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REVIEW OF COSTING, BUDGETING & FINANCING TOOLS FOR STRATEGIC AND OPERATIONAL PLANNING WITH A FOCUS ON IMMUNIZATION

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Abstract

The objective of this review was to evaluate costing, strategic planning, and budgeting tools with a focus on immunization. The review was conducted to guide development of a new approach for estimating the costs of a National Immunization Strategy (NIS). The aim was to learn from previous experiences and integrate some of the best practices into the new NIS costing approach.

A total of eight tools were evaluated; six tools were immunization specific, one tool was developed for tuberculosis budgeting and funding analysis, and the OneHealth tool takes a health systems approach. The tools were assessed according to four components: (i) Functions and objectives, (ii) Purpose and scope, (iii) Methodology and (iv) Institutionalization.

The comprehensive Multi-Year Planning costing tool for immunization, the OneHealth tool and the tuberculosis budgeting and funding analysis were all developed for estimating resource requirements of a strategic plan. PAHO's Expanded Programme of Immunization costing tool was developed for estimating resource requirements of an Annual Operational Plan. The Uzbekistan template for annual budgeting of vaccines and injection tool was designed so that resource requirements can be directly linked with budget templates. The Supply Division Forecasting Tool is useful for estimating quantity requirements and gaps for vaccines and supplies, but it cannot be used for predicting costs. The Flu tool and the Cervical Cancer Prevention and Control Costing tool estimate incremental costs of vaccine introduction and are not suited for budgeting and planning cycles.

An approach that links strategies and activities in the NIS with immunization services components is recommended. Resource requirements for activities should be calculated using relatively simple costing methods. Since vaccine procurement is considered the most important expenditure of the immunization budget, these costs should be calculated in detail. It is essential that the costing exercise is tailored to the Ministry of Health budget structure and process.

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List of abbreviations

AOP	Annual operational plans
cMYP	Comprehensive Multi-Year Plan
C4P	Cervical Cancer Prevention and Control Costing tool: HPV vaccination module
EPI	Expanded Programme on Immunization
HPV	Human papillomavirus
IEC	Information, communication and education
NIS	National immunization strategy
PAHO	Pan American Health Organization
SDFT	UNICEF Supply Division vaccine forecasting tool
SIICT	Seasonal Influenza Immunization Costing Tool
TBBFT	Tuberculosis budgeting and funding analysis tool
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1. Introduction

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1.1 Background

For the past 15 years, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) have recommended that countries use the comprehensive Multi-Year Plan (cMYP) guidelines to develop strategic plans for immunization services. These guidelines include an immunization costing and financing tool for assessing current and predicted programme costs. This tool has become comprehensive over time by combining costs and financing components into a single approach and has responded to changing events with gradual updates.

In 2016–2017, a rapid assessment of the cMYP process was completed using 14 country case studies, 12 country desk reviews and interviews with several stakeholders. One of the major findings was that despite adding value to multi-year planning, the cMYP costing tool was too complex, with data collected for the tool not actively used for budgeting or expenditure monitoring. Users found it particularly difficult to cost shared resources, with many users lacking confidence in the validity of estimates. To address the findings of the rapid assessment, UNICEF

and its partners developed a road map for improving the cMYP process through:

- streamlining the strategic planning process
- increasing usability and the impact of annual operational plans (AOPs) and budgeting processes
- changing the cMYP costing approach and tool
- building national capacity for immunization planning that is well integrated into national health planning and budgeting processes.

The first component was addressed by studying best practices for strategic planning and developing national immunization strategy (NIS) guidelines.[1] For the second component, UNICEF conducted a landscape analysis of cMYPs and AOPs in 30 countries eligible for support from Gavi, the Vaccine Alliance, assessing how they develop and use AOPs, along with their links to budgets and cMYPs.[2] The study showed that while several countries develop AOPs for their immunization services, AOP resource requirements do not tend to align with cMYP costing, with budget and budget cycle alignment often suboptimal.

1.2 Objective

The aim of this review was to assess best practices of existing costing, strategic planning and budgeting tools. Its objectives included identifying tools used for costing and budgeting health interventions, especially immunization programmes, developing a framework for assessing the tools and assessing the identified tools against the assessment framework's indicators.[3,4] The findings will be used to develop an approach that countries can use to estimate costs and budgeting needs for both their strategic plans and AOPs for immunization, which is in line with the road map's second and third objectives.

2. Methodology

2.1 Selection of costing and financing tools

Initially, three immunization costing tools were identified, with the review also covering the joint United Nations OneHealth tool for health sector-wide strategic planning.

During discussions with WHO, UNICEF and Steering Committee members,[I] three additional immunization tools and one tuberculosis (TB) budgeting and funding tool were added to the review. All tools were assessed using the latest guidelines and software versions available. The costing tools reviewed included:

1. Immunization-specific tools
    a. cMYP costing and financing tool
    b. UNICEF Supply Division vaccine forecasting tool (SDFT)
    c. Uzbekistan National Immunization Programme budget tool
    d. Pan American Health Organization (PAHO) immunization costing tool
    e. Seasonal Influenza Immunization Costing Tool (SIICT)
    f. Cervical Cancer Prevention and Control Costing (C4P) tool: HPV vaccination module
2. Other tools
    a. OneHealth tool
    b. TB budgeting and funding analysis tool (TBBFT)

Details of the developers, documents, software versions and websites are provided in annex 1.

2.2 Analysis framework

The tools were assessed according to four components, each with their own set of indicators:

A. Functions and objectives

B. Purpose and scope

C. Methodology

D. Institutionalization

I Steering Committee members included: Jennifer Asman (UNICEF Social Policy Section), Logan Brenzel (Bill & Melinda Gates Foundation), Anais Colombini (Gavi Secretariat), Charu C. Garg (UNICEF consultant), Ulla Griffiths (UNICEF), Aleksandra Krukar (UNICEF Supply Division), Eric Laurent (UNICEF consultant), Karin Stenberg (WHO), Anthony Swan (Gavi Secretariat), Nathalie Van de Maele (WHO), Emily Wootton (WHO) and Karene Hoi Ting Yeung (WHO).

A. Functions and objectives

1. Costs for a particular programme by activities, inputs or a combination of both
2. Costing perspective (of the planner, service provider, payer or patient)
3. Baseline costs, future costs and budget requirements[II]
4. Who finances what and financing gaps on unmet needs (for a programme as a whole or specific interventions and activities)
5. Programme benefits: i) efficiency (e.g. through reduced wastage); ii) effectiveness in terms of outcome (e.g. mortality/lives saved); iii) impact on equity
6. Indicators for country and global reporting

B. Purpose and scope

1. Time period: costs estimated for short- (1 year), medium- (1–3 years) or long-term planning (> 3 years)
2. Economic or financial costs, or both[III]
3. Total or incremental costs, or both[IV]
4. Program-specific costs only, shared costs or both[V]
5. Recurrent costs, capital costs or both
6. Costs at different administrative levels

C. Methodology

1. *Methods and assumptions*
   a. Future resource requirements based on coverage or impact, with or without budget constraints
   b. Costing methods: top down or bottom up
   c. For each activity, estimation methods used:
      - the ingredients approach (price x quantity)
      - analogous estimation (based on estimates

II Future costs and budgeted requirements: Future costs normally depend on current costs, expected coverages, quantities and prices. Capital costs are taken as depreciated costs. In budget requirements, capital costs depend on the actual value of the capital that needs to be procured.

III **Financial costs** reflect financial outlays for goods and services needed to carry out a public health or medical intervention, and as such are similar to expenditures. However, in contrast to expenditure data, financial costs depreciate capital expenditures over time.
Economic costs (i.e. opportunity costs) reflect the full value of all resources utilized in producing a good or service. Economic costs reflect 'opportunity costs' as they represent consumed resources, which therefore removes the opportunity to allocate the resources to another purpose (https://ghcosting.org/pages/standards/glossary#D).

IV **Incremental costs** are the positive difference in costs between new interventions or different amounts of an intervention from existing interventions.

V **'Programme-specific costs'** include the cost of inputs used specifically for a programme that are not shared with any other health services. They will only be available for use by the programme in question. All shared inputs that are part of the health system or are used by other programmes are not included in programme-specific costs.

for earlier projects and activities, and past data)

- expert judgment (institutional knowledge)
- parametric estimations (using resources/cost items that drive cost)

d. Target, covered and treated populations identified[VI]

e. Method for capital costs: which capital costs are included (e.g. vehicles, incinerators, equipment, buildings) and how the costs are calculated (actual, depreciated by useful life years, discounted or a combination)

f. Whether start-up costs/ introduction costs are calculated (e.g. microplanning, initial training and social mobilization/information education and communication (IEC) material development)

g. Budget requirements linked with financing sources and funding gaps

h. Possibility of subnational analysis

i. Whether the tool provides a process to cost alternative strategies/scenarios

j. Whether consistency tests are available

k. Whether the tool has default data

l. What software the tool uses

2. *Activities: Which of the following activities are part of recurrent costs?*

a. Planning and coordination

b. Service delivery through the programme (through fixed facilities)

c. Service delivery through campaigns

d. Logistics for service delivery (e.g. cold chain)

e. Supervision and administration

f. Training

g. Advocacy, communications and demand generation

h. Monitoring and disease surveillance

i. Maintaining information systems, research and evaluation

j. Others

3. *Inputs or cost items collated: For each of the activities identified, which inputs are included?*

a. Human resources, specifically linked to the programme

b. Shared human resources engaged in activities other than the

VI The target population comprises those who should receive the interventions and the covered population is the percentage of the target population that the intervention reaches.

