4,590,580
Helmand	476,980	255,162	1,593,328	435,200	84,461	6,963	39,692	93,244	1,821,218	2,244,141	12,093	4,077	2,620,737	9,687,296
Herat	783,712	502,836	3,024,009	892,550	173,522	14,280	81,405	181,087	1,411,536	1,777,516	22,126	2,798	3,288,596	12,155,972
Jawzjan	242,129	145,340	885,539	254,528	49,452	4,072	23,214	52,605	456,157	570,255	6,564	944	997,922	3,688,722
Kabul	1,809,010	1,179,619	7,090,913	2,093,859	398,777	33,499	190,970	424,817	3,843,546	4,840,092	51,906	7,619	8,145,903	30,110,530
Kandahar	547,979	331,114	2,017,049	579,868	111,730	9,277	52,887	119,845	2,226,902	2,783,911	14,954	4,607	3,263,654	12,063,777
Kapisa	198,731	118,472	721,984	207,476	40,660	3,319	18,923	42,880	436,755	545,999	5,351	904	868,362	3,209,816
Khost	276,423	156,439	965,140	270,346	52,403	4,325	24,657	56,899	1,409,856	1,749,785	7,242	3,037	1,845,628	6,822,181
Kunarha	216,868	122,706	757,031	212,051	41,115	3,393	19,340	44,629	984,325	1,221,655	5,680	2,121	1,346,578	4,977,492
Kunduz	453,240	272,092	1,657,821	476,504	92,567	7,623	43,459	98,482	1,016,639	1,270,928	12,289	2,103	2,004,059	7,407,806
Laghman	198,293	119,708	729,247	209,641	40,440	3,354	19,120	43,328	954,188	1,192,856	5,406	1,974	1,304,537	4,822,093
Logar	175,528	105,334	641,792	184,467	35,852	2,951	16,824	38,125	356,834	446,088	4,757	738	745,174	2,754,464
Maidan Wardak	266,231	160,187	975,936	280,530	54,342	4,488	25,586	57,979	1,691,820	2,114,991	7,235	3,500	2,092,724	7,735,550
Nangarhar	622,812	402,996	2,423,004	715,330	137,582	11,444	65,242	145,131	1,898,914	2,391,261	17,733	3,764	3,276,668	12,111,881
Nimroz	79,529	44,961	277,390	77,697	15,081	1,243	7,086	16,353	431,908	536,045	2,081	931	552,702	2,043,007
Nooristan	76,708	40,813	254,897	69,610	13,600	1,114	6,349	14,914	335,502	413,412	1,934	751	456,017	1,685,622
Paktika	224,268	119,918	748,827	204,531	39,716	3,272	18,654	43,822	513,550	632,807	5,683	1,150	948,004	3,504,203
Paktya	265,949	150,313	927,379	259,758	50,433	4,156	23,691	54,670	535,902	665,112	6,958	1,155	1,092,373	4,037,849

Panjsher	**68,418**	**41,231**	**251,189**	**72,207**	**13,960**	**1,155**	**6,586**	**14,923**	**141,732**	**177,183**	**1,862**	**293**	**293,257**	**1,083,997**
Parwan	**299,053**	**178,614**	**1,088,437**	**312,800**	**61,156**	**5,004**	**28,529**	**64,648**	**694,065**	**867,670**	**8,067**	**1,436**	**1,338,628**	**4,948,107**
Samangan	**186,738**	**105,660**	**651,864**	**182,593**	**35,403**	**2,921**	**16,653**	**38,430**	**324,384**	**402,596**	**4,891**	**699**	**724,236**	**2,677,068**
Sar-e-Pul	**269,326**	**152,413**	**940,303**	**263,389**	**51,058**	**4,214**	**24,022**	**55,434**	**596,221**	**739,975**	**7,056**	**1,285**	**1,151,422**	**4,256,117**
Takhar	**439,664**	**264,391**	**1,610,819**	**463,018**	**89,756**	**7,408**	**42,229**	**95,695**	**2,845,051**	**3,556,677**	**11,941**	**5,886**	**3,498,194**	**12,930,729**
Urozgan	**180,328**	**96,710**	**603,847**	**164,948**	**31,912**	**2,639**	**15,044**	**35,341**	**790,239**	**973,748**	**4,583**	**1,769**	**1,075,918**	**3,977,027**
Zabul	**156,992**	**83,909**	**523,972**	**143,113**	**27,805**	**2,290**	**13,053**	**30,663**	**388,251**	**478,411**	**3,977**	**869**	**687,325**	**2,540,629**
Total	**12,346,819**	**7,332,128**	**44,798,758**	**12,801,455**	**2,475,755**	**204,805**	**1,167,554**	**2,656,801**	**33,521,664**	**41,875,029**	**350,930**	**74,191**	**59,192,178**	**218,798,067**

Note: The estimates are based on the assumption of uniform unit cost across all provinces.

