Cost–Effectiveness Analysis of a Behavior Change and Social Marketing Intervention*

FEASIBILITY STUDY (PHASE 1) FINAL REPORT
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ABSTRACT

This report develops a methodology for understanding an ex-ante cost-effectiveness analysis (CEA) regarding optimal breastfeeding promotion. This is a behavior Change and Social Marketing activity.

The study compares the "with" to the "without" project case scenarios. A model has been developed to estimate the cost per Disability-Adjusted Life Year (DALY) saved, cost per diarrhea case averted, cost per diarrhea death averted, and cost per stunting case averted.

Keywords: Optimal breastfeeding, nutrition, cost-effectiveness analysis, behavior change, social marketing, Rwanda

JEL Classification: I15, D61, O55

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The comments received on the draft report resulted in many revisions and improvements in the study and are greatly appreciated.

ACRONYMS

DALY	Disability-Adjusted Life Year
DBF	Dominant Breastfeeding
EBF	Exclusive Breastfeeding
ECD	Early Childhood Development
FRW	Rwandan Franc
FtF	Feed the Future
IYCF	Infant and young children feeding
LEAP	Learning, Evaluation, and Analysis Project
MOH	Ministry of Health
NBF	No Breastfeeding
NGO	Non-governmental organization
NISR	National Institute of Statistics of Rwanda
ORS	Oral Rehydration Salts
PBF	Partial Breastfeeding
PSI	Population Services International
TAR	Total Attributable Risk
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	United States Dollar
WHO	World Health Organization

EXECUTIVE SUMMARY

Project Description

The U.S. Agency for International Development (USAID) has asked the Learning, Evaluation, and Analysis Project (LEAP) team to develop an ex-ante cost-effectiveness analysis (CEA) regarding optimal breastfeeding promotion for the designated USAID/Rwanda Feed the Future (FtF), Nutrition: Behavior Change and Social Marketing activity. The LEAP team has undertaken this analysis in two phases. The purpose of this report is to describe the activities and analysis undertaken in the first phase as well as to outline a proposed methodology to be used in carrying out the remainder of the analysis.

Methodology

In this report, the study team presents a model that it has developed to link the effectiveness of optimal breastfeeding behavior change and social marketing activities with selected nutrition outcome indicators.

Data Sources

1. Effectiveness

To measure the effectiveness of a prospective intervention for Behavior Change and Social Marketing, the study team has estimated the change in the incidence of mortality and morbidity of children with and without the proposed intervention. These estimations are derived from the baseline data available from nationwide surveys and the results of existing programs undertaken in Rwanda.

Baseline data were identified through a field visit and review of the relevant literature. The following outcome results data were needed for conducting the proposed CEA: (1) the exclusive breastfeeding rate after intervention, and (2) the rate of infant breastfeeding and consumption of solid foods at 6–8 months after intervention.

2. Cost

To review the cost of the intervention, a financial model of all the activities involved in the Behavior Change and Social Marketing project performed by the various participants has been developed. The cost data could possibly be obtained from the actual experience of project implementers in Rwanda, but if such information cannot be obtained from current project contractors, the budgetary costs will be derived by using accounting principles to make budget projections.

3. Sources of the outcome results data and cost data

(1) *Strengthen and Scale-Up Community-Based Nutrition Interventions/Programs (CBNP) to Prevent and Manage Malnutrition in Children Under the Age of 5 Years and in Pregnant and Lactating Mothers*, led by the Ministry of Health (MOH). The results of these programs, if available, would assist in the completion of this cost-effectiveness study. To date, MOH has been reluctant to discuss the possibility of releasing this information. A mid-term report on the results of this program would typically exist by this point in the project, as it is scheduled to end in 2013.

(2) *KURA NEZA Project: Early Childhood Development (ECD) Interventions at Community Level*, sponsored by USAID and implemented by CARE International. The results of this project would be sufficient for the completion of this study. A draft report has been prepared regarding the results of this project, but to date the LEAP team has not been given access to this information. USAID is expecting to receive a results report on this project in the near future.

