Assessing the costs and cost-effectiveness of rapid-scale up for the maternal, neonatal, and child health:

The economic component of the impact evaluation strategy for the Catalytic Initiative

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List of Abbreviations

BMGF	Bill and Melinda Gates Foundation
CI	The Catalytic Initiative to Save One Million Lives
CCM	Community Case Management
CHAs	Community Health Agents
CMH	Commission on Macroeconomics and Health
DALYs	Disability Adjusted Life Years
DEA	Data Envelopment Analysis
DHAs	District Health Accounts
GDP	Gross Domestic Product
GNI	Gross National Income
HFS	Health Facility Survey
IC	Incremental Costs
ICER	Incremental Cost-Effectiveness Ratio
IIP	The Institute for International Programs
IMCI	Integrated Management of Childhood Illness
JHU	The Johns Hopkins University
LiST	Lives Saved Tool
MCE	Multi-Country Evaluation
MDGs	Millennium Development Goals
MNCH	Maternal, Neonatal, and Child Health
NGO	Non-Governmental Organization
OOP	Out-Of-Pocket payments
RMM	Rapid Mortality Monitoring
SFA	Stochastic Frontier Analysis
TC	Total Costs
UN	United Nations
UNFPA	United Nations Population Fund
WHO	World Health Organization
WHO-CHOICE	WHO's Choosing Interventions that are Cost-Effective programme

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1. Introduction

Most low-income countries are making slow progress in addressing child and maternal mortality – too slow to achieve Millennium Development Goals (MDGs) 4 and 5 by 2015. Governments, donors and development agencies are responding to the situation by redoubling efforts to stimulate and support child survival activities in countries, particularly in Africa. The Catalytic Initiative to Save a Million Lives (CI) is a central part of the movement to accelerate progress towards achieving MDGs 4 and 5.

In late 2006, the Bill and Melinda Gates Foundation (BMGF) approved a grant to the World Health Organization to work with other United Nations (UN) agencies to provide "proof of concept" that accelerating coverage with interventions of proven efficacy can be achieved rapidly and will lead to reductions of at least 25% in under-five mortality. Although WHO is the grantee, each UN agency is responsible as lead partner for one country. WHO is the lead partner in Malawi, UNFPA in Mozambique, and UNICEF is the focal agency for the project in Burkina Faso, leading and coordinating support provided by other UN agencies. This grant to WHO is considered part of the larger Catalytic Initiative.

This project includes an independent prospective evaluation led by the Institute for International Programs (IIP) at The Johns Hopkins University (IIP-JHU) in collaboration with research institutions in each collaborating country.

The overall objective of the impact evaluation is to serve as a "proof of concept" that it is possible to rapidly intensify effective interventions targeting maternal, neonatal and under-five mortality. Other objectives of the impact evaluations include:

1. Measure the additional number of children saved through the "accelerated" approach;
2. Measure the cost per child life saved in "accelerated" approach districts relative to the other districts of the country;
3. Supply the MOH and partners with information on the effectiveness of the implementation of the project.

Objective two utilises the methods and tools of economic evaluation, which are rooted in the fundamental problem by which economists characterize decision-making: making choices between alternatives in the context of scarce resources. Within the scope of national and international public health, these choices are often framed in the debate as to which interventions should have priority.

Economic evaluation attempts to identify ways in which scarce resources can be employed efficiently. Efficiency has two principal meanings in this context. First, there is **technical** (or *operational*) **efficiency**, which concentrates on maximizing the achievement of a given objective within a given budget – "doings this right". Second, there is **allocative efficiency**, which is a broader concept as it focuses on choosing the optimal mix of interventions for a given level of expenditure – optimal in the sense that

they maximize health gains – “doing the right things”. When allocative efficiency is being analysed, as in the case of cost-effectiveness, technical efficiency is often adjusted to be equalized in each of the comparison branches [1].

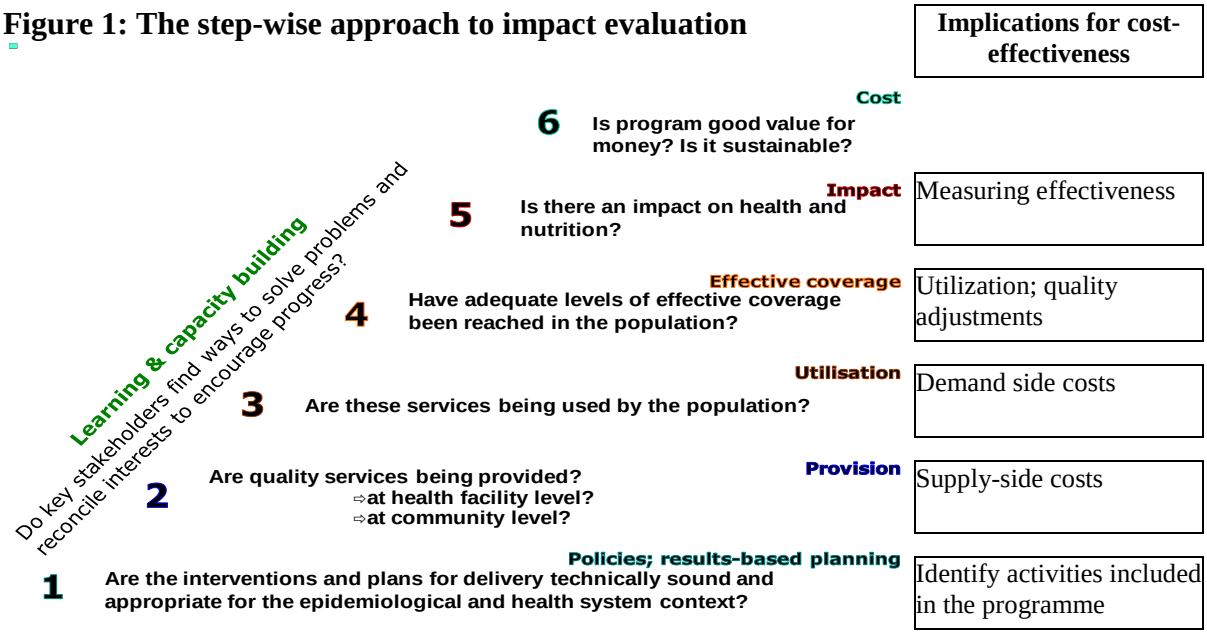
This document outlines generic recommendations for use in the economic evaluation of rapid-scale up of MNCH programmes as a component of the larger impact evaluation. It is intended to be a guide for estimating costs across country studies to ensure consistency in data collection, analysis, and reporting; it is not anticipated that all countries will desire to answer all the questions potentially addressed by economic evaluations, or that all of the proposed data collection activities will be undertaken in all settings. Rather, this document serves to propose possible activities and analyses; decisions as to which components are appropriate should be made in each country during the evaluation design process (see Appendix 2 for an example). While the extent to which the results from economic evaluations can be generalized is questionable [2], the collection of data in a standardized way is necessary if any comparisons across settings are to be undertaken. Thus, as with other components of the impact evaluation, it is recommended that country-specific evaluations adhere to the recommendations set forth in this document to the extent possible.

The IIP evaluation approach is based on a step-wise evaluation philosophy (see figure 1), with specific questions adapted to the country-level situation [3,4]. To answer the questions posed within this approach, a number of cotemporaneous studies will be undertaken, which may include:

1. Careful documentation of programme activities in both control and rapid scale-up districts (step 1 through 3);
2. Measuring the quality of case management for common childhood illnesses provided at health centres and/or by CHAs (step 2);
3. Prospective evaluation of the impact of the Rapid Scale-Up (steps 3 through 5);
4. Rapid mortality monitoring (RMM) (steps 3 through 5);
5. Collection of vital events by community members such as community health agents (CHAs) (steps 3 through 5);
6. Costs and cost-effectiveness evaluations (step 6).

Additionally, and of note to readers of this document, a separate component on assessing and evaluating the equity implications of the whole programme are included in the IIP evaluation. It is anticipated that the economic component will contribute to and supplement the equity analyses.

Figure 1: The step-wise approach to impact evaluation



Source: [3,4]

Details of each of these components of the impact evaluation are available elsewhere [ref or refs].

While the last step directly incorporates the output of an economic evaluation in the overall evaluation philosophy, the step-wise approach can also be adapted to shape the questions asked and data collected within an economic evaluation. For example, at the first step, collecting data on the budgetary allocations for planned activities can help to identify what activities will be included in the rapid scale-up for which cost data need to be calculated and also to establish (at a preliminary level) the adequacy of the budget in relation to the planned activities.

The second step reflects the need to collect cost of activities from a **supply-side perspective**. Step 2 represents the minimal step required for an economic evaluation, but a full economic evaluation should assess costs from the **perspective** of society (including both **supply**- and **demand-side perspectives**) and not just the health care system or **supply-side** [5,6]. Thus, costs to patients are assessed in conjunction with step 3. Data from steps 2 and 3 can be used to answer questions of **technical efficiency** – e.g., are services being delivered for a minimal amount of inputs? (or, are the maximum number of services being delivered for a given set of inputs?) [7,8].

Data from steps 4 and 5, combined with the costs from steps 2 and 3, then answers the questions posed in step 6, which assesses questions of **allocative efficiency** – are the proposed activities (e.g., those encompassed under the rapid-scale up) providing good value for money as compared to not doing these activities or compared to other possible activities? This step necessitates the use of either process indicators (at a minimum) such as utilization rates [Step 4], or (more ideally) health outcome measures such as deaths

averted, life years saved, disability adjusted life years (DALYs), or the like [Step 5]. A further step, needed for a complete economic evaluation, is to assess the non-health impact of health interventions, which may include the impact of improved health on people's productivity, educational attainment, etc. [9] [other refs].

This document is intended first for economist working in the IIP evaluation, other staff at IIP working on the evaluation, and their partners. It is secondarily intended for distribution among other economist conducting economic evaluation of large-scale health programmes. Finally, it is intended as background reading for people working in public health in developing countries seeking to gain an understanding of the principals and methods used in the economic evaluation of large scale programmes. As such, it covers a range of suggestions, some standard to most, if not all, economic evaluations and some more specific to the issues related to economic evaluations of large-scale programmes in developing countries. More advanced analysis topics are not covered in detail in this document; it is likely that these issues will be addressed by analysts that have the training to apply the appropriate techniques, but the specifics of the techniques will change based on the data available.