APPENDIX 11A: TOTAL COST AND SCALE-UP COST BY PROVINCE, BY UNIT COST ASSUMPTION

	High-value unit cost assumptions		Low-value unit cost assumptions	
Province	**Total costs 2016–20 (US$, millions)**	**Scale-up costs 2017–20 (US$, millions)**	**Total costs 2016–20 (US$, millions)**	**Scale-up Costs 2017–20 (US$, millions)**
Badakhshan	8.04	2.64	5.31	1.85
Badghis	3.71	1.19	2.43	0.83
Baghlan	7.53	2.47	5.04	1.75
Balkh	8.58	2.71	5.52	1.88
Bamyan	2.87	0.89	1.83	0.62
Daykundi	3.06	0.96	1.96	0.66
Farah	3.02	0.93	1.90	0.63
Faryab	5.86	1.79	3.67	1.22
Ghazni	10.31	3.37	6.90	2.38
Ghor	4.59	1.43	2.95	0.99
Helmand	9.69	3.25	6.66	2.33
Herat	12.16	3.84	7.81	2.66
Jawzjan	3.69	1.17	2.39	0.81
Kabul	30.11	9.60	19.55	6.70
Kandahar	12.06	4.04	8.25	2.90
Kapisa	3.21	1.03	2.10	0.72
Khost	6.82	2.33	4.76	1.68
Kunarha	4.98	1.69	3.45	1.21
Kunduz	7.41	2.38	4.86	1.67
Laghman	4.82	1.63	3.34	1.18
Logar	2.75	0.88	1.79	0.61
Maidan Wardak	7.74	2.67	5.45	1.94
Nangarhar	12.11	3.97	8.07	2.81
Nimroz	2.04	0.70	1.43	0.51
Nooristan	1.69	0.57	1.17	0.41
Paktika	3.50	1.13	2.33	0.80
Paktya	4.04	1.29	2.64	0.90
Panjsher	1.08	0.35	0.71	0.24
Parwan	4.95	1.60	3.25	1.12
Samangan	2.68	0.85	1.73	0.59
Sar-e-Pul	4.26	1.37	2.80	0.96
Takhar	12.93	4.47	9.11	3.25
Urozgan	3.98	1.35	2.76	0.97
Zabul	2.54	0.83	1.70	0.58
Total	218.80	71.36	145.62	50.36

Note: The estimates are based on the assumption of uniform unit cost across all provinces.

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APPENDIX 11B: TOTAL COST PER CAPITA BY PROVINCE, BY UNIT COST ASSUMPTION

Province	Cost per capita using high-value unit cost assumptions	Cost per capita using low-value unit cost assumptions
Badakhshan	1.57	1.04
Badghis	1.39	0.91
Baghlan	1.54	1.03
Balkh	1.20	0.77
Bamyan	1.19	0.76
Daykundi	1.24	0.79
Farah	1.10	0.69
Faryab	1.09	0.68
Ghazni	1.56	1.04
Ghor	1.24	0.79
Helmand	1.95	1.34
Herat	1.19	0.76
Jawzjan	1.27	0.82
Kabul	1.26	0.82
Kandahar	1.82	1.24
Kapisa	1.35	0.89
Khost	2.21	1.54
Kunarha	2.05	1.42
Kunduz	1.36	0.89
Laghman	2.01	1.39
Logar	1.31	0.85
Maidan Wardak	2.41	1.70
Nangarhar	1.48	0.99
Nimroz	2.30	1.61
Nooristan	2.12	1.47
Paktika	1.50	0.99
Paktya	1.36	0.89
Panjsher	1.31	0.86
Parwan	1.38	0.91
Samangan	1.28	0.83
Sar-e-Pul	1.41	0.93
Takhar	2.44	1.72
Urozgan	2.11	1.46
Zabul	1.55	1.04
Total	1.49	0.99

Note: The estimates are based on the assumption of uniform unit cost across all provinces.

