Methods for the Costing Component of the Multi-Country Evaluation of IMCI

Department of Child and Adolescent Health and Development

World Health Organization

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Acronyms

CEA: cost-effectiveness analysis

DALY: disability adjusted life years

EPI: Expanded Programme on Immunization

FTE: full time equivalent

GDP: gross domestic product

IMCI: Integrated Management of Childhood Illnesses

MCE: The Multi-Country Evaluation of IMCI Effectiveness, Cost and Impact Multi-country evaluation

MCH: Maternal and Child Health

NGO: non-governmental organization

PPP: purchasing power parity

QALY: quality adjusted life years

STD: sexually transmitted diseases

YLL: year of life lost

YLS: year of life saved

Introduction

The Multi-Country Evaluation of IMCI Effectiveness, Cost and Impact (MCE) is a global effort coordinated by the Department of Child and Adolescent Health and Development of the World Health Organization (1). There are two main goals for the costing component of the MCE. The first is to provide evidence on whether IMCI is of high, moderate, or low cost-effectiveness compared to other ways of using scarce health resources. The second is to provide health planners and donors with information on the cash expenditures (the financial costs) that were needed to introduce IMCI in the first place and then to keep it running. The first type of information assists decision-makers in countries that are considering whether to implement and/or continue IMCI by showing the extent to which IMCI is an efficient use of scarce health resources. The second type of analysis (called financial analysis in the rest of this document) is useful for monitoring, planning and/or budgeting purposes in those settings.

Cost-effectiveness in respect to the first goal can be analysed in two ways. The first is to estimate the total costs and total health effects of providing IMCI services to children under five (sometimes called "average CEA"). The counterfactual for this analysis is no provision of services to children under five. The second is to estimate the additional costs of adding IMCI to current treatment practices and compare those costs with the additional health benefits that accrue ("incremental CEA"). Both forms are useful but require costs (and effectiveness) to be calculated in different ways, as described below.

"Incremental cost analysis" generates useful information on the additional resources used to implement and run IMCI in a particular setting. By definition, however, this type of analysis is context driven and depends on the current interventions and the amount of pre-existing infrastructure (capital and labour, for example). Also, it does not reveal the total amount of resources required to provide services for under-fives using IMCI; all such services have an opportunity cost and could be used elsewhere. For this reason, the protocol has sought to determine the average costs of implementing IMCI *in addition to* the incremental costs.

The purpose of this report is to present a generalized methodology to conduct economic evaluation of under-five health programmes, including but not restricted to IMCI. It has not so far been feasible to undertake costing studies in all countries interested in implementing IMCI; consequently, this report is intended to be a guide for estimating costs across IMCI sites to ensure consistency in data collection, analysis and reporting. Provision of information on the resources being used and their prices in a standardized format as proposed by the report allows policy-makers in other settings to determine whether the results are applicable to their populations. By comparing the parameters (e.g., quantities and prices) in the new setting with those for a specific study area, policy-makers will be able to adjust the results to their own setting, e.g., by adjusting for differences in the supply or availability of qualified health workers, amounts of equipment and supplies, the availability of donated equipment or volunteer time, and differences in the disease burden of the population. To make it possible to generalize information to other settings, both the quantities and the prices of resources used should be presented or at least made available.

The Multi-Country Evaluation of IMCI (MCE) is being carried out in five countries. Accordingly, the costing protocol described here is designed to ensure that all relevant cost data are collected in a standard way across different sites. A standard methodology ensures that cross-national costs can be compared in order to understand the variations of costs within and between the countries

concerned. The core minimum requirements are described but individual evaluation sites are free to collect and analyse additional data to meet their specific objectives, so long as the standard protocol is not jeopardized.

Specific Objectives of the Costing Component

Average and incremental cost-effectiveness analysis requires that costs be estimated in specific ways. This is covered by the first two objectives described below. The third objective is related to the need to provide governments and donors with information about financial resources needed for the IMCI strategy.

The specific objectives of the cost component of MCE are:

1. To estimate the total resource requirement of providing IMCI in a district – i.e., estimating the full costs of providing services to children under five using IMCI. These costs are estimated from the perspective of the society as a whole. All costs are included, regardless of the source. This allows a generalized cost-effectiveness analysis (see Murray et al. 2000), which can indicate whether treating children using IMCI is a good use of scarce health resources (2;3).
2. To estimate the additional (incremental) costs of introducing and running IMCI from the societal perspective – e.g., what resources are required in addition to those already being used for the provision of health care services in that setting. This allows a conventional incremental cost-effectiveness analysis, indicating whether the additional benefits over current practice justify the additional resources (4;5).
3. To provide the study sites with information on the financial expenditures that were involved in introducing IMCI and running it subsequently in their settings. This allows countries to plan for sustained or scaled-up implementation of IMCI.

Methods

Any costing exercise requires a clear definition of the "perspective" of the cost analysis. In many countries, households continue to bear many of the costs associated with health care. A programme that shifts costs from government to households may appear to be cost-effective if only the government's perspective is considered, although it may not necessarily improve social welfare or represent a good use of health resources for the society as a whole. To assess the cost-effectiveness of IMCI (the first use of cost data described above), it is important to estimate the full societal costs of interventions (e.g., all resources used by the intervention, regardless of who pays for them – governments, donors or households). Even though the costs incurred by the providers and households are recorded separately, the question whether IMCI is a good use of scarce health resources can only be answered from the societal perspective. To do this, the estimate of the full costs of IMCI to society are combined with estimates of its effectiveness, obtained from another part of the MCE. The incremental cost-effectiveness analysis of IMCI permits future planners to compare, for example, the health gain per dollar from choosing to implement IMCI in a population with the health gain per dollar from other strategies.