Conclusions and Recommendations

This study compares the "with" to the "without" project case scenario. A model has been developed to estimate the cost per Disability-Adjusted Life Year (DALY) saved, cost per diarrhea case averted, cost per diarrhea death averted, and cost per stunting case averted. The information in the project records of similar interventions being carried out in Rwanda would enable the population of this model and the completion of a CEA of well-defined Behavior Change and Social Marketing activity for the promotion of exclusive breastfeeding and optimal complementary feeding practice. Although the LEAP team hopes to obtain this information from MOH and other development partners, at this point in time it has not received the data from these projects. The team anticipates that with the assistance of USAID/Rwanda, such information will be made available for the purpose of completing this study.

Although actual implementation-cost data based on the experience of implemented breastfeeding promotion projects in Rwanda would be ideal, this information is not nearly so critical. It is possible to estimate a reliable set of cost or budget data for a well-defined project-implementation strategy that would reflect the expected cost of such an intervention. A considerable body of literature exists that describes the nature and magnitude of the costs of similar breastfeeding promotion programs in neighboring countries.

The LEAP team cannot recommend that USAID immediately proceed to the second phase of this proposed study until the preliminary results data from the similar interventions now underway in Rwanda are made available. Once such information is released for use in this analysis, an ex-ante CEA of the proposed Behavior Change and Social Marketing project could be completed in an expeditious manner. All the other required information has been collected in Phase 1 of the study or is available from the published literature on this topic. It is the team's expectation that, because USAID has been a major sponsor of the above-mentioned Behavior Change and Social Marketing interventions in Rwanda, the agency will be able to assist in obtaining the release of this information from its implementing partners. The LEAP team is optimistic that with the support of USAID/Rwanda, the implementing partners of USAID-sponsored projects would make the required data available soon to assist with the completion of Phase 2 of this project.

COST–EFFECTIVENESS ANALYSIS OF USAID/RWANDA FEED THE FUTURE PROJECT, NUTRITION: BEHAVIOR CHANGE AND SOCIAL MARKETING

FEASIBILITY STUDY (PHASE 1) REPORT

INTRODUCTION

The U.S. Agency for International Development (USAID) is one of the major donors funding nutrition programs in Rwanda. USAID/Rwanda has requested that the Learning, Evaluation, and Analysis Project (LEAP) team develop a cost-effectiveness analysis (CEA) for the designated USAID/Rwanda Feed the Future (FtF), *Nutrition: Behavior Change and Social Marketing* activities.

The LEAP team has undertaken this analysis in two phases. In Phase 1, the team conducted a study over a 1-month period, including 2 weeks of fieldwork to identify the data needed to complete a CEA of the Behavioral Change and Social Marketing Initiative. By the end of Phase 1, the team was to determine whether enough data were available from this or similar programs in Rwanda to allow for the development of a complete CEA in Phase 2 and then formally notify USAID/Rwanda of its findings.

The objective of this current report is to present the activities and analysis that the LEAP team has performed during the first phase of this study as well as to outline a proposed methodology to be used in carrying out an ex-ante CEA of the Behavioral Change and Social Marketing Initiative. In addition to sketching out the methodology, this report reviews the availability of the necessary data to carry out a sound analysis and identifies any information gaps. Finally, the report offers a recommendation regarding how the various information gaps might be addressed so that the CEA can be completed with a high degree of professionalism and accuracy.

Field-Visit Activities

The proposed USAID nutrition project on Behavior Change and Social Marketing activities is still in the planning stage. At the request of USAID/Rwanda, the LEAP team has been asked to produce an ex-ante CEA of this planned USAID nutrition intervention regarding the promotion of optimal breastfeeding based on the results of similar projects that were previously completed or remain ongoing. The incremental CEA compares the baseline situation with the expected outcome of the scheme; in other words, the team has assessed the “with” and “without” project case scenarios.