APPENDIX 12: GENERAL PROGRAM COST BY CATEGORY AND YEAR (US$, MILLIONS)

Intervention	2016	2017	2018	2019	2020	Total
Program staffing	0.40	0.40	0.40	0.40	0.40	$2.01
Training	3.70	3.66	3.70	3.48	3.43	$17.98
Train the Trainer	0.05	0.54	0.05	0.56	0.05	$1.24
Training development costs	0.00	0.05	0.00	0.00	0.00	$0.05
Supervision	1.69	1.69	1.69	1.69	1.69	$8.44
Transportation	2.57	2.61	2.57	2.61	2.58	$12.94
Monitoring and evaluation	0.21	0.26	0.31	0.37	0.44	$1.60
Surveillance surveys	0.01	0.48	0.11	0.11	0.11	$0.83
Equipment	1.71	6.78	1.08	1.65	1.25	$12.48
Policy, communications, & advocacy	0.21	0.26	0.31	0.37	0.44	$1.60
Miscellaneous	0.01	0.01	0.01	0.01	0.01	$0.03
Total	**10.6**	**16.7**	**10.2**	**11.3**	**10.4**	**$59.19**
% of total BPHS nutrition package cost (including program cost)	33%	39%	25%	23%	19%	27%

APPENDIX 13: IMPACT AND COST-EFFECTIVENESS BY PROVINCE, 2020

Province	Deaths averted	Cases of stunting averted	Case-years of anemia averted	DALYs averted	Cost per death averted (US$)	Cost per case of stunting averted (US$)	Cost per case-year of anemia averted (US$)	Cost per DALY averted (US$)
Badakhshan	842	188	4,943	22,356	$3,132	$14,060	$17.71	$117.93
Badghis	439	102	1,616	11,659	$2,701	$11,591	$28.15	$101.71
Baghlan	807	135	4,710	21,435	$3,058	$18,331	$17.57	$115.15
Balkh	1,179	182	6,050	31,301	$2,301	$14,868	$19.93	$86.64
Bamyan	396	92	845	10,513	$2,259	$9,768.12	$48.80	$85.05
Daykundi	408	77	858	10,826	$2,347	$12,403.59	$48.99	$88.37
Farah	449	142	1,648	11,931	$2,062	$6,511.59	$28.04	$77.64
Faryab	884	191	4,549	23,478	$2,028	$9,369.10	$20.09	$76.37
Ghazni	1,088	118	5,830	28,890	$3,100	$28,529	$19.27	$116.76
Ghor	611	146	2,251	16,225	$2,348	$9,813.72	$28.15	$88.43
Helmand	819	113	1,948	21,742	$3,970	$28,822	$43.36	$149.51
Herat	1,679	233	6,239	44,590	$2,286	$16,486	$27.81	$86.07
Jawzjan	479	104	2,471	12,716	$2,446	$11,232.30	$20.01	$92.13
Kabul	3,939	525	5,350	104,604	$2,438	$18,293	$74.54	$91.81
Kandahar	1,091	213	2,598	28,969	$3,706	$19,006	$43.01	$139.56
Kapisa	390	84	543	10,365	$2,641	$12,278.62	$74.84	$99.47
Khost	509	66	2,720	13,506	$4,577	$35,412	$19.27	$172.36
Kunarha	399	100	2,342	10,594	$4,225	$16,781	$17.56	$159.12
Kunduz	896	181	5,269	23,805	$2,657	$13,171	$17.57	$100.05