2. Specific objectives of the cost and economic component of the impact evaluation

The economic component of the larger impact evaluation is intended to assess the cost of the interventions aimed at reducing MNC mortality. This component of the analysis has two specific and interrelated objectives:

1. Determine the cost of the activities funded by the CI. The specific activities employed under the CI will vary by country, and the specific activities for which costs are estimated will be identified in conjunction with the broader evaluation.
2. To estimate the cost and cost-effectiveness of providing the MNCH prevention and care services the CI activities are seeking to influence at both the facility- and community-level. Understanding the cost-effectiveness necessitates the use of effectiveness data from the broader evaluation.

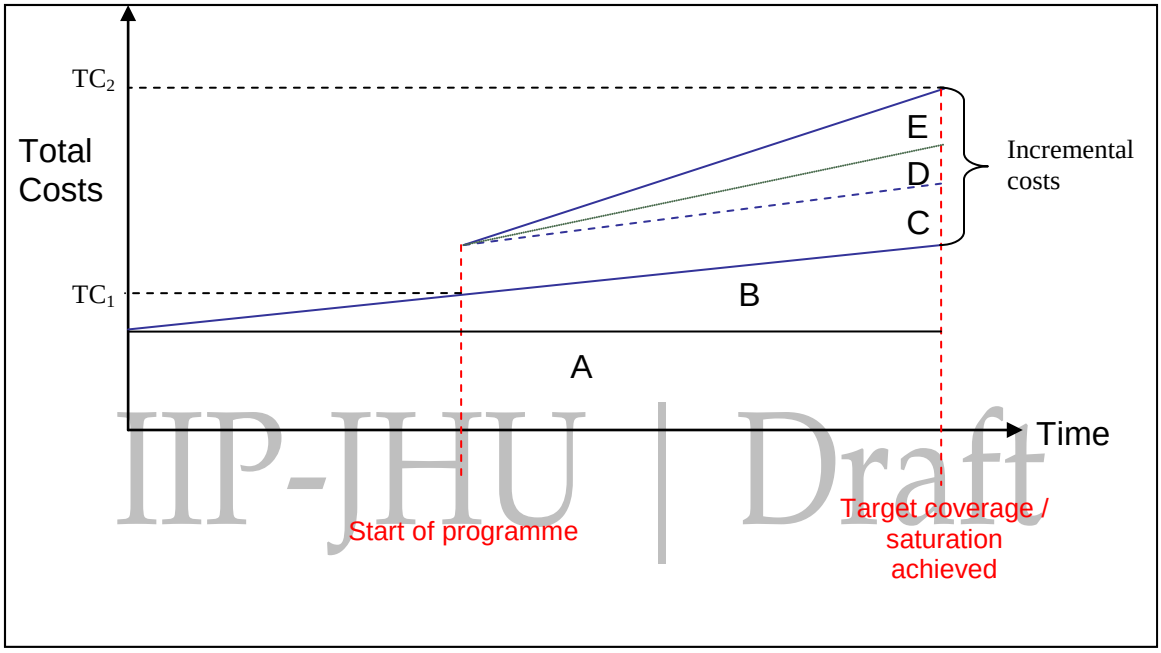
Other objectives can be added as per country needs. Some secondary analyses that can be conducted with the data that needs to be collected in order to meet these two objectives are suggested in sections 5 and 6 below.

3. Methods

3A. Conceptual framework for assessing the cost of rapid scale-up

Figure 2 presents a conceptual diagram of the **total costs** involved in the rapid scale-up of MNCH interventions.

Figure 2: Conceptual framework for assessing the cost of rapid scale-up



The x-axis in the diagram represents time from before the start of the rapid scale-up programme until target levels of coverage (or mortality reduction) have been achieved (or until the end of the evaluation). The y-axis represents the **annualized, total costs** of MNCH activities, with higher levels of costs being associated with higher levels of **total costs**.

There are five cost categories represented in the framework:

Area A: The rectangular region above the X-axis represents the total amount of resources used for MNC health services and preventive action at the beginning of the observation period.

Area B: Represents the change in **total costs** normally associated with secular trends in most health systems[1]. The change in **total costs** can be attributed to changing population, inflationary pressures, and the introduction of new technologies, among other factors. In

[1] Area B could also be thought of as the change in area A over time.

this diagram, secular trends are seen as increasing **total costs** (as is normally, but not universally, the case); this does not conceptually imply that average or marginal costs are necessarily increasing. Nor is there any particular reason to believe that secular trends will affect **total costs** in a linear way as depicted in the diagram (this is done here for simplicity's sake). Note that secular trends will affect the **total costs** of the MNCH programme both before and after the introduction rapid scale-up.

Area C: Represents the **start-up costs** associated with the rapid scale-up; these costs are specific for the rapid scale-up programme and thus are **incremental** to the costs represented in Areas A and B. In economic terms, the **start-up** costs will be **annualized** over the lifetime of the programme and thus are shown in the figure as constant over time, although this again may not necessarily be the case. The size of area C to some extent depends on the **analytic horizon** of the analysis.

Area D: Represents the operational programme-level costs associated with the rapid scale-up; these costs are specific for the rapid scale-up programme and thus are **incremental** to the costs represented in Areas A and B. Again, there is no pre-determined pattern for how these costs will change over time; for convenience they have been depicted here as increasing with the expansion of rapid scale-up activities.

Area E: Represents the increased costs due to the increased patient load under the rapid scale-up programme. Again, as rapid scale-up increases coverage, **total costs** will invariable increase, but there is no *a priori* reason to believe that unit costs will remain constant, increase, or decrease. Area E must be assessed as part of the economic component of the impact evaluation. It should be noted that any changes in unit costs due to programme scale-up will also, likely, affect the unit costs associated with areas A and B.

The costs associated with areas C and D may be estimated using four different methods:

1. Documentation approach: Through careful documentation of activities and correctly identifying which costs are unique to the rapid scale-up and allocation of the costs for activities shared by rapid scale-up and other activities;
2. First difference approach: The costs for C and D may be estimated by calculating programme costs at baseline and subtracting these baseline costs from the total programme costs observed after implementation. This approach ignores secular trends;
3. Aggregate difference approach: Subtracting the programme costs in the control districts from the programme costs in the rapid scale-up districts after rapid scale-up has occurred [1]. This assumes that the baseline costs in the control and rapid-scale up areas are the same.
4. Difference-in-difference approach: Methods 2 and 3 can be combined to control for secular trends. In this methods, programme costs are collected before and after rapid scale-up in both the control and implementation districts, and the difference in costs in the control districts is interpreted as the secular trend in programme

costs, and taken out of the difference in costs between the two time points in the rapid scale-up districts [1].

It should be noted that the assumption that secular trends are similar in the comparison and rapid scale-up districts is dubious. Even if districts are randomized, the likely small number of districts available for randomization and interference by other, non-CI programmes (an interference which usually cannot be considered random) likely mean that randomization alone may not ensure comparability [10]. Further, randomization (by itself) does not tell us why secular trends are as observed, and thus does not contribute to an understanding of the causes of heterogeneity in secular trends [11]; the generalizeability of cost data depends critically on understanding the particular activities and settings the data reflect and how these are similar to or different from other settings[2]. Thus, for this analysis, it is recommended that method 1 be used in combination with one of the other methods (method 4 is the preferred) in order to assess which costs are attributable to rapid scale-up.

Similar methods should be used to estimate Area E, but further adjustments may be necessary. Having time series cost data tracked by activity may allow for the calculation **of total, average, and incremental cost** per recipient in both the scale-up and control areas, since the change in the utilization, population, and the unit costs will be possible. Using the full change (comparing baseline to full implementation) in unit costs in the rapid scale-up areas would assume that all changes in the unit costs of service delivery and the utilization rate are attributable to the rapid scale-up, which ignores the influence of secular trends (See Appendix 1 for more details). Thus, secular trends may be controlled for using comparison areas (i.e., using the aggregate or difference-in-difference approaches described above).

However, the collection of time series cost data is obviously time consuming and expensive; thus, it is recommended that if costs are to be collected only at one point in time, that the costs be collected after programme implementation occurs. This method still allows for the comparison of **average costs** in the control and implementation areas. Comparison of **incremental costs** can be done by subtracting the costs per recipient in the control districts from that in the implementation districts under the assumption that the only differences of note between the districts is the programme itself [1].

Since the assumption that control and implementation districts are the same except for the CI programme itself is a strong assumption, it is recommended that adjustments for utilization rates and differences in unit costs are made before analysis of **incremental costs** is done. Data collected in the documentation component of the impact evaluation, in addition to data collected for the economic component, should provide details on the changes in utilization rates of various health providers over the course of programme implementation in both control and comparison areas. Thus, it may be possible to assess whether utilization was the same in the two areas before programme implementation, and whether changes in utilization followed a similar trajectory in the two areas. However,

[2] Assignment of districts to the CI programme and control branches will not be done at random for other parts of the impact evaluation.

there is data to suggests that unit cost change with the **scale of production** (c.f., [12-15]), indicating that econometric methods may need to be used to control for scale and efficiency in the production of health services between comparison and implementation areas [14][other refs]. This may be a useful approach to making findings from the aggregate difference approach more robust, and thus is recommended, at a minimum, for **sensitivity analysis**.

Given the uncertainties in deriving the **incremental costs** at the health service delivery level, it is especially important to carefully track resources at the programme level that were spent specifically in support of the rapid scale up and include these as **incremental costs**.

3B. Framing the analysis

Before an analysis is done, the target audience[s] for the results should be defined. In most cases there will be multiple audiences for the results of the evaluation, notably policy makers in the country where the evaluation is done, policy makers in other countries considering similar programmes, donors, NGOs, and other citizen groups. The analysis should be framed such that it addresses the **perspectives** of different target audiences.

It is recommended that the widest possible **perspective** be used for the economic component of the evaluation, in line with most guidelines for economic evaluation [1,5,6]. There are multiple **perspectives** from which costs can be presented; costs could be presented only for the public or national health system, the entire health system, for both health care providers and patients, and/or from the societal **perspective** (which includes the impact of a health intervention on other sectors such as future productivity increases due to health gains, etc.). The provider and patient **perspective** allow for the inclusion of the short-term costs to all relevant parties in the economic analysis, and is particularly important when patients bear substantial cost to access and receive care. Thus, economic estimates should include costs to the government (by level of government and, if relevant, social security agency), to donors, to other non-governmental agencies, and to patients [1,16]. In addition to assessing who bears the costs, it is also of use to determine where the cost is incurred – in the community, at a health centre, at a hospital, or at the programmatic level (i.e., at levels above the direct provision of health care such as NGO or district management, training, supervision, etc.) [17].