programme being costed (e.g. staff time for service delivery, supervision and administration)

c. Consumables specifically used in the programme (e.g. vaccines and syringes)

d. Consumables shared across programmes (e.g. maintenance of vehicles and fuel costs)

e. Capital equipment specifically for the programme (e.g. refrigerators)

f. Capital equipment shared across programmes (e.g. vehicles, building space)

g. Other operational costs (e.g. per diems and travel costs for meetings, electricity, water and supplemental activities, such as the organization of a national immunization day)

4. *Key outputs: Which key outputs/ indicators are included?*

a. Total costs for the programme, per capita or covered child/ person, and by activity

b. Costs of programme-specific consumables

c. Programme-specific costs and shared costs reported separately

d. Future resource requirements, financing available and funding gaps for a number of years and level of disaggregation

e. Indicators for financial sustainability (linked to macro variables)

f. Indicators for efficiency, resource allocation or equity

g. How the outputs are presented (summary table/graphs)

D. Institutionalization: The considered variables were difficult to evaluate from a desk review, but were assessed based on information within the tools

1. Ease of use: availability of user manual/ guidance/online support to explain the costing tool and data-collection process; the extent of technical support and training (duration and number of sessions) required; tool automation

2. Governance structure: specific policy for cost estimations (e.g. in a policy document/part of a legal framework); the existence of a steering committee, technical working group and technical team for stakeholder involvement and the production and dissemination of materials; road map suggested with a governance structure

3. Financing and human resources for conducting the costing and planning exercise: when relevant, guidance should be able to produce the information regularly; guidance and training available to the team with roles for collecting, producing/ analysing, disseminating and using the information gathered

4. Dissemination and use: whether the tool provides guidance on the use of information for annual budget cycles and to inform national and global targets and indicators

The framework and indicators were mapped to the requirements outlined in the NIS guidance[2] and summarized in Table 1.

Table 1. Summary attributes/indicators against which the tools were assessed for national immunization strategy resource requirements

Functions, purpose and scope attributes
1. Resource requirements for the programme to run as usual
2. Resource requirements by activity
3. Future resource requirements: number of years for which the resource requirements are estimated: Short (1 year), medium (2–3 years) and long term (> 3 years)
4. Future resource requirements for new activities
5. Financing gaps
6. Planner and payer perspective: who finances what?
7. Adjustments to future requirements with available budget
8. Future resource requirements in the context of fiscal space
9. External resources for future requirements
10. Programme resource requirements and shared costs are separate
11. Resource requirements at different administrative levels
Resources for input indicators linked directly to the programme
12. Human resources (e.g. salaries for programme staff or per diems for shared staff)
13. Consumables for the programme (e.g. vaccines, fuel for the cold chain or vehicles)
14. Capital/non-consumables for the programme (e.g. cold chain equipment) Uses Actual (A), Depreciated (D) or Discount (O) rates for capital items
Shared resource indicators differentiated
15. Human resources (e.g. salaries of shared staff for service delivery or supervision)
16. Consumables shared across programmes (e.g. vehicles)
17. Capital/non-consumables shared across programmes (e.g. buildings, office equipment)

Programmatic activity indicators – resources required estimated for activities
18. Planning and coordination – per diems and meeting costs (excluding shared costs)
19. Supervision and administration – per diems and meeting costs (excluding shared costs)
20. Operational activities (e.g. training, communications, monitoring, surveillance, demand creation), per diems and materials, excluding shared costs
Price and quantities estimated for consumables (especially vaccines and supplies)
21. Estimates for quantities take wastage rates and buffer stock into consideration
22. Prices are differentiated for vaccines procured in domestic markets compared with international markets, with the latter including freight costs, clearance taxes, insurance, customs, handling, processing and storage costs, etc.

3. Assessment of the tools

A desk review of the tools was conducted based on latest available guidelines, software versions, literature, presentations and expert views to assess their characteristics against the framework. A summary of the assessment is provided in annex 2, along with the key positive aspects and limitations of each tool, especially in the context of NIS resource requirement estimations.

3.1 Comprehensive Multi-Year Plan (cMYP): planning and costing user guidelines and tool, 2018[5]

Purpose and scope: The *WHO-UNICEF Guidelines for Comprehensive Multi-Year Planning for Immunization* support strategic thinking and planning for immunization through seven steps: i) situation analysis; ii) objectives and milestones; iii) planning strategies; iv) links to national and global goals with timelines; v) monitoring and evaluation; vi) costing, financing and resource mobilization; and vii) cMYP implementation. The 2014 version of the user guide for the planning and costing tool provides guidance on estimating baseline costs and financing of an immunization programme, making projections for future resource requirements to achieve programme objectives during the cMYP time period, and analysing corresponding funding gaps. The user guide acknowledges uncertainty in future financing and recommends that tasks and costs be updated in annual plans to monitor implementation. The tool estimates costs/expenditures for a baseline year and resource requirements for four future years for six cMYP components: i) vaccine supply and logistics (routine); (ii) service delivery; (iii) advocacy and communications; (iv) monitoring and disease surveillance; (v) programme management; and (vi) supplemental immunization activities. The resource requirements are assessed against available funding by source and funding gaps are calculated. At the programme level, risks are categorized to assess whether the future funding is secure or probable. Funding gaps are assessed for four different cost categories (vaccines, personnel, transportation, and maintenance and overhead) as well as the six components.

Description of the tool: The Excel-based tool (V3.9.8, December 2018) has 21 worksheets, five of which are hidden, containing calculations and variables. These worksheets can be unhidden if required. Four worksheets require data to be entered (the data entry, financing, co-financing and annual plan worksheets) and six are result sheets. The data entry worksheet requires data to be entered in 10 sections and 25 tables. These 10 sections are: i) reference information (country administrative levels, baseline and projection years, macroeconomic information, currency and responsible person); ii) demographic (baselines and forecasts for routine immunization and supplemental immunization activities, past and future diphtheria-

tetanus-pertussis (DTP3) coverage); iii) vaccines and injection supplies; iv) personnel; v) vehicles and transport; vi) cold chain equipment, maintenance and overheads; vii) operational costs of supplementary immunization activities; (viii) programme activities (training, IEC, social mobilization, etc.), other recurrent costs and surveillance assumptions (detection and notification, case and outbreak verification, data management, laboratory, supportive activities); ix) other equipment needs and capital costs (waste management, surveillance/laboratory equipment, office equipment, etc.); and x) buildings and building overheads.

The financing worksheet requires information on financing sources, which it uses to map yearly resource requirements for each cost category by financing source and risk types (available or probable financing). Annual capital costs and shared costs can be either included or excluded in resource requirement estimations. The tool also calculates sustainability indicators in addition to these estimations. The annual plan worksheet requires a list of activities and budgets to be entered for each year of planning to monitor expenditure tracking and implementation during the year.

Methodology: Costs of inputs and activities shared with other programmes can be estimated separately and is optional, but strongly recommended. The tool mainly uses the ingredients approach for cost calculations, and also the budgeting approach for some activities that are not cost drivers, such as training, social mobilization and surveillance, and general guidelines for vehicle and cold chain maintenance. The tool uses inflation to determine cost projections and the actual costs of required capital equipment for future resource requirements, calculating depreciated capital costs.

The baseline cost of vaccines and injection supplies can be taken from the WHO Expanded Programme on Immunization (EPI) Logistics Forecasting Tool[6], if available for the country in question, or calculated using the ingredients approach. The quantity of vaccines and supplies under the ingredients approach are calculated by taking into account immunization schedules, target populations, coverage, buffer stock and wastage targets, and in-stock quantities. Quantities are estimated separately for traditional and new vaccines. UNICEF reference prices are used for vaccine and supplies prices, with a 15 per cent freight charge applied. Value added tax and customs duties may also be applied and country-specific prices can be used. Indicative prices (updated February 2017) are provided for Gavi-supported vaccines in the 2018 version of the tool.

Personnel costs for routine immunization are estimated using staff categories, the percentage of staff time spent on immunization activities and staff salaries. For outreach activities and supervision and monitoring, the average number of days in a month and per diems are used for each staff type. Campaign costs include per diems for staff and other operational costs for transport, social mobilization and training, among others.

Capital includes vehicles, cold chain equipment, waste management equipment (e.g. incinerators), surveillance and laboratory equipment and office equipment

(e.g. computers). Costs are based on the number of vehicles/equipment used (quantities), their unit cost (prices) and their utilization by the programme (percentage spent on immunization). Utilization of cold chain equipment (e.g. freezers, refrigerators, cold boxes, or vaccine carriers) and the main spare part categories (e.g. burners, wicks) are assumed to be 100 per cent for immunization.

Fuel costs for vehicles are covered under transport costs, and are estimated based on the average mileage of vehicles, average fuel consumption per unit of mileage and the price of fuel. Vehicle maintenance costs are suggested at 15 per cent of fuel costs, with cold chain equipment maintenance estimated as 5 per cent of capital costs.

Programme activities and other recurrent cost categories covering areas such as social mobilization, advocacy and communication activities, training, programme management and monitoring and disease surveillance are calculated using lump sum costs.

Costs per building type, such as fixed facilities for immunization services, cold room buildings, laboratories or incinerator buildings, are calculated based on the average price of the new building, average monthly overhead costs (water and electricity) and the percentage of space used by the immunization programme.

