

## Cost of implementation of malaria vaccination programmes in five sub-Saharan African countries (Burkina Faso, Kenya, Ghana, Mozambique and Tanzania)

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### Introduction

- ❑ The malaria vaccine candidate RTS,S/AS01 has received a positive scientific opinion from the European Medicine Agency and has been recommended for pilot implementation by the World Health Organization (WHO)
- ❑ RTS,S/AS01 vaccination in children 5-17 months of age at the first dose, with 3 doses given with 1 month interval, and the 4th dose 15 to 18 months after the 3rd dose would require new vaccination visits
- ❑ In order to prepare the potential large scale introduction of RTS,S/AS01 it is important to estimate the costs and resources needed.
- ❑ This study complements other cost studies on the vaccination for other antigens and explores different scenarios of vaccine administration such as outreach approach

## Objectives

Estimate the incremental resources and cost of implementation of RTS,S/AS01 in 5 sub-Saharan countries: Burkina Faso, Kenya, Ghana, Mozambique and Tanzania

### Collection of information on how the current EPI is deployed

- Necessary EPI staff, competencies and skills
- Necessary logistical resources and supply/distribution/storage chain aspects up to the point of vaccination;

### Expected changes needed to implement RTS,S/AS01

- Determination of organizational changes and additional resources necessary
- Under different scenarios of co-administration with DTP or with Vitamin A supplementation or new visit outside current EPI

EPI = Expanded Programme of Immunization

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## Study team

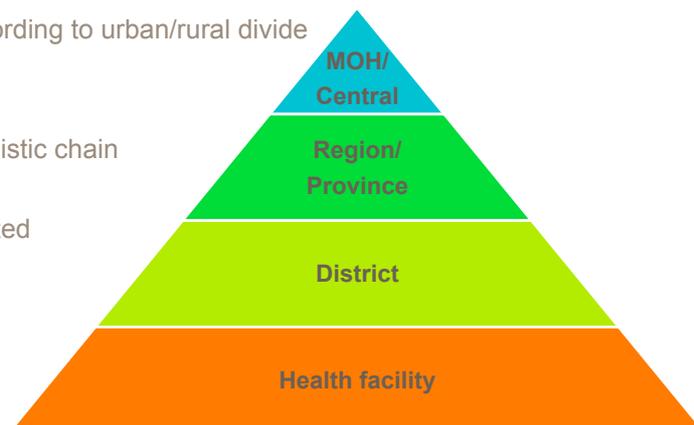
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- **Burkina Faso:** Fadima Yaya Bocoum, Institut Free Afrik, Ouagadougou
- **Ghana:** Justice Nonvignon, School of Public Health, University of Ghana
- **Kenya:** Vincent Were, Simon Kariuki, Centre for Global Health Research, KEMRI
- **Tanzania:** Mwifadhi Mrisho, Fakihi Bakar, Ifakara Health Institute
- **Mozambique:** Khatia Munguambe, Sergio Alonso, Centro de Investigação em Saúde de Manhiça
- Christophe Sauboin and Oscar Leeuwenkamp for GSK Vaccines in Belgium



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## Methods: data collection

- 5 countries included in the study
  - Different geographical, socio-economic and epidemiological conditions
- Within each country choice for sites according to urban/rural divide
- Key informants of the EPI interviewed at all levels of the health system and logistic chain
- Semi-structured interviews were conducted from February to December 2015 among 57 EPI focal persons



MOH: Ministry of health

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## Methods: Analysis strategy

**Micro-costing approach: collect information on resources and costs based on different scenarios of delivery i.e. health facility or outreach**

Key informants from EPI

Resources needed:  $q_i$

Existing capacities:  $e_i$

International references (WHO-CHOICE)

Unit costs:  $p_i$

### Estimation of marginal costs per dose delivered

$C_{ms}$  = additional costs incurred when expansion of existing resources if required