Province	Deaths averted	Cases of stunting averted	Case-years of anemia averted	DALYs averted	Cost per death averted (US$)	Cost per case of stunting averted (US$)	Cost per case-year of anemia averted (US$)	Cost per DALY averted (US$)
Laghman	394	71	2,313	10,473	$4,145	$23,052	$17.49	$156.07
Logar	347	47	479	9,216	$2,534	$18,639	$74.84	$95.43
Maidan Wardak	528	123	3,108	14,015	$5,057	$21,619	$17.49	$190.43
Nangarhar	1,346	241	3,212	35,736	$2,947	$16,472	$42.84	$110.97
Nimroz	146	41	859	3,882	$4,788	$16,914	$17.56	$180.32
Nooristan	131	32	703	3,478	$4,360	$17,759	$19.35	$164.20
Paktika	385	59	2,053	10,218	$2,947	$19,379	$19.35	$110.97
Paktya	489	76	671	12,977	$2,643	$16,885	$75.15	$99.53
Panjsher	136	25	187	3,607	$2,550	$13,875	$74.84	$96.04
Parwan	588	124	3,056	15,627	$2,711	$12,869	$20.01	$102.09
Samangan	344	77	1,762	9,122	$2,467	$11,075.81	$20.09	$92.90
Sar-e-Pul	496	104	2,894	13,158	$2,766	$13,186	$17.64	$104.15
Takhar	871	176	2,087	23,131	$5,127	$25,306	$43.01	$193.07
Urozgan	310	56	423	8,240	$4,340	$24,019	$75.45	$163.43
Zabul	269	51	641	7,150	$3,071	$16,269	$43.36	$115.63

Note: The estimates are based on the assumption of uniform unit cost across all provinces.

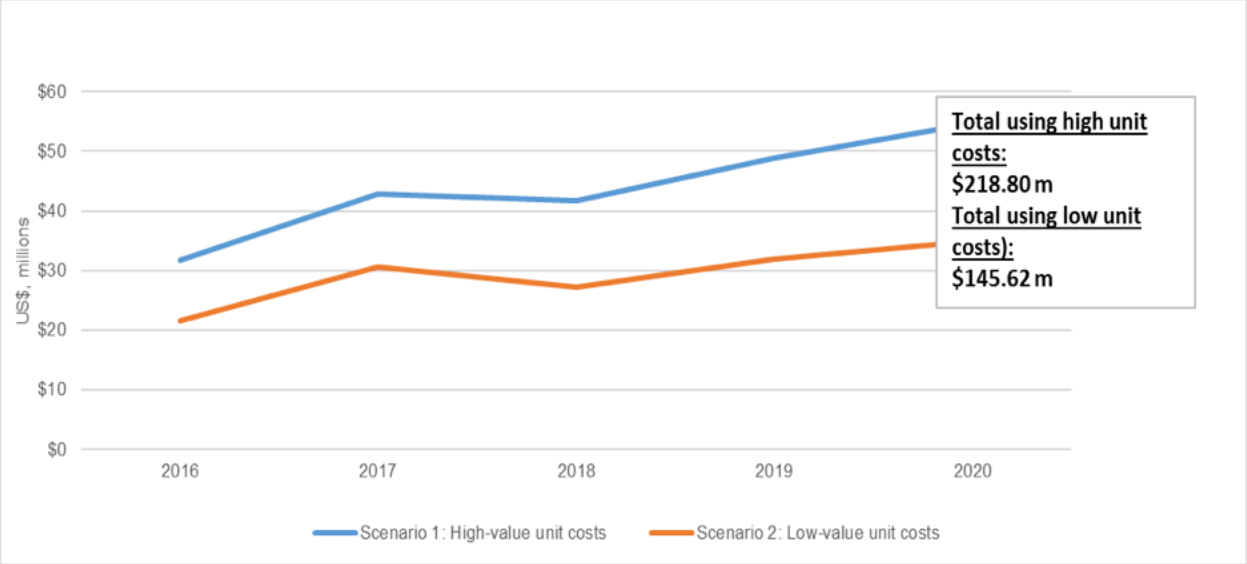
APPENDIX 14: SENSITIVITY ANALYSIS

Since there is uncertainty regarding some of the key parameters used in the analysis, it is important to consider how changes in those parameters may affect the estimates of the costs, impacts, cost-effectiveness, and economic benefits. Key parameters that are varied include unit costs, which were collected from multiple sources; discount rates; and expected GDP growth rates.

First, the analysis considers the uncertainty of unit costs, which were collected from three sources. It is possible that the unit costs used for the analysis are not representative of the cost of BPHS service provision in each province in Afghanistan, which use different implementing agencies.

As noted above, in the core analyses the highest unit cost for each intervention was used. The sensitivity analysis shows that using the lowest values would result in a total cost that would be 33 percent lower than the estimate based on the high unit cost values. The total cost in the low-cost scenario of the BPHS Nutrition package would be $145.62 million over five years (Figure 14.1); the average annual national per capita cost is lowered to $0.99 per person per year, with a range of $0.68 in Faryab to $1.72 per capita in Takhar.