1. Study Design

How costs are calculated varies with the objective of the costing exercise. For the first objective mentioned above, total costs of under-five child-health care in the districts implementing IMCI are calculated. The second objective can be achieved in two ways. Both require that costs be estimated in districts implementing IMCI and in districts not implementing IMCI.

a. *The aggregate method*: Total costs of providing services to children and adults in the districts without IMCI are subtracted from the total costs of providing services in IMCI districts (after standardization for population size). This method implicitly assumes that all observed differences in costs between these two areas (or same area over two time periods) are due to IMCI. If, for example, more adults present for treatment in IMCI districts after the introduction of IMCI, these additional costs are attributed to the introduction of IMCI.

b. *The disaggregated method*: This is identical to the aggregate method, but focuses only on the costs of treating under-fives. Therefore, this method estimates the cost of providing services to under-fives in IMCI and non-IMCI districts (or before and after the introduction of IMCI in the same area). This assumes that any changes in costs associated with service provision to adults are unrelated to IMCI.

The second method is recommended for MCE.

The third objective is being achieved through a separate but parallel exercise to report the financial costs attributable to the decision to undertake IMCI to the particular study sites. This includes both start-up costs and the cost of subsequently running the programme. These costs are summarized by the year when they are incurred.

2. Principles of Costing

The intervention: The intervention is defined as planning and implementing IMCI in a district. The cost of IMCI is therefore defined as the cost of implementing and running the intervention in a standardized district. To derive the costs of IMCI in a standardized district, investigators record information on costs as well as the size of population, both over-five and under-five. Expressing the costs for a standardized district is necessary for comparative purposes across different sites. All results are standardized for a hypothetical district with 50,000 children under five years.[5] If the actual size of a district is different from the standard size, a scaling factor is used to inflate or deflate the actual cost to derive the cost for the standard size. For example, if the cost results are from a small district with 30,000 children, costs per standard district can be derived by scaling up the cost by the ratio 50:30.

The rationale of the costing exercise: Costing seeks to identify the resources (either total or additional) used in providing services based on IMCI. This reflects all resources used for the provision of services for children under five that could have been used elsewhere. Provider and

[5] The actual size can be changed subsequently. The 50,000 under-five population is used here for illustrative purposes.

household costs are separated in the analysis although the cost-effectiveness analysis is based on all costs, regardless of who incurs them and who pays for them.

Start-up and post-implementation costs: Start-up costs include all the resources (capital and recurrent items) attributed to IMCI from the time when a decision was made to implement IMCI in a country until the first health worker began providing IMCI services in health facilities. Start-up (pre-implementation) costs cover such activities as local adaptation of IMCI guidelines, preparation of training materials and the initial training of personnel at the national and district levels. Since the start-up costs are incurred before the intervention begins while the benefits of start-up are spread over a long period, the full start-up cost from the societal perspective is viewed as a capital purchase that provides services over a link time. Capital expenditure during the start up phase is annualized over the expected life of the resources. Other items of expenditure in the start up period are annualized over the expected life of the intervention as a whole. See Annex 1, sections D and E, for details of start-up cost analysis. For the financial cost analysis, however, start-up costs are not annualized and all actual expenses incurred are reported in the years in which they occur.

Costing capital: From the societal perspective, the value of capital includes the opportunity cost of its purchase and the rate at which it is used up (commonly called depreciation). In the districts where markets for the rent of equipment and buildings exist and work relatively well, rental prices are the best approximation of the annual cost of capital – both the opportunity cost and depreciation. This is why the cost questionnaires seek information on rental prices. Where markets are either non-existent or imperfect, capital costs are annualized on the basis of the replacement cost and the expected lifetime of the items.

Technical efficiency and costs: To understand why costs and cost-effectiveness vary across facilities, districts or countries, it is necessary to know whether excess capacity varies significantly across settings. The reason is that the cost per outpatient visit is likely to be high in a health centre with a relatively low utilization rate (i.e., a health centre with few patient visits) compared with a similarly sized centre that receives many visits each day. In the latter case, fixed capital costs are shared over a larger number of visits. Country analysts are requested, therefore, to keep a record of the extent of capacity utilization to permit subsequent interpretation of the cost estimates.

One way of defining capacity utilization is to set norms for what would be expected in each setting. For example, the norm for technical efficiency could be the number of patients per worker per day seen at the busiest health centres, or at a given health centre during its busiest months. This could be used for establishing the degree of excess capacity at other centres or at other periods of the year. Another method of defining the norm is to obtain expert opinion in the country. No method is perfect, but the first and most important implication is that individual countries should collect and report utilization rates of the health facilities.

The WHO costing template (CostIt) is used to report and analyse costs (6). Alternatively, the STATA statistical package is used by some MCE sites (7). One of the characteristics of the CostIt template is the automated adjustment of technical efficiency. This function can be used to adjust costs to the "norm" obtained from either of the two ways described above. The template adjusts for technical efficiency differently for recurrent and capital cost categories. For recurrent costs, only staff time is adjusted for capacity utilization. Personnel capacity utilization norms, such as the number of outpatient visits per clinical staff or the number of laboratory tests per laboratory technician, are used to adjust the observed average cost. For capital costs, two categories are used –

medical equipment and all other capital costs – and adjustments for technical efficiency require separate information on capacity use for each of these two categories.