To complete this work, the study team developed the “without” and “with” estimations using the baseline and results data from existing programs undertaken in Rwanda, and then the team supplemented this data with information culled from the results reported in the published literature for similar studies in this field.

During the field visit to Rwanda, which took place June 9 through June 24, 2012, the LEAP team visited key stakeholders from the following organizations: USAID/Rwanda, the Ministry of Health (MOH), World Vision International, UNICEF, Concern Worldwide, Catholic Relief Services (CRS), Care International, the Cooperative Housing Foundation (CHF), and Population Services International (PSI)/Rwanda.

Background

Excluding neonatal disorders, the most common causes of childhood deaths in developing countries are diarrhea and lower respiratory-tract infections. Breastfeeding's ability to combat infant and childhood morbidity and mortality against these diseases has been well established.[1] The World Health Organization (WHO) promotes exclusive breastfeeding for the first 6 months of life with continued breastfeeding up to 2 years of age and beyond as a global public health recommendation.[2] The lack of exclusive breastfeeding among infants age 0 to 5 months and no breastfeeding among children 6 to 23 months of age are associated with increased diarrhea morbidity and mortality.[3]

The United Nations Children's Fund **(**UNICEF) and WHO also recommend introducing solid food to infants at approximately 6 months, because by that age breast milk is no longer sufficient on its own to maintain a child's optimal growth. During the transition (age 6 to 23 months) to a typical family diet, prevalence of malnutrition (such as stunting) increases substantially in many countries due to increased rates of infection and poor feeding practices.

This analysis assesses the effectiveness of promotion strategies for exclusive breastfeeding of infants younger than 6 months with the following outcome indicators:

1. Cases of diarrhea averted
2. Number of diarrhea deaths averted
3. Number of disability-adjusted life years (DALYs) gained

In addition to these three outcome indicators, this report discusses the effectiveness of promotion strategies for continued breastfeeding up to 23 months with an additional outcome indicator: cases of stunting averted.

METHODOLOGY

Measuring the Effectiveness

To measure the effectiveness of such interventions, the first step is to develop a model of the channels through which the intervention is expected to yield the desired result. The second step is to obtain the data required to calibrate the model to estimate through simulation the expected results for the ex-ante evaluation of the proposed interventions.

1. Modeling

Because this analysis is an ex-ante CEA, the LEAP team does not have access to the direct outcome data (such as diarrhea incidence or diarrhea mortality for the proposed intervention). In such a situation, it is therefore necessary to link optimal breastfeeding promotion with nutrition outcome indicators.

[1] Lamberti et al. 2011, p. S15.

[2] World Health Organization 2001.

[3] Popkin et al. 1990, p. 874–882.

The goal is to make projections of the outcome results by breastfeeding-exposure levels, which are classified according to current WHO definitions[4] (see table 1):

Table 1. Criteria that define breastfeeding practices

Feeding practice	Requires that the infant receive	Allows the infant to receive	Does not allow the infant to receive
Exclusive Breastfeeding (EBF)	Breast milk (including milk expressed or from a wet nurse)	Oral rehydration salts (ORS), drops, syrups (vitamins, minerals, medicines)	Anything else
Dominant Breastfeeding (DBF)	Breast milk (including milk expressed or from a wet nurse) as the predominant source of nourishment	Certain liquids (water and water-based drinks, fruit juice), ritual fluids and ORS, drops, syrups (vitamins, minerals, medicines)	Anything else (in particular, nonhuman milk, food-based fluids)
Partial Breastfeeding (PBF)	Breast milk (including milk expressed or from a wet nurse)	Any other liquids or nonliquids, including milk and nonmilk products	NA
No Breastfeeding (NBF)	N/A	Formula and/or animal's milk and/or any other liquids or nonliquids	Breast milk
Breastfeeding (BF)	Breast milk (including milk expressed or from a wet nurse)	Anything else: any food or liquid, including nonhuman milk and formula	NA

A. **Modeling for Effectiveness on Diarrhea Morbidity, Diarrhea Mortality, and DALYs Gained (Death Due to All Causes)**

The basic model describing the relationships between the number of diarrhea cases averted and the number of deaths from diarrhea averted, the baseline diarrhea morbidity and mortality rates, and the effect of an intervention on the morbidity and mortality risk of diarrhea is described below.