Figure 14.1. Sensitivity Analysis: Total Cost of High-Value and Low-Value Unit *Costs*

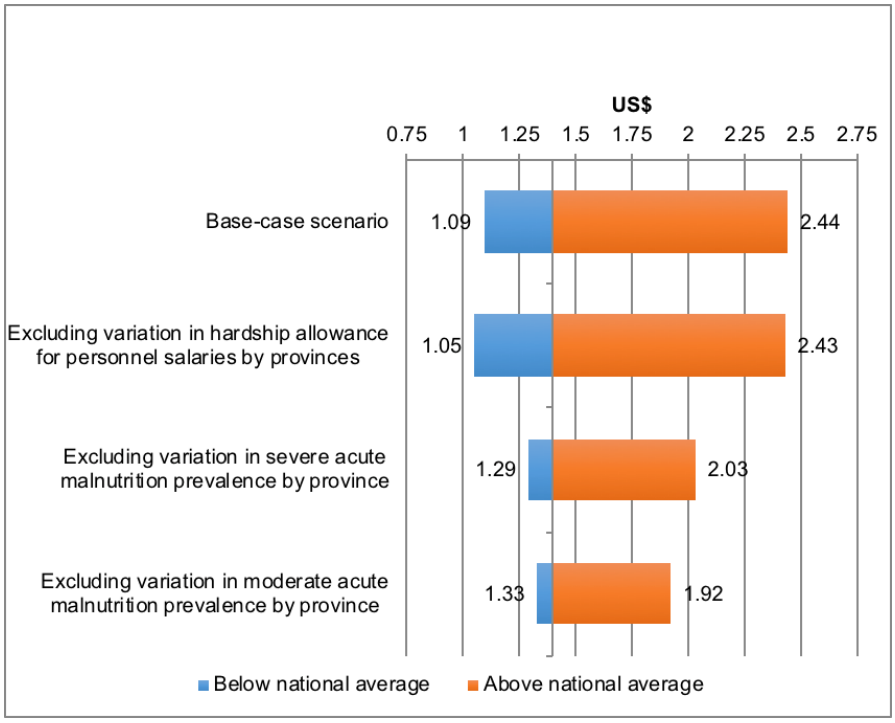


Another major potential source of uncertainty is the selection of the population data used for the basis of the costing analysis. The base-case scenario used estimates from the Afghanistan Central Statistics Organization (CSO), which reported that the total national population in Afghanistan was 27.6 million in 2016–17. The World Population Prospects (WPP), however, offers an alternative population projection of 33.7 million in 2016—approximately 20 percent higher. Using the WPP population estimates may result in a total cost for the BPHS Nutrition package of $263 million, which is roughly $45 million higher than estimates using the CSO statistics.

The key drivers of variation by province are the prevalence of both moderate acute malnutrition in children and severe acute malnutrition in children. The hardship allowance of 10, 20, and 30

percent of base salary allocated to BPHS personnel in some provinces also affects the per capita cost by province, but to a much lesser extent than severe acute malnutrition and moderate acute malnutrition prevalence. In fact, the range in per capita cost from a low of $1.09 in Faryab to a high of $2.44 in Takhar can be nearly entirely explained by these three factors: excluding all three sources of variation reduces the range to less than $0.02 between provinces (see Figure 14.2).

Figure 14.2. One-Way Sensitivity Analysis of the Range of Per Capita Cost by Pro*vinc*e, *2*016–20, US$



The key drivers of variation in cost per DALY averted by province are predominantly the prevalence of moderate acute malnutrition and severe acute malnutrition in children. Similar to the sensitivity analysis on per capita cost by province, the range in cost per DALY averted between from a low of $76 in Faryab to a high of $193 per capita in Takhar can be explained by these two factors. Similarity, the high prevalence of anemia in pregnant women is the key driver of cost-effectiveness for anemia reduction. The prevalence of anemia in pregnant women is higher than 20 percent in both the Northeastern and Eastern regions, which were deemed most cost-effective for reducing anemia.