To adjust personnel costs, the following data are required: total number of full time equivalent (FTE) clinical staff in the facility, total number of outpatient visits and duration of data collection (in working days) to obtain the number of outpatient visits per FTE clinical staff per day[6]. If, for example, this ratio is 17 visits per FTE clinical staff-member per day and the norm has been set at 25 visits per FTE clinical staff per day, then the capacity adjustment factor automatically adjusts personnel costs to 68% capacity (17/25). In the same way laboratory technician costs are adjusted according to the ratio of the number of laboratory tests per technician per day. For capital costs, the number of tests per item of equipment per day is used to adjust equipment costs. Other capital costs are adjusted by using the same ratio developed for clinical staff costs as an approximation of the overall capacity utilization at this type of facility.

Exchange rates: Individual sites report their results in local currency units. For international comparisons, costs are converted to a common currency, e.g., international dollars based on purchasing power parity (PPP) or US$ at official exchange rates.[7] All cost data in the MCE analysis are adjusted for inflation to the base year of reporting the results. Costs incurred in earlier years are inflated with the GDP deflator, which is available from the Department of Finance. If it is not available, the consumer price index is used.

3. Data sources

To derive the costs of IMCI in a district, data need to be collected from all levels of the system involved in introducing or supporting IMCI. These are typically:

- First-level facilities that provide primary health services to children
- Referral facilities that provide hospitalization care to children
- District-level (or region) administration that supports IMCI implementation and operation
- National-level administration supporting IMCI implementation and operation
- Households that incur costs in seeking and obtaining treatment

Table 1 below indicates the cost data to be collected at each level and the possible sources of data. The table is presented by cost component to show the variations in sources of data by component. Data are not directly collected from referral level facilities as seen from the table. The study monitors the number of under-five admissions through the household survey and the district-level data collection tool. However, given that interventions offered at the referral level are not likely to change, at least in the short term, after the introduction of IMCI, costing studies at the referral level are not routinely carried out by the MCE. Instead, we propose to use information that is already available on unit cost per bed day (preferably in paediatric wards) in each site.[8] This, together with the number of under-five admissions, is used to estimate the costs related to any change in the

[6] Number of outpatient visits per clinical staff per day = Total number of outpatient visits in the period of data collection divided by the total number of clinical staff in the facility times the number of working days covered by the data collection.

[7] For countries where the PPP is not available, the official exchange rate is used.

[8] This assumes that the unit cost per bed day will be the same in IMCI and non-IMCI districts. However, if IMCI referral guidelines are implemented in referral facilities, it will be important to undertake a hospital costing study to capture the differences in unit cost between IMCI and non-IMCI districts.

number of admissions after the introduction of IMCI.[9] However, if individual countries wish to do a full hospital costing study they are encouraged to do so. The WHO CostIt template can be used for this purpose.

If IMCI is delivered at the outpatient clinics of district hospitals this cost should be included. Again, we suggest using the unit cost of a paediatric outpatient visit from other sources if possible. If not, it may be necessary to do a full hospital costing study. All costs collected at the different facilities are scaled up to the district level using utlization data on total outpatient visits and admissions. See the Section C of the Annex for details of scaling up referral costs.

In this document, it is assumed that the government is the principal provider of IMCI services. In some countries however, Non-Governmental Organisations (NGOs) are playing a major role in providing primary health care in their districts. If the NGO facilities in those districts are targeted by IMCI training and supervision and are included in the district health plan, they should be included in the evaluation of the costs of IMCI at those districts. Instruments to be used for cost data collection and analysis have been developed by WHO. These instruments have been designed to collect data from government facilities, and have been tested in these facilities. If costs are to be collected from NGO facilities, the data collection tools will require additional piloting and adaptation.

[9] See Section C of the Annex for details about the method to obtain costs of referral care for under-five at the district

Table 1. Type of cost data collected at each level

Item:	**1st Level Facility**	**District level**	**National level**	**Household level**
1. **One-Time Start-up Costs** (*activities to be tracked include planning and orientation meetings, IMCI training, etc.)*				
Personnel (full costs including time and per diems for training, etc.)		X	X	
Infrastructure costs (building, equipment, furniture and means of transport)		X	X	
Supplies and other operating costs for planning, etc. in the pre-implementation phase		X	X	
2. **Post-implementation (Operating) Costs** *(activities include retraining, supervision, provision of care etc). The tools developed for collecting data divide costs by activity and then by type of input*)				
Personnel	X	X	X	
Drugs and supplies	X	X	X	
Utilities, maintenance and operating transport costs	X	X	X	
Infrastructure costs (building, equipment, furniture and means of transport)	X	X	X	
Number of outpatient visits to health facilities by age group	X	X		
Number of referrals to secondary and tertiary centers by age group	X	X		X
3. **Household Costs**				
Out-of-pocket purchases of consultation 1. From the type of facilities in the sample 2. From facility-types not in the sample				X
Out of pocket purchases of medications 1. From facility types in the sample 2. From facility-types not in the sample				X
Other medical costs				X
Other non-medical costs				
Travel time, waiting time and travel costs to first-level facilities				X
Travel time, waiting time and travel costs to referral facilities				X

4. Data collection

This section presents the cost items collected at each level.