The number of diarrhea cases averted = $N_{\text{Target population}}$ * Baseline diarrhea morbidity rates * Proportionate reduction in diarrhea morbidity risk with intervention (1)

The number of diarrhea deaths averted = $N_{\text{Target population}}$ * Baseline diarrhea mortality rates * Proportionate reduction in diarrhea mortality risk with intervention (2)

The basic model describing the relationships between DALYs gained from reduction of all-cause deaths, the baseline all-cause mortality rate, and the effect of such an intervention on the all-cause mortality risk is described below.

[4] World Health Organization (WHO). *Indicators for assessing infant and young child feeding practices: Conclusions of a consensus meeting held 6–8 November 2007 in Washington D.C., USA.*

DALYs gained = $N_{Target\ population}$ * Baseline all-cause mortality rates * Proportionate reduction in all-cause mortality risk with intervention * 32.5[5] (3)

where: $N_{Target\ population}$, the target population is the number of children 0 to 23 months of age.

Because current international breastfeeding recommendations distinguish between children ages 0 to 5 months, 6 to 11 months, and 12 to 23 months, this analysis is stratified for these age groups.

a. ***Exclusive Breastfeeding (0–5 Months)***

The general relationship between different breastfeeding-exposure levels and morbidity and mortality risk is combined to estimate the total attributable risk (TAR) for children between 0 and 5 months of age and is shown in equation 4.

$$TAR = (1 * EBF) + (RR_{DBF} * DBF) + (RR_{PBF} * PBF) + (RR_{NBF} * NBF) \quad (4)$$

where: EBF = proportion of infants exclusively breastfed;

RR_{DBF} = risk of morbidity/mortality in the predominantly breastfed group relative to exclusively breastfed infants; DBF = proportion of infants predominantly breastfed;

RR_{PBF} = risk of morbidity/mortality in partially breastfed group relative to exclusively breastfed infants; PBF = proportion of infants partially breastfed;

RR_{NBF} = risk of morbidity/mortality in the nonbreastfed group relative to exclusively breastfed infants; NBF = proportion of infants not breastfed.

Proportionate reduction in morbidity

or mortality risk = $(TAR_{Baseline} - TAR_{Intervention})/TAR_{Baseline}$ (5)

Relative risks are taken from the literature and reported in table 2, below.

Table 2. Relative risks of selected outcomes by breastfeeding-exposure level in infants 0–5 months of age[6]

	Diarrhea incidence	Diarrhea mortality	All-cause mortality
RR_{EBF}	1	1	1
RR_{DBF}	1.26	2.28	1.48
RR_{PBF}	1.68	4.62	2.84
RR_{NBF}	2.65	10.52	14.40

[5] For global estimates, the World Bank suggests that the death of an infant is equivalent to the loss of approximately 32.5 DALYs.

[6] Lamberti et al. 2011, p. S15.

b. ***Complementary Breastfeeding (6–23 Months)***

The general relationship between the breastfeeding rate and morbidity or mortality risk is combined to estimate the total attributable risk for children between 6 and 23 months of age and is shown in equation 6.

$$TAR = (1 * BF) + (RR_{NBF} * NBF) \quad (6)$$

where: BF = proportion of infants breastfed; RR_{NBF} = risk of morbidity/mortality in the nonbreastfed group relative to breastfed infants;

NBF = proportion of infants not breastfed.

Proportionate reduction in morbidity or mortality risk is estimated using equation 5.