Additionally, the scope of the study should be carefully delineated to be realistic and to be as relevant as possible. Thus, the target population for the majority, but not necessarily all, of activities associated with the rapid scale-up should be included in the cost estimates. For example, if most activities in a particular country are concerned with child health, it may be desirable, for the sake of study feasibility, to exclude costs for care of mothers during pregnancy and childbirth. The levels at which programme activities are focused should also be considered; thus, if a particular programme is focusing on a community-based approach then costs at the community level need to be included but it

may be possible to exclude costs at the hospital level without seriously compromising the integrity of the study.

One decision that needs to be made early in the study is the scope of childhood illnesses to be assessed. The main focus of the CI interventions is on community-based management of childhood diarrhoea, malaria, and pneumonia. However, one of the main outcomes of interest is an estimate of costs per child death averted for which an estimate of **total costs** for all illnesses is needed. We recommend collecting data on all health care utilization. This allows for a more accurate allocation of costs among the different health conditions. Collecting data on costs for only specific diseases may ease the amount of data that needs to be collected, but this ease of data collection comes with two principal threats to the validity of the study:

1. If it is anticipated that rapid scale-up will involve increased usage of health centres (e.g., cases referred from the community level) or that the community level may at some point start treating additional diseases, or any other source of confounding (e.g., introduction of a new vaccine) may occur over the evaluation period then collecting costs for a limited subset of diseases would poorly match the effects data (which cannot be attributed solely to efforts to combat the subset of diseases for which costs were collected).

2. Collecting costs for specific diseases does not allow for the allocation of patient costs in the case of multiple diagnoses. It is likely that in most cases this will be a very minor bias; the exception may be the relationship between fevers and malaria.

Recognizing that the recommended approach is more complex than collecting data only for childhood diarrhoea, malaria, and pneumonia, if care for diarrhoea, malaria, and pneumonia account for a large proportion of **total costs**, it may be possible to focus on these three diseases without loosing too much information. Also, collecting data for all cause mortality makes the calculation of changes in morbidity (e.g., for use in DALYs) a very large undertaking, and may eliminate these types of metrics from being used. In each country, whether a large majority of costs can be attributed to a limited set of diseases will need to be evaluated in the piloting of the data collection activities.

3C. Classification of costs

In addition to classifying costs as **total, average and incremental**, sufficient disaggregation of costs will be necessary to establish cost per child. Preferably, cost per specific type of disease would also be estimated (see section on section 3B above and 3E below for more discussion of this topic).

3C1. Capital and start-up costs: Certain activities, such as training of health workers, have an effect that last beyond one year (**start-up costs**). Additionally, certain tangible items are used in the delivery of health services for more than one year (**capital items**). Start-up costs are best **annualized** over their useful life, while cost of **capital** items is best estimated by rental costs if these are available. If rental costs are not available, then

capital items should be annualized over their useful life. Annualizing costs should be done in accordance with standard economic evaluation guidelines (e.g., [5] and the glossary of terms below).

Defining start-up costs requires careful delineation of when the rapid-scale up starts, and what activities should be classified as rapid scale-up as opposed to normal activities. It is suggested that start-up costs be attributed to the MNCH rapid scale-up from the time when a decision was made to "accelerate" certain activities in intervention districts relative to the comparison districts. It is anticipated that start-up costs will cover such activities as local adaptation of Community Case Management (CCM) guidelines, preparation of training materials and the initial training of personnel at the national and district levels

Separation of **fixed and variable costs** should also be undertaken; this usually, but not necessarily, closely matches separation of **capital and start-up cost** classifications. Assessing the **fixed and variable cost** breakdown is useful, when done in conjunction with an assessment of the sources of financing, for answering questions related to programme sustainability.

3C2. Economic costs and financial costs: Economic costs include all costs to society and include items that may not require direct remuneration, while financial costs reflect all activities that require payment. The primary difference between these costs is in the valuation of opportunity costs; within the recommendations set forth here, the primary differences will consist of the opportunity costs to patients to access care and the inclusion of staff salaries, e.g., for training (the payment of salaries for the time staff spend in training is not generally included in the financial cost of training). Both of these items are discussed elsewhere (see section 3G). Note also, however, that financial costs may not directly translate into budgetary expenditures; for example, allocation of staff time to MNCH activities may mean that the total costs for these activities increases, but the budgetary outlay required remains the same (as, e.g., staff shift away from other activities). For the purposes of economic evaluation, economic costs should be used.

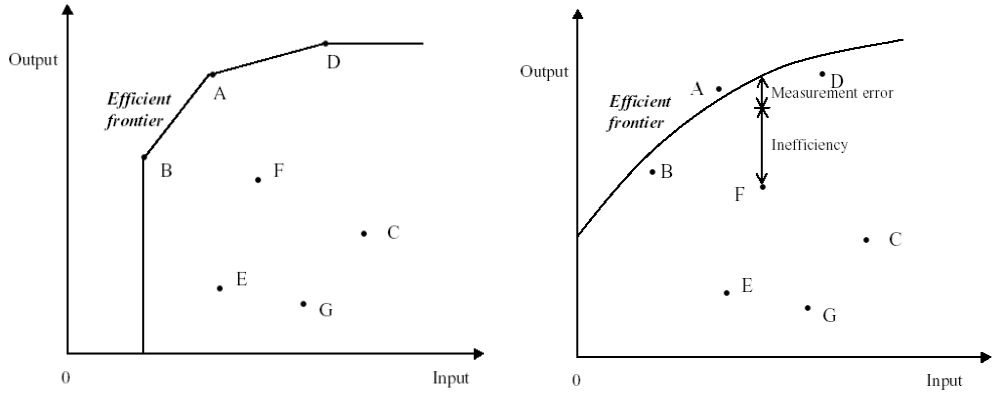
3C3. Technical efficiency: In order to properly compare control and intervention districts, the differences in **technical efficiency** should be controlled [1,18]. This adjustment is necessary so that the rapid scale-up initiative is not seen as favourable/unfavourable simply because of the variance in the ability of the districts under study to deliver health services efficiently. However, such adjustment is not straightforward. Previous guidelines have suggested straight-line adjustments to observed **capacity utilization** be made in order to account for various levels of efficiency [1,18]. However, given that this is an assessment of the rapid-scale up of interventions and that technical inefficiency may be due in part to scale inefficiencies and / or case-mix [7], adjustment for inefficiencies using data envelopment analysis (DEA), stochastic frontier analysis (SFA), and/or other statistical methods should be done, if possible, at least to assess the sensitivity of findings to various forms adjusting for technical inefficiency (see Box 1).

In addition, the quality of care may be considered when adjusting the cost data [c.f., refs]. This should only be done, however, if intermediate variables are being used for the effectiveness component of the cost-effectiveness analysis (e.g., cost per child treated). If outcome variables are used (such as deaths averted) and well measured, then the outcome measure itself will already encompass the variability in quality of health care services, and no adjustments should be made on the cost side (i.e., costs should match the effects). However, variations in the quality of care, as measured elsewhere in the impact evaluation, may well be important when discussing the results of the cost-effectiveness evaluation, and adjustments to baseline data may be necessary.

Box 1: Data envelopment analysis & stochastic frontier analysis3

Frontier methods entail the estimation of an efficiency frontier or envelopment surface from observed sample data based upon best performance within the sample. Measurement of the deviation of individual production units from this frontier allows the calculation of relative efficiency scores, and the computation of potential efficiency gains if units could achieve best performance levels. There are two major features that distinguish alternative empirical approaches for forming the frontier and measuring efficiency and productivity: whether they are parametric or not, and whether they are deterministic or stochastic. Parametric methods assume a specific functional form for the frontier, whereas non-parametric methods do not. Deterministic methods assume that the distance of a unit from its frontier is a result of inefficiency whereas stochastic methods assume that some of this is due to random error. Data envelopment analysis (DEA) is a non-parametric, deterministic method, while stochastic frontier analysis (SFA) is a parametric, stochastic method (ref book).

Data envelopment analysis & stochastic frontier analysis



3D. Study design

There are three principal methods of estimating costs that are recommended for this study: modelled costing, **top-down** costing, and **bottom-up** costing. Within each of these methods, there may be multiple sources or ways of collecting data. These methods are seen as complementary methods that can be used to obtain a complete collection of cost

data, and for cross-checking each other. Modelled cost analysis should only be done before or at the very start of the rapid scale-up programme, while **top-down** costing is usually done retrospectively, although it could be done on a repeated basis. **Bottom-up** costing is usually cross-sectional, and thus could be done on a repeated basis.

3D1. Model based cost estimates using existing data: As part of the impact evaluation, the Lives Saved Tool (LiST) is being applied *ex ante* in countries in order to provide input to programme planners that will allow them to adapt their plans to increase the probability that the rapid-scale up will have the anticipated effect on MNCH [19]. Given recent calls to more fully assess the accuracy of *ex ante* cost-effectiveness analysis with data collected after implementation [20], as well as to inform policy makers of an expected level of cost-effectiveness for their planned activities, it is recommended that the effects based on the LiST tool be combined with a modelled costing exercise to derive an *ex ante* cost-effectiveness ratio. It is recommended that the cost-effectiveness be estimated for the rapid scale-up areas incremental to the control areas.

Both unit costs of delivering services and the programme level costs of operating the rapid-scale up will need to be estimated in order to carry out this activity. It is not recommended that a full provider and patient **perspective** analysis be undertaken at this stage since it is unlikely that there will be sufficient data on patient expenditures to realistically estimate these costs (if, however, such data are available, then a wider **perspective** can and should be assumed). Thus, any comparison with later results should be adjusted to account for the **perspective** used in this analysis.

For modelled unit costs, costs can be estimated based on any of the following methods. The preferred methods, reflecting the most context specific data, are listed first. However, different methods can be used to derive unit costs to the extent possible in order to perform **sensitivity analysis**.