The results of the cost-benefit analysis are sensitive not only to assumptions about future discount rates but also to the unit costs selected and the long-term GDP growth rate. If the low-value unit cost is used, the benefit-cost ratio in the base-case scenario increases from 13 to 18). If a higher long-term mean GDP growth rate of 5 percent is assumed, the estimated economic benefits produced by the BPHS nutrition package to target levels increase to $1.3 billion and return on investment of 21 dollars for each dollar invested (Table 14.3). Under this scenario of a 5 percent GDP growth rate, scaling up the preventive interventions only would generate the highest return on investment of approximately 47 dollars for each dollar invested. The current low labor force participation rate of females in Afghanistan limits the contribution of anemia reduction to increasing economic productivity in all scenarios.

Table 14.3. Net Benefits of the BPHS nutrition package, 2016–20 at 5% GDP growth rate

Cost-benefit analysis (at 5 % GDP growth rate)	Discount rate			
	3%		5%	
	Net present value of benefits (US$, millions)	Benefit-cost ratio	Net present value of benefits (US$, millions)	Benefit-cost ratio
Scenario 1: BPHS scaled up to target* program coverage levels				
All interventions	$1,360.3	**21.4**	$607.5	**10.3**
Preventive	$1,336.4	**46.9**	$612.6	**23.2**
Curative	$50.8	**1.5**	$7.8	**0.2**
Scenario 2: BPHS scaled up to full program coverage				
All interventions	$2,061.0	**19.5**	$916.1	**9.4**
Preventive	$2,012.5	**33.5**	914.4	**16.4**
Curative	$88.2	**1.9**	$20.3	**0.5**

Additional interventions:

Another factor affecting cost and impact is the selection of interventions. The current BPHS nutrition package does not include some evidence-based high-impact nutrition interventions identified by the 2008 and 2013 *Lancet Series*. The next part of this Appendix considers the potential cost and impact of expanding the package to include four additional interventions. The additional interventions include: iron and folic acid supplementation for adolescent girls, fortification of wheat flour, fortification of edible oil, and implementation and enforcement of the WHO International Code on the Marketing of Breastmilk Substitutes. Units costs for these interventions are shown in Table 14.4.

Table 14.4. Unit Costs for Four Additional Interventions

Intervention	Unit cost per beneficiary (US$ / year)	Source
1. Iron and folic acid supplementation for adolescent girls a) School-based delivery	0.46	WBG
b) Community-based delivery	3.31	MOPH
2. Fortification of wheat flour	0.36	GAIN
3. Fortification of edible oil	0.04	GAIN
Intervention	**National cost (cost for covering the entire country) (US$ / year)**	**Source**
4. Implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes (national lump sum cost per year)	284,831	WBG

Note: GAIN = Global Alliance for Improved Nutrition; MOPH = Ministry of Public Health; WBG = World Bank Group.

Tablea14.5 shows that adding these four interventions to the BPHS Nutrition package would require $4.45 million more over five years, or only an additional 2 percent of the public sector costs of the BPHS package. The per capita cost would increase by $0.03, from $1.49 for the current package to about $1.53. For the two fortification interventions, it is estimated that $18.66 million over five years would be passed on to the consumer in the form of higher prices of fortified oil and wheat. These costs are in addition to those estimated for the public sector cost.

Table 14.5. Estimated Total Costs of the Additional Interventions (US$ Millions)

Intervention	BPHS Nutrition Plus package (US$, millions)
Additional interventions in the BPHS Nutrition Plus package	
1. Iron and folic acid supplementation for adolescent girls	$1.39
2. Fortification of wheat flour	$1.47
3. Fortification of edible oil	$0.17
4. Implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes	$1.42
Four additional interventions subtotal	**$4.45**
Additional costs borne by private sector/households	**$18.66**

It was possible to estimate the impact of only two of the four additional interventions: wheat flour fortification and iron and folic acid supplementation for adolescent girls. Adding these two interventions to the BPHS Nutrition package would result in 875 additional deaths averted, an additional 1.49 percentage point reduction in case-years of anemia in pregnant women, and a 1.97 percentage point reduction in anemia in women of reproductive age (Table A14.6). In total, these interventions were projected to avert an additional 88,898 DALYs.

Table 14.6. Additional Impacts of Scaling Up the BPHS Nutrition Plus Package

Impact	Total
Additional deaths averted	875
Additional case-years of anemia in adolescent girls and women averted	307,107
Additional percentage point reduction in anemia in pregnant women	1.49%
Additional percentage point reduction in anemia in women of reproductive age	1.97%
Additional DALYs averted	88,898

With a cost per DALY averted of $16, wheat flour fortification would be among the most cost-effective interventions in the BPHS nutrition package. The cost per DALY averted for iron and folic acid supplementation for adolescent girls—estimated to be $136. The effects of the implementation and enforcement of the WHO Code on the Marketing of Breastmilk Substitutes and fortification of edible oil could not be estimated since these interventions are not included in the LiST model. These addition of these interventions would not significantly change the low cost per DALY averted and high benefit-cost ratio of the BPHS Nutrition package.