Relative risks are taken from the literature and reported in table 3, below.

Table 3. Relative risks of selected outcomes by breastfeeding exposure level in children 6–23 months of age

		Diarrhea incidence	Diarrhea mortality	All-cause mortality
6–11 months	RR_{BF}	1	1	1
	RR_{NBF}	1.32	1.47	5.66
12–23 months	RR_{BF}	1	1	1
	RR_{NBF}	1.32	2.57	2.23

Based on this model, the differences in breastfeeding practices before and after interventions can be translated into differences in diarrhea morbidity and mortality as well as DALYs gained.

B. Modeling for Effectiveness on Stunting Morbidity

Complementary Breastfeeding (6–23 Months)

The basic model describing the relationships between the number of stunting cases averted, the baseline stunting morbidity rate, and the effect of an intervention on the morbidity risk of stunting is described below.

The number of stunting cases averted = $N_{Target\ population}$ * Baseline stunting morbidity rates * Proportionate reduction in stunting morbidity risk (7)

The general relationship between the proportion of infants consuming solid foods at ages 6 to 8 months and stunting morbidity risk is combined to estimate the total attributable risk for children between 6 and 23 months of age and is shown in equation 8.

$$TAR= (1 * NSF) + (RR_{SF} * SF) \quad (8)$$

where: SF = proportion of infants consuming solid foods at 6 to 8 months; RR_{SF} = risk of morbidity in the group consuming solid foods relative to the group not consuming solid foods;

NSF = proportion of infants not consuming solid foods at 6 to 8 months.

Proportionate reduction in stunting morbidity risk is estimated using equation 5.

The value of the relative risk RR_{SF} variable is taken from the literature[7] and equals 0.50.

Based on this model, the differences in feeding practices before and after interventions can be translated into differences in stunting morbidity.

2. Data Sources and Limitations

A. Baseline Data

Baseline data have been assembled from multiple sources through field visits and literature review. From the information that is available, the LEAP team developed a baseline set of estimates for this intervention.

a. *Breastfeeding Rate*

As shown in the model, the breastfeeding rate is critical for measuring its effectiveness on diarrhea morbidity, diarrhea mortality, and DALYs gained.

Two sets of breastfeeding baseline data came from two different sources: One set is from *Rwanda 2010: Demographic and Health Survey*, by the National Institute of Statistics of Rwanda (NISR) in collaboration with MOH; the other set is from *Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey—2009*, by the United Nations World Food Programme, National Institute of Statistics of Rwanda (NISR), UNICEF, and World Vision, listed in tables 4 and 5 below.

Table 4. Breastfeeding rate in infants 0–5 months of age in Rwanda, 2010, using *Rwanda 2010: Demographic and Health Survey*

Exclusive breastfeeding	Predominant breastfeeding	Partial breastfeeding	No breastfeeding
84.9%	1.9%	12.6%	0.6%

Source: *Rwanda 2010: Demographic and Health Survey*, p. 146.

Table 5. Breastfeeding rate in children 6–23 months of age in Rwanda, 2010, using *Rwanda 2010: Demographic and Health Survey*

	Breastfeeding	No breastfeeding
6–11 months	97.9%	2.1%
12–23 months	90.1%	9.9%

Source: LEAP team calculation based on data from *Rwanda 2010: Demographic and Health Survey*, p. 146.

According to *Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey—2009*, the rate of exclusive breastfeeding for infants between 0 and 5 months of age is 38 percent (p. 67). These two surveys yield significantly different results for the baseline rate of exclusive breastfeeding. The dispersion in the results of these two national surveys has allowed the team to estimate high and low impact rates that likely represent the actual situation in the various districts of Rwanda.

