Financing for immunization at sub-national levels: A systematic literature review
Financing for immunization at sub-national levels

A systematic literature review

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Keywords: immunization, financing, Uganda, sub-national, resource tracking tools, financial management systems, costing and budgeting tools

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<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>CMYP</td>
<td>Comprehensive Multi-Year Plan</td>
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<td>DRC</td>
<td>Democratic Republic of the Congo</td>
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<td>EPI</td>
<td>Expanded Programme on Immunization</td>
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<td>FSDT</td>
<td>Financial Sustainability Diagnostic Tool</td>
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<td>GAVI</td>
<td>Global Alliance for Vaccine Introduction</td>
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<td>GoU</td>
<td>Government of Uganda</td>
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<td>HPV</td>
<td>Human Papilloma Virus</td>
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<td>LMICs</td>
<td>Low and Middle Income Countries</td>
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<td>MBB</td>
<td>Marginal Budgeting for Bottlenecks</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MoFPED</td>
<td>Ministry of Finance, Planning and Economic Development</td>
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<td>MoH</td>
<td>Ministry of Health</td>
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<td>NASA</td>
<td>National AIDS Spending Assessment</td>
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<td>NHA</td>
<td>National Health Accounts</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
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<td>PETS</td>
<td>Public Expenditure Tracking Survey</td>
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<tr>
<td>PCV</td>
<td>Pneumococcal Conjugate Vaccine</td>
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<td>SHA</td>
<td>System of Health Accounts</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Introduction

Background

In 2012, the World Health Assembly endorsed the vision laid out in the Decade of Vaccines framework [WHO 2012], which calls for more equitable access to immunization for all people regardless of who they are or where they live. Indeed, immunization has long been considered one of the most important and cost-effective public health interventions to reduce child mortality and morbidity. Vaccine preventable deaths constitute nearly one-third (29%) of all deaths among children aged 1-59 months [Liu et al 2012]. Moreover, immunization has been estimated to avert more than 2-3 million deaths annually, largely due to measles, diphtheria, whooping cough and tuberculosis [WHO 2013].

Despite the well-recognized importance of immunization to child survival, financing for routine immunization services is heavily dependent on external funding in most low- and middle-income countries (LMICs), which may not be provided at predictable or sustainable levels. In recent years, many countries have increased domestic funding for immunization services, which offers the potential of more sustainable immunization financing. Yet, despite this increase, government contributions alone fall short of projected costs for fully immunizing children in these settings. A 2008 study of 54 LMICs indicated that government spending on immunization was only $US 3 per child during the period 2000-2006 [Lydon et al 2008]. A more recent analysis in 56 countries based on the Comprehensive Multi-Year Programme (cMYP) found that government contributions toward immunization grew by 67% during the period 2006-2012 [Nader et al 2014]. Yet, this is still far less than the projected cost of $US 54 per fully immunized child needed in 2010-2015 [Brenzel et al 2012].

Indeed, LMICs will continue to rely on external financing for immunization services into the near future – and financial sustainability of these programs will, therefore, remain a top concern. The GAVI Alliance defines financial sustainability as [GAVI 2004]:

Although self-sufficiency is the ultimate goal, in the nearer term sustainable financing is the ability of a country to mobilize and efficiently use domestic and supplementary external resources on a reliable basis to achieve current and future target levels of immunization performance in terms of access, utilization, quality, safety and equity

GAVI Alliance has worked with countries eligible for their support to develop financial sustainability plans. These plans require not only mobilizing and securing adequate funds, but also better management and transparency in the use of resources. Yet, few low- and middle-income countries have effective financial management systems in place to monitor how immunization resources flow through the system and are then used at the point of service delivery. Indeed, in these settings, such financial data are often weak, incomplete, inaccurate or entirely missing [Guthrie et al forthcoming].

As a result, there is a general inability to accurately assess the results (returns) on investments made to date by governments and their partners. Moreover, governments and their partners have limited ability to calculate credible cost estimates of current service delivery since this requires knowing how much was truly spent on service provision compared to the coverage obtained. There is also limited understanding at the sub-national level about immunization funding delays, leakages and reallocations that could impede service delivery, and which must be rapidly identified and resolved in order to achieve immunization program goals.
GAVI Alliance partners broadly agree on the urgent need to develop a method suitable for different contexts to rapidly assess the flow, use and tracking of funds for routine immunization services at sub-national levels, particularly at the point of service delivery [Peny et al 2005; Lydon et al 2008]. The application of the tool would assist UNICEF and all GAVI Alliance partners to better target technical assistance to LMICs that optimize sub-national resource management, improve predictability of funds, and enhance the sustainability of financing through increased efficiency.

As a first step in this process, there is a need to better understand any tools or approaches previously used to assess financial flows for immunization services, or in other sectors. The aim of this study was to conduct a systematic review of the literature for immunization costing studies and tools, financial management systems and any previous methods to track the flow and use of resources for immunization services. The results of this study will be used to inform the development of a rapid assessment tool for pilot testing in select Ugandan districts. The results of this subsequent study are presented in a separate UNICEF working paper [UNICEF 2014].

**Aim**

To conduct a systematic review of the literature regarding barriers to financing routine immunization services at sub-national levels, and the tools used to assess these barriers in Uganda and other LMICs. In addition, literature on costing tools and costing studies for immunization are reviewed.