4.1. Data collection at the national level

National-level start-up and post-implementation costs: Start-up costs (see Table 1 above for the categories of start-up cost data) and post-implementation costs of IMCI, such as those associated with monitoring and supervision, review meetings and training, are assessed to estimate the cost of implementing and maintaining IMCI at the national level. These are collected through standardized interviews with key informants as well as a record review. See Section E of the Annex for details of the type of data collected.

4.2. Data collection at the district level (both IMCI and non-IMCI districts)

1. ***District start-up costs:*** In IMCI districts, the inputs to start-up activities that were undertaken before IMCI was provided at health facilities are collected using the district level tool e.g., planning meetings, IMCI training, etc.

2. ***District post-implementation costs:*** In both IMCI and non-IMCI districts, the costs at district level of managing and supervising child health care are collected through interviews with district personnel and record reviews.

3. ***Facility level facility costs collected at the district level:*** Different countries have different systems for recording and storing financial data. In some countries the most reliable records are kept at district level. In other countries, the facility records are more reliable. The key data elements for facility costs are:

- Wage rates, per diems and number and type of staff
- Rental rates (price of capital) and the amount of capital
- Drug prices and quantities of drugs
- Other disposables – prices and quantities
- Operating costs e.g., transportation costs
- Patient utilization rates

The IMCI costing tools can be easily adapted to reflect country level setting and source of data. Each element needs to be reliably measured at one level, although in some cases, e.g., when it is expected that some records may be incomplete at one level but the same type of information exists at another level, a study team may decide to collect the same type of information from both levels, e.g., district and facility levels, to cross-check and validate the collected data. In such a case, it will be necessary to decide how to reconcile discrepancies. The measurement modules for each of the elements can and should be arranged to suit the local health system.

4.3. Data collection at the first-level health facility

Many of the costs of providing care to patients at facilities cannot be collected at the national or district level. Most important among these costs are the share of capital costs and staff time used for treating children under-five. Methods to allocate capital and staff time to children and to IMCI (i.e. methods for joint cost attribution), will need to be cross-validated before the estimates are used as building blocks in the construction of total cost estimates. The elements used for joint cost attribution include:

1. Data gathered from interviews and inventories of:
   - share of the building, vehicle and equipment that is principally used for under-five, for adults or for both adults and children.
   - staff time allocation between children under-five and adults.

2. Data from treatment registers, drug inventories and drug dispensing records on:
   - the consumption of drugs by adults and by children under-five.

3. Data from registers (on an 'annual' basis):
   - total number of visits for consultation for over and under-five.
   - total number of vaccinations.
   - total number of well child visits.
   - laboratory tests for under-fives.
   - referrals of children to hospitals and referral facilities.

4. Data gathered from case management observation on:
   - the average duration of patient encounters with the health provider for adults and under-five children.

4.4. Data collection at the household level

The data collected are those described in Table 1 above.

Data Analysis

As stated earlier, the three objectives of the costing exercise require costs to be analyzed in slightly different ways. All, however, involve summation of costs identified at each level, i.e. households, first-level facility, referral, district and national levels.

1. Total costs of under-five care in a district based on IMCI (Objective 1)

The total costs of providing services for children under-five based on IMCI is the sum of the costs of under-five care in a standardized IMCI district at all levels as described below.

1. The total costs at **facility** level of under-five health services. Total costs from the sampled facilities will be scaled up to estimate the total facility costs of delivering under-five care based on IMCI in the district as a whole.[10]

2. The costs of **referral** of under-five children in the whole district.[11]

3. The costs at **district** level of implementing, managing and supervising under-five child health care in the district.

4. The share of costs at **national**[12] level of child health program management will be attributed to each district.

5. **Household** costs incurred in seeking and obtaining treatment for children under-five.

2. Incremental cost estimates of under-five care (Objective 2)

a. The aggregate approach: In this approach, the total costs of care for "all patients" in a standard district without IMCI is subtracted from the total costs in a standard district with IMCI. The difference is interpreted as the change in costs as a result of IMCI, whether these costs were incurred for children or adults. Total costs for all patients in an IMCI or a non-IMCI district is simply the summation of costs at all levels as described in Objective 1 above. The costs at the facility level represent all costs, not only costs of under-fives. Costs at other levels are those for under-five care based on the assumption that they are unlikely to change after the introduction of IMCI.[13]

In order to adjust the cost estimates for any secular increases/decreases in real costs in the non-IMCI districts (e.g. due to epidemics or economic changes), total district costs is measured both before and after the implementation of IMCI in both IMCI and non-IMCI districts.

	Control District	IMCI Districts
Before	A	B
After	C	D

Let A, B, C, and D represent the total cost (per 100,000 people) in a standardized district (IMCI and Non-IMCI) before and after the implementation of IMCI.

Incremental costs **of adding IMCI to standard practice at district level** is estimated from the de-trended before and after differentials between the total district costs in IMCI and non-IMCI districts

[10] Technical details in scaling up costs to the district level are in Section B of the Annex.

[11] See Section C of the Annex for details of obtaining referral costs at the district level.

[12] This should include provincial or regional level costs if these organizational structures exist. Data collection and analysis for provincial and regional-level costs will be the same as that of the national-level.