APPENDIX 15: COSTS AND BENEFITS OF SCALING UP BPHS TO FULL PROGRAM COVERAGE

Tables A15.1 and A15.2 report the breakdown of the costs and benefits, respectively, of scaling up all interventions to full program coverage levels. Table 15.3 reports the cost-effectiveness of the package by intervention.

Table A15.2. Estimated Total Costs of Scaling Up BPHS Nutrition Interventions to Full Coverage, 2016–20

Interventions and their components	Total cost by intervention (US$, millions)	Share of total cost (%)
Prevention		
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	13.59	
b) Complementary feeding education	4.97	
c) Community food preparation demonstration	1.67	7.8
2. Vitamin A supplementation for children	8.61	3.3
3. Control and prevention of diarrheal diseases and parasitic infections a) Deworming in children	13.25	
b) Deworming in adolescent girls	3.18	19.4
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	34.10	
4. Promotion of balanced micronutrient-rich foods	23.86	9.2
5. Iron and folic acid supplementation for pregnant women[a]	4.64	1.8
6. Promotion of iodized salt	0.20	0.1
7. Growth monitoring	2.18	0.8
8. Vitamin A supplementation for pregnant women	3.32	1.3
Program costs for prevention interventions	33.96	13.0
Subtotal for preventive interventions (intervention + program costs)	**147.53**	**56.6**
Treatment		
9. Treatment of severe acute malnutrition (with and without complications)	39.13	15.0
10. Management of moderate acute malnutrition	47.54	18.2
11. Clinic-based nutrition surveillance	0.35	0.1
12. Screening for acute malnutrition and micronutrient deficiencies	0.07	0.0
Program costs for treatment interventions	26.05	10.0
Subtotal for treatment interventions (intervention + program costs)	**113.15**	**43.4**
Total costs for prevention and treatment (intervention + program costs)	**218.80**	**100**
Additional costs borne by private sector/households	**0.34**	n.a.

Note: n.a. = not applicable.
a This intervention is called “maternal nutrition” in BPHS documentation.

Table 15.2. Impact of Scaling Up the BPHS nutrition package to Full Program Coverage

BPHS nutrition package	DALYs averted	Deaths averted	Cases of stunting averted	Case-years of anemia averted	Additional infants exclusively breastfed
Preventive Interventions					
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	902,680	10,950	2,883	n.a.	385,630
b) Complementary feeding education	190,210	2,298	30,120	n.a.	n.a.
c) Community food preparation demonstration	n.a.	n.a.	n.a.	n.a.	n.a.
2. Vitamin A supplementation for children	50,933	2,671	17,721	n.a.	n.a.
3. Control and prevention of diarrheal diseases and parasitic infections a) Deworming in children	n.a.	n.a.	n.a.	n.a.	n.a.
b) Deworming in adolescent girls	n.a.	n.a.	n.a.	n.a.	n.a.
c) Therapeutic zinc treatment and oral rehydration solution for diarrhea in children	309,765	14,033	n.a.	n.a.	n.a.
4. Promotion of balanced micronutrient-rich foods	n.a.	n.a.	n.a.	n.a.	n.a.
5. Iron and folic acid supplementation for pregnant women[a]	11,863	n.a.	n.a.	305,291	n.a.
6. Promotion of iodized salt	n.a.	n.a.	n.a.	n.a.	n.a.
7. Growth monitoring	n.a.	n.a.	n.a.	n.a.	n.a.
8. Vitamin A supplementation for pregnant women	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal – impact of all preventive interventions	**1,465,452**	**29,952**	**33,644**	**305,291**	**385,630**
Curative Interventions					
9. Treatment of severe acute malnutrition (with and without complications)	194,499	9,063	n.a.	n.a.	n.a.
10. Management of moderate acute malnutrition	73,561	2,197	n.a.	n.a.	n.a.
11. Clinic-based surveillance	n.a.	n.a.	n.a.	n.a.	n.a.
12. Screening	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal – impact of all curative interventions	**268,061**	**11,260**	**n.a.**	**n.a.**	**n.a.**

