



Cost analysis of routine immunisation in Zambia



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ABSTRACT

Background: This study aimed to inform planning and funding by providing updated, detailed information on total and unit costs of routine immunisation (RI) in Zambia, a GAVI-eligible lower middle-income country with a population of 13 million.

Methods: The exercise was part of a multi-country study on costs and financing of routine immunisation (EPIC) that utilized a common, ingredients-based approach to costing. Data on inputs, prices and outputs were collected in a stratified, random sample of 51 facilities in nine districts between December 2012 and March 2013 using a pre-tested questionnaire. Shared inputs were allocated to RI costs on the basis of tracing factors developed for the study. A comprehensive set of costs were analysed to obtain total and unit costs, at facility and above-facility levels.

Results: The total annual economic cost of RI was \$38.16 million, equivalent to approximately 10% of government health spending. Government contributed 83% of finances. Labour accounted for the lion's share (49%) of total costs followed by vaccines (16%) and travel allowances (12%). Analysis of specific activity costs showed that outreach and facility-based services accounted for half of total economic costs. Costs for managing the program at district, provincial and national levels (above-facility costs) represented 24% of total costs. Average unit costs were \$7.18 per dose, \$59.32 per infant and \$65.89 per DPT3 immunised child, with markedly higher unit costs in rural facilities. Analyses suggest that greater efficiency is associated with higher utilisation levels and urban facility type.

Conclusions: Total and unit costs, and government's contribution, were considerably higher than previous Zambian estimates and international benchmarks. These findings have substantial implications for planners, efficiency improvement and sustainable financing, particularly as new vaccines are introduced. Variations in immunisation costs at facility level warrant further statistical analyses.

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1. Introduction

Accurate, detailed information on costs of routine immunisation (RI) programmes is critical to inform policy, planning, management and funding of countries' Expanded Programmes on Immunisation

(EPI) [1]. While comprehensive multi-year plans (cMYPs) provide planners and funders with estimates of current and future EPI resource requirements, they are not generated from facility-level information [2]. Periodic studies using facility-level surveys would generate more robust costing data which is increasingly important in a context of intensified competition for health financing along with introduction of new, relatively expensive vaccines.

A number of studies in the last two decades examined costs and financing of RI with traditional vaccines [3–8]. Multi-country studies suggest considerable variations between countries and possible changes in both unit costs and in levels of government funding for programmes [8,9]. However, the number of studies examining RI program costs has dwindled since 2000, although costs of new

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vaccines have enjoyed increased attention [10–12]. The literature suggests that previous analyses of RI costs should be interpreted with caution due to changes in vaccines, prices, health system costs, service delivery models and contexts and methodological inconsistencies [13].

Thus there is limited knowledge about the costs of RI in African countries. Zambia required updated understanding of RI costs to reflect introduction of single-dose liquid Pentavalent vaccine in 2007, in the context of challenges in achieving full immunisation coverage above 80% across all districts [15,16]¹ and ahead of phasing in new vaccines (PCV, rotavirus and measles second-dose) from 2012.

2. Objectives

The study aimed to comprehensively describe RI economic and financial costs to inform planning, management and funding. Specific objectives were to generate estimates of facility-based delivery costs of RI and to identify factors that may affect programme costs and productivity which can be explored in further analyses.

3. Methods

The investigation followed a common methodology (Common Approach) developed for the multi-country EPIC study, adapted to reflect Zambia's context and data availability [13].² The study examined all costs related to routine immunisation, defined as services provided regularly as part of the government programme at facilities, outreach sites and Child Health Weeks, but excluding supplementary immunisation activities. A sample of 51 facilities was randomly selected proportional to numbers of facilities within strata of facility types – Rural Health Centres (RHCs) and Urban Health Centres (UHCs) – across nine districts in three provinces which were purposively selected to be representative of typical contexts across Zambia. These strata are used in Zambia's health system planning, and the sample included 36 of Zambia's 1037 RHCs (which serve populations of approximately 10,000 in rural areas), and 15 of the 228 UHCs, (serving 30–50,000 people in urban or peri-urban settings) [17]. The strata include hospital associated health centres, which provide PHC for communities near hospitals. Costs were analysed by line item and 11 standard EPI functions [13]. Semi-structured questionnaires were used to obtain data on RI activities and associated costs from staff and managers at facility, district, provincial and national levels.