[13] This might not be totally accurate, but it is not possible to obtain the full costs of administration at district and national levels.

Then D-B represents the increase in costs that results from both IMCI and secular trends. The incremental cost of IMCI implementation, controlling for the trend, can be estimated as:

[1] Incremental Cost of IMCI implementation = (D-B) – (C-A)

If "before IMCI" cost estimates are not available, the following approximation can be used:

[2] Incremental Cost of IMCI implementation = D-C

This approximation assumes that the control and intervention districts are perfectly matched in the sense that A ≅ B. IMCI is seldom implemented at random and great effort should be taken to ensure that control and intervention districts are comparable if this approximation is used.

b. The disaggregated approach: This is the recommended approach. In this approach the total costs of care for *children under-five* in a standard district without IMCI is subtracted from the total costs in a standard district with IMCI. The difference is regarded as the change in costs as a result of IMCI that are related specifically to children under-five. To control for any secular trend as described above, the total costs of under-five care before and after IMCI should be collected if possible in IMCI districts. At the same time, the costs of under-five care in non-IMCI districts should also be collected (at two points in time).

The aggregated and disaggregated approaches may well give different results. This difference may be used to check if the introduction of IMCI changed patterns of provider or patient behavior in relation to adult care as well as child care.

Incremental analysis could be undertaken from the provider perspective, the household perspective or from the social perspective. This is the reason we suggest separating out the costs into provider and household costs as there is value in looking at the additional use of resources from all perspectives. Start-up costs are also measured for the incremental analysis - they would not have been incurred without the introduction of IMCI. Again, they are treated as capital costs for the cost-effectiveness analysis and annualized or discounted using standard procedures.

3. The Financial Perspective (Objective 3)

Health ministers and donors in the "MCE study sites" may be interested to know how much additional cash expenditure was required to implement and run IMCI in their country. This is useful for budgeting and planning purposes in those settings, and to inform future IMCI planning in other countries.

Financial analysis can also be undertaken in terms of incremental or total costs. The former relates to the additional expenditures required to establish and run IMCI, while the latter relates to the expenditures required for all resources involved in IMCI. The costs estimated for sections 1 and 2 above can easily be transformed into total and incremental financial costs. In section 1, all the resources required to run IMCI in a district are valued at the prices actually paid for them. Capital costs are not annualized but are allocated to the years in which they occur. Accordingly, a "budget" showing the time path of expenditures required to set up and run IMCI in the district could be developed. This shows incremental financial costs. Given that we are not suggesting the use of shadow prices in this analysis, the main difference between the financial and economic cost

approaches is in the treatment of volunteer labor, donations of drugs and equipment and in the annualization of capital.

It is also possible to undertake a financial analysis from the viewpoint of the different payers for health. Again, it is useful to separate out the financial costs to households from those of the provider(s).

Instruments

The MCE has developed four cost data collection tools to collect costs at the following levels (national, district, facility and households), available at: www.who.int/imci-mce. CostIt software for data reporting and analysis can be obtained from: www.who.int/evidence/cea. Data can be entered directly in CostIt software or by using other software for data entry such as EPI-INFO or Fox Pro software, then transfer the data to other statistical packages such as STATA to perform the analysis.

Standardized Presentation of Results for Objectives 1 & 2

1. Societal (economic) costs

The following are general presentation issues to ensure comparability and transparency of the results.

1. ***Provider Programme costs*** are divided into "*start-up*" and "*post-implementation*" costs. "***Start-up***" costs are defined as all costs incurred in the pre-implementation phase of the programme/intervention and include capital as well as recurrent categories that were specifically used in programme pre-implementation activities. All pre-implementation costs, including recurrent costs, are annualized in the economic analysis of Objectives 1 and 2. ***"Post-implementation"*** costs are divided into capital and recurrent categories and represent costs of running the programme for one year.

2. ***Household Care Seeking Costs*** such as travel costs, purchasing of special equipment, etc. are reported. Consultation fees and drug fees paid at the type of facilities included in the health facility survey *are not* included in the household cost summary tables from the societal perspective to avoid double counting. However, other treatment seeking costs outside the type of facilities included in the survey are added such as consultation fees, travel costs and drug costs at private practitioners, pharmacies or traditional healers. These costs are scaled up to obtain district level estimates of treatment seeking costs to households.

N.B.: There is a great deal of controversy in the literature about whether time costs should be valued in money terms and if so, how to do it.(8) Time costs reflect valuation of the time lost in obtaining care, e.g. waiting time, travel time and time lost due to illness. For the principal MCE analysis we recommend to present time lost separately in physical units of time rather than as a monetary value.

2. Financial costs

Cost-effectiveness, whether generalized (based on costs from Objective 1) or incremental (Objective 2), are based on economic costs - or the costs to society of using scarce resources in one intervention rather than in another. In the above description of costs, the economic perspective was assumed. However, it is possible to use the same costing approach to measure and record the financial costs – i.e., cash payments by a particular payer. From the provider perspective, for example, the cost of volunteer labour would not be included. From the household perspective, the costs of all payments are included, regardless of to whom they were paid. It is important to note that financial costs from the provider and household perspectives should not be added together unless an attempt is made to subtract household care seeking costs that were incurred at the facility from provider "facility" costs.

From Costs to Cost-Effectiveness

Once the cost of IMCI at the district has been established, the next step is to determine its effectiveness. The overall economic evaluation design seeks to compare the outcomes in intervention areas to those in control areas. Although QALYs or DALYs are often used to measure and compare outcomes, the outcome measure used by most MCE studies is the Years of Life Saved (YLS). YLS is a more natural standard unit for cross-comparison. In addition, in the under-five age group and for the conditions addressed by IMCI, YLS probably offer a fair approximation of DALYs averted. In the global burden of disease study, years of life lost (YLL) accounted for 90% of DALYs lost from communicable diseases throughout the world and a higher fraction in less developed countries.[14](9) It is unlikely that the study will be able to consider the impact of IMCI on such factors as the duration and severity of episodes of illness, which would be required to rigorously estimate the impact in terms of DALYs.

The analysis of both costs and effects will generate three cost-effectiveness ratios in terms of costs per YLS of IMCI in a standardized district, e.g. with ***50,000 children under-five.***

1. Total costs of IMCI/YLS from treating all under-fives based on IMCI. This is the cost-effectiveness ratio which will enable policy makers to decide whether treating children based on IMCI is a good use of scarce resources compared to all other possible uses.

2. Incremental costs of introducing IMCI (aggregate approach)/difference in YLS between intervention and comparison districts. This will show if the additional costs of adding IMCI into the current system justified the additional health benefits.

3. Incremental costs of introducing IMCI (disaggregate approach)/difference in YLS between intervention and comparison districts. This is another way of determining if the additional costs of adding IMCI into the current system justified the additional health benefits.

Neither 2 nor 3 above is the totally correct way of considering the incremental cost-effectiveness of introducing IMCI. Number 2 takes into account the fact that IMCI may lead to additional costs

[14] In 1990 the cohort aged 0-4 experienced a total of 224 million YLL due to all causes of which 192 million YLL were due to the communicable, maternal, perinatal, and nutritional conditions addressed by IMCI. Years of life lost due to disability (YLD) were 44 million for all causes, but 20 million for the communicable conditions addressed by IMCI (9) .

among adults as well as children in the numerator. However, the denominator takes account only of different outcomes among children. On the other hand, there is consistency between numerator and denominator in number 3, but this CE ratio does not allow for the possibility that IMCI may induce unexpected changes in adults. The ideal measure would monitor changes in outcomes in both children and adults but this is not possible in this study. Accordingly, the analyst will need to determine if there are differences in the results from 2 and 3 above, and seek to understand what types of changes were induced in adults and whether they are really attributable to IMCI.

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Annex: Technical issues involved in the estimation of costs at the district level

As described above, the total costs, either for under-fives in the disaggregated method or for all people in the aggregate method, in an IMCI or a non-IMCI district, is the sum of:

1. The total costs at **facility** level of health services. As described in section A and B below.

2. The total costs of **referral** for under-fives in the whole district. See section C below.

3. The costs at **district** level of implementing, managing and supervising under-five child health care in the district (Section D).

4. The share of costs at **national** level of child health program management will be attributed to each district (Section E).

5. Household Costs incurred in seeking and obtaining treatment for children under-five **(**Section F).

Results of total costs in IMCI and non-IMCI districts should then be standardized to a district containing 10,000 children under-five years.[15]

A. Allocation of shared costs to under-five care at the facility-level

Total costs of under-five care at facility level can be classified into three main categories: labour, drugs and overhead costs. Allocation of shared costs to under-five care are done as follows.

A.1. STAFF TIME ALLOCATION TO UNDER-FIVE CARE:

Staff time allocation is tedious but not complex. The principles are the following:

1. All the time of staff totally involved in providing care to under-fives is included.

2. None of the time of staff totally involved in providing care to adults is included.

3. Staff who provide care to both adults and children require some of their time to be allocated to under-fives. The principles are:

   a.) any blocks of time routinely allocated to under-fives, such as immunization clinics which take a full morning a week, are totally attributed totally to under-fives;
   b.) blocks of time spent treating adults, such as regular STD clinics, are totally attributed to adult care;
   c.) other time spent treating patients is allocated partly to under-fives and partly to adult care;
   d.) as part of the facility costing protocol, observers will measure the time taken to treat a sample of adults and a sample of children. Taken together with the number of adults and

[15] The actual size can be changed subsequently. The 10,000 under-five population is used here for illustrative purposes.

children treated overall, this is used to allocate the time of staff spent partly on adults and partly on children.

4. Staff who do not treat patients. Their time is allocated to children under-five using the proportion of total number of under-five visits to total number of all visits.

These are the principles, and why the facility data collection tools require data on variables such as blocks of time spent treating children or adults. This is also why the timing of provider interactions with adults and children is specified. It covers the possibility that children take more (or less) time than adults, and that IMCI may have resulted in changes in the average amount of time spent with children and/or adults. The way all the data is put together to allocate staff costs can be illustrated in equation form, and is available from the authors on request.

A.2. ALLOCATION OF THE SHARE OF DRUG COSTS TO UNDER-FIVE CHILDREN

Allocation of under-five share of total drug costs at the facility-level is done through random sampling of days from drug dispensing registers in the period of data collection, i.e. one year. The total amount of drugs dispensed in the selected days is collected from all the visits that occurred in that day. From this data, the proportion of drugs dispensed to under-fives and over fives is estimated for each drug. This proportion is used to scale up the cost of drugs for under-five children using data collected on the total amounts and unit prices of drugs received by the facility in the year of data collection.

A.3. ALLOCATION OF THE SHARE OF OVERHEAD COSTS TO UNDER-FIVE CHILDREN

Allocation of overhead share of costs at facility-level, i.e., building, equipment, furniture, general administration etc. is based on the proportion of number of under-five visits (curative and preventive) to all age visits (curative and preventive).

B. Scaling up total costs of under-five care in the sampled facilities to the district-level

To scale up total costs of care in the sampled facilities to the district level, three steps are required. Here we describe scaling up using the disaggregate method of calculating costs – e.g. focusing on the treatment of under-fives. For the aggregate method, replace under-fives with all patients.
Step 1: divide the sampled facilities into small, medium and large.

Step 2: within each category, add the total costs of treating under-fives in all the sampled facilities – e.g. total costs in all small facilities. Divide by the total number of under-five visits in those facilities to get the unit costs of treating under-fives in small, medium and large facilities separately. E.g.

[Equation 1] $A_s = \sum_{i=1}^{Ns} (TC_{is} / U_{is})$ where

A_s = average cost of treating under-fives in small facilities in the sample,
TC_{is} = total cost of treating under-fives in the ith small facilitiy,
U_{is} = the number of under-fives treated (utilization) in the ith small facility, and
Ns = the number of small facilities in the sample.

Step3 :to scale up for all facilities in the district, including those not sampled, requires multiplying utilization in all small facilities in the district by the average cost calculated in step 2 (As). This is repeated for medium and large facilities to give:

[Equation 2] $TC_D = \sum_{i=1}^{Fs} (A_s * U_{is}) + \sum_{i=1}^{Fm} (A_m * U_{im}) + \sum_{i=1}^{Fl} (A_l * U_{il})$ where

TC_D =Total costs of all facilities in the district,
F = the number of facilities (small, medium and large) in the district,
A_s = average cost of treating under-fives in small facilities calculated from the sample,
U_{is} = utilization by under-fives in the ith small facility in the district,
A_m = average cost of treating under-fives in medium facilities,
U_{im} = utilization by under-fives in the ith medium facility,
A_l = average cost of treating under-fives in large facilities, and
U_{il} = utilization by under-fives in the ith large facility.

C. Costs of referral of under-five care in the whole district

The number of under-five admissions in a district in a year is collected. At least data from two years should be collected in each district to control for secular trends. It is unnecessary to separate IMCI from non-IMCI addressable causes of hospitalization, because ultimately the question will be whether or not a particular hospital stay occurred because IMCI had been implemented. Simply knowing the diagnosis will not answer this question. Differences in discharges times the cost per discharge between IMCI districts and non-IMCI districts will provide the incremental costs of referral associated with IMCI implementation.

D. Estimation of the total costs of under-five care at the district administration office *(i.e., excluding peripheral facility costs)*

The costs of under-five care at the district is the sum of the management costs of under-five care plus the share of the overhead costs at the district allocated to under-five services. This is augmented in IMCI districts by the start-up costs of IMCI programme. Data collection of district-level overhead costs is a complicated process and methods of allocation of shared costs are largely arbitrary. For this reason the MCE study will not attempt to collect these costs on the assumption that overhead costs will not vary after the introduction of IMCI and so can be considered as sunk costs.

The resources used in the start-up costs of IMCI as well as the management of under-five care are discussed in Table 1 above and include inputs such as personnel and per diems, supplies and other disposables, transportation and other operating costs as well as existing and new infrastructure that were incurred due to IMCI.

The following are some clarifications on data collection and analysis issues:

It is important to note that the pre-implementation IMCI training costs at the district level should only represent the training courses initiated at this district. This is to avoid double counting with the national level costs of training district trainers as well as the training of district supervisors that occurred in other districts. These costs are attributed to the districts where the costs were incurred. Pre-implementation costs of training are capital costs and are therefore presented as annualized costs.

Supplies and other disposables such as costs of printing of IMCI training materials and guidelines that were developed in the pre-implementation phase at the district (and are not included in national level costs) are collected and their costs are annualized and attributed to the start-up costs

of IMCI from the economic perspective. From the financial perspective those costs are not annualized and their costs are shown as the annual expenditure of those items without any discounting.

New or reallocated capital resources that were incurred during the pre-implementation phase of IMCI are identified. This information should be cross-checked with data collection at the national level to avoid double counting and the net costs incurred at both levels are annualized in the economic summary tables. Only new capital purchases are included in the costs summary from the financial perspective.

Factor inputs that are likely to contribute to the larger share of management costs of under-five care at the district include the following: personnel working on a daily basis in the IMCI programme, EPI (Expanded Programme on Immunization) and MCH (Maternal and Child Health) departments; and transportation costs for distribution of drugs as well as transportation of supervisors to the peripheral facilities. To obtain the share of transportation costs to under-fives, several steps are undertaken. First, the means of transport used in the distribution of drugs and supervisors are identified. The log books for those means of transport are reviewed to obtain the total amount of fuel consumed in those trips. Allocation of the transportation costs to distribution of drugs and supervision transport costs is done separately if transportation trips had several purposes. A share of this cost is then be attributed to under-five care. The first can be done arbitrarily by assigning equal shares to the different purposes of the trip. The share of under-five costs of transportation of drugs and supervisors can be done in different ways. For example, using the proportion of under-five visits to all visits can be one way of doing this. The under-five share of total drug costs at the facilities can be another way to allocate the share of under-five costs of transportation of drugs. Sensitivity analysis is necessary to interpret these results.

The total costs of under-five care at the district office is the sum of the start-up costs (in IMCI districts) and the management costs of under-five care (IMCI and Non-IMCI districts).

E. Estimation of the share of national level costs to under-five care

The same argument described above for the share of overhead costs to under-five care at the district-level applies here for the national-level share of overheads. Hence, These costs are not collected and are considered as sunk costs that are not expected to change due to a decision to implement IMCI in the country. On the other hand, all costs incurred due to the implementation and maintenance of IMCI are measured and a share is attributed to the costs of under-five care in IMCI and non-IMCI districts. The quantities and prices of the resources used in the following IMCI activities is identified separately for pre-implementation and post-implementation phases of IMCI, as each of them require a different analysis of costs.

The following are some clarifications on data collection and analysis issues:

PRE-IMPLEMENTATION COSTS:

Pre-implementation meetings for planning, orientation and other IMCI start-up activities are identified. The opportunity costs for staff time used in attending those meetings are evaluated and a share of their salaries is attributed to the economic costs of IMCI. The salaries of IMCI personnel who attended those meeting are not included as they are already included in the start-up and post-implementation costs of the IMCI programme at the national level. These costs are not included in the summary table from the financial perspective.

New or reallocated infrastructure due to the implementation of IMCI are identified and their costs are included in the start-up cost of IMCI from the economic perspective. Only new capital purchases are included in the financial costs. This cost includes any building space, equipment or furniture required for the implementation of IMCI at national district and facility levels. Double counting should be avoided, however, when estimating new or reallocated capital costs at district offices as well as infrastructure costs at health facilities. This should also be netted out from the costs of new or reallocated infrastructure used in the IMCI programme offices and those costs that are included in the total costs of running the IMCI programme at the national level.

For the economic cost analysis, all capital and recurrent items incurred in the pre-implementation phase are annualized using appropriate life spans relevant to each item and country. For cross-country comparisons, a standard rate is used. For financial costs, annual expenditures is entered without any discounting in the years they were incurred.

POST-IMPLEMENTATION COSTS:

Post-implementation IMCI training courses are identified separately for each year post-implementation. This is important to determine the method of allocation of these costs. Two options are available. If post-implementation training occurs regularly and is targeting new health workers to expand the IMCI programme, these costs are treated as recurrent costs and do not need to be annualized. However, if the training courses are done on an irregular or intermittent basis and are targeting new district trainers who might also serve a larger number of districts, these costs are treated as capital costs and are annualized. They are distributed among all districts who would benefit from the training.

Post-implementation meetings for the continuous monitoring and evaluation of IMCI activities are collected for one year, and this cost should be treated as a recurrent cost. One of the IMCI activities may include the inclusion of the IMCI guidelines in the curricula of medical schools. This activity may occur in the post-implementation phase but its effect will be spread over time. For this reason, it is considered as a capital cost and hence, meetings and other costs incurred due to this activity are annualized.

A share of the total costs of under-five care at the national level is attributed to the district level costs. This is done separately for pre-implementation and post-implementation costs. Pre-implementation costs are distributed to all districts in the country with the assumption that all the districts will eventually implement IMCI at some stage. The allocation of post-implementation costs is more complicated. Recurrent costs are distributed only over the number of districts implementing IMCI in a given year. Capital costs that target future IMCI districts, such as training of additional national and district trainers or the inclusion of IMCI guidelines in the curriculum of schools, are distributed over all the districts in the country including those who are not yet implementing IMCI.

F. Scaling up household costs to the district level

Household care seeking costs fall into three main categories: Consultation, drug and travel costs. Methods of scaling up cost data collected from the sample of households to the district level are described below.

1. **CONSULTATION COST (ALL PROVIDERS):** The number of visits households make to different types of providers is collected through a standardized household questionnaire along with the associated costs. Consultation fees paid at the types of facilities included in the costing study (where costs have already been included) are not included in the economic costs summary tables. They would be included in the financial costs tables from the household perspective. To scale up the costs to the district level, there are two options. The first would be simply to adjust the total number of visits to the different type of providers reported in the household questionnaire to allow for the difference between the sample size and the population size. This would be dangerous for a number of reasons, the most important being the fact that the household questionnaire asks about contacts with health providers in the last 2 weeks. Any seasonality in visits over the year would not be captured. For that reason, costs are scaled up using the second method. Details of the total number of visits to government facilities are available at the district level. This is used as the baseline. Then the ratio of visits to other types of providers to visits to government facilities observed in the household survey is used to estimate the visits to the other types of providers at the district level.

2. **DRUG COSTS (ALL SOURCES):** Household drug costs from all sources are collected through the household questionnaire. Methods of scaling up and presentation of results are the same as described above for consultation costs.

3. **TRAVEL COST (TO ALL PROVIDERS):** Average costs of travel to each type of provider are estimated per person travelling. Average number of persons travelling are estimated for each type of provider. Average costs of travel are multiplied by average number of persons traveling. The sum is multiplied by the number of visits to each type of provider to scale up travel costs to the district level.

This is the preliminary plan for scaling up household costs. The methods described above may need to be adjusted after the analysis of the collected data.

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