[7] Marriott et al. 2012, p. 354–370.

b. *Diarrhea Incidence*

The annual incidence of diarrhea ($I_{Annual,}$ episodes of diarrhea per child per year) can be converted from the 2-week diarrhea prevalence (P_{14}) data in *Rwanda 2010: Demographic and Health Survey* by using the following formula:

$$I_{Annual} = P_{14} * 14/(14 + d) * 26 \quad (9)$$

where: d, the average duration of a diarrhea episode (the usual duration of a diarrheal episode is 5 days, with a range of 3 to 7 days)

Table 6. The annual incidence of diarrhea (episodes of diarrhea per child per year) in children 0–23 months of age in Rwanda, 2010

	0–5 months	6–11 months	12–23 months
I_{Annual}	1.26	4.18	4.79

Source: LEAP team calculation based on data from *Rwanda 2010: Demographic and Health Survey*, p. 133.

c. *All-Cause Mortality Rate*

The mortality rate (deaths per 1,000 live births) for different age groups can be calculated by using the survey data in *Rwanda 2010: Demographic and Health Survey*. It is listed in table 7, below.

Table 7. Early childhood mortality rates (deaths per 1,000 live births) in Rwanda, 2010

	0–5 months	6–11 months	12–23 months
Mortality rate	39	11	5

Source: LEAP team calculation based on data from *Rwanda 2010: Demographic and Health Survey*, p. 102.

d. *Diarrhea Mortality Rate*

In *2011 World Health Statistics* (WHO), 24 percent of deaths among children under 5 years of age is attributed to diarrhea. The diarrhea mortality rate can be calculated by multiplying the distribution rate by the all-cause mortality rate in table 7, as shown in table 8, below.

Table 8. Early childhood diarrhea mortality rates (deaths per 1,000 live births) in Rwanda, 2010

	0–5 months	6–11 months	12–23 months
Diarrhea mortality rate	9	3	1

Source: LEAP team calculation based on data from *Rwanda 2010: Demographic and Health Survey*, p. 102.

e. *Rate of Infant Breastfeeding and Consuming Solid Foods at Ages 6 to 8 Months*

The baseline value used in this study for the rate of breastfeeding and consumption of solid foods at ages 6 to 8 months is 61.2 percent. This value was obtained from *Rwanda 2010: Demographic and Health Survey*.

f. *Stunting Rate*

The stunting rate in infants ages 0 to 5 months is listed in *Rwanda 2010: Demographic and Health Survey*, and the stunting rate in children ages 6 to 23 months can be calculated by using this survey data, as reported in table 9, below.

Table 9. Early childhood stunting rates (low height for age) in Rwanda, 2010

	0–5 months	6–11 months	12–23 months
Stunting rate	17.0%	22.6%	49.3%

Source: LEAP team calculation based on data from *Rwanda 2010: Demographic and Health Survey*, p. 143.

B. Data After Intervention

Based on the LEAP team's models, the rate of infant breastfeeding and consumption of solid foods at ages 6 to 8 months after intervention are critical outcome indications when estimating the intervention's effectiveness.

The *National Multi-Sectorial Strategy to Eliminate Malnutrition in Rwanda*, coordinated and led by MOH and partially funded by USAID, has an initial 3-year action plan of implementation from July 2010 to June 2013 and includes eight strategic nutrition interventions. *Strategy of Strengthen and Scale-Up Community-Based Nutrition Interventions/Programmes (CBNP) to Prevent and Manage Malnutrition in Children Under the Age of 5 Years and in Pregnant and Lactating Mothers* is one of the strategies. This strategy contains interventions promoting and protecting optimal infant and young children feeding (IYCF) at the community level. The expected results after intervention as proposed by MOH's *Action Plan for Implementation* is to reach an exclusive breastfeeding rate of 70 percent and to have 80 percent of children up to 2 years of age receiving appropriate complementary food.

The ongoing *KURA NEZA Project* funded by USAID and implemented by CARE International, *Early Childhood Development (ECD) Interventions at Community Level*, includes similar interventions at the community level. This 5-year project started in 2010, and a mid-term evaluation will be conducted later in 2012.