A. Unit costs collected during a baseline survey of health service providers (such as health centres, hospitals, and minimally trained health workers in the community). If such data are available, or are available from another study recently undertaken in the country, then these can be used either directly, or with adjustments due to anticipated changes in capacity utilisation. Note, however, that costing should reflect the economic costs of delivering services and thus unit costs should include costs for human resources and **capital** items. However, if it is decided in consultation with local health authorities that the rapid scale-up will allow for the more efficient use of human resources and **capital** items, then adjustments to the unit costs may be done. Alternatively, rapid-scale up may require the hire of additional staff or expanding services to areas where the catchment population will not be sufficient to allow for delivery of services in a technically efficient manner. To the extent possible, these considerations should also be included in the estimation of unit costs.
B. Unit costs can be used as estimated by previously undertaken econometric studies; it is recommended that WHO-CHOICE (http://www.who.int/choice/costs/en/) unit costs be used since there available on a country-by-country bases. WHO-

CHOICE unit costs include human resources but exclude drug items; thus excluded costs will have to be estimated using method C.

C. Unit costs estimated based on treatment protocols (and estimated staff time if options A and B are not used). While this method suffers from the bias that medical personnel rarely follow treatment protocols, it does allow a relatively quick assessment of the potential costs of delivery of the programme. An alternative, and more desirable, approach is to elicit resource usage from providers using vignettes, but again there is a trade-off in using this method against pragmatism.

Given the intention of comparing these results with later, more detailed costing, use of these unit costs will allow for an assessment of the merits of using these kinds of data to estimate cost projections. Note that methods for performing this type of analysis within the LiST tool are being developed.

For these methods, assumed utilization at different levels of providers (e.g., health centre versus community level) will need to be modelled.

For the estimation of programme costs, ideally data would be extrapolated from budgets that have been prepared for the rapid-scale up programme. It may then be assumed that other programme costs are equal between the comparison and rapid scale-up areas for purposes of assessing the **incremental costs**. If these data are unavailable, then detailed interviews with programme managers can be used to estimate the level of programme costs anticipated.

3D2. Bottom up cost analysis: Bottom up costing involves three aspects:

1. Visits to health facilities / service providers to collect quantities of goods used in the delivery of MNC health services. This method captures the amount of goods actually used, which are then multiplied by the unit prices of the goods – that is, an ingredients approach should be employed. This method should accurately reflect the economic costs of delivering services at the level for which data are collected.
2. Surveys of patients to collect information on the costs associated with accessing and receiving care. Costs at this level should reflect both out-of-pocket payments made to access and receive care and the opportunity costs of their time (when adopting a patient and provider **perspective** – see the section on uncertainty analysis [3F] below). Note that if out-of-pocket payments are made to health facilities / providers included in point #1, care must be taken to avoid double counting of costs.
3. Detailed review of programme accounting and expenditure reports to estimate programme level costs.

3D3. Top down cost analysis: There is increasing evidence that increases of funding by themselves do not always result in the increase in services. Barriers to the effective usage of funds, such as leakage, corruption, poor incentive structures, etc. can have a detrimental impact on the effective use of funds [21]. Thus, the costs collected using the

bottom-up approach may 'miss' financial expenditures and provide an unrealistic estimate of the 'true' costs of services. Further, **top-down** and **bottom-up** approaches each provide a different basis from which to estimate **total costs** and thus represent complementary means of assessing the accuracy of the data collected. The **top-down** approach is in line with the step-wise evaluation philosophy outlined in the introduction to this document insofar as it answers questions concerning not just how much was spent but where the spending is done (e.g., it helps to answer questions about whether services were adequate).

The **top-down** approach should focus on financial expenditure data and link these data to other resources such as staff and service and population data. Data is collected by conducting interviews at pertinent governmental levels about the financial flows and costs of health service delivery in general and specifically related to MNCH. Financial and other records are used to abstract data related to particular activities. All costs should be reported; for example, costs for expatriate staff should be included and priced as such.

3E. Allocation methods

Some staff or facility space may be fully dedicated to MNCH activities, in which case their full costs should be included in the costs estimation. However, some overhead (**capital** and administrative) costs for this study will have to be allocated to MNCH activities. To do this, it is recommended that direct allocation methods be used for this analysis[3].

Direct allocation requires a single metric on which to allocate a particular cost. Structural overhead costs, such as utilities, and staff not involved in direct patient contact should be allocated according to utilization variables (e.g., the percentage of visits that are from children). However, equipment, facility costs, and staff costs that are shared between different types of patients are usually allocated according to the amount of staff time spent on particular activities. The gold-standard for determining the proportion of time staff spent on particular activities remains time-motion studies [23]. However, time-motion studies are time consuming and often expensive. While provider interviews tend to underestimate non-productive time [23], this bias may not be as important when assessing relative time spent between activities, which is what is of interest here. (That is, provider interviews should only assess the relative time spent on MNCH activities in reference to their productive time, not total time.) Thus, provider interviews are recommended as the minimum level necessary for allocation of shared costs. If possible, some sub-sample of providers may be selected for time-motion to ascertain the level of bias produced by using provider interviews and make adjustments to the allocation ratios.

In some countries, it may be of interest to determine costs and cost-effectiveness by disease categories. For example, as noted above, the rapid scale-up initiative may focus

[3] Other methods are, of course, available (c.f., [5]) and while the allocation method used has been shown to influence the unit cost of services at hospitals [22], it is likely to have a smaller impact at health centres and at the community level where overall administrative costs are lower.

on treating malaria, pneumonia, and diarrhoea, and the unit costs for each disease, as well as their comparative cost-effectiveness, may be of interest. In this case, allocation of costs allocated to MNCH activities may then need to be further sub-divided. Whether or not unit costs should be differentiated, or whether unit costs will only be distinguished based on the cost of the drugs involved should be decided at the beginning of the study if these types of analyses are desired. To determine if there are any differences in the amount of time staff spend on a particular disease, either timing of visits by different types of patients (preferred) or provider interviews are needed. **Average costs** per case for laboratory and drug work will need to be determined. This can be assessed based on patient records (if they include such data) to determine the quantities of goods used and then multiplied by the unit cost of a particular item. Note that detailed costing in laboratories may be needed to accomplish this. If these data are unavailable, then a sample of patients will need to be observed, provider vignettes be used, or quantities can be estimated using treatment guidelines (the least preferable method).

If patients seek care for multiple diseases, allocation of their costs should be done based on simple percentages. For example, if a patient presents with two diseases, the costs associated with accessing care should be assigned 50% for each disease.

3F. Uncertainty analysis

It is recommended that **probabilistic uncertainty analysis,** following standard methods, be done for all data that is collected via sampling [5,18,24]. In addition, for data that is not based on sampled data, but may reflect bias or uncertainty, it is recommended that plausible ranges for the data be included in **probabilistic uncertainty analysis**, and a separate **sensitivity analysis** be conducted. Various methods have been proposed to value the time patients spend seeking care. Given the remaining controversy around these issues, **sensitivity analysis** will be used, varying time spent from zero (i.e., excluding this costs) to the minimum wage. If survey data allow, other methods can be explored [18].

3G. Data sources, collection methods, and data collection tools

This section briefly outlines the means of data collection available. All the data could be collected in stand alone activities for the economic component, but it is preferred that some data be collected in conjunction with other evaluation activities. Suggestions for these collaborative data collection activities are listed below.

It is expected that sample sizes identified to detect differences in other studies will be adequate to detect differences for costing purposes. Note, however, that the unit of measure for different costing methods is not the same; i.e., for **bottom-up** costing the unit of measure may be health centres (clustered in districts) while for **top-down** costing the unit of measure may be the district (and an **average cost** calculated for all health centres in that district).

Table 1 summarized the sources of data by the level at which data is collected.

Modelled costs: Data based on existing studies and proposed budgets should be used. Barring these data, WHO-CHOICE unit costs, treatment protocols and interviews with programme managers can be used. If baseline data is being collected, this activity can await or be adjusted based on these results.

Facility costs (**bottom-up**): It is recommended that costs be collected alongside the health facility surveys which will take part in another module of the impact evaluation. The health facility survey is intended to evaluate the quality of care delivered to children attending outpatient facilities, and the data collected overlaps the data needed for costing studies. It is recommended that data collection instruments and methods be adapted to the local health system from those used for the Multi-Country Evaluation of the Integrated Management of Childhood Illness (MCE-IMCI) study [1], which are available at http://www.who.int/imci-mce/Publications/facility_costs.pdf.

Cost should be collected for the following categories:
Personnel; drugs and supplies; utilities, maintenance and operating transport costs; infrastructure costs (building, equipment, furniture and means of transport); number of outpatient visits to health facilities by age group; and, number of referrals to secondary and tertiary centres by age group.

Facility costs (top-down): It is recommended that costs be collected at the district level reflecting the costs of operation for the entire health care delivery system. This can be done by adapting a public health expenditure tracking survey (available at http://econ.worldbank.org/external/default/main?theSitePK=477916&contentMDK=20292627&menuPK=546432&pagePK=64168182&piPK=64168060#PETS) or district health accounts style analysis [16,25,26]. Thorough piloting is needed for this approach to be successful.

Data to be collected include:

District and sub-district catchment populations (population dependent on public health services); financial and service data (where appropriate) on services that are coordinated outside the district, e.g. Works Department, non-governmental organisations; health services offered in the district and sub-district (service points, administrative authority, relationships between authorities / facilities and range of services); number of visits (headcounts) by service level type (e.g., hospital, health centre); staffing of clinics (total number of staff per category); and budget and expenditure data (total, recurrent and **capital** and by standard line items) by level of health system. It is particularly important to identify all sources of funding for health care providers and capture all of these sources in this analysis.

Community level provider costs (**bottom-up**): It is recommended that costs be collected alongside quality surveys. Tools have been developed to enable this process and have been incorporated into the quality survey questionnaire. Costs to be collected include the

allocation of the workers' time to treating MNC illnesses; review of drug usage may also be possible depending on the types of registers and records kept at the community level.

Community level provider costs (top-down): Line items related to community level health providers will be abstracted from the general **top-down** process described above for the **top-down** approach to facility costing.

District-level programme costs: This will be done by interviews with programme managers and abstraction of data from financial records at the district health office. Relevant data include MNCH activities at the district health office or at local NGOs such as: staff and personnel associated with running MNCH programmes; supplies and office equipment and space for these staff; vehicles (and vehicle operating costs), training, supervision, meetings, and monitoring and evaluation costs associated with MNCH and the rapid-scale up programmes.