Total combined impact	**1,733,513**	**41,212**	**33,644**	**305,291**	**385,630**

Table 15.3. Total Scale-Up Cost and Cost per Benefit Unit, by Intervention of the BPHS nutrition package to Full Program Coverage

Intervention	Total additional scale-up cost (US$ millions)	Cost per benefit unit				
		Cost per DALY averted	Cost per life saved	Cost per case of stunting averted	Cost per case-year of anemia averted	Cost per child exclusively breastfed
1. Promotion of good infant and young child nutrition and hygiene practices a) Support and promotion of exclusive breastfeeding	7.79	9	711	2,701	n.a.	10
b) Complementary feeding education	4.94	26	2,149	164	n.a.	n.a.
c) Community food preparation demonstration	1.89	n.a.	n.a.	n.a.	n.a.	n.a.
2. Vitamin A supplementation	3.98	78	1,492	225	n.a.	n.a.
3. Control and prevent diarrheal disease and parasitic infections a) Deworming in children	6.13	68	1,497	n.a.	n.a.	n.a.
b) Deworming in adolescent girls	3.96				n.a.	n.a.
c) Therapeutic zinc and oral rehydration solution for diarrhea in children	10.92				n.a.	n.a.
4. Promotion of balanced micronutrient rich foods	20.37	n.a.	n.a.	n.a.	n.a	n.a.
5. Iron and folic acid supplementation for pregnant women[a]	4.07	343	n.a.	n.a.	13	n.a.
6. Promotion of iodized salt	0.73	n.a.	n.a	n.a	n.a	n.a.
7. Growth monitoring	1.86	n.a.	n.a	n.a	n.a	n.a.
8. Vitamin A supplementation for pregnant women	1.54	n.a.	n.a	n.a	n.a	n.a.
Subtotal –preventive interventions	**67.52**	**46**	**2,254**	**2,007**	**221**	**175**
9. Treatment of severe acute malnutrition (with and without complications)	23.53	121	2,596	n.a.	n.a.	n.a.

10. Management of moderate acute malnutrition	27.32	371	12,434	n.a.	n.a.	n.a.
11. Clinic-based nutrition surveillance:	0.44	n.a.	n.a.	n.a.	n.a.	n.a.
12. Screening for acute malnutrition and micronutrient deficiencies	0.09	n.a.	n.a.	n.a.	n.a.	n.a.
Subtotal –curative interventions	**51.38**	**192**	**4,563**	**n.a**	**n.a**	**n.a**
Total for BPHS Nutrition package	**118.9**	**69**	**2,885**	**3,534**	**389**	**308**

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This paper examines the costs, impacts, and cost-effectiveness of scaling up over five years the nutrition interventions included in Afghanistan's Basic Package of Health Services (BPHS) as a first step in investing in the early years to build human capital. The total public investment required for the scale up to government-set program coverage levels is estimated to be $44 million per year over five years, or $1.49 per capita per year. Each dollar invested would yield at least $13 in economic returns and even under conservative assumptions regarding future economic growth, the economic benefits exceed the cost by six times: $815 million over the productive lives of the beneficiaries. This scale up would prevent almost 25,000 child deaths and over 4,000 cases of stunting and avert a loss of 640,000 disability-adjusted life years (DALYs) and almost 90,000 cases years of anemia. Almost 100,000 more children would be exclusively breastfed. However, this scale-up would only have a marginal effect – a decrease of less than one-half percentage point – on stunting prevalence because the current government-set target program coverage rates are very low for the preventive interventions that affect stunting. A substantially greater impact could be achieved if preventive interventions could be scaled to full program coverage levels, which would require less than $5 million more a year. This would triple the number of DALYs averted, double the number of deaths averted and avert almost eight times as many cases of stunting, resulting in a 2.6 percentage point decline in stunting over the five-year period (from 41% to 38%). The prevalence of anemia in pregnant women could be reduced by 12 percentage points and the prevalence of exclusive breastfeeding could be increased by 18 percentage points. In addition, this investment is projected to generate economic benefits of $815 million over the productive lives of the beneficiaries. Each dollar invested would yield more than $13 in economic returns. Sensitivity analysis was conducted for the total cost, cost-effectiveness, and economic returns on investing in the BPHS nutrition interventions.

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