To date, the results for *Strategy of Strengthen and Scale-Up Community-Based Nutrition Interventions/Programmes (CBNP)* and *Early Childhood Development (ECD) Interventions at Community Level* have not been made available to the LEAP team. Obtaining the results of these interventions is key for the completion of a high-quality CEA for this type of intervention in Rwanda.

The LEAP team is trying to build contacts within MOH and is working to obtain the indicator-monitoring results from *Strategy of Strengthen and Scale-Up Community-Based Nutrition Interventions/Programmes (CBNP)*. For *Early Childhood Development (ECD) Interventions at Community Level*, the team has been informed that a draft report has been prepared but has not yet been released.

For the team to complete an accurate CEA of the Behavioral Change and Social Marketing Initiative in this specific area, it is very important to have access to the results of one or more of these similar projects that are now being carried out in Rwanda. If a more accurate set of information were to be released at a later date, the CEA of this type of intervention could be easily updated using the quantitative spreadsheet model constructed as part of the CEA.

Measuring the Cost

The costs of this intervention will include the costs of supporting the development of breastfeeding support centers, educational workshops, and training for health-care specialists and hired staff members. It is expected that the cost information will be obtained from USAID's budget data for the planned project that detail the investment costs and operating costs of the Behavioral Change and Social Marketing Initiatives. In addition, cost information on the programs presently being implemented by MOH and CARE International would be very useful for tailoring USAID's budget to match the type of interventions that the LEAP team is able to prepare a CEA for due to the particular focus of the results expected from the ongoing *Strengthen and Scale-Up Community-Based Nutrition Interventions/Programmes (CBNP)* and *KURA NEZA Project*. In addition, an extensive literature is available on the structure and cost of such projects in other African countries, such as Uganda[8] and Ghana.[9]

Downstream savings result from the reduced cost of averted cases of diarrhea requiring physician visits and hospitalization. From society's point of view, savings also include the indirect cost of the time and wages lost by parents attending to ill children. This information is estimated based on data from Rwanda as well as estimates of time savings found in the relevant literature.

The net cost is the investment in the scheme of an intervention minus the "downstream savings" from increased breastfeeding initiation and duration.

The basic model describing net cost, intervention investment, and downstream savings is described below.

Net cost = Intervention investment – savings on reduction of diarrhea physician and hospital fees – time and wages lost by parents attending to ill children (9)

Savings on reduction of diarrhea physician fees = The number of diarrhea cases averted * Percentage of diarrhea cases seeking treatment from health facility or provider * Average unit cost per visit for diarrhea consultations * Average number of physician visits per diarrhea episode (10)

Savings on reduction of diarrhea hospitalization = The number of diarrhea cases averted * Percentage of diarrhea cases hospitalized * Inpatient unit cost per bed day * Average number of days spent in the hospital (11)

Indirect cost of the time and wages lost by parents attending to ill children = The number of diarrhea cases averted * The average duration of a diarrhea episode* Gross national income (GNI) per capita per work day (12)

[8] Chola et al. 2011, p. 11.

[9] Chee et al., December 2010. *Cost and Effectiveness Analysis of LINKAGES' Breastfeeding Interventions in Ghana.*

1. *Parameters and Assumptions*

The discussion below outlines the values of a number of key variables that have been employed in the CEA of this intervention.

In *Rwanda 2010: Demographic and Health Survey*, the percentages of children with diarrhea seeking treatment from a health facility or provider at ages 0 to 5 months, 6 to 11 months, and 12 to 23 months are 15.8 percent, 42.9 percent, and 46.5 percent, respectively.

The average unit cost per visit for diarrhea consultations (2,179 FRW) and inpatient unit cost per bed day (9,693 FRW) are taken from *2006 Rwanda Health Center and Hospital Cost Study* and adjusted by the inflation rate.

The average duration of a diarrhea episode is usually 5 days.