Note that to the extent possible, this method should collect quantities (and unit costs), rather than **total costs**. This is especially true if unit costs are likely to vary by the financing source – which is the case for many donor-funded activities. Separation of unit costs and quantities allows for the quantities to be multiplied by a standard unit cost, and thus enhance comparability of the findings across districts. Standard unit costs may vary depending on the target audience, but should be used consistently with an analysis. Thus, for national policy makers, unit costs derived from Ministry of Health or Ministry of Finance budget guidelines should be used; unit costs for drugs should be taken from central stores or similar institutions. For international comparisons, international databases can be used to derive prices for medications and supplies.

In addition, health information system data will be collected to determine number of patient visits, etc. as appropriate.

Quantities are also necessary to assess the full opportunity costs of activities. For example, the salaries of staff should be included in the costs of training (i.e., a five day training session should include five days of salary cost for the staff attending the training). These data are usually not captured in budgets and adjustments need to be made after the data is collected; this process requires quantities.

In addition, unit prices for goods may be collected at this level (e.g., staff salaries, rental prices, etc.), which is useful in determining actual expenditures and assessing sustainability, but it is recommended that standardized unit cost be used for economic evaluation.

National and donor level costs: This will be done by interviews with programme managers and abstraction of data from financial records. Particular care will be used to identify all the relevant sources of finance for MNCH activities in both the control and rapid scale-up areas; this should be done in conjunction with the documentation aspect of the impact evaluation. Relevant data include, but are not limited to: staff and personnel associated with running MNCH programmes; supplies and office equipment and space

for these staff; vehicles (and vehicle operating costs), training, supervision, meetings, and monitoring and evaluation costs associated with the MNCH and rapid-scale up programmes.

In addition, unit prices for goods may be collected at this level (e.g., costs for drugs, equipment, other tradable items, etc.).

Patient level costs: Patient level costs can be collected in conjunction with at least three other activities: exit interviews with patients at facilities during facility surveys; exit interviews with patients at the community level in conjunction with community-level worker surveys; and, household surveys. Cost to be collected include: amounts spent on seeking care (i.e., costs for transportation and accommodation); number of different providers from which care was sought and expenditures at each type of care provider for drugs, investigations and other services; and, wages lost and productive time lost in seeking care.

Table 1: Types of data potentially collected by site and method

Item	Method	Location				Notes
		Community	Facility	Government	Household	
Modelled costs	Budget review / interviews / literature review		X – [possible; vignettes]	X –National / Donor		In conjunction with *Documentation*
Start-up costs	Budget review / interviews			X – District / National / Donor		In conjunction with *Documentation*
Facility costs (bottom-up)	Site visits / observations		X			In conjunction with *facility quality surveys*
Facility costs (top-down)	Budget and allocation reviews, public expenditure tracking		X	X – District		
Community level provider costs (bottom-up):	Site visits / observations	X				In conjunction with *quality surveys*
Community level provider costs (top-down):	Budget and allocation reviews, public expenditure tracking	X	X	X – District		
District-level programme costs:	Budget and allocation reviews, public expenditure tracking, interviews			X – District		
National and donor level	Budget and			X – National		In conjunction with

costs:	allocation reviews, interviews			/ Donor		*Documentation*
Patient level costs at community level:	Exit interviews	X				In conjunction with *quality surveys*
Patient level costs at facility level:	Exit interviews		X			In conjunction with *facility quality surveys*
Patient level costs at all levels:	Household survey				X	In conjunction with *mortality monitoring, slimline* or other household surveys

4. Data analysis and outcomes

Both the **top-down** data and the data collected through activities conducted in conjunction with the other sub-studies of the impact evaluation will be analyzed to produce estimates of cost-effectiveness. A number of process, intermediate, and outcome indicators are available to be compared with cost. These are summarized in table 2. To the extent possible, all of these indicators should be used since they all provide useful information. However, the minimum set of recommended includes:

1. Cost per child (or maternal) death averted;
2. Cost per child (or mother) correctly treated, overall and by source of treatment (public versus private [following the recommendations of this study would only be collected from patients as OOP costs]; and for public sources by level of care – community, outpatient, and inpatient if applicable);
3. Cost per child (or woman of child-bearing age).

The **analytic horizon** to be used is annual cost and effects. Costs will be presented as annual equivalent costs, while effects will be deaths averted in 1 year of the programme.

Appendix 3 presents some possible formats for the presentation of results. Costs should be presented in the currency most relevant for the target audience; likely this means that results should be presented in local currency units (for national policy makers), in US dollars (for donors and programme managers in other countries), and in **purchasing power parity** adjusted dollars (for comparison with other studies and for international policy makers).

Total costs: Total cost will be calculated by summing the costs at the various levels. For example, costs at facilities will be estimated from the **bottom-up** approach by multiplying unit costs by the number of children visiting health facilities (the unit costs may be weighted if the sampling scheme was stratified by type of facility). Differences, if any, between the **top-down** and **bottom-up** approaches will be handled in **sensitivity analysis**.

Average costs: Cost per child and cost per child successfully treated will be determined by dividing the **total costs** by the appropriate denominator.

Incremental costs and cost-effectiveness: As indicated in the conceptual model section of this document, **incremental costs** should be estimated by taking the **average costs** of care for MNCH in a district without rapid scale-up and subtracting it from the **average costs** in a district with rapid scale-up. However, any costs (especially at the programmatic level) that can be specifically attributed to the rapid scale-up initiative should be added

after this subtraction has taken place, except in the condition that very similar activities were documented to have taken place in the control district.

Table 2: Types of process, intermediate, and outcome indicators and data needed

Type of indicator	Indicator	What the indicator measures	Data needed for indicator*
Process	*Ex ante* cost-effectiveness	Results-based planning	Budget projections, work plans, coverage targets
Process	Incremental/total cost per child treated	Services provided	Utilization rates
Process	Incremental/total cost per preventative item delivered (e.g., bednet or vitamin A capsule)	Services provided	Utilization rates
Process	Cost per Capita	Services provided, programme effort, and sustainability	Population
Intermediate	Incremental/total cost per child correctly treated	Treatment leading to health gains	Utilization rates adjusted by quality
Intermediate / outcome	[Marginal] cost of quality improvement	Improvements in services due to programme	Quantitative measure of quality improvements
Outcome	Incremental cost per child (or maternal) death averted	Mortality reduction	Mortality rates
Outcome	Incremental cost per life year gained	Mortality reduction	Mortality rates and age of death (and life expectancy)
Outcome	Incremental cost per DALY averted	Mortality and morbidity reduction	Mortality rates, age of death (and life expectancy), average morbidity associated with diseases, correct treatment by disease
Outcome	Incremental cost less incremental gains in productivity per DALY averted	Mortality and morbidity reduction and impact in sectors other than health	Mortality rates, age of death (and life expectancy), average morbidity associated with diseases, correct treatment by disease plus long-term gains in educational attainment, worker productivity, etc.

*In addition to the cost data discussed in this document

Once the **incremental cost** has been established, it can be compared with the incremental deaths averted to determine the incremental cost-effectiveness ratio (ICER). Deaths averted is seen as the minimal level of presentation for effectiveness data; other metrics

(e.g., life-years saved, DALYs averted) can also be applied if relevant for a particular country (note that these metrics also imply a different **analytic horizon**).

The **ceiling ratio** represents a decision maker's valuation of a unit of health gain and is a particularly crucial and politically sensitive element of economic evaluation, as it is the relative value against which the acceptability of ICERs are judged. If the value of an ICER is below the **ceiling ratio**, an intervention is deemed acceptable on grounds of cost-effectiveness. Based on the recommendation of the Commission on Macroeconomics and Health (CMH), WHO classifies interventions as 'highly cost-effective' for a given country if results show that they avert a DALY for less than the per capita national GNI or GDP (and 'cost-effective' if it is less than three times the per capita national GNI) [9].

We will also recommend placing findings in a broader context by comparing them to other economic evaluations that have been undertaken in the same or neighbouring countries after adjustments have been made for inflation. Placing results in the context of a ceiling ratio provides a general picture of the programme's value for money, but does not address the issue of whether it is the best use of additional resources. Comparing the results to other studies will partly alleviate this problem. It also informs the decision maker about other options to the programme besides 'doing nothing', 'the status quo', or what is happening in the comparison areas. However, the methods and assumptions in other studies may be different from those employed here or in comparison with each other, which makes these comparisons problematic. Results need to be interpreted with these short-comings made clear.

5. Limitations

While this document aims to lay out a comprehensive method for gathering costs data, restraints to time and evaluation budgets, as well as real-world considerations applicable to evaluating large scale programmes [10], provide some limitations to the methods described here. Some of these limitations are listed in the document itself; major limitations are repeated or introduced in this section. These limitations are meant to increase the cognizance of investigators to the need for careful collection of data, thorough documentation of data sources, and for the sharing of analysis techniques across settings as the evaluation proceeds.

A selected list of limitations / challenges include:

1. Difficulty in attributing costs to the rapid scale-up programme as opposed to baseline or secular differences between districts. This inability to directly observe the 'counter-factual' necessitates careful documentation as well as cost analysis of programme level activities. Various statistical methods may also be used to try to assess the effects of changing coverage on unit prices, etc.

2. Adjustment of cross-sectional data for **technical efficiency**. In addition to using linear adjustments, we advocate the use of 'best practice' techniques such as DEA or SFA in order to ascertain that differences in costs between districts are not due to differences in **technical efficiency**.

3. Complications in allocating costs to MNCH activities (or to disease specific activities). This is discussed in sections 3B and 3E.

4. Recall and survey bias in estimating patient expenditures. Use of surveys usually results in recall bias, in that respondents may not report some expenditure that they made on health care items [27,28]. This can results from failure to recall items, or a failure of the survey questionnaire to appropriately prompt respondents. If budgets allow, test-retest and other methods may be used to try to determine reliability and validity of these surveys. Following most surveys, we recommend that recall lengths asked in the survey be limited (e.g., two weeks or one month).

5. While patient and provider costs will be measured in the approach outlined in this document, other non-financial factors which may have an influence on patient demand for services (e.g., institutional factors such as trust, altruism, volunteerism, community norms, reciprocity, and duty (c.f., [29,30])) are not assessed [31]. Nor is there a component which assessing the willingness-to-pay for MNCH services, in order to determine to what extent people value these services (and not for use in, e.g., price setting) (c.f., [32]). Thus, a holistic determination of why rapid-scale up works / does not work will not be possible.