The shared costs for human resources, buildings and transport are estimated separately. The inclusion of these shared costs in final costs is optional, but strongly recommended in the user guide, as shared inputs are likely to be quite significant in most countries. Excluding certain shared costs can "underestimate the total cost and resource requirements of the programme if other inputs (such as vehicles) are frequently shared with other programmes".[7]

Future costs and resource requirements are determined separately for cost categories and are estimated based on population growth and expected coverage, the utilization of new and underutilized vaccines, supplementary immunization activities and inflation rates, among others. Through analysing previous funding it is possible to determine the programme's main donors as well as the level of government contributions for immunization funding.

Outputs: These include costs for routine immunization and supplemental immunization activities, costs per capita and costs per child vaccinated. The share of vaccines and supplies in total immunization costs are estimated separately from shared health system costs. Baseline costs are displayed by six cost categories and delivery strategies (fixed site, outreach and campaigns), with baseline funding profiles presenting the share of funding by governments and external sources. Information is displayed by financing sources and funding gaps for both secured and probable financing, as well as by the tool's six components. Sustainability is assessed by linking immunization indicators to total health expenditures, government health expenditures and gross domestic product. The user guide provides different scenarios that can be developed for future resource requirements, such as by changing coverage targets or wastage rates, or available government

funding. However, separate data files must be created in the tool, and results must be manually compared for different scenarios. If the tool is updated annually, it provides indicators for the WHO/UNICEF annual Joint Reporting Form.

Institutionalization: The cMYP guidance document and the user guide for the costing tool provide principles and suggestions for ownership, commitment and buy-in from an inter-agency coordination committee. The costing tool has a guidance document and inbuilt automation.

Limitations: While the developers of the tool recommend estimating shared costs separately, it is important to consider which shared costs are important along with the purposes they serve. Shared costs are an important part of cost analysis and efficiency calculations, but have less relevance for immunization programme budget requirements. Estimating shared costs is challenging, especially for capital such as buildings, office equipment and laboratory equipment, and can be difficult to measure as immunization programmes have no influence over such costs.

The cMYP costing tool is not linked to ministry of health budgets and tends to have no relationship with such expenditure. The tool's use in budgeting and planning is therefore limited.

The presentation of cost categories is not consistent across the tool's different worksheets and user guide. The costing and funding gap worksheet describes six components (plus the shared cost component) from which costs and future resource requirements are derived, which does not correspond to the eight cost categories included on the data entry worksheet. The costing worksheet also describes cost categories under four major headings and 18 subheadings for recurrent costs, which differs from the 21 cost categories found on the financing worksheet that are used to compare resource requirements with available resources.

Based on the 2017 Mott MacDonald evaluation, road map and landscape documents from 2019[8] and expert views and suggestions, the tool was found to have several limitations. The most significant limitations are listed, with the aim of deriving recommendations for the NIS resource requirements tool.

1. Countries mainly consider the cMYP as a required document for Gavi funding applications.

2. There is no yearly review.

3. The programmatic and costing parts of the cMYP are not sufficiently connected.

4. Costing for AOPs and cMYPs are not linked. Due to uncertainties and governments' inability to commit to future financing beyond the budgeting year, financing requirements for the future should be evaluated on a regular basis.

5. The cMYP does not provide a budget, rather the AOP is the basis for the budget. A landscape analysis of cMYP/AOP alignment scored low in terms of

system components, activities, activity timelines and budget alignment.

6. Integration of cMYPs with AOPs or wider health operational plans is lacking. The staff that prepare the AOP often do not know about cMYP strategies and resources.

7. Numbers are not considered reliable and are not transferred into annual budget cycles.

8. AOPs embedded in cMYPs must be aligned with other country plans and linked with the budget cycle. Rolling budget planning would make this more useful.

9. The cMYP costing tool is complex and difficult to use and is largely completed by consultants. There is limited stakeholder participation both in the cMYP development process and for the completion of costing using the tool.

3.2 UNICEF Supply Division vaccine forecasting tool (SDFT) and user guide, 2019

Purpose and scope: The tool estimates quantities required for vaccines, devices, cold chain equipment and deworming drugs. The forecast for the first year is based on target populations, estimated coverages, number of doses, wastage rates, stock quantities and buffer stock. It assesses the requirements that can be met from domestic sources for each vaccine and device and what should be procured through the UNICEF Supply Division. The quantities procured through the UNICEF Supply Division are mapped by financing source and unfunded quantities are estimated. Users need to fill in future year quantities, taking into account country uncertainties in the phase-in of a vaccine and in consultation with a coordination committee.

Description of the tool: The tool is in Excel format and has four worksheets: a review form, a forecast worksheet, a cold chain forecast worksheet and instructions. The review form lists 49 vaccines, 3 deworming tablets and 10 devices (syringes and safety boxes) and has a cold chain section. Users can change or add items, if required.

The forecast worksheet is divided into nine sections. Section 1 focuses on programmatic requirements and consists of five tables. These tables require users to choose products (vaccines, syringes and devices) from a dropdown list and to enter information on target populations, coverage rates, doses required per person, wastage rates and stocks available for each product. Section 2 requires users to enter a report on stockouts, with section 3 comprising two tables on the procurement mechanism and financing sources for products and unfunded quantities. Section 4 has a shipment plan for the quantity and timing of vaccines and devices to be procured through the UNICEF Supply Division determined in sections 1 and 3. The forecast requirements are to be entered by users by month for year 1, by quarter for year 2 and annually for years 3, 4 and 5. Section 5 contains notes regarding the forecast and section 6 provides space for inputs on the willingness and ability to use vaccines

approved for a controlled temperature chain. Section 7 provides space for inputs on preference for doses per container/vial size beyond those currently offered by UNICEF, while section 8 provides space for inputs on the interest to procure novel vaccines. Section 9 provides space for the UNICEF country office to make comments regarding the forecasting and plans for ensuring Gavi co-financing.

The cold chain forecast worksheet has four sections. Section 1 focuses on the procurement mechanism and financing sources, consisting of two tables that require information on quantities to be procured nationally and for products to be procured through the UNICEF Supply Division. Section 2 focuses on shipment information (the shipment size and arrival date) and also requires information on the forecasted quantities for coming years. Section 3 contains additional notes regarding the forecast and section 4 provides space for the UNICEF country office to make comments. The cold chain equipment considered are compression fridge freezers, vaccine carriers, vaccine cold boxes, ice packs, solar fridge freezer, cold/freezer room and temperature monitoring devices.

Methodology: The tool estimates vaccine quantities based on target populations, coverage, the number of doses per person and wastage rates. The quantities are estimated by using the formula shown in the tool's user guide:[7]

$$\text{Total (doses)} = \frac{\text{Target pop} \times \text{Estimated coverage}}{100} \times \text{Doses/person} \times \frac{100}{(100 - \text{Estimated wastage (\%)})}$$

The number of auto-disable syringes, reconstitution syringes and safety boxes required are calculated automatically based on vaccine requirements. A 10 per cent wastage rate is applied for syringes and safety boxes. The total doses or supplies that require procurement are adjusted for buffer stock and current stock available. Estimated total procurement requirements for vaccines, syringes and safety boxes are calculated separately for routine immunization and supplementary activities. The tool forecasts vaccine requirements in doses, deworming drugs in tablets and cold chain equipment in units for one year.

Outputs: The tool estimates total quantities of vaccines, syringes and safety boxes to be procured separately for routine immunization and supplementary activities for one year. For products that are to be procured through the UNICEF Supply Division, the tool identifies financing sources and estimates underfunded quantities. The number of products to be procured by the government or other agencies independently (without going through the UNICEF Supply Division) are presented separately. Financing sources for procurement through the UNICEF Supply Division are broken up into quantities funded through regular UNICEF resources and other resources (e.g. the Canadian International Development Agency), and quantities funded through procurement services, such as government targeted funding (World Bank, Asian Development Bank) and Gavi financing.

Institutionalization: The exercise is completed yearly in preparation for vaccine procurement through the UNICEF Supply Division.

Limitations: The tool uses the concept of quantities funded by different sources but does not present monetary values. Data are not disseminated or linked to national or international reporting. The tool does not have individual input and output sheets, nor does it provide any outputs as graphs, guidance on methods or formulas to forecast future requirements for products. Users instead have to directly enter future forecasts into the tool.

Given that the tool is solely for vaccine supplies, it does not take into account any programme costs such as service delivery or other activities.

3.3 Uzbekistan template for annual budgeting of vaccines and injection supplies and vaccine procurement budgeting template user guide, 2020

Purpose and scope: The main purpose of the tool developed for Uzbekistan is to calculate the country's annual budget needs for vaccines and injection supplies. The tool streamlines cMYP projections of vaccine and injection supplies forecasting and budgeting, and translates long-term resource requirement projections (within cMYP) into annual budgets to improve the budget preparation, financing and procurement of vaccines that meet country needs, while using best practice standards for vaccine forecasting. The user guide provides a standard methodology and step-by-step instructions on how to calculate the budget and resource requirement projections for vaccines and supplies in accordance with the vaccine calendar, vaccine specifications, coverage, wastage rates and demographics extracted from the cMYP costing and financing tool. The vaccine forecasting and budgeting methodology is derived from the methodological framework underpinning the cMYP costing and financing tool. The tool links to the latest cMYP costing and financing tool by drawing all data necessary for vaccine and injection supply forecasting and prices.

Description of the tool: The Excel-based tool comprises 21 worksheets, 17 of which are described in the user guide. Three of the four additional worksheets focus on cold chain equipment, with the last worksheet specifically for Gavi support for new vaccines.