The proportion of all diarrhea episodes requiring hospitalization for infants (0 to 11 months) and children 12 to 23 months of age in developing countries is taken from the literature[10] and is 1.5 percent and 0.2 percent, respectively.

The average number of days of diarrhea-related hospitalization and the average number of physician visits per diarrhea episode are taken from the literature[11] and are 3.3 days and 1.4 visits, respectively.

The GNI per capita is the GNI converted to U.S. dollars using the World Bank Atlas Method, divided by the midyear population. It is US$570 in Rwanda for 2011.

2. *Data Sources and Limitations*

Optimal breastfeeding practices can be promoted at different levels. The proposed USAID nutrition project on Behavior Change and Social Marketing activities is still at the planning stage. Because nongovernmental organizations (NGOs) and USAID partners have an established presence and network within the communities and conduct many health-promotion activities as part of their ongoing programs, the Behavior Change and Social Marketing activities should combine community-level programming and Behavior Change Communication (BCC) methods to promote appropriate breastfeeding levels more effectively within these ongoing programs.

USAID/Rwanda has encouraged the LEAP team to contact the implementing partners of USAID's existing nutrition projects directly for budget outline information regarding activity costs and target issues. To address the cost aspects of the intervention, the LEAP team proposes constructing a model that describes the activities performed by the various participants involved in this intervention and that breaks down the cost of each of their activities. A preliminary analysis of the cost of the intervention is sketched out below.

[10] Parashar et al. 2003, p. 565–572.

[11] Granados-García et al. 2009, p. 18–25.

A. Direct Costs

a. Development of materials (protocols, community health worker [CHW] booklets, training module, and community mobilization tools)
b. Training workshops (sensitizing local leaders by district, organizing cascade training sessions for master trainers and CHWs)
c. Staff time (conducting nutritional counseling and promotion of infant and young-child feeding practice, conducting nutritional counseling of pregnant and lactating mothers, and disseminating messages using multiple communication channels)
d. Health campaigns
e. Monitoring (supervision and monitoring at all levels)

B. Indirect Costs

Cost of the intervention office (rent, utilities, support staff, administration)

C. Capital Costs

Annualized cost of equipment, furniture, and vehicle of the intervention office, calculated based on useful life

To the team's knowledge, *Strengthen and Scale-Up Community-Based Nutrition Interventions/Programmes (CBNP) to Prevent and Manage Malnutrition in Children Under the Age of 5 Years and in Pregnant and Lactating Mothers* and *Strategy of Behavior Change Communication* led by MOH have budget lines and target populations for their activities that are aimed toward eliminating malnutrition.

The LEAP team's plan would be to develop a financial or budgetary model of all the activities that would needed if such a Behavioral Change and Social Marketing Initiative were implemented. Wherever possible, the cost data will be obtained from the actual experience of project implementers in Rwanda. If such information cannot be obtained from current project contractors, then the budgetary cost numbers will be estimated using best practices of accounting principles for making budget projections for such an intervention.

CONCLUSIONS AND RECOMMENDATIONS

In this study, a model has been developed for the estimation of the cost per disability-adjusted life year (DALY) saved, cost per diarrhea case averted, cost per diarrhea death averted, and cost per stunting case averted. The information comes from the experience of similar interventions being carried out in Rwanda that would enable the team to populate this model and to carry out a complete cost-effectiveness analysis (CEA) of the well-defined Behavioral Change and Social Marketing activities for the promotion of exclusive breastfeeding and optimal complementary breastfeeding practice. Although the Learning, Evaluation, and Analysis Project (LEAP) team is optimistic about obtaining this information from the Ministry of Health (MOH) and other development partners, to date it has not received the data from these projects. The team anticipates that with the assistance of USAID/Rwanda, such information will be made available for the purpose of this study.

Although Rwanda-based actual implementation cost data would be helpful, it is not nearly so critical for these calculations. It will be possible to estimate a set of cost or budget data for a well-defined project-implementation strategy that would closely reflect the expected cost of such an intervention.

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