6. Similarly, this analysis, in and of itself, does not answer questions related to the sustainability of the rapid scale-up programme after scale-up has been achieved. A full sustainability analysis would require fiscal space analysis which could then be compared to the costs of the programme. Further studies may be needed on human resources, such as the retention rate, costs for refresher training, and the costs for requiting and training new cohorts of workers, all of which may not be well observed in the time span of the evaluation. However, the data recommended to be collected in this document can give some picture of the resources needed to continue to programme.

7. Finally, the outlined methods do not address the extent to which inefficiencies (or efficiency) are related to other goals of the health system, especially equity goals. The data collected as part of this analysis can be used to determine the equity of OOP payments for health care (c.f., [ref]), and contribute to the equity of the benefit of health services. Further, comparisons of equity and efficiency may also be possible.

6. List of recommendations

This document lays out a number of suggestions for how to do a cost analysis alongside an evaluation of a large scale, population based programme. These recommendations reflect a balancing act between pragmatism and precision of the measurement of costs, and also reflect the concerns with collecting cost data in a non-randomized study design. This section provides a summary of suggestions and recommendations.

1. **Incremental costs** should be compared with incremental effects [section 3A]. To estimate **incremental costs**, it is necessary to estimate the counter-factual costs (i.e., what costs would have been without the programme). Estimation of the counter-factual could be subject to confounding. In order to assess the degree of, and control for, confounding, econometric modelling may be necessary. Minimally, confounding due to the **scale of production**, case-mix, **technical efficiency**, and quality of care should be assessed, although other confounders are possible. The following techniques are recommended for adjusting for confounding:
    a. **Scale of production**: Econometric modelling to determine the relationship between average cost and number of children treated.
    b. Case-mix: Development of relative weights for different diseases based on observed drug and laboratory costs associated with a single treatment episode of a disease. Staff time could also be adjusted, but is not likely to be necessary and thus of lesser importance.
    c. **Technical efficiency**: Minimally, straight line adjustments based on cases seen per worker (or bed occupancy for hospitals inpatient departments if applicable). Ideally, DEA or stochastic frontier analysis would be used; note that this may be combined with assessment of the scale of production.
    d. Quality of care: Use of quality index or downward adjustment of utilization numbers based on the correct treatment rate in econometric modelling to determine the effects of differences in quality of costs. This type of analysis can also be used to determine the marginal cost of quality improvement, which is an outcome of merit in its own right.

    More details on these methods are being developed.

2. Use the widest possible perspective when assessing costs [section 3B]. Costs to both the patient and the provider should be included. Opportunity costs, which reflect the economic value of time, should also be included, but should be subjected to **sensitivity analysis**. Economic costs should be used for the economic evaluation, but other cost metrics (financial or budgetary) may be useful for other analyses.

3. Costs should include those costs most relevant to the programme being evaluated [section 3B]. The major focus of the programme, and the metrics used in the effectiveness evaluation, should determine what costs are collected, and how specific the allocation of costs should be. Allocation methods [section 3E] would

ideally be based on time-motion studies, but other methods may be acceptable. Use of direct allocation methods to calculate the costs assigned to specific programmes is likely sufficient.

4. Cost data should be gathered from multiple entry points / perspectives [section 3D]. To the extent possible, **top-down** and **bottom-up** methods should be used to corroborate the data and to ensure that all sources of finance are captured, and use of a difference-in-difference approach along with documentation can help determine the incremental costs. Costs ideally would be collected before and after implementation, but if only one data collections session is possible, costs should be collected after implementation [section 3A]. Additionally, *ex ante* cost-effectiveness can be performed [section 3B]. However, all efforts should be made to collect and calculate costs based on the ingredients approach, which allows for inclusion of opportunity costs and also allows for adjustments in unit prices. Synergies in data collection should be exploited whenever possible; for example, patient surveys can be conducted with quality assessment or facility cost visits [section 3G].

5. Total costs, average costs, and incremental costs should be presented in the results [section 4]. The target audience for the results should be carefully considered when the results are presented, and the most appropriate metrics for an audience should be used. Costs should also be presented in local currency units, US dollars and PPP adjusted dollars.

6. Deaths averted should be the minimal metric used for effectiveness [section 4]. This does not preclude using more intermediate, process oriented indicators for effectiveness, such as cost per case treated or cost per case successfully treated. It also does not preclude use of further outcome measures, such as DALYs. However, cost data should be collected on all child health care utilisation so as to best reflect the outcome metrics, which may preclude the use of outcome measures such as DALYs.

7. Results should be presented in relation to both ceiling ratios and with respect to other studies [section 4]. This gives the best available information to decision makers about the range and possibilities of choices available and how the programme evaluated compares with these options

8. Probabilistic uncertainty analysis and sensitivity analyses should be performed [section 3F]. Plausible ranges of outcomes should always be presented alongside point estimates.

Table 3: Summary of main recommendations*

Aspect of study	Objective	Method			Notes
		Best	**Good**	**Not recommended**	
Comparator to the program	To assess the incremental costs and effects as accurately as possible		**Comparison areas controlling for confounding**	No control for confounding; no comparison areas (e.g., before-after analysis only)	Randomization is the ideal but likely not possible for large scale programmes
Effectiveness measure	To most completely and comparably capture changes in population health	DALYs or QALYs	**Deaths averted**, life years saved	Child treated	Multiple outcome measures can and should be reported
Means of estimating incremental costs	To accurately estimate the true costs of the programme in relation to the existing health system	**Data collection from multiple points of entry (top-down, bottom-up) and at different times (before, after) and via multiple means (difference-in-difference and documentation)**	Data collected from large sample bottom-up OR top-down using econometric methods to assess changes in time	Data collected from a small sample of facilities, little control of data for potential confounders	
Allocation methods	To accurately determine what proportion of shared resources are consumed by the programme	Time-motion studies	**Interviews with providers**	Rules of thumb	Perhaps can try time-motion studies with a small number of providers to calibrate provider interview data
Perspective	To include the viewpoints	Long-term	**Short-term**	Supplier	Note that supplier

	and interest of all relevant parties to a decision	societal	**patient and supplier perspective**	perspective only	perspective may be the only feasible alternative
Inclusion of the private sector	To gain a truer understanding of societal costs and effects	Full mapping, costing, and effectiveness study for private providers	**Include patients OOP payments to private providers**	Ignore the private sector	This may be more or less important depending on the context, but an evaluation of a large scale programme should acknowledge in some ways the alternative service providers utilized by patients
Time horizon	To fully capture the relevant effects and costs	Lifetime	Life of the programme; **one year**		
Interpretation and presentation of results	To best inform decision makers about the range and possibilities of choices available and how the programme evaluated compares with these options	Comparison to other programmes with same target population implemented at the same time as the programme of interest	**Comparison to both a ceiling ratio and other studies of geographic and topical relevance**	No reference point for placing the results in a meaningful context	Options are not necessarily mutually exclusive
Uncertainty & sensitivity analyses	To present the results with an accurate estimate of the precision of the measurements	**Probabilistic with special sensitivity analysis to variables not well estimated**	Best case/worst case analysis	Single variable sensitivity analysis	Little reason not to do probabilistic uncertainty analysis

*Recommended methods for this study are highlighted in **Boldface**

References

1. Adam T, Bishai D, Kahn M, Evans D. Methods for the Costing Component of the Multi-Country Evaluation of IMCI. 2004. Geneva, World Health Organization.
Ref Type: Report

2. Anderson R: **Systematic reviews of economic evaluations: utility or futility?** *Health Econ* 2009.

3. Bryce J, Victora CG, Habicht JP, Vaughan JP, Black RE: **The multi-country evaluation of the integrated management of childhood illness strategy: lessons for the evaluation of public health interventions.** *Am J Public Health* 2004, **94:** 406-415.

4. Habicht JP, Victora CG, Vaughan JP: **Evaluation designs for adequacy, plausibility and probability of public health programme performance and impact.** *Int J Epidemiol* 1999, **28:** 10-18.

5. Drummond M, Torrance G, O'Brien B, Stoddart G, Sculpher M: *Methods for Economic Evaluation of Health Care Programmes*. Oxford: Oxford University Press; 2005.

6. Hutubessy RC, Baltussen RM, Torres-Edejer TT, Evans DB: **Generalised cost-effectiveness analysis: an aid to decision making in health.** *Appl Health Econ Health Policy* 2002, **1:** 89-95.

7. Jacobs R, Smith P, Street A: *Measuring efficiency in health care: analytic techniques and health policy*. Cambridge: Cambridge University Press; 2006.

8. Masiye F, Kirigia JM, Emrouznejad A, Sambo LG, Mounkaila A, Chimfwembe D *et al*.: **Efficient management of health centres human resources in Zambia.** *J Med Syst* 2006, **30:** 473-481.

9. The commission on macroeconomics and health. Macroeconomics and health: investing in health for economic development. 2001. Geneva, World Health Organization.
Ref Type: Report

10. Victora CG, Black RE, Bryce J: **Evaluating child survival programmes.** *Bull World Health Organ* 2009, **87:** 83.

11. Deaton A. Instruments of development: Randomization in the tropics, and the search for the elusive keys to economic development. 2009.
Ref Type: Unpublished Work

12. Berman P, Brotowasisto, Nadjib M, Sakai S, Gani A: **The costs of public primary health care services in rural Indonesia.** *Bull World Health Organ* 1989, **67:** 685-694.

13. Johns B, Baltussen R: **Accounting for the cost of scaling-up health interventions.** *Health Econ* 2004, **13:** 1117-1124.

14. Kumaranayake L: **The economics of scaling up: cost estimation for HIV/AIDS interventions.** *AIDS* 2008, **22 Suppl 1:** S23-S33.

15. Over M: **The effect of scale on cost projections for a primary health care program in a developing country.** *Soc Sci Med* 1986, **22:** 351-360.

16. WHO: *Guide to producing national health accounts: with special applications for low-income and middleincome countries.* Geneva: World Health Organization; 2003.

17. Johns B, Baltussen R, Hutubessy R: **Programme costs in the economic evaluation of health interventions.** *Cost Eff Resour Alloc* 2003, **1:** 1.

18. Baltussen R, Adam T, Tan-Torres ET, Hutubessy R, Acharya A, Evans DB *et al.*: **Methods for generalized cost-effectiveness analysis.** In *WHO Guide to Cost-Effectiveness Analysis*. Edited by Tan-Torres ET, Baltussen R, Adam T, Hutubessy R, Acharya A, Evans DB *et al*. Geneva: World Health Organization; 2003:2-106.