An ingredients-based, 'bottom-up' approach was used to analyse all relevant immunisation economic and financial costs at the facility and higher levels of the health system. A step-down approach to allocating total programme costs was not used, but specific, shared costs were allocated to RI using a set of allocation factors and assumptions, such as share of staff time or square metres of facility space used for RI. Significant shared costs included those of human resources (HR), vehicles, buildings and utilities. HR costs were allocated according to the share of staff time spent on immunisation. (see Appendix A for details of costing).

The economic cost of capital items was discounted using a 3% discount rate, while the financial costing depreciated capital costs on a straight line basis. Volunteer labour was included in

¹ To 2012, full immunization was defined as receiving BCG, OPV3, DTP–HepB–Hib3, and Measles 1.

² See Brenzel L, Young D, Walker DJ. Costs and financing of routine immunization: approach and selected findings of a multi-country study (EPIC). Vaccine 2015, <http://dx.doi.org/10.1016/j.vaccine.2014.12.066>, [in press] for a link to the Common Approach [14].

Table 1

Aggregated total RI economic costs by expenditure line item and level of health system in Zambia (\$, 2011).

	Cost (US\$, 2011)	% of total
Expenditure line item		
Salaried labour	18,861,822	49.4
Per diem & travel allowances	4,389,987	11.5
Vaccines	6,167,984	16.2
Vaccine injection & safety supplies	185,702	0.5
Other supplies	297,187	0.8
Transport/fuel	2,348,864	6.2
Vehicle maintenance	420,650	1.1
Cold chain energy costs	119,545	0.3
Printing	77,645	0.2
Building overhead, utilities, communication	1,075,464	2.8
Cold chain equipment	568,066	1.5
Vehicles	2,007,144	5.3
Other Equipment	557,284	1.5
Buildings	1,085,278	2.8
TOTAL economic cost	38,162,622	100
Level of health system		
Facility (incl. vaccines)	31,156,342	82
District	5,385,501	14
Provincial	937,609	2
National	683,170	2

economic but not financial costs.³ Costs are reported in 2011 US\$ (\$1 = ZK4787) but HR costs reflect substantially higher 2012 pay scales to facilitate interpretation in the current context.

Data were captured in Excel and transferred to a costing database for further cleaning, analysis and production of unit costs. Unit costs for UHC and RHC were weighted according to the proportion of doses delivered at each site. Unit costs for district and higher levels were calculated using the same approach. The total national cost of RI was calculated by applying the weighted average unit costs by facility type to the total number of doses administered in UHC and RHC in Zambia in 2011. Differences in facility costs were demonstrated with scatter plots. Natural log transformations of variables were used where data showed high variation.

Several limitations may have affected accuracy of results. Allocation of staff time to RI activities relied on interviewee estimates in each site, not direct observation, due to time and resource constraints. However, triangulation was used to check plausibility and consistency of estimates. Quality of record keeping at the facility, district and central level was variable and required additional assumptions to be made in analysis of vehicle use and vaccine wastage rates.

4. Results

4.1. Total costs of RI and major contributors

Table 1 summarises the aggregated national total economic costs of RI in Zambia by line item, function and level of the health system. The total cost in 2011 was estimated at \$38.16 million. Items funded by government were estimated to contribute 83% of this total.

The largest line item cost was labour, amounting to 49% of the total facility RI cost. Vaccines contributed to 16% to the total, followed by 12% for travel allowances and 6% for transport and fuel. Together these items contributed 83% of total costs. Capital items, mainly vehicles, buildings and cold chain equipment, contributed 11% of total costs. Cold chain equipment costs comprised 1% of the total.

³ The financial costing does not indicate cash flows. The Common Approach referred to these as fiscal costs, which were not calculated for RI.

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