Three worksheets have a budget format required by the Ministry of Finance for commodities procured locally and through UNICEF. These worksheets extract the necessary budget calculations into the fixed Ministry of Finance budget submission format. Once the budget has been calculated, the Ministry of Health/EPI can print out the sheets, which are ready to be included in the budget proposal to be submitted to the Ministry of Finance. After the introduction worksheet are five result sheets with budgets for commodities to be purchased through different sources, i.e. locally, through UNICEF or through others. The next seven worksheets are data entry worksheets for calculating quantities and budget requirements for

vaccines and commodities. The tool also has two result sheets from the cMYP costing tool and two dictionary sheets.

Methodology: The tool underpins the cMYP costing tool methodology by defining and refining certain concepts. The target population is described as the cohort to be vaccinated (e.g. children younger than five years) and the covered population as the target population (cohort x coverage percentage). The doses needed depend on the number of doses to be administered, which is defined as the target population x number of vaccine doses in a vaccination calendar, and vaccine wastage. The total quantity required for budgeting depends on the doses needed, along with doses to fill the buffer. Budgeting is completed separately for commodities procured locally and through the UNICEF Supply Division.

All the data needed to start vaccine forecasting are preloaded from the cMYP costing and financing tool, except for syringes, non-routine immunization vaccines, market prices and UNICEF charges that are additional to commodity costs. The user guide emphasizes the difference in price (P) and therefore the costs for the commodity or vaccine if purchased locally or through the UNICEF Supply Division. Local prices are market prices, whereas UNICEF prices are based on a procurement price, UNICEF contingency buffers, freight costs, handling charges, insurance and local customs taxes. The total annual budget is determined by the formula: $(Q \times P)_{\text{purchased locally}} + \{[(Q \times \text{catalogue } P)_{\text{UNICEF}} + (\text{buffer contingency, freight and handling costs}) + (\text{customs taxes})]*\text{exchange rates} + \text{local customs fees}\}$, where Q is the quantity purchased.

The vaccine and corresponding syringes budgeted are divided into two streams: routine immunization and non-routine immunization. The tool assumes that routine immunization vaccines are procured through the UNICEF Supply Division and that injection supplies are procured locally (except for vaccines supported by Gavi and co-financed by the Government). The tool suggests keeping larger buffer stocks (25–50 per cent) to minimize the risks from exchange rate fluctuations or increased demand.

The user guide identifies the responsibilities for data collection, providing details on what data need to be entered into each worksheet and how each worksheet functions.

Outputs: These are provided in the consolidated sheet as budget requirements for different types of vaccines, syringes and safety boxes from all supply channels. The consolidated sheet presents the adjusted data against vaccine forecast requirements in a summary sheet from the cMYP costing tool for any projection year.

Institutionalization: The tool was developed specifically with the aim of ensuring institutionalization. It is directly linked to Uzbekistan's budgeting process and outputs can be generated to be used in the budget negotiation process.

Limitations: The tool provides requirements for one year only and does not provide funding gaps and future requirements. The user guide has changed the terminology commonly used for target and covered populations, with the target population described

as a cohort and the covered population referring to the target population.

The tool has a limited application for NIS as it only estimates costs for vaccines, injection supplies and cold chain equipment and not for activities included in the NIS.

3.4 Annual Plan of Action of the Expanded Programme on Immunization, PAHO, 2014

Purpose and scope: The PAHO EPI tool is a managerial tool for programming, monitoring and prioritizing activities to foster efficient and timely achievements of objectives and goals.[VII] The user guide covers seven key elements of the planning process: i) situation analysis; ii) priority setting; iii) the formulation of objectives and goals; iv) the creation of an annual plan of action; v) the implementation of activities through indicating responsibilities and timelines; vi) monitoring and supervision; and vii) evaluation at least once annually.

The annual plan of action (the fourth element) includes 12 components: i) political party and legal frameworks; ii) planning and coordination; iii) biologicals and supplies; iv) cold chain; v) training; vi) communication and social mobilization; vii) operating costs; viii) supervision and monitoring; ix) epidemiological surveillance and laboratory; x) information systems; xi) research; and xii) evaluation. For each of these components, the user guide provides definitions and examples of activities, the latter of which are identified in rows, with resource requirements calculated by identifying recurrent and capital costs under different budget heads (in columns). Sources of financing (domestic and external) are identified for each component and activity, and the funding gap is calculated by subtracting the total resource needs from the financing available.

Description of the tool: The Excel-based tool has 17 worksheets, the first two of which provide definitions of terms and matrices that show common costs in the EPI budget linked to specific components. The third worksheet is an output sheet that provides a consolidated summary of the 12 EPI components (in rows). The data are also consolidated by administrative levels. Each component has its own worksheet (12 in total) that must be filled in with activities, expected results, cost items and expenses linked to each activity, the administrative level at which the expense would be incurred, timelines and available financing by sources (both external and domestic). The final two worksheets provide outputs as graphs and tables, as well as a comparison table for planned and executed resources.

Methodology: The estimated costs for planned activities under the 12 components are based on cost items such as the payment of salaries, consultancies,

VII Additionally, PAHO's ProVAC initiative promotes evidence-based decision-making for the introduction of new vaccines through a suite of tools, including Excel-based models, guidance/training tools and data sources. It helps countries estimate the costs of vaccines and supplies, as well as the cost to deliver the programme, impacts and cost-effectiveness to inform the national decision-making process on new vaccines. COSTVAC helps estimate the cost of routine immunization from a sample of health facilities and administrative levels of the health system. UNIVAC is a single universal vaccine impact and cost-effectiveness decision support model (www.paho.org/provac-toolkit/tools/download-tools/).

per diems, vehicle maintenance and fuel, vaccine purchases, cold chain maintenance and meeting costs, along with other recurring costs. Capital costs are added for planned expenses on cold chain equipment, vehicles, buildings and other capital costs. Operation costs include customs clearance, staff salaries, fuel for vehicles, stationary, printer ink and office supplies and equipment, building and furniture purchases.

Resource needs are estimated using all inputs: staff, consumables and capital. The service delivery component is estimated as part of the operating costs. Data are entered by different levels of the health system (municipal, regional and central) depending on the level at which the expense is expected to be incurred.

External financing includes what the country is requesting from each external source for different activities. Domestic financing includes all resources that the government allocates to EPI, resources assigned from social security, financing through credits from the World Bank or International Development Bank and any other financing source. Funding gaps are estimated by subtracting financed expenditure by different sources from the planned expenditure for each component.

Outputs: The tool's outputs are provided as tables, including the total funding required, resource requirements for each of the 12 components (total, percentages and by administrative levels), funding requests by administrative levels from different sources and the variation between planned and executed budget components and administrative levels. A comparison table presents planned requirements against the amounts executed for each activity.

Institutionalization: Most countries in the Americas typically use the tool as a checklist to ensure that they do not forget any components in their planning. Some use the tool more systematically.

Limitations: The tool cannot separately estimate service delivery costs at facilities or for campaigns, nor does it calculate accurate vaccine supply quantities using coverage rates, wastage rates or buffer information. It also does not estimate future costs beyond one year. The user guide does not mention shared costs, yet some costs, such as furniture and office supplies, are likely to be shared across programmes, which the tool instead includes within operational costs.

3.5 WHO Seasonal Influenza Immunization Costing Tool (SIICT) – Flutool plus, 2017[9,10]

Purpose and scope: Flutool plus was developed for policymakers to project the incremental costs of introducing influenza vaccines to specific target populations, such as pregnant women, health workers, children younger than 5 years, adults over 65 years and people with chronic health conditions. It can estimate total resource requirements for each activity, financing needs for each activity and funding gaps by activity, in terms of both financial and economic costs. Financial costs include only the value of the resources spent directly on vaccine introduction by a government throughout the year. These

do not include any shared costs that have already been paid by a ministry, such as for buildings, salaries of existing health staff, vaccines paid for by non-government sources and volunteers' time. Economic costs include the value of staff time spent on flu vaccination service delivery, which are part of shared costs. The tool allows users to estimate resource requirements for one year to fund strategies for vaccinating target populations. It presents both domestic and external financing sources as well as the funding gap. The nine activities included under the tool are: i) the procurement of vaccine and injection supplies; ii) microplanning; iii) training; iv) social mobilization and IEC; v) cold chain equipment purchases; vi) service delivery of vaccines to target populations; vii) monitoring and evaluation; viii) supervision; and ix) waste management.

Description of the tool: The SIICT is an Excel-based tool with 35 worksheets, including a cover, home page with a quick summary (report) of results and links to setup and costing worksheets and reports, and a table of contents. It has four sections, as detailed below.

First, the quick summary or report section includes five worksheets: i) a dashboard summarizing recurrent and capital costs by activities and by number of persons vaccinated by target population; ii) a service delivery analysis (including scenarios for different proportions or coverage in different service delivery types – routine immunization and supplementary immunization activities); iii) graphs for financial, economic and recurrent costs by activities; iv) an incremental cost summary for planned activities and products; and v) a financing sheet with amounts required by activities, along with financing sources and funding gaps.

Second, the setup section has 13 worksheets that require data on the flu vaccination programme's start year, financial assumptions, target populations and coverage predictions, labels describing the health system infrastructure and service types and costs for nine activity worksheets. The cost estimates can be directly entered in the activity worksheets, or the user can select estimates from the detailed assumption worksheets if they have been calculated there.

Third, the detailed costing assumptions section has eight worksheets that estimate data on resource use for nine categories of activities. The data estimated via these worksheets can be input into the activity sheets found in the setup section, and act as optional detailed costing or estimator worksheets.

Fourth, the appendices have seven worksheets, which include reference data, cost ingredients, model documentation, look-up tables and checks worksheets.

The sheets and cells are colour-coded to represent input data, data linked to another cell in the workbook, calculated data, unfilled cell and labels.

Methodology: The tool enables users to estimate incremental financial and economic costs. Economic costs that include shared costs are useful for providing a complete picture of resources that are tied up in the provision of a new vaccine,

and can be used if a cost-effectiveness or cost-benefit analysis is to be conducted.

Costs are estimated based on assumptions about a service delivery strategy (fixed clinics, community-based or campaigns), the vaccination programme's start year and phasing to reach different locations, plans for training, IEC and meetings. Costs are calculated for different target populations by delivery strategy and are separated into recurrent and introduction costs.

The incremental recurrent costs are: i) vaccines and injection supplies (including freight, clearance, insurance and import taxes); ii) health staff time for IEC, service delivery and supervision; iii) per diem and transport expenses for service delivery and supervision; iv) production of material and radio and television slots for IEC; v) vaccination cards and surveillance; and vi) fuel for waste management incinerators.

The incremental introduction costs include: i) microplanning; ii) initial training and IEC material development; iii) cold chain equipment; iv) vehicle requirements; and v) incinerators. When calculating financial costs, the capital costs are annualized with straight-line depreciation using their expected useful life years. For economic costs, depreciation with discounting is used.

The tool has a financing sheet with amounts required based on recurrent costs derived under economic costs and non-annualized capital investments. It presents financing sources from different payers and the funding gap for vaccines and injection supplies, other recurrent activities and capital equipment.

Simple scenario analysis can be conducted by using different percentages of the population covered by different service delivery modes. The setup requires data to be entered for country characteristics, demographic and economic data, and immunization coverage goals, along with a range of variables, including procurement, training, social mobilization and IEC, service delivery, monitoring and evaluation, price data, and salaries and per diem rates for staff. The total costs of vaccines to be procured is based on the price of a single dose and quantities to be procured. The cost (or price) of a single dose is calculated separately for the procurement of a single vaccine dose in a prefilled auto-disable syringe and the procurement of vaccine doses in a vial. Costs per dose are calculated based on market value and add-on charges such as insurance, customs clearance, handling preclearance, processing and port storage. The quantities are based on target populations, wastage rates and reserve and buffer stock required. Capital costs are annualized for total predicted costs.

Outputs: These are provided as tables and charts. Key outputs are the total costs of adding the influenza vaccine to specific regions/provinces or at the national level, total financial and economic costs and cost per immunized person (e.g. per immunized pregnant woman). Recurrent costs are separated into financial and economic costs by activities, target population eligible, vaccines and type of delivery.

Institutionalization and sustainability: The tool is easy to use and has clear instructions. Since the tool is used to introduce vaccines and is only required

for new target populations, it may not need to be institutionalized.

Limitations: The tool only provides financing requirements for one future year. Economic costs include incremental costs of staff for routine immunization per service delivery, incremental costs of shared resources, cold storage expansion costs and vehicle procurement costs. Capital investments are annualized to calculate financing requirements. The tool cannot be used for budget mapping or budgeting cycles.

3.6 WHO Cervical Cancer Prevention and Control Costing (C4P) tool: HPV vaccination module, 2020[11]

Purpose and scope: The C4P tool has two modules: human papillomavirus (HPV) vaccination and cervical cancer screening and treatment. The HPV vaccination module provides information for programme managers and policymakers on the retrospective and projected incremental costs of HPV vaccination to determine sustainability and scalability. The tool enables users to estimate service costs and coverage based on national data and needs. Coverage rates are estimated based upon service distribution, population needs and predicted scale-up. It estimates both financial and economic costs for 10 cost components: i) vaccine and injection supply; ii) cold chain expansion (annualized); iii) microplanning; iv) training; v) sensitization; vi) social mobilization; vii) service delivery; viii) supervision; ix) other (recurrent); and x) other capital investments. All introduction costs are considered as investment costs. Additional/incremental resources required to implement HPV vaccination are calculated at the national level. Costs are estimated separately for five future years by components included under financial and economic costs.

Description of tool: C4P is an Excel-based costing tool, which aims to be transparent and logical by allowing users to see all inputs, calculations and outputs. The tool has a dashboard with outputs that are mainly in the form of tables. Its input sheets are for economic data, target populations, coverage, quantities and unit costs of the 10 components. Introduction costs can be added under other investments. The tool also has detailed costing plug-in sheets to calculate costs for each component, which describe activities and use different cost items/inputs for activities to calculate the costs.

Methodology: The HPV vaccination module estimates incremental costs of HPV vaccine introduction. Any existing capacity that the HPV programme can use are not included in the costs. If there is cold storage capacity for HPV vaccines, related costs are not taken into account for incremental costs. The tool estimates costs within the broad activity categories and are operationally differentiated into financial and economic costs, and recurrent and capital costs. Financial costs are defined as costs to the government and do not include the costs of existing staff time, donated vaccines, volunteer time or the discounted value of capital. Investment costs include introduction activities that last more than one year and capital goods. Introduction activities can be initial training

material, communication material, planning and cold chain supplementary material.

Cost projections are based on target populations, coverage percentage, doses to be administered and dropout rates. Targets reached through schools, health facilities and outreach activities are separated. Retrospective costing is based on actual doses administered of each vaccination type through different delivery channels.

For procurement costs, both retrospective and future prices of vaccines, injection syringes and safety boxes are estimated based on market and procurement prices. Subsidies for procured vaccines, syringes and safety boxes are taken into account in economic costs as are additional costs, including freight, insurance, handling and other charges. Projections for the quantities of vaccine doses and syringes to be procured are based on populations, estimated coverage and wastage rates.

The tool includes an estimation of service delivery costs, as well as costs associated with social mobilization, information and education, among others. Service delivery costs are estimated when vaccinations for a single person are completed and when vaccinations are provided to a group. Activities can be entered under different cost components such as staff allowances, supplies and materials, and other direct costs, with their total costs estimated for retrospective and future years.

Cold chain equipment and other capital investments are captured based on the price for the current year, requirements for current and future years and depreciated values based on the equipment's useful life years. For economic costs, discounting and depreciation are used.

Outputs: The tool provides outputs as tables, except for one chart for administered vaccines. The tables provide a total baseline and future costs as well as financial and economic costs in local and United States dollars per fully vaccinated person. Total costs are presented for vaccines and syringes and by each activity type. Summary tables are generated for counts and population coverage.

Institutionalization: The manual suggests a robust planning process and the creation of a team with roles and responsibilities. However, similar to the SIICT, the C4P tool is only used to estimate the costs of introducing a new vaccine, meaning there is no need for institutionalization.

Limitations: The tool does not provide information on funding gaps or what specific financing sources fund, nor does it show the payer perspective. It was updated for multiple age cohort vaccination in May 2019 and is now running as version 4 (updated in July 2020), yet the user guide still applies to the tool's previous version (for single age cohort vaccination only) and is dated 2016. The user guide for the latest version (multiple age cohort vaccination) is not yet available. Some aspects in the user guide are not present in the tool, such as a subnational analysis and strategy worksheet and outputs in form of charts. The user guide suggests carrying out a scenario analysis by using different service delivery strategies or adjusting coverage rates, which is not built into the tool.

The tool's estimated financial and economic costs cannot be directly used to estimate resource requirements. For financial costs, donated vaccines must be excluded and the value of capital investments must be depreciated. The tool cannot be used for budget mapping or budgeting cycles.

3.7 OneHealth tool, 2012, 2020[12]

Purpose and scope: The OneHealth tool was first released in 2012, along with a technical note and start-up manual. Since then, there have been several software updates to the tool. The tool provides a unified framework to support integrated planning for health services and health systems, and is intended to support the integration of programme-specific plans and costs within broader health sector strategies. The tool can be used to explore:

1. The cost implications of scaling up different health programmes, strategic investments in health system readiness or service packages.

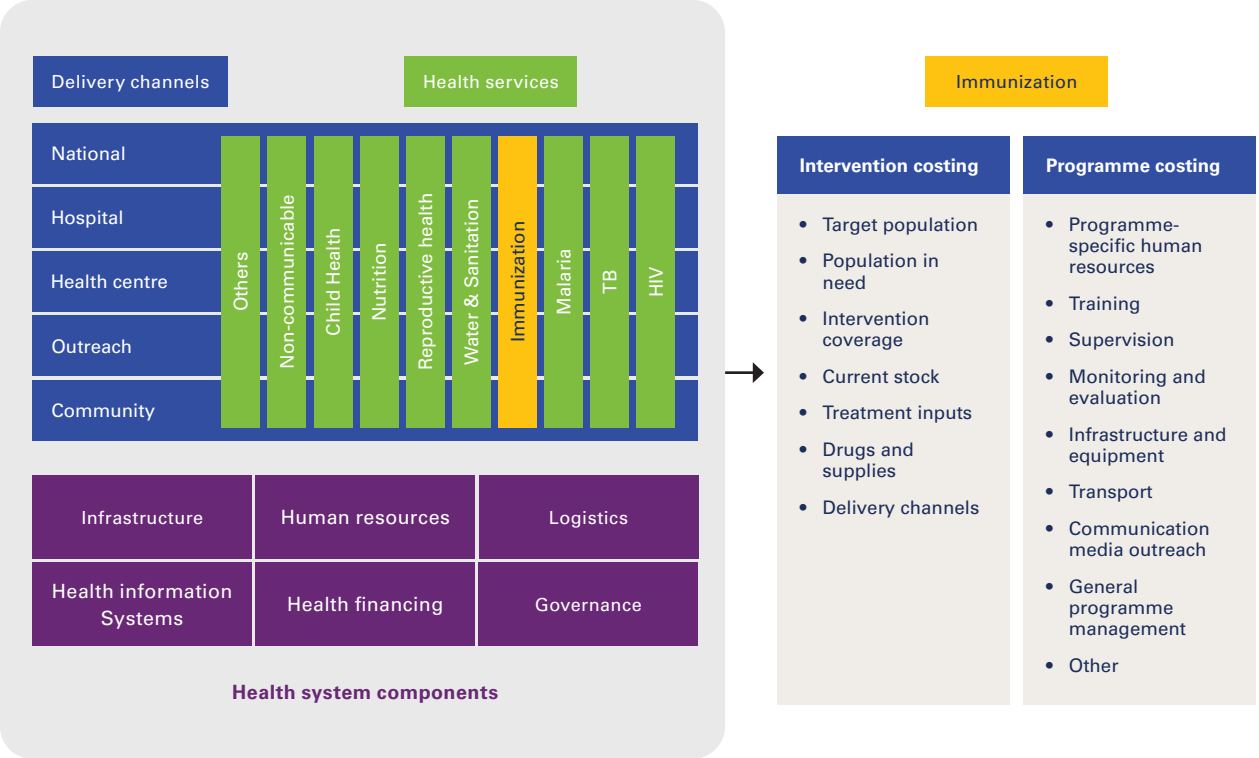
2. How planned health system investments match the required system capacity to deliver different service packages.

3. The health impact from expanding health intervention coverage and addressing risk factors when impact modules are activated.

The tool allows users to map costs into various budget structures, project available fiscal space and examine the financing gap. The greatest benefit of using the tool to inform disease programme planning is when it can be fully integrated into a broader planning process that examines the entire health system and includes a discussion on resource allocation and priority setting both between and within programmes.

Description of tool: The tool uses Windows-based software (Spectrum version 4.761) and is organized in a modular format. Health services are organized in disease programme or platform modules (of which one programme module is immunization), whereas health system modules are designed around the six health system building blocks: i) health workforce; ii) infrastructure; iii) logistics and supply chain; iv) health information system; v) health systems financing; and vi) governance. The health services modules are organized around delivery channels so that the costs of any programme can be estimated. Costs under each health services module are also estimated for interventions and the programme, as shown in Figure 1. Each vaccine is considered as an intervention under the immunization module. Coverage targets and doses required for each vaccine are set by the user and prices are either selected from a dropdown list or entered into the tool to estimate the direct intervention costs of vaccines and supplies. The programme costing module requires inputs for activities such as supervision, training, infrastructure and equipment, among others. Any number of headings can be added under programme costs and resources can also be entered by administrative level. Health system modules can be used to estimate shared costs, including the health workforce and logistics.

Figure 1. OneHealth tool components for health systems and health services and areas for immunization programme costing



Source: Adapted from a presentation on the OneHealth tool, supported by the United Nations Inter-Agency Working Group on Costing; K. Stenberg.

The tool allows users to select a country and download related default data stored at the national level that includes demography, epidemiology/disease burden, coverage rates, health service input prices, currency exchange rates and certain health system requirements. Users can view, use and/or change the default data. The tool can create subnational projections, but does not store default data for lower levels. Users can select a baseline year and then decide on the years for which to create cost projections.

Methodology: The OneHealth tool uses a modular approach, meaning that health interventions can be allocated to different disease/programme modules, depending on the user's preferences and the country context. It links planned increases in intervention coverage with the required increase in system capacity, enabling users to compare service targets with planned health system investments. The tool has an optional bottleneck analysis function, which users can use to identify service coverage constraints and then develop action plans to overcome them.

The immunization programme module has two main components: intervention costing and programme costing (Figure 1). The tool has default delivery modes – fixed and community facilities, outreach, hospitals

– that users can edit as needed and to which they can add new ones if required.

The interventions listed under the intervention costing tab for the immunization programme are the vaccines that would be delivered for a given coverage. The tool uses default data on treatment inputs, including coverage and the prices of different vaccines and supplies, the number of doses required per covered population and the mode of delivery. Users should check these default data and change them as needed. Price data can be changed from year to year, reflecting expected future price changes. The cost of human resources time is not estimated in the immunization module, but the data on total health providers time required for delivering immunization interventions as per the service protocols can be estimated and is provided in the results section of this module. These data are compared with the planned human resources capacity in the system, and provide human resource planners with insight on the immunization programme's staff requirements.

Programme costing under the immunization module is linked to both operational costs for running the programme and administration costs for program management and administration. Operational costs include IEC, training (start-up and in-service), quality assurance, demand generation, transport, supervision and office expenses, among others, which can be added as required.

For a given activity and delivery channel, costs are estimated using an ingredients approach (price x quantity) for each input (vaccines and supplies) for all the covered population. Only manufacturer prices for drugs are included in intervention costing, with distribution costs and taxes covered under logistics in the health system module. All specific costs for immunization and paid for by the immunization programme, such as vaccines, consumables, per diems for staff, training, can be recorded in the immunization module, whereas shared costs, such as staff, vehicles (maintenance or purchase), infrastructure or equipment that are used for multiple programmes and diseases, are considered part of the health system module. The cost of supply chain management is part of the logistics module under health system costs.

The tool also includes costs that may be funded by different sources. Within the budget mapping module, users can first map different costs of the immunization program to different budget categories (such as human resources, training, equipment, vaccines, supplies, supply management, monitoring and evaluation, planning and overheads), before mapping the budget categories to different financing sources. All unallocated expenditures represent the funding gap for a given programme, which can be assessed by programme, but not by activity.

The tool provides several commands in a dropdown menu to copy, paste, duplicate or interpolate data between different years. Copy and paste functions between the tool and Excel can be used for several tables and also for the tool's outputs.

Outputs: These include total and incremental costs by year, programme, activity, type of vaccine and mode of

delivery platform, as well as budgets by financing source and cost implications for scale-up. The tool also produces outputs that can be used to examine any health system implications in delivering a specific package, such as on human resources, capital equipment and logistics. Outputs can be used to compare costs with available resources, assess financing gaps and conduct scenario analysis. The tool can display several types of outputs/results, the format of which can be selected (i.e. table or chart) for one or several years and by total or subgroup.

The tool can be used for equity sensitive planning (e.g. low-income quintile compared with other quintiles) and the outputs for each projection can be combined to inform a national health plan. However, this would require data to be specified, available and entered into the tool for different population subgroups.

Institutionalization: The tool is very comprehensive and significant training is required to use it. Various resources are available, including the user guide, start-up manual, technical notes and frequently asked questions. These can be downloaded from www.avenirhealth.org/software-onehealth.

Limitations: The tool has significant data requirements as it covers the entire health system, while also allowing for detailed planning by programmes and interventions. Compared to Excel tools, it is slow to upload as it goes through iterations to upload country data for several programmes. The tool is Windows-based and requires specific software to run on Macintosh computers.

Some components included under the health system module are specific to the immunization programme and are not shared costs. For example, the cold chain, costs of supply chain management for vaccines and injectables, distribution and taxes should all be included as part of the immunization costing module. Furthermore, to estimate correct vaccine quantities in the immunization module, coverage rates should account for vaccine wastage rates, buffer stock and stock outs, which are currently included under the logistics module. Resource requirements for quantities procured internationally should be calculated using procurement prices (as opposed to domestic), to which the costs of handling charges, freight and taxes should be added.

The term programme costing is confusing when used as part of immunization costing, as immunization itself is a programme. The tool's user guide notes that programme activities should be treated as suggested activities for consideration and not as an absolute requirement for scaling up. However, these operational activities are essential for running the immunization programme and should be included as an essential part of resource requirements.

Estimation methods for same components seem to differ across the immunization and health system modules, which makes it difficult to determine whether there is consistency. In-service training is one such example, as it can be estimated as a percentage of trained staff or in terms of the cost per trainee per the type of training and number of trainees, or as a lump sum value.

There is no clear distinction between default values and values that are manually changed. Although the tool provides a data source and comment option, colour coding for default values would be more helpful.

The tool does not provide a funding gap for each activity or input, but instead provides unallocated funds for the whole programme. For the immunization programme, the results for financing sources and gaps are not displayed across different types of vaccines or programme activities, which makes it difficult to determine which products and activities have funding gaps.

The tool's website contains eight documents on its guidelines and manuals, but it is not clear for what purpose or how these documents should be used. For example, the current OneHealth tool user manual is more than 600 pages, but only has one short chapter on costing, as it focuses mainly on impact modules. The start-up or technical manual, which provides clarity on the framework, function, scope and way the tool is set up to conduct different analyses, is from 2012 and mentions future updates in several places. Guidelines on what should be included under a programme (e.g. immunization) would be helpful for programme planners.

3.8 WHO OneHealth TB module companion book for TB budgeting and funding analysis, 2020

Purpose and scope: The primary purpose of the WHO OneHealth TB module companion book for TB budgeting and funding analysis, henceforth described as the TB budgeting and funding analysis tool (TBBFT) (2020) is to facilitate budgeting for national strategic plans for TB control.[13] The tool is linked with the OneHealth tool methodology and the End TB Strategy. Users can follow a step-by-step process to establish a budget based on epidemiological projections, available funding per TB intervention and programme area, and calculate the funding gap. Results can be mapped to the formats required for budgeting national strategic plans or for funding applications to donors. Based on the population covered, the tool can estimate budgets, where financing sources should be directed and the funding gap for five future years. It also helps inform analyses of funding by different sources, as well as gap analyses by programme, activity and at a more detailed level.

Description of the tool: The tool uses Excel and has been designed to facilitate data collation for use in the OneHealth tool, acting as a repository of results produced in the OneHealth tool that can be shared with planners. It can also be used independently to budget for TB in line with the OneHealth methodology, but with a single scenario. The tool has 73 worksheets to facilitate data collection for a detailed list of interventions, programme activities and inputs for budget analysis, and presents results by commodities, service delivery (staff costs) and programme activities. Users must first choose a country to prompt default baseline data on epidemiology and unit cost data, and select a target population for specific interventions. The tool has sheets that define terminology and interventions and uses baseline data for budgets,

human resources and facilities. The unit cost sheet is used as a repository for all drugs, laboratory tests, consumables, equipment, visits and inpatient unit costs used throughout the budgeting. It suggests data to be collected or applies its available default data. Th calculation sheets for each intervention calculate average costs of consumables, reagents and supplies, the results of which are reflected in the unit cost repository page. Based on services and prices, the tool calculates commodities and patient support budgets.

For staff time, medical costs per intervention by service delivery type are estimated, using primary data from external calculations or staff time norms and staff salaries. The tool has a template for estimating the cost of a single training session or meeting. This template is followed by 27 sheets for entering the costs of programme activities and logistics. This produces three different result sheets and mapping to Global Fund and WHO budget formats, as well as additional mapping for national plans that can be integrated. An available funding and gap analysis can be completed by interventions, for the TB programme and at a more detailed level through using the tool's pivot tables.

Methodology: The TBBFT starts by listing broad interventions that are in line with the TB national strategic plan. Target populations and populations in need are entered into the tool for different interventions for a baseline year and future years. These data can be taken from the OneHealth TB module or can be added by users.[VIII] The baseline budget for TB in the national strategic plan is entered and the costs per patient by treatment type are calculated, based on the number of patients on different types of treatment. Each line item under budget categories is explained or defined. The tool has several sheets to collect baseline health system data for different types of health facilities, construction costs, operating costs, staff positions and staff salaries.

When available, the TBBFT uses unit costs for delivering interventions, which are generated from national primary data-collection efforts carried out in line with global standards.[IX] Unit costs are either compiled locally or based on international standards for the treatment of different TB severities (first-line, second-line, extensively drug-resistant, laboratory, prevention, screening), using the costs of drug regimens, supplies and reagents. Commodity costs consider stockouts and wastage. Unit cost data are extracted from primary data collection using a costing tool that extrapolated the data to other settings. The Global Health

VIII Target populations can be estimated using two different methods: simple TIME Estimates (statistical model) or TIME Impact (dynamic mathematical model).

IX The value TB costing suite and TB costing user guide are additional resources that calculate both the financial and economics costs and recurrent and capital costs of TB interventions delivered at health facilities. The value TB costing suite calculates unit costs for each intervention in terms of service, outputs (drug-sensitive TB, drug-resistant TB, multidrug-resistant TB, extensively drug-resistant TB), activity (outpatient visit, inpatient bed day, support service), input category (staff, consumables), delivery platform (hospital, clinics, community), type of technology used for treatment (first-line, second-line, palliative care, monitoring) and population receiving the treatment (children, adults, those with comorbidities). These unit costs can be used in the TBBFT.

Cost Consortium costing tool[x] could be used for this purpose, but requires the consumables component to be extracted to follow the OneHealth tool methodology.

The costs per intervention per patient are calculated based on the delivery of full treatment or an activity. The number of services per intervention are collected and total costs per intervention are calculated using coverages for a baseline year and future years with intervention quantities and prices. Intervention costs are calculated separately for each delivery channel.

Staff time, equipment, space/utility unit costs must be compiled. Staff costs can be calculated using the time required by delivery providers to carry out the intervention at different delivery levels, or can use the number of outpatient and inpatient visits for the intervention. Staff costs per minute are estimated for each intervention, with the total human resource costs then calculated for a baseline year and future years based on the volume of services.

The costs of programme activities are calculated separately in sheets for management, administration and maintenance, training, monitoring and evaluation, infrastructure, equipment, transport, communication, advocacy, research and partnerships. Other costs under the programme components are for meetings, consultants, material to be distributed and mass media, among others. Costs of new equipment specifically for the TB programme, along with their maintenance, are also included.

Logistics costs are taken from the health system component in the OneHealth tool and are included in the TBBFT. These costs include warehouse operating costs, vehicle and transport costs and staff logistics costs.

Outputs: The TBBFT presents the budget results for each intervention by different cost types – commodities, programme costs and human resource time costs – for five future years. Each activity line or budget area is mapped to a cost type (commodity or programme) and can also be mapped to Global Fund and WHO budget reporting categories and national strategic plan categories. Staff costs under each intervention are differentiated by service delivery type. Annual budgets, committed funding by different domestic and international sources and gaps for TB by interventions are presented for different years. Staff time costs are not added as a default but are presented separately and can be added, if relevant.

Institutionalization: The TBBFT has only recently been released (February 2020). Its linkages with Global Fund and WHO budget categories indicate its sustainability for countries completing Global Fund applications or if mapping is completed for country budgets.

Limitations: The TBBFT is in line with the OneHealth tool and uses OneHealth terminology and methodology, which may make it difficult to follow for those unfamiliar with the OneHealth tool. The TBBFT has a user guide, but only for sample interventions. It uses unit cost data of different items and treatment

x See https://ghcosting.org/pages/tools/costing_tool.

categories to produce a baseline budget, which can be a tedious exercise if unit costs are not available. Despite being quite detailed in terms of supporting costing teams to thoroughly consider interventions and activities that are required for the TB programme, the data requirement is extensive. In fact, the presentation of components across 73 sheets may be daunting for programme planners. It is difficult to understand the linkages through these different sheets to the OneHealth tool and how the OneHealth tool can be used for inputs and outputs. The tool's functionality with the OneHealth tool is missing in the user guide, especially with respect to budgeting.

The tool has the interesting function of being able to link interventions to Global Fund and WHO categories, and also uses the budget categories of national strategic plans. However, its ability to link country budget categories and budgeting cycles is currently lacking.

4. Conclusions

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The cMYP tool, OneHealth tool and TBBFT all have several functionalities to estimate resource requirements for a strategic plan, while the PAHO tool's purpose is to provide estimates of resource requirements for AOPs. The TBBFT, OneHealth tool and Uzbekistan tool can link resource requirements with budget templates. The Uzbekistan tool is particularly useful for vaccine and injection budget planning, but it cannot estimate other programme requirements. The SDFT is useful for estimating quantity requirements and gaps for vaccines and supplies, but cannot predict costs. The Flutool plus and C4P tools both estimate economic and financial costs separately and by activity, but are not suited specifically for budgeting and planning cycles.

5. Recommendations

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Based on this assessment of different costing tools, key recommendations for developing an approach to estimate the costs of an NIS include the following:

1. Resource requirements should be calculated separately for AOPs and NIS based on activities and inputs (specific to each activity) for the immunization programme.

2. The assessed tools use different terminology and categories for components, interventions and activities and for cost/category inputs. Components and subcomponents, with which EPI staff are familiar, can be defined based on EPI review guidelines.[14] These include:

   a. program management and financing – policy, governance, coordination

   b. human resources and management – capacity-building, supervision, etc.

   c. vaccine supply, quality and logistics – supply, cold chain, transport, waste

   d. service delivery – delivery strategy, quality

   e. immunization coverage monitoring

   f. disease surveillance

g. demand generation-advocacy, communication and community engagement.

3. NIS activities included under strategies and objectives can be mapped to these EPI components and subcomponents to find their costs in a systematic manner. The activities can also be classified as high, medium or low priority and as new, ongoing or replacement activities.

4. Resource requirements that are linked to estimates of required quantities of vaccines and supplies should take into account population coverage, estimated wastage rates, buffer stock and current stock available. The estimated requirements for different vaccines and injection supplies should also be differentiated according to routine and supplementary immunization campaigns and by types of populations covered for each type of vaccinations.

5. Prices used to estimate resource requirements for vaccines and supplies should be differentiated for commodities purchased locally and procured internationally, as the latter will include freight charges, taxes, handling charges and customs fees, and require exchange rates to estimate resource requirements.

6. While most tools tend to use the ingredients approach to calculate costs, simpler estimation methods should be used for programmatic activities where possible, such as analogous estimation, expert judgment or parametric estimation.

7. AOPs may be planned by administrative level. This approach can be complicated for NIS resource planning, which should therefore be restricted to the national level.

8. Tools should include a country budget template and provide the functionality for countries to link their budgeted amounts to it, which the immunization programme can then directly use for resource requirement needs. Planned and executed budgets must be compared annually to adjust resource requirements for objectives and activities in the NIS. Executed immunization programme budgets for the past year should be used to understand the resources and strategies already funded through the immunization programme.

9. Executed immunization programme funding should be compared to macro variables, such as government health expenditures and gross domestic product, and trends should be assessed to understand the possibility of a larger fiscal envelope (i.e. the extent of budgetary/governmental resources available) for immunization programmes. Trends in executed contributions to immunization programmes from different donor sources should also be compiled and future funding from ministries of health and other sources for each component should be planned based on past funding. NIS resource requirements for future years should be in line with incremental costs and adjusted every year based on the AOP expenditure and programme performance review.

10. Shared costs are an important part of health systems planning, but they should not be included when estimating resource requirements for immunization budget calculations. Nevertheless, it is useful to know shared resource requirements for planning purposes and all shared resources essential for NIS implementation should be listed, with an estimate of required physical resources.

11. In terms of functionality, tools should:

    a. be transparent and logical, allowing users to see all inputs, calculations and outputs

    b. be easy to navigate and provide for consistency checks

    c. provide a standard list of vaccines and supplies, including the presentation, dose and price of each vaccine, along with the option for countries to choose relevant vaccines for their planning

    d. provide default data as much as possible and allow countries to override these if required

    e. show links between executed budgets, AOPs and NIS (a checklist should be used to record activities planned in NIS and executed in AOPs)

    f. have the capability to produce outputs as tables and graphs

    g. have the capability to generate indicators for financial sustainability and scenarios analysis

    h. have an easy-to-use user guide, training material and online support, as well as clear inbuilt steps.

12. Institutionalization of any tool is only possible if there is a higher-level directive and the tool is useful for the budgeting, monitoring and dissemination of certain indicators. Higher-level directives are possible for countries adopting an NIS, but budgeting is an important process that every country follows. Countries have their own budgeting methods, which include programme-based, input-based or activity-based budgeting, and line items can vary (ranging from 0 to 42, with an average of 8 across 33 countries surveyed in Africa)[15] across countries. Broader line items should be suggested for country mapping or country budget line items should be linked to a standard classification of resources, such as by EPI components. It is important that countries use indicators that are linked to policy options (such as fiscal space) and that they monitor their resource requirements for immunization.

6. Annexes

Annex 1.
List of tools assessed with the user guides and software tool version

Tool name and tool owner	User guides reviewed with web links	Software tool version and year
Immunization-specific tools		
I. Comprehensive Multi-Year Plan (cMYP) costing and financing tool Tool owner WHO	WHO-UNICEF Guidelines for Comprehensive Multi-Year Planning for Immunization, September 2013 update https://apps.who.int/iris/bitstream/handle/10665/100618/WHO_IVB_14.01_eng.pdf Comprehensive Multi-Year Planning (cMYP): A tool and user guide for cMYP costing and financing, 2014 update https://apps.who.int/iris/bitstream/handle/10665/128051/WHO_IVB_14.06_eng.pdf	1. cMYP costing and financing tool model V3.9.8, December 2018 No weblink 2. Filled V3.9.4_ML revised February 2017 from Mongolia, personal communication
II. SDFT Tool owner UNICEF	SDFT No weblink	UNICEF Supply Division costing tool, 2019 No weblink
III. Uzbekistan National Immunization Programme budget tool Tool owner UNICEF	Uzbekistan vaccine procurement budget template: user guide, 2020 No weblink	Uzbekistan annual budgeting of vaccines and injection supplies template, 2020 No weblink
IV. PAHO immunization costing tool Tool owners PAHO and WHO	Instructions for Developing the Annual Plan of Action of the Expanded Program on Immunization https://docplayer.net/29002241-Instructions-for-developing-the-annual-plan-of-action-of-the-expanded-program-on-immunization.html	PAHO annual Plan of Action tool, 2014 No weblink

Tool name and tool owner	User guides reviewed with web links	Software tool version and year
V. Flutool plus: WHO Seasonal Influenza Immunization Costing Tool (SIICT) Tool owner WHO	Flutool plus – WHO Seasonal Influenza Immunization Costing Tool (SIICT) https://apps.who.int/iris/bitstream/handle/10665/331931/9789240004030-eng.pdf	WHO Seasonal Influenza Immunization Costing Tool (SIICT) version 1.1 https://www.who.int/teams/immunization-vaccines-and-biologicals/immunization-analysis-and-insights/vaccine-impact-value/modelling/influenza-economics
VI. Cervical Cancer Prevention and Control Costing (C4P) tool: HPV vaccination module Tool owner WHO	WHO Cervical Cancer Prevention and Control Costing (C4P) Tool (Cost Projection): Section 5 – Prevention and control costing – Analysis and planning module for screening and treatment www.who.int/immunization/diseases/hpv/IDCCP_Toolkit.PDF HPV vaccination module: 5-year scale-up to national introduction user guide, version 2.1 No weblink	WHO Cervical Cancer Prevention and Control (C4P) vaccination module, version 4, July 2020 https://cdn.who.int/media/docs/default-source/immunization/hpv/who-cervical-cancer-prevention-and-control-costing.pdf?sfvrsn=b56c33cb_7
Other health programme costing tools/tools linked indirectly to immunization		
VII. OneHealth tool Tool owner WHO and Inter-Agency Working Group (IAWG)	OneHealth tool: Technical Notes, 2012 OneHealth tool: Start-up Manual OneHealth tool: User Manual, 2019 https://avenirhealth.org/software-onehealth.php	OneHealth tool, version 4.761, August 2019 https://avenirhealth.org/Download/Spectrum/OneHealthInstall.EXE
VIII. TB budgeting and funding analysis tool (TBBFT) Tool owner WHO	Costing Guidelines for Tuberculosis Interventions www.who.int/publications/i/item/9789240000094 WHO OneHealth Tool TB Module Companion Book: Paediatric TB interventions – Practical overview, 2020 No weblink	WHO OneHealth TB module companion book for TB budgeting and funding analysis version 1, February 2020

Annex 2.
Positive aspects and limitations for each tool with respect to resource requirement estimations

Tool	Summary conclusions for each tool
cMYP	**Positive aspects** The tool is quite detailed and provides a programme's baseline costs as well as future resource requirements and funding gaps for products by activities and separately by modes of delivery. Vaccine supplies take into account wastage and buffer stocks. It also links resource requirements to sources of financing and funding gaps for recurrent and capital costs and separates these by modes of delivery. However, activities and inputs are mixed.
	Limitations The tool is not well linked to budget cycles and operational plans. It does not seek to cost strategies outlined in NIS, but instead for a programme as a whole. It is therefore not clear which costs represent 'business as usual' and which represent new activities and initiatives planned under an NIS.
SDFT	**Positive aspects** The tool provides detailed information on different quantities that are procured from domestic sources and though different external sources along with gaps in requirements.
	Limitations It does not provide information on costs and budget requirements and does not take into account any activities.
Uzbekistan National Immunization Programme budget tool	**Positive aspects** The tool fits into the country's budgeting process very well and only takes into account vaccines and supplies, which is a major cost component of the immunization programme.
	Limitations Assumptions about other activities included elsewhere may not allow the vaccination programme to run well. These operational components of the programme may therefore need to be budgeted in separate lines, which prohibits the estimation of resource requirements if new activities are introduced.

Tool	Summary conclusions for each tool
PAHO	**Positive aspects** The tool uses a component/activity and input approach to estimate resource requirements by administrative level for a given component. Resource requirements for vaccines, supplies, the cold chain and activities are separated. The resources required for given activities are mapped to financing sources and funding gaps are estimated. The tool compares budget resources with executed resources.
	Limitations Some shared costs seem to have been built into the activities. The tool does not estimate the resource requirements for future years, nor does it estimate funding gaps separately for recurrent and capital costs. It also does not explicitly provide the functionality to estimate vaccine requirements, taking wastage, stockouts and buffers into account. It is not clear whether the tool is linked to budgeting codes and budget cycles.
Flutool plus/ SCIIT	**Positive aspects** The tool estimates economic and financial costs separately. Estimations for resource requirements, linkages to financing sources, and funding gaps are provided separately for products and activities and for recurrent and capital costs. The tool provides scenario analysis for changes in coverage or a delivery strategy. Vaccine prices can be differentiated for different procurement options. The tool also takes into account wastage and stockout buffers. It is easy to understand and use.
	Limitations The tool uses economic costs to calculate resource requirements. Shared costs are included. It cannot be used for budget mapping or budgeting cycles. It only provides resource requirements for one future year.
C4P tool	**Positive aspects** The C4P tool is similar to Flutool plus, except it provides resource requirements for five future years. It also provides retrospective and prospective costs and baseline resource requirements can be estimated by types of population cohorts and by type of service delivery. Differentiated prices and adjusted quantities of vaccines and supplies can be estimated. It provides resource requirements using incremental recurrent costs and actual capital costs.
	Limitations Shared costs cannot be estimated separately and are part of economic costs. The tool does not provide information on funding gaps, nor on who finances what activities. The payer perspective is not shown in the tool and it cannot be used for budget mapping or budgeting cycles.

Tool	Summary conclusions for each tool
OneHealth tool	**Positive aspects** The tool has a separate module for immunization in which intervention and programme costing can be done independent of the health system. Resource requirements for vaccines, supplies and programme activities can be estimated for the baseline year and future years. Shared costs can be estimated separately under the health system module. Programme budgets can be linked to financing sources and the programme's funding gap can be estimated.
	Limitations Costs and resources for the cold chain, handling charges, taxes and wastage rates, among others are not part of immunization programme costing but are included as a part of logistics under health system costing. Budget and funding gap analysis is carried out at the programme level and therefore cannot be separated for activities and for recurrent and capital expenditures. Although the tool has budgeting and fiscal space modules, their use for programme-specific planning is limited.
TBBFT	**Positive aspects** The tool is for planners and payers and assesses budget requirements for future years by interventions, commodities and delivery channel. Shared resource requirements are estimated separately. The tool uses OneHealth's costing tool terminology and methodology. The logistics part is included in programme costing. The costs of activities and commodities can be linked to budget heads. Financing can be estimated by different financing sources and funding gaps can be estimated by activity and commodity. The tool uses both international and domestic prices for commodities.
	Limitations The data requirement is considerable, and 73 worksheets per Excel file is overwhelming. The tool's user guide is linked to specific interventions. The tool does not have sustainability indicators, nor can it be used directly for scenario analysis. Outputs are provided as pivot tables and no graphs are linked to the results. Links to the OneHealth tool are via the manual transfer of the price and quantity and any other inputs.

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