19. Bryce J, Friberg I, Kraushaar D, Walker N. LiST as a catalyst in program planning: Experiences from Burkina Faso, Ghana and Malawi. Int.J.Epidemiol. 2009.
Ref Type: In Press

20. Murray CJ, Frenk J: **Health metrics and evaluation: strengthening the science.** *Lancet* 2008, **371:** 1191-1199.

21. Gauthier B. PETS-QSDS in Sub-Saharan Africa: A stocktaking study. 2006. Montreal, Institute of Applied Economics, HEC.
Ref Type: Report

22. Riewpaiboon A, Malaroje S, Kongsawatt S: **Effect of costing methods on unit cost of hospital medical services.** *Trop Med Int Health* 2007, **12:** 554-563.

23. Bratt JH, Foreit J, Chen PL, West C, Janowitz B, De VT: **A comparison of four approaches for measuring clinician time use.** *Health Policy Plan* 1999, **14:** 374-381.

24. Briggs A: **Probabilistic analysis of cost-effectiveness models: statistical representation of parameter uncertainty.** *Value Health* 2005, **8:** 1-2.

25. de Savigny D, Munna G, Mbuya C, Mgalula L, Machibya H, Mkikima S *et al*.. District health expenditure mapping: A budget analysis tool for council health

management teams. Discussion Paper No. 1. 2001. Tanzania, Ministry of Health.
Ref Type: Report

26. Health Expenditure Review Task Team. Guidelines for district health expenditure reviews in South Africa: A guide for managers in the health sector. 2001. South Africa, Department of Health, Health System Trust, MSH.
Ref Type: Report

27. Xu K, Ravndal F, Evans DB, Carrin G: **Assessing the reliability of household expenditure data: Results of the World Health Survey.** *Health Policy* 2009, **91:** 297-305.

28. Deaton A: *Measuring Poverty in a Growing World (or Measuring Growth in a Poor World)*. Princeton, NJ: Princeton University; 2004.

29. Jan S: **A holistic approach to the economic evaluation of health programs using institutionalist methodology.** *Soc Sci Med* 1998, **47:** 1565-1572.

30. Jan S, Pronyk P, Kim J: **Accounting for institutional change in health economic evaluation: a program to tackle HIV/AIDS and gender violence in Southern Africa.** *Soc Sci Med* 2008, **66:** 922-932.

31. Walker DG, Jan S: **How do we determine whether community health workers are cost-effective? Some core methodological issues.** *J Community Health* 2005, **30:** 221-229.

32. Borghi J, Thapa B, Osrin D, Jan S, Morrison J, Tamang S *et al*.: **Economic assessment of a women's group intervention to improve birth outcomes in rural Nepal.** *Lancet* 2005, **366:** 1882-1884.

Glossary of terms

Allocative efficiency: choosing the mix of interventions that maximizes health gain for a given level of expenditure.

Analytic horizon: the period of time over which the costs and health outcomes that occur as result of the programme are considered. An example would be including the lifetime health effects on a 1-year birth cohort of children, and including costs incurred for the first 5 years of life.

Annualization: the conversion of **capital items** and **start-up costs** into *annual equivalent costs*, so that the time metric for these items matches other cost items. The annual equivalent costs is given by the following formula [5]:

$$E = \frac{K - \left(S/(1+r)^n\right)}{A(n,r)}$$

Where:
E = Annual equivalent costs
K = purchase price or initial outlay for an item / activity
S = the resale value (often assumed to be zero)
r = the discount rate / interest rate
n = the useful life of the equipment / activity
A(n,r) = the annuity factor (n years at interest rate r)

Average costs: the total cost divided by the number of recipients (or by the total target population).

Bottom-up: a costing method which starts with the recipient of health services and itemize the quantities of goods and services received at that level (and allocates shared resources to a particular patient or service centre).

Capacity utilization: the extent to which staff or facilities are fully used. For example, bed occupancy rate at a hospital is a measure of capacity utilization. Capacity utilization is a measure used in determining **technical efficiency**.

Capital items: items which can be used repeatedly for more than 1 year, such as cars, medical equipment, and buildings. Often, only items above a certain threshold value are considered (e.g., only items with a value above $500 are included in the costs).

Ceiling ratio: the level of cost per unit of outcome below which an intervention is considered cost-effective. GDP per capita was recommended by the Commission on Macroeconomics and Health to determine if an intervention is 'very cost-effective'.

Demand-side: the perspective of the agent or person that is the recipient or purchaser of a good.

Fixed costs: costs that do not change with an increase in production in the short-run. The costs for buildings can be a fixed cost in the short-run.

Incremental costs: the difference in cost between two alternatives; for example, the difference in cost between implementing the rapid scale-up programme and not implementing the rapid scale-up programme.

Perspective: (also referred to as viewpoint): perspective of the bearers of the costs and benefits of an intervention, e.g., society, government, health-care providers, patients. Perspective can also refer to the time for which costs or benefits are collected (e.g., short-run or long-run costs or benefits).

Probabilistic uncertainty analysis: a method of analysis that explicitly incorporates parameter uncertainty. The defining point is that variables are specified as distributions rather than point estimates as in a deterministic analysis.

Purchasing power parity: a PPP exchange rate is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as a US dollar would buy in the United States.

Scale of production: the level of outputs produced. Changes in the levels of output may mean **average costs** change in both the long and short run. Microeconomic theory defines short-run increases in production as increases that are possible by changing one of the inputs to production (the variable inputs, e.g. drugs), while the other inputs are assumed constant (the fixed inputs, which are usually thought of as capital). In the long run, on the other hand, microeconomic theory assumes that all resources used in production can be varied; for example, new buildings can be built, new people trained, etc. This does not necessarily mean that the cost structure remains static. For example, doubling all inputs could exactly double output (constant returns to scale), more than double output (economies of scale) or produce less than double the amount of output (diseconomies of scale).

Sensitivity analysis: an exploration of the impact on the results of changing the value of one (or more) parameter(s) while keeping the values of all other parameters unchanged.

Start-up costs: certain activities, such as training of health workers, which have an effect that last beyond one year.

Supply-side: the perspective of the agency or firm that is producing a good.

Technical efficiency: providing maximal health care for a given cost, or delivering a certain service at minimal cost. When comparing different areas, cost-effectiveness

often standardizes the level of technical efficiency so that cost-effectiveness ratios represent a comparable cost metric; that is, comparing a district that 'does things well' against a district that works inefficiently may make an intervention appear attractive or not but, in fact, simply reflects the districts' ability to implement programmes.

Top-down: a costing method which starts with the total health budget and then allocates costs to specific programmes.

Total costs: the sum of all costs associated with a programme.

Variable costs (also referred to as recurrent costs): costs that change with every change in the amount produced. For example, drugs are a variable costs since they directly depend on the number of patients seen.

Appendix 1: Estimating incremental costs

The **total costs** of rapid scale-up for a given district, TC_2 from Figure 2, is the sum of all the costs observed after rapid scale-up has occurred:

$$TC_2 = \sum_{A}^{E} TC_i \quad [1]$$

This equation can be decomposed into service delivery and programme costs:

$$TC_2 = \sum_{A,B,E} TC_i + \sum_{C,D} TCi \quad [2]$$

(Although properly, costs A and B contain both programme and service delivery costs, this is easily dealt with in a further decomposition of equation 2, which for simplicity is not done here).

The service delivery costs can then be further disaggregated as follows:

$$\sum_{A,B,E} TC_i = TC_A + TC_B + TC_E \quad [3],$$

further specifying each subcomponent of this equation into:

$$\sum_{A,B,E} TC_i = \sum_{j=1}^{n} \left(\sum_{k=1}^{m} (UC_{jk} \times Util_{jk} \times Pop_{jk}) \right) \quad [4]$$

Where *j* represents the type of service delivery (e.g., community worker, health centre, or hospital), *k* represents individual service delivery units, *UC* represents the average unit cost of delivery at a particular health service delivery unit, and *Util* represents the utilization rate and *Pop* represents the catchment population of the health service unit *k*. That is, for example, the **total costs** of health centres is the sum across all health centres of unit costs at each health centre multiplied by the number of visits (utilization rate multiplied by the population) at that health centre. The **total costs** then is the sum of the costs for health centres, community workers, etc. When sampling of health centres is involved, an error term may be added to equation 4; it may also be more useful simply to multiply the average unit costs observed at all health centres by the total number of outpatient visits to derive **total costs**, in which case, equation 4 would be rewritten:

$$\sum_{A,B,E} TC_i = \sum_{j=1}^{n} \left(\overline{UC}_j \times \sum_{k=1}^{m} (Util_{jk} \times Pop_{jk}) \right) \quad [5]$$

Total cost figures are relevant for planning and resource tracking questions, and are easily converted into **average costs**. **Incremental costs** are of more use in cost-effectiveness analysis, however, since they address the best use of additional resources, or the best use of re-programming current resources [5]. The combined areas of C, D, and E represent the **incremental costs** of the rapid scale-up programme, and can be calculated for a district as follows:

$$IC_2 = \sum_{A}^{E} TC_i - \sum_{A}^{B} TC_i \qquad [6],$$

where IC_2 is the **incremental cost** of rapid scale up.

For unit costs, using equation 5, the **incremental costs** for service delivery can be written:

$$\sum_{A,B,E} IC_i = \sum_{A,B,E}\left[\sum_{j=1}^{n}\left(\overline{UC}_j \times \sum_{k=1}^{m}\left(Util_{jk} \times Pop_{jk}\right)\right)\right] - \sum_{A,B}\left[\sum_{j=1}^{n}\left(\overline{UC}_{j|\sim E} \times \sum_{k=1}^{m}\left(Util_{jk|\sim E} \times Pop_{jk}\right)\right)\right] \qquad [7]$$

Here, $\overline{UC}_j$ is the unit costs observed after scale-up, $\overline{UC}_{j|\sim E}$ represents the unit costs that would have occurred in the absence of rapid scale-up, and $Util_{k|\sim E}$ represents the utilization rate that would have occurred in the absence of the rapid scale-up programme. There may, of course, in a large impact programme, be some differences in the catchment population due to the life-saving activities of the rapid scale-up programme itself, and Pop_{jk} should more properly be written as $Pop_{jk|\sim E}$ in the rightmost term in equation 7, but it is unlikely that this can be accounted for in this evaluation. The right-most term in equation 7 is the unobserved counter-factual: what costs would have been without the rapid scale-up programme.