**Specific objectives**

Focus areas for the systematic literature review included:

1. Immunization resource tracking methods, financial management systems, costing and budgeting tools for immunization programs, as well as costing studies for immunization services
2. Methods to assess financial sustainability of immunization programs
3. Studies conducted to track sub-national immunization financial flows
4. Relationship between immunization expenditure tracking and cost estimate accuracy
5. Sub-national involvement in financing and planning immunization activities
Methodology

Literature search and selection

An extensive review of the published and grey literature was conducted. A search for published literature was conducted in electronic databases including Scopus (Medline and Embase) and PubMed. Searches were conducted for the period of 1966 to present. Searches were made using the article title, abstract and keywords. Once documents were retrieved using the search terms in the table below, the abstracts were further reviewed for relevance to the study. Any abstracts that did not meet the focus area research questions outlined in the previous section were discarded. Table 1 summarizes the search strategy and results.

Table 1: Literature search strategy and results

<table>
<thead>
<tr>
<th>Focus areas</th>
<th>Search Term</th>
<th>Results Scopus (Access date: 06/11/13)</th>
<th>Results PubMed (Access date: 06/11/13)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>“Immuni?ation” or “Vaccin*” AND “Africa” AND (donor support OR international aid OR international spending OR financial flows OR health expenditure* OR health account* OR financial account*)</td>
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<td>0 retrieved</td>
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<tr>
<td>1</td>
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<td>0 relevant</td>
</tr>
<tr>
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<td></td>
<td>1 relevant</td>
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</tr>
<tr>
<td>4</td>
<td>(“resource track*” OR “Expenditure Track*”) AND (“immuni?ation OR Vaccin*”) AND “Uganda”</td>
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<td>0 retrieved</td>
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<td>1b) Costs</td>
<td>((TITLE-ABS-KEY(cost*)) AND (TITLE-ABS-KEY((immuni?ation OR (vaccine*))) AND (TITLE-ABS-KEY(low income countries))) AND NOT (TITLE-ABS-KEY(animals))</td>
<td>282 retrieved</td>
<td>0 retrieved</td>
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<tr>
<td></td>
<td></td>
<td>18 relevant</td>
<td></td>
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<tr>
<td>5</td>
<td>TITLE-ABS-KEY(((district OR sub-national) AND (immuni?ation OR vaccine) AND (low income countries) AND (planning)))</td>
<td>11 retrieved</td>
<td>0 retrieved</td>
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</table>
The results of the comprehensive literature review shows a dearth of articles in the published literature pertaining to expenditures tracking and identification of financial bottlenecks for immunization in Uganda or other countries. This is a major gap in the literature that needs to be addressed in order to better inform planning of immunization services going forward.

Further literature searches were conducted through the websites of international and national (Ugandan) entities. International organizations specified in the search included: World Health Organization (WHO), World Bank, United Nations Children’s Fund (UNICEF), United States Agency for International Development (USAID), GAVI, Pan-American Health Organization (PAHO), Center for Global Development, Organization for Economic Cooperation and Development (OECD), Sabin Institute, African Development Bank (ADB) and the Bill and Melinda Gates Foundation.

National entities in Uganda were also searched for grey literature. Websites for Ministry of Health (MoH), Ministry of Finance, Planning and Economic Development (MoFPED) were searched. Other national sites specified in our search included groups that conduct budget advocacy for health in Uganda including the Civil Society Budget Advocacy Group (CSBAG), Uganda National Health Consumers Organization (UNHCO), Uganda Local Government Association (ULGA) and National NGO forum. In addition, hard copies of unpublished work done by these entities were reviewed for the study.
Results

Immunization resource tracking methods and tools

Resource tracking tools

Resource tracking tools provide valuable information to decision-makers on the flow of funds from the source to their beneficiaries, and how resources are subsequently used. There are a number of tools that have been used for resource tracking in LMICs.

The Public Expenditure Tracking Survey (PETS) was developed by the World Bank [Dehn et al 2003; Reinikka et al 2004] to track expenditures at all levels of government and to provide information on leakages (funds diverted or misappropriated) or delays in fund disbursement in public finance. It was first used in Uganda in 1996 to track public expenditures in the education sector [Reinikka et al 2004; Ablo et al 1998]. The evaluation revealed evidence of fund leakage due to poor controls, although a repeat PETS evaluation conducted in 2002 showed significantly reduced leakages [World Bank 2002].

Most PETS have been conducted in the general public sector and in social sectors like education [Dehn et al 2003]. However, with regard to deliberate efforts to track expenditure on immunization services, there is only one instance in the literature where PETS has been used. The World Bank, using the PETS tool, recently conducted a resource tracking study for immunization services in Tajikistan [Brenzel et al 2008]. An immunization specific module was inserted into the Tajikistan PETS Health Survey at both national and sub-national levels.

The Tajikistan case study provides useful insight to the likely challenges and advantages of using the PETS tool for the immunization sector. The fact that resource tracking for immunization was nested in a broader exercise for the health sector using the PETS survey tool provided a good opportunity for immunization expenditures to be directly compared to overall health expenditures. In addition, it allowed expenditures shared with other program areas to be taken into account, which decreased the likelihood of overestimating immunization expenditures. An observation from the study was that most tools like PETS are prone to inaccuracy in expenditure estimates due to weak financial information systems in LMICs, such as Tajikistan.

National Health Accounts (NHA) is another important tool for tracking health expenditures. It provides policymakers with detailed information about health system financing and resource allocation [OECD 2011; WHO 2003]. NHA is an internationally accepted methodology used to determine a nation’s total health expenditure patterns, including public, private, and donor spending. NHA methodology tracks the flow of health funds from a specific source (where the money comes from) to its specific intermediary (who manages the money, who makes allocation decisions) to its specific end use (services provided) to who is providing services using the resources (providers) to how the funds are ultimately spent (health care functions).
The NHA has recently been aligned with the System of Health Accounts (SHA) classifications [OECD 2011; WHO 2003; Poullier et al 2002]. Figure 1 depicts the SHA framework, which includes the following accounting dimensions and categories:

- Five accounting dimensions:
  - Healthcare financing schemes
  - Revenues of financing schemes - sources of funding for the health sector
  - Providers - entities that provide health care services and goods
  - Functions - types of health care activities
  - Capital formation in health systems
- Health care provision categories (human resources, pharmaceuticals, etc.)
- Beneficiary categories (age, gender, socio-economic, geo-political, etc.)
- Global burden of disease classification. In this classification, immunization is categorized under prevention of communicable diseases.

**Figure 1: System of Health Accounts (SHA) framework**

Source: OECD 2011
The National Health Accounts methodology embodies the principles of the United Nations System of National Accounts 1993 and is essentially a sequence of events:

\[
\text{Expenditure} = \text{consumption} + \text{investment} = \text{Provision of goods and services} = \text{Sources of financing} = \text{taxes + payroll taxes + private disbursements}
\]

Source: OECD 2011

The methodology is not only able to track public health expenditures but also uses a system of sub-accounts to track expenditure on child health (including immunization), reproductive health, and HIV. More recently, the methodology has been revised and now includes \textit{inter alia} new health sub-accounts to track resources for tuberculosis and malaria as well.

The first NHA in Uganda was done for general health expenditure in 1998 [Republic of Uganda, Ministry of Health 2004]. Following a decade of no resource tracking in Uganda, the results of the recently concluded NHA 2008/09 and 2009/10 were published in 2013 [Republic of Uganda, Ministry of Health 2013]. The NHA 2008/09 and 2009/10 was conducted at national and sub-national levels, and included a sample of 40 districts, 13 municipalities and 53 general hospitals. Unlike the NHA 1998/99-2000/01, the NHA 2008-2010 tracks general health expenditure as well as expenditure for reproductive health and child health services.

The child health sub-account in the NHA methodology is limited with regard to immunization. While attempts are made to disaggregate the expenditure on child health by intervention or type of service, the level of disaggregation is limited to broad categories such as ‘curative care’ versus ‘prevention’ or ‘outpatient’ versus ‘inpatient’ services. It is, therefore, not easy to separate expenditure on immunization from other prevention services or outpatient activities conducted in the health sector.

In addition, the implementation of NHA in Uganda highlights the difficulty of adopting international standardized systems for expenditure tracking in Uganda. The NHA 2008/9-2009/10 for Uganda identifies the differences in classification of public expenditure between the Government of Uganda and the NHA classification system as a major challenge to mapping expenditures [Republic of Uganda, Ministry of Health 2013]. In addition, the Ugandan Ministry of Health notes that the quality of the data was a major limitation since there was often missing information and, in some cases, the entities were reluctant to release their data. Lastly, they noted that there were many overlaps in expenditures data for the reproductive and child health accounts with no means of disaggregating expenditures from the two sectors. Therefore, in most cases, recourse to expert opinion was prevalent, which could undermine the strength of the evidence.

In conclusion, the NHA system provides a good methodology for tracking general health expenditures at the national level with some attempt at sub-national levels as well. While there is a provision for tracking expenditure on child health interventions, it does not easily permit tracking immunization services specifically. The NHA methodology and process provides a useful template for the design of a resource tracking tool for immunization, or possibly a tool that might nest a module for immunization (as was the case with PETS in Tajikistan). Even though it has not been used in Uganda, it certainly provides a potential platform for incorporation of resource tracking for immunization. However, it would require the development of a standardized survey tool designed specifically for immunization.
that is inclusive of all modes of immunization service delivery (routine and supplementary). Developing a standardized tool would also require the development of a new set of international codes for immunization expenditure, extensive technical guidance (on the likely expenditure categories) and extensive stakeholder consultation. Since the tool has been used in LMICs, including Uganda, it would be easy to institutionalize and readily acceptable to stakeholders.

A search for resource tracking tools specific for immunization in the published and grey literature was conducted. The results show that at the global and national levels there have been some efforts to develop tools for resource tracking for immunization services. At the global level, the Institute of Health Metrics and Evaluation (IHME) is developing a resource tracking framework for the Global Vaccine Monitoring and Evaluation/Accountability framework [GAVI 2010]. The intention is to conduct a retrospective analysis of funding flows from development partners, governments and, to the extent possible, civil society organizations (CSOs) at the global, regional and country levels. This tool would be used for routine immunization programs for the period 2006-2010 in the 94 countries identified in the Decade of Vaccines Collaboration (DoVC) costing and financing analysis. The available information does not suggest that sub-national resource tracking will be conducted.

At country level, there is the recent effort of the Gates-funded multi-country study on costing and financing of routine and new vaccine introduction (NUVI) programs [Guthrie et al forthcoming]. The project included three aspects: costing routine immunization at service delivery level, costing new and under-utilized vaccines introduction (NUVI), and mapping resources for immunization.

The research team adapted the SHA codes to provide further disaggregation, and applied a data collection tool format that drew on both the NHA and the National AIDS Spending Assessment (NASA) tools. This tool provides a valuable starting point for the tracking of resources on immunization at the national and sub-national levels. However, the process of obtaining sub-national level spending data was particularly challenging due to the lack of disaggregation and codification of such spending within the public financing system.

Recently, another resource tracking study on immunization expenditure was conducted in Uganda [Guthrie et al forthcoming]. The study estimated expenditure by source in three different scenarios. The first scenario took into account expenditures by government on the health system while the second scenario excluded these costs. The methods employed for resource tracking in the study involved the formulation of two data extraction tools. The formulation of the tools was guided in the aforementioned resource tracking study in Uganda [Guthrie et al forthcoming]. The codes were similar to those in the System for Health Accounts. The team used the tools for key informant interviews and for review of relevant documents.

The preliminary results of the first scenario in this investigation confirm the findings in the above study. Specifically, this study found that there has been a 17% increase in GoU funding from 2011/12 to 2012/13. In general, public funds is the biggest contributor to immunization services providing 44.6 billion UGX in 2011/12 and 44.0 billion UGX in 2012/13. This is approximately, 63% and 53% of total funding in 2011/12 and 2012/13, respectively. This estimation includes health system costs such as staff salaries allocated to immunization services in Uganda. The study found that the greatest proportion of immunization services provided in Uganda is by government health facilities (50.8% in 2011/12 and 51% in 2012/12) followed by the administrative agencies (National Medical Stores, UNEPI and the District Health Offices). When the shared health system costs are excluded in the second scenario, external aid (GAVI, UNICEF and WHO) is the largest source of funds for immunization services. Those expenditures
are mainly for vaccines and supplies. In this scenario, government expenditure toward immunization amounted to USD 1.5 million in 2011/12 and 2012/13, which is approximately 17.5% of total spending on immunization.

Financial management systems

Since 2004, the Government of Uganda has used the Oracle-based Integrated Financial Management System (IFMS) covering all central government ministries, including 25 agencies and 8 local governments under tier 1 (oracle-based) [Semakula et al 2012]. Other local governments are included under tier 2 (Navision-based). IFMS combines budget preparation, budget execution, accounting and reporting systems. Currently, the system has six modules including: (1) public sector budgeting (2) purchasing (3) payables (4) receivables (5) cash management and (6) general ledger. This system is used for managing funds for various public services in Uganda, including a range of health programs, and namely immunization. This includes funds that are on-budget as well as donor funds, like those from GAVI. In addition to the auditor general, donor funds (including GAVI) are monitored closely by an independent private auditing firm.

The IFMS is linked to other arms of government crucial for financing health care and immunization. This includes the Bank of Uganda and the Uganda Revenue Authority, which generate revenue for health through general taxation. IFMS implementation is not without its challenges, as noted by Semakula et al 2012. The software requires regular updates and the hardware requires replacement, both of which are costly. The government of Uganda has adopted an output-based budgeting mechanism for all sectors, but IFMS is not able to adapt to the new changes in this system.

This has necessitated the development of an Output-Based Tool (OBT) for planning of health services. It is not clear how this system links with tracking resources specifically for immunization services. Going forward, it might be prudent to conduct an assessment of this and, if not already linked together, to determine how the tool could be improved to better track resources for immunization services.

Costing and budgeting tools for immunization programs

The World Health Organization recognizes the importance of estimating resource needs for immunization. A number of standardized tools for costing immunization services have been developed for use in LMICs. These include the WHO costing tool and the PROVAC-CostVac tool, developed by the Pan American Health Organization, as well as the Marginal Budgeting for Bottlenecks (MBB) tool developed by World Bank, WHO and UNICEF. These tools are discussed in detail below.

The WHO Comprehensive Multi Year Planning tool is an important costing tool for EPI planning, which was first developed in 2005 and has since been revised [WHO 2005]. It is an excel-based tool with detailed guidelines for use, which has been implemented in many countries (including Uganda) to prepare immunization country plans. It consists of a number of excel worksheets including:

- One set-up sheet that allows users to identify the country, the health administrative structures and the period for which cost estimates are projected.
- Three worksheets to input needs for cold chain, personnel, vaccines, equipment and infrastructure.
- One calculation worksheet that projects costs based on quantities input in previous worksheets and their unit costs.
- One worksheet that shows the total EPI cost estimates.
• One worksheet that assesses the funds available for the immunization program. Sources include government funds and those from external sources or donor partners.
• One worksheet that details current and future resource requirements, resources available from all sources and the resulting funding gap.

This tool is usually implemented in conjunction with both the vaccine forecasting tool [WHO 2012] and the cold chain equipment manager [PATH 2012]. The vaccine forecasting tool is used to determine total vaccine quantities required while the cold chain equipment manager provides inputs on cold chain equipment quantities needed for procurement.

The main advantage of this tool is that it provides specific information on financial sustainability. Despite this, however, the tool is “data hungry” and requires training EPI staff in its use. In addition, the tool does not provide for the involvement of sub-national planners in the planning process.

**The Provac-CostVac tool** was developed by PAHO and WHO for use by Latin American countries [Castañeda-Orjuela 2013]. It is an excel-based, user-friendly tool that has a technical manual for guidance on its use. The tool is a standardized EPI costing tool that improves the speed, consistency and availability of cost data for national immunization program managers and decision makers. It was intended to help countries carry out immunization program costing according to WHO guidelines, and to provide a transparent framework for collecting and analyzing cost data at both national and sub-national levels. The tool provides for the consideration of shared health system costs by including labor and infrastructure costs. It can also be used to provide estimates of resource needs for EPI and the private sector within a country. The tool has been successfully piloted in Colombia at four levels of decision-making (national, departmental, municipal, and health facility levels) [Castañeda-Orjuela 2013].

In the Columbian pilot program, paper-based surveys were used to collect costing data [Castañeda-Orjuela 2013]. Data collected at the central level included number of vaccine doses applied, reported coverage and wastage rates *inter alia*. Additional information on costs for the four most relevant items (e.g. personnel, cold chain, vehicles and buildings) was collected from 112 health facilities sampled for the pilot. The pilot also included a sample of 6 municipalities and 3 departments that were selected to estimate the costs at these two levels. The study showed the importance of determining costs at lower administrative levels.

The core tool is a set of excel worksheets that include:
• One set-up sheet that enables the user to define the country, year and health system structure.
• Five data collection worksheets/surveys that include basic information on facilities, labor, cold chain, equipment and infrastructure. Data is collected at different administrative levels using paper-based tools and entered directly into these worksheets.
• Calculation worksheets
• Output sheets that include cost by input, by administrative level and by geographic area. Outputs include: (1) total costs (2) cost by item (vaccine and supplies, personnel, cold chain, vehicle, facility and other costs) (3) costs by program level (central level, intermediate administrative level, and service delivery level) and (4) costs per dose applied and per fully immunized individual.
The tool is able to estimate costs for routine immunization services as well as supplementary immunization activities. It is, however, limited in that it does not provide for fiscal space analysis and therefore does not assess the financial sustainability of immunization. This tool is not explicit with regard to identifying and budgeting for bottlenecks. Therefore unless deliberate efforts are taken to consider bottlenecks, they might not be budgeted for using this tool.

The Vaccine Introduction Tool (ProVac-VIC) is a costing tool developed by PAHO specifically for estimating the resource needs of introducing new vaccines [Castañeda-Orjuela 2013]. The vaccines included in the tool are pneumococcal conjugate vaccine (PCV), rotavirus vaccine, human papilloma virus (HPV) and influenza vaccine for adults. The tool is both user-friendly and comprehensive in terms of cost categories considered for the vaccines. However, this tool is restricted to only new vaccines and therefore cannot be used to assess full EPI costs, nor to assess financial sustainability of programs.

The Marginal Budgeting for Bottlenecks (MBB) was developed by the World Bank, World Health Organization and UNICEF [Soucata et al 2002] and focuses on interventions for maternal and child health, including immunizations. The immunization strategies include new vaccines (PCV, HPV and rotavirus). The tool was developed in the wake of the debt relief program (HIPC) for developing countries and the subsequent need to link increased financial resources available to LMICs to the achievement of the health-related Millennium Development Goals (MDGs). Therefore, the tool is geared towards the identification of non-financial constraints of health service delivery in these settings, and has three main modules for planning to overcome bottlenecks:

- One module is to identify bottlenecks, which include constraints in implementation at the household/community, facility and outreach levels.
- One module is to cost interventions and their demand- and supply-side strategies in order to overcome constraints. These include the marginal costs to:
  - Overcome gaps in access at the above levels
  - Overcome human resource bottlenecks for implementation
  - Overcome logistical and supply bottlenecks
  - Overcome demand-side barriers to utilization
  - Overcome bottlenecks in terms of technical and organizational quality
- One module is to estimate expected impact of policy on maternal and child health outcomes.

The MBB tool provides a comprehensive assessment of likely costs and bottlenecks relevant for immunization of children. Its particular strength is the detailed assessment of constraints at the sub-national level, which enables countries to consequently plan for them [O’Connell et al 2013]. It also provides a mechanism to assess fiscal space and financial sustainability, and to possibly also determine the equity impact of immunization policies.

The major challenge is the lack of a tool to estimate the logistics requirements for immunization services, particularly the cold chain. This might be due to the fact that the tool includes other service areas. Another limitation is that the MBB tool does not explicitly consider supplementary immunization activities. It appears that there is a huge trade-off in the sensitivity of the tool with regards to addressing these immunization-specific issues and the desire to capture comprehensively all resource requirements for achieving improvements in maternal and child health outcomes.

The OneHealth Tool developed by Futures Institute is used to support costing, budgeting and financing of national health sector strategies in developing countries, with a focus on integrated planning and health system strengthening [Stenberg et al 2012]. The OneHealth Tool has been used in more than 25
LMICs to date. This tool is modular to permit either program-specific costing (while taking into account health system requirements) or costing using a health systems approach. While the proposed added value comes from assessing resource needs for the entire health sector across programs and system components, the tool can be used look at disease or program-specific resource requirements. For example, the tool was used to determine resource needs for non-communicable diseases in LMICs.

One module is the Lives Saved Tool (LiST) [Walker et al 2013] that carries out immunization-specific estimates of the impact of changes in immunization coverage on children’s lives saved. Combined with the systems strengthening costing components of OneHealth, the tool can forecast the unit costs of scaling up immunization coverage and the estimated additional financing flows required to do this.

**Costing studies of immunization services**

The literature review revealed studies that had been conducted to cost EPI programs and/or the introduction or delivery of single vaccines. Table 2 summarizes the studies that were identified in the review as well as the results of these costing studies.

Table 2 shows that most of the identified studies were conducted in LMICs. In addition, the majority of studies were quite out-dated, having been conducted in the 1980s or 1990s. The majority of studies included whole EPI programs while a few considered single vaccines. In addition, few studies looked at the introduction of new vaccines and their costs.
Table 2: Costing studies of immunization services

<table>
<thead>
<tr>
<th>Study (author, year)</th>
<th>Country</th>
<th>Study type</th>
<th>Intervention(s) studied</th>
<th>Cost (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Le Gargasson et al 2013</td>
<td>Benin Ghana</td>
<td>Primary analysis</td>
<td>Introduction of new vaccines</td>
<td>Not available</td>
</tr>
<tr>
<td>De la Hoz-Restrepo et al 2013</td>
<td>Colombia</td>
<td>Systematic review</td>
<td>Non-vaccine costs of introducing rotavirus and PCV</td>
<td>Median cost per dose of rotavirus: $0.74 (LICs) $6.39 (HICs)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Median cost per dose of PCV: $1.27 (LICs) $8.70 (HICs)</td>
</tr>
<tr>
<td>Castañeda-Orjuela et al 2013</td>
<td>Colombia</td>
<td>Primary analysis</td>
<td>Costs of EPI program</td>
<td>Cost/FIC (under 1 yr): $153.62 ($93.96-$420.80) MMR inclusive: $15.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yellow fever inclusive: $15.52</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Cost/FIC (2 years): $111.19-$436.32</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cost/dose delivered: $3.95 (including vaccine cost)</td>
</tr>
<tr>
<td>Yoo et al 2009</td>
<td>USA</td>
<td>Primary analysis</td>
<td>Universal influenza vaccine</td>
<td>Median cost/vaccination: $28.62 ($18.67-$45.28)</td>
</tr>
<tr>
<td>Khan et al 2004</td>
<td>Bangladesh</td>
<td>Primary analysis</td>
<td>Costs of vaccine delivery by level of health facility</td>
<td>1999 costs. Cost/FIC: $6.91 Cost by facility type: Static sites: 7500 Outreach: 2100 Cost/EPI session: $42.00 Cost per dose administered: $1.18</td>
</tr>
<tr>
<td>Thiem et al 2011</td>
<td>Vietnam</td>
<td>Primary analysis</td>
<td>Introduction of oral cholera vaccine</td>
<td>$0.89</td>
</tr>
<tr>
<td>Levin et al 2001</td>
<td>Ghana</td>
<td>Primary analysis</td>
<td>EPI program and National Immunization Days</td>
<td>Cost/dose: $0.41 Cost/FIC: $16.63 Cost/capita: $0.43</td>
</tr>
<tr>
<td>Kaddar et al 2000</td>
<td>Morocco Bangladesh Cote d’Ivoire Colombia</td>
<td>Primary analysis</td>
<td>EPI program and National Immunization Days</td>
<td>Cost/dose (routine): Morocco: $1.12 Bangladesh: $0.84 Cote d’Ivoire: $0.51</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Cost/dose (NIDS): Morocco: $0.45 Bangladesh: $0.17 Cote d’Ivoire: $0.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cost/dose (both): Morocco: $0.77 Bangladesh: $0.52 Cote d’Ivoire: $0.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cost/FIC: Morocco: $20.89</td>
</tr>
<tr>
<td>Study (author, year)</td>
<td>Country</td>
<td>Study type</td>
<td>Intervention(s) studied</td>
<td>Cost (US$)</td>
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<tr>
<td>Phonboon et al 1989</td>
<td>Thailand</td>
<td>Primary analysis</td>
<td>EPI</td>
<td>Cost/FIC: $5.30-$33.20 (1987 costs)</td>
</tr>
<tr>
<td>Glazner et al 2004</td>
<td>UK</td>
<td>Primary analysis</td>
<td>Cost of immunization among provider types</td>
<td>Cost per dose (no vaccine): Pediatric practices: $8.15 Family practice: $5.79 Public health facilities: $5.41 Cost per dose (with vaccine): Pediatric practices: $10.67 Family practice: $7.57</td>
</tr>
<tr>
<td>Waters et al 2004</td>
<td>Cameroon</td>
<td>Primary analysis</td>
<td>EPI not campaigns</td>
<td>Cost/FIC: $12.73</td>
</tr>
<tr>
<td>Pegurri et al 2005</td>
<td>Brazil Ecuador Mauritania Kenya Mozambique Colombia</td>
<td>Systematic review</td>
<td>Different immunization strategies</td>
<td><strong>Brazil</strong>: Outreach teams: Cost/dose: $4.00-$6.00 (all ages) Mass Campaigns: Cost/dose: $3.00–$4.00 (all ages) Routine: Cost/dose: $4.00–$17.00 (all ages) Ecuador Outreach teams: Cost/FVC: $930.00 (all ages) Mass Campaigns: Cost/FVC: $14.00 (children &lt;3 years) Routine: Cost/FVC: $7.00 (all ages) Mauritanian Outreach teams: Cost/FVC: $29.00 (all ages); $245.00 (under 1) Mass Campaigns: Cost/FVC: $15.00 (all ages); $157.00 (under 1 year) Routine: Cost/FVC: $11.00 (all ages) Colombia Outreach teams: Mass Campaigns: Cost/dose: $1.00–$20.00; mean $6.00 (all ages) Cost/FVC: $34.00–$222.00; mean $102.00 (under 1 year) Routine: Cost/dose: $1.00–$16.00; mean $4.00 (all ages)</td>
</tr>
<tr>
<td>Study (author, year)</td>
<td>Country</td>
<td>Study type</td>
<td>Intervention(s) studied</td>
<td>Cost (US$)</td>
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<tr>
<td>---------------------</td>
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<tr>
<td>Walker et al 2004</td>
<td>Peru</td>
<td>Primary analysis</td>
<td>Variation in costs of vaccination by geographical region</td>
<td>Cost/FVC: $7.00–$191.00; mean $46.00 (under 1 year)</td>
</tr>
</tbody>
</table>
| Batt et al 2004     | Turkey Senegal Cameroon | Systematic review | Cost of EPI | Routine Immunization:  
|                     |         |             |             | Cameroon: Cost per dose: $0.11  
|                     |         |             |             | Cost/FIC: $2.19 (1986/87 dollars)  
|                     |         |             |             | Mass immunization:  
|                     |         |             |             | Turkey: Cost/dose: $1.08 (1985 dollars)  
|                     |         |             |             | Senegal: Cost/dose: $1.24  
|                     |         |             |             | Cost/FIC: US$ 18.93 (1985/86) |
| Quentin et al 2012  | Tanzania | Primary analysis | Cost of HPV vaccination for Tanzanian girls | Cost/FIG: $9.76 (excludes vaccine)  
|                     |         |             |             | $26.41 (includes vaccine)  
|                     |         |             |             | Class-based delivery:  
|                     |         |             |             | $66 (Total Program costs/ FIG)  
|                     |         |             |             | Age-based delivery  
|                     |         |             |             | $100 (Total Program costs/ FIG)  
| Hutubssey et al 2012 | Tanzania | Primary analysis | HPV vaccination in Tanzania | Cost/FIG: $5.77  
| Guthrie et al forthcoming | Uganda | Primary analysis | Immunization services in Uganda and cost of introduction of new vaccines | Weighted average unit cost per DTP3 vaccinated child: US$ 18.40 (RRH) to US$ 43.94 (HC II).  
|                     |         |             |             | Cost per dose: US$4.6 (RRH) to US$9.17 (HCII)  
|                     |         |             |             | Cost per child: US$6.35 to US$ 3.49  
|                     |         |             |             | Cost per PCV dose: US$6.39  
|                     |         |             |             | Cost per PCV vaccinated child: US$26.62  

a Cost per fully immunized child (FIC)  
b Cost per fully vaccinated child (FVC)  
c High cost because only 5 children where fully vaccinated  
d Cost per fully immunized girl (FIG)
The literature review shows that costing methodologies vary across studies. A few of the studies were explicit about the perspective that informed the costing. For most studies, however, the perspective could only be inferred as the provider’s perspective. The most common outcome was the cost of fully immunizing a child. The definition of a fully immunized child varied with studies. For example, Batt et al (2004) showed that studies reviewed defined a fully vaccinated child as one who had received DPT3 while Costañeda-Orjuela et al (2013) defined it as using rotavirus vaccine. Thus the unit costs detailed in the table should be interpreted cautiously with regard to comparability and interpretation across different settings.

Two studies used well-designed costing tools such as the ProVac-CostVac [Costañeda-Orjuela et al 2013] and the WHO Cervical Cancer Prevention and Control Costing Tool [Hutubessy et al 2012]. The rest of the studies, on the other hand, developed their own survey tools for data collection. Despite these differences, however, all studies included the relevant cost categories for immunization.

Studies included in this review differed in the way costs were reported. While most studies used more output related unit costs (cost per fully immunized or per fully vaccinated child), some included process related costs (cost per dose delivered) [Batt et al 2004; Kadder et al 2000; Pegurri et al 2005]. In general, it is difficult to state the range of costs since most studies were conducted in different countries or used different denominator definitions.

In addition, only a few studies have determined the costs of vaccine delivery at sub-national levels. Three studies reported the cost by facility level or type [Guthrie et al forthcoming; Prosser et al 2008; Glazner et al 2004] while others reported the cost by delivery strategy [Pegurri et al 2005; Khan et al 2004; Brenzel et al 1994]. In general, the evidence suggests that mobile or outreach teams are more costly for every fully vaccinated child than static/fixed site delivery. In addition, the review of the literature shows that in high-income countries, the cost per dose is higher at higher levels of practice than at lower levels [Prosser et al 2008; Glazner et al 2004]. This is in stark contrast to what was observed in Uganda where lower level facilities had higher unit costs than referral facilities [Guthrie et al forthcoming]. The studies show that mass campaigns are generally less costly than routine programs. Lastly, studies that included the introduction of new vaccines such as HPV and rotavirus show that, in general, vaccine costs is the largest driver of overall program costs [Hutubessy et al 2012; Le Gargasson et al 2013].

In general, the review of costing studies shows that methodologies are broadly similar, but vary with regard to tools used, range of costs considered and denominator definitions. These differences, along with the fact that the studies were all conducted at different times, make meaningful comparisons difficult. This makes the case for developing standardized guidance on costing for immunization programs even stronger.
Methods to assess financial sustainability of immunization programs

While existing resource tracking methods are used to monitor flow of funds to the beneficiary, they are largely not specific to assess the flow of immunization funds and bottlenecks at the sub-national level, or financial sustainability of programs.

A search for tools assessing bottlenecks at the sub-national level in the published literature and on websites of prominent budget monitoring groups for health in Uganda was unfruitful (e.g. Civil Society Budget Advocacy group (CSBAG), Uganda National Health Consumers Organization (UNHCO)). Other sites reviewed included the International Budget Partnership, a prominent budget-monitoring group.

The Financial Sustainability Diagnostic Tool (FSDT) was developed by the World Health Organization and GAVI to diagnose bottlenecks to financial sustainability [WHO 2003]. The FSDT tool, however, is mainly used to assess bottlenecks at the national level but not at sub-national levels. It is used to guide financial sustainability planning for immunization that is requisite for GAVI funding. It asks questions of national immunization program managers, donors, civil society partners and district health officers to:

- Monitor progress toward financial sustainability and better management of national immunization programs within health sector development using simple qualitative indicators.
- Assess the country capacity to formulate and implement a Financial Sustainability Plan using the framework and guidelines provided by the GAVI Financing Task Force [GAVI 2004].
- Identify the strengths of current immunization programs in countries and highlight areas for further improvement to achieve financial sustainability.
- Provide guidance on technical assistance and training needed to strengthen current immunization financing systems, structures, staffing and strategies.

Studies conducted to track sub-national immunization financing flows

Our review identified one recent study conducted in the Democratic Republic of the Congo (DRC) [Le Gargasson et al 2014] that identifies bottlenecks in the flow of funds for routine immunization services from national to sub-national levels. This study was conducted using document reviews of budgetary processes from the Ministry of Finance. Key informant interviews were conducted with central level staff at the Ministry of Health (MoH), Budget (MoB) and Finance (MoF) to understand immunization financing flows to sub-national levels. Results of these interviews informed the systematic document review subsequently conducted by the team. Table 3 lists the themes and questions addressed in the interview schedule.
Table 3: Rapid assessment tool for immunization funding bottlenecks in Dem. Rep. of Congo

<table>
<thead>
<tr>
<th>Issue</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>General questions</td>
<td>- Identification of credit lines for immunization financing (both specific to immunization and shared with other programs)</td>
</tr>
<tr>
<td></td>
<td>- Whether the creation of a dedicated budget line improved the availability of funds</td>
</tr>
<tr>
<td></td>
<td>- Whether credit lines that fund immunization benefit from a ‘simplified procedure’</td>
</tr>
<tr>
<td></td>
<td>- Whether health centers receive a budgetary allocation</td>
</tr>
<tr>
<td>Budget elaboration</td>
<td>- Description of the process relating to the identification of needs and planning</td>
</tr>
<tr>
<td></td>
<td>- Advantages and drawbacks of the process</td>
</tr>
<tr>
<td></td>
<td>- Suggestions to improve the process</td>
</tr>
<tr>
<td>Budget adoption</td>
<td>- Assessment of budget adoption calendar adequacy</td>
</tr>
<tr>
<td></td>
<td>- Suggestions to improve the timeline of budget adoption</td>
</tr>
<tr>
<td>Mobilization rate</td>
<td>- Sufficiency of mobilization rate (for credit lines relating to immunization financing)</td>
</tr>
<tr>
<td>Budget Execution</td>
<td>- Identification of difficulties faced during the different steps of commitment, liquidation, authorization and payment phases</td>
</tr>
<tr>
<td></td>
<td>- Suggestions to overcome difficulties</td>
</tr>
<tr>
<td>Future perspectives on the budget process</td>
<td>- Reflection on how current reforms can improve the budget process</td>
</tr>
</tbody>
</table>

Source: Le Gargasson et al 2014

The study found that bottlenecks in immunization funding flows in DR Congo include:

- **Budget elaboration**: These bottlenecks include budget ceilings that are often set too low for the health sector, including immunization programs. In addition, the study found that these ceilings do not take into account real program needs.

- **Budget adoption**: There are delays in the planning process that result from delays in donors passing on information to the government regarding their financial commitments. In addition, donors sometimes do not provide any information on what they plan to spend on health.

- **Budget execution**: Bottlenecks at this phase of budgeting relate to reductions of the trimestral credits (at the discretion of the Ministry of Budget), reprioritization by the Treasury that sometimes does not reflect the priorities of the health sector (more often this is due to emergencies), delayed processing of monetary transfers to sub-national levels due to the fact that the Treasury Director may not be available or there are numerous forms to complete.

In general, the bottlenecks in the process include a mixture of human-related factors such as lack of motivation or availability of responsible officers; excessive use of off-budget procedures; limited human resources and capacity; lack of motivation; interference from ministries with the standard budget process; dependency toward the development partner’s disbursements schedule; and lack of budget implementation tracking. The qualitative component of the study was limited to interviewing key players at the central level, and might have been enriched by including respondents from sub-national levels as a means of triangulating information obtained at central level.
Relationship between immunization expenditure tracking and cost estimate accuracy

The literature review did not identify any studies that assessed the extent to which weak resource tracking contributes to the inability to generate accurate estimates of financing required to achieve and sustain equitable coverage targets. This finding represents a gap in the literature that should be addressed. Such a study would help underscore the value of resource tracking tools in the planning of immunization services.

Sub-national involvement in financing and planning immunization activities

The literature review on sub-national involvement in planning and costing immunization services did not render any results. This search included electronic databases and the grey literature, notably the Ministry of Health resource center in Uganda. This represents a gap in the literature that should be addressed in the future.
Discussion

This literature review has demonstrated that in low-income countries there is emerging interest in resource tracking for immunization services especially at the sub-national level. Such information is useful for determining the financial sustainability of immunization services in these countries.

Despite the importance of resource tracking studies for immunization, the number of studies conducted in LMICs is few. This is a situation that should be addressed in order to enable countries and donors to better plan programs. In addition, there is a need to develop standardized resource tracking tools. The literature has shown that available tools have often been developed in an ad hoc manner as the need has arisen. Standardized resource tracking tools for immunization would enable comparisons between countries, permit identification of inefficiencies that may exist and what can be done to address them. An example from the HIV field is the National AIDS Spending Assessment (NASA) approach developed by UNAIDS over several years and applied in many countries. NASA is a systematic, comprehensive and standardized approach to tracking the wide range of sources, providers and activities in the HIV arena. A similar approach could be applied to the tracking of immunization expenditure.

The literature suggests that within low-income countries there is growing, albeit still limited, evidence regarding bottlenecks in the flow of funds from national to sub-national levels. The two studies that have been conducted in Uganda and DRC show that the majority of problems arise from the budgetary process, insufficient funds and also from human factors (such as lack of motivation or poor availability of key staff). Such information certainly highlights the areas that should be addressed in order to strengthen the effective use of funding in the future. The two studies serve as a useful starting point in the design of an approach to rapidly assess sub-national immunization financing bottlenecks. However, it is important to note that there is a need to pilot more of these studies in different countries given their differing contexts.

The plethora of information on unit cost data for immunization and the availability of costing tools for immunization is promising for purposes of planning services. However, there are few studies that have examined the costs of delivering immunization services at sub-national levels. This is important for proper planning since the costs may vary by facility level.

Overall, the review has demonstrated that in low-income countries there have been steps taken toward improving financial management systems for immunization. There is also growing evidence on costs for immunization services that can aid planning at national and sub-national levels.

There still is no evidence regarding the participation of districts in planning immunization services and the impact of weak resource tracking on planning for immunization services. These gaps in the literature should be addressed so as to better inform planning for immunization in the future. Future research should explore the extent of participation of districts in planning, the effectiveness of district participation in planning for immunization (impact on decisions made), factors facilitating or constraining effective participation of districts and mechanisms that can be used to effectively engage them if they are not presently well engaged.
References