At least four factors may contribute to a misspecification of the counter-factual unit costs. These are:

1. *Scale and scope of production*: Average unit costs are known to change with the number of clients seen at a particular health services delivery site, and are also known to change as new health service delivery sites are established. In addition, the type of technology used to delivery health services affects the overall average unit costs; e.g., CHAs likely have a different cost function than health centres, etc.
2. *Case-mix*: Control and comparison areas may have a different mix of patients and thus have, to the extent that different diseases influence costs, different average unit costs. For example, scaling-up programmes may mean that children with less (or more) serious illnesses start attending health service sites, altering the costs associated with their treatment.

3. *Quality of care*: Intervention and control areas may deliver services at different levels of quality which impacts their respective costs; scale-up may also alter the overall average level of quality with which services are delivered.
4. ***Technical efficiency***: Different areas may delivery health services at different levels of **technical efficiency**, resulting in differences in costs which may lead to inappropriate decisions in regards to **allocative efficiency** (see more detailed discussion in the text).

Other environmental factors may also influence costs. For example, the relative remoteness of a district may influence transportation time and costs which in turn may influence the cost for drugs, supervision, training, etc. Estimates of the counter-factual cost should therefore use standardized unit prices.

Appendix 2: Example of how these methods are being applied in Malawi to estimate cost and cost-effectiveness

The aim of the study is to estimate the cost and cost-effectiveness of the MNCH rapid scale-up in Malawi. The specific objectives are to:

1) estimate cost and cost-effectiveness of the MNCH rapid scale-up from the **perspective** of the health care system ("**top-down**" or supply-side);
2) estimate cost and cost-effectiveness of the MNCH rapid scale-up from the **perspective** of households ("**bottom-up**" or demand-side).

We will estimate the health care system costs from both the **top-down** and **bottom-up**; the former ensures that our estimates will remain within the overall resource envelop while the latter approach helps describe variation in resource use at among facilities. The two approaches are described below.

Health care system costs: Top-down approach
We will conduct expenditure tracking through the development of district health accounts (DHAs) that include a description of all financial resources from all sources that are used for maternal and child health, using standard procedures adapted for use in Malawi.

Health care system costs: Bottom-up
For this component we will collect data on costs by incorporating questions and activities into the other studies in the evaluation. Specific information about the costing component for each activity is detailed below.

- Household surveys
  We will add questions on costs borne by households seeking and receiving care by source of care (public and private, all levels of care from home care through referral-level care) to the household surveys conducted as a part of this evaluation (see sub-studies 1 and 2).
- WHO Health facility survey
  In May 2009, the WHO conducted a health facility survey (HFS) to evaluate the quality of care delivered to sick children attending outpatient facilities (see Substudy 1). We will explore the possibility of returning to the facilities sampled in order to collect information on resource use, time allocation and unit cost data, and to interview caregivers at the completion of their visit to assess costs associated with their child's illness episode, using instruments adapted from the MCE. The WHO plans to repeat the survey in 2011 and we will explore whether it is possible in that round of data collection to integrate our tools after submitting an amendment with full details to the IRB for approval.
- HSA quality of care survey
  As part of this study, we will collect data on the type and quantity of drugs provided; using price data we will estimate the cost of drugs. The study will also ask about the

allocation of the HSAs' time to treating childhood illnesses which will enable us to apportion their time accordingly. We also plan to interview caregivers at the completion of their contact with the HSA to assess costs (both financial and time spent) associated with this illness episode.

- Start-up costs
  We will estimate the **start-up** costs associated with the MNCH rapid scale-up. These costs will be collected using interviews and record reviews based at the national- and district-level as part of the documentation exercise.

Appendix 3: Example of tables for reporting results

Important Notes:
-All tables should include uncertainty
-All tables should include percentage as well as total breakdowns
-All tables may be disaggregated by district
-All tables may be aggregated to show intervention areas and non-intervention areas

Total Costs

Total costs should be calculated for discrete units. This could be per patient or per health facility. In either case, the number of patients seen is a necessary component of calculating **total costs**; that is, in a standard ingredients based approach, the price of inputs is multiplied by a quantity of need. However, some overhead costs (i.e.., programme costs) are not amenable to collection at units of quantities suitable for patient care inputs. Thus, the total programme costs can be added to the **total costs**, or a 'unit cost' of programme inputs (total programme inputs divided by number of patients) can be multiplied by number of patients. There is no mathematical difference in the results, but it is a conceptual mistake to assume that 'unit costs' of programmatic inputs remains constant across time, geographic units (districts), etc. However, there may be times when this method is used if it is too costly to collect information in all districts, although results should be interpreted with due caution.

Thus, the tables below represent first stage aggregation; there should be separate tables for each district, which are then summed to obtain **total costs**. The summing could/should be done separately for intervention districts and non-intervention districts or other strata of interest (rural/urban, e.g.). Private sector should be included if possible or relevant.

Costs are usually not collected to determine a difference in cost between districts, but rather simply to estimate the **total costs** with a certain range of statistical error in each district. Thus, no p-values are reported in these tables, although the presentation of confidence intervals is an important component. Records on the total number of patients will also have to be collected.

Total costs: by level and sector

Component	Public Sector						Private Sector						Total	
	Hospital		HC		CHAs		Hospital		HC		Other			
	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%
Programme Costs														
Supervision														
Training														
Advocacy														
Media														
Etc.														
Sub Total														
Treatment Costs														
Drugs														
Labs														
Consultations														
Bed-days														
Etc														
Sub Total														
Patient Costs														
Previous visits														
Transportation														
Opportunity costs														
Etc														
Sub Total														
Total														

Note: Uncertainty ranges for cost inputs may not all reflect 'true' 95% confidence intervals. Smaller costs may not warrant collection of uncertainty ranges, but plausible ranges may be assigned by analysts. Other inputs, such as programme costs, may be completely observed and therefore have no error due to sampling. Note 2: 95% confidence intervals may not be symmetric, but rather determined by bootstrapping due to the skewed nature of the data.

Note 3: Uncertainty ranges for total costs may be determined by probabilistic uncertainty analysis combining the ranges of the many different inputs.

Total costs: All interventions, by year

Component		Public Sector						Private Sector						Total	
		Hospital		HC		CHAs		Hospital		HC		Other			
		Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%
Intervention area															
	Programme Costs														
	Treatment Costs														
	Patient Costs														
Comparison area															
	Programme Costs														
	Treatment Costs														
	Patient Costs														
Etc															
Total															

Notes:
-Further intermediary tables are needed. The tables presented here reflect the results of the analysis, but 'Table 1must also be constructed showing sample size and characteristics of patients / facilities by intervention area, district, etc.

Total Number of Patients

Component	Year 1					Year 2				
	Hospital	HC	CHAs	Other	Total	Hospital	HC	CHAs	Other	Total
Intervention area										
Comparison area										
Etc										
Total										

Note: If a sample of facilities are used, then confidence intervals should also be included in this table. Number of visits by type of disease can also be presented if available.

Average Costs: All interventions by year

Component		Public Sector						Private Sector						Total	
		Hospital		HC		CHAs		Hospital		HC		Other			
		Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%
Intervention area															
	Programme Costs														
	Treatment Costs														
	Patient Costs														
Comparison area															
	Programme Costs														
	Treatment Costs														
	Patient Costs														
Etc															
Total															

Note: A further table can be presented which does not aggregate data by sector; i.e., it just shows totals either by facility type/delivery point or in sum.

Incremental Costs

The example tables presented below assume that **total costs** have been collected. Similar possibilities for aggregation / disaggregation are possible for **incremental costs** as for **total costs**; for brevity's sake they have not been duplicated here.

Incremental number of patients

	Change compared to baseline				
Component	Hospital	HC	CHAs	Other	Total
Intervention area					
Comparison area					
Etc					
Total					

Note: If a sample of facilities are used, then confidence intervals should also be included in this table.

Incremental costs per patient treated

	Change compared to baseline									
	Hospital		HC		CHAs		Other		Total	
Component	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%	Mean (95% CI)	%
Intervention area										
Programme Costs										
Treatment Costs										
Patient Costs										
Total										
Comparison area										
Programme Costs										
Treatment Costs										
Patient Costs										
Total										
Etc										
Total										

Other Outputs: Deaths Averted (or other metric)

Comparing costs with other outputs relies on the inputs from other teams, notably in this example the rapid mortality monitoring outputs. Uncertainty from both costs and effects needs to be factored into the outputs. If desired, it is possible to put in either p-values or the probability that an intervention will be found cost effective (compared with some ceiling value) in a final column.

Incremental costs per death averted

Intervention	Deaths (95% CI)	Deaths Averted (95% CI)	Costs (95% CI)	Incremental Costs (95% CI)	ICER (95% CI)
Comparison area					
Intervention area					

Other Outputs: Financing

Financing concerns two central questions. First is the equity of payments amongst user of health services and is addressed in tables 1 and 2 below. Second is the assessment of relative contributions by different sources of financing.

Table 1: Mean OOP by year, district, sex, socioeconomic status, and distance to care facility

Variable	Sub-category	Payments				P-Value
		Average	95% CI		n	
			Lower limit	Upper limit		
Year	1					
	2					
	Etc.					
Districts	1					
	2					
	Etc.					
Sex	Male					
	Female					
SES Quintile	Poorest (1)					
	2					
	3					
	4					
	Richest (5)					
Distance to facility	<1 hour					
	1-2 hours					
	2-5 hours					
	6+ hours					

Note: Table 1 may have to be done per disease or at least separating maternal, neonatal, and child visits.

Table 2: Out-of-pocket payments by care facility

District	Type	Intervention Area	Cost Sharing	Ownership	Average	Confidence interval		n	P-value
						Low	High		
1	Hospital	Yes	Yes	NGO					
1	HC	Yes	No	Public					
1	CHAs	Yes	No	Public					
2	Hospital	No	Yes	Private					
2	HC	No	Yes	Private					
etc									

Table 3: Sources of financing

Component	Districts									Total		
	1			2			3					
	Public (%)	Patient (%)	Donor (%)	Public (%)	Patient (%)	Donor (%)	Public (%)	Patient (%)	Donor (%)	Public (%)	Patient (%)	Donor (%)
Programme Costs												
Supervision												
Training												
Advocacy												
Media												
Etc.												
Sub Total												
Treatment Costs												
Drugs												
Labs												
Consultations												
Etc												
Sub Total												
Patient Costs												
Transportation												
Lost wages												
Etc												
Sub Total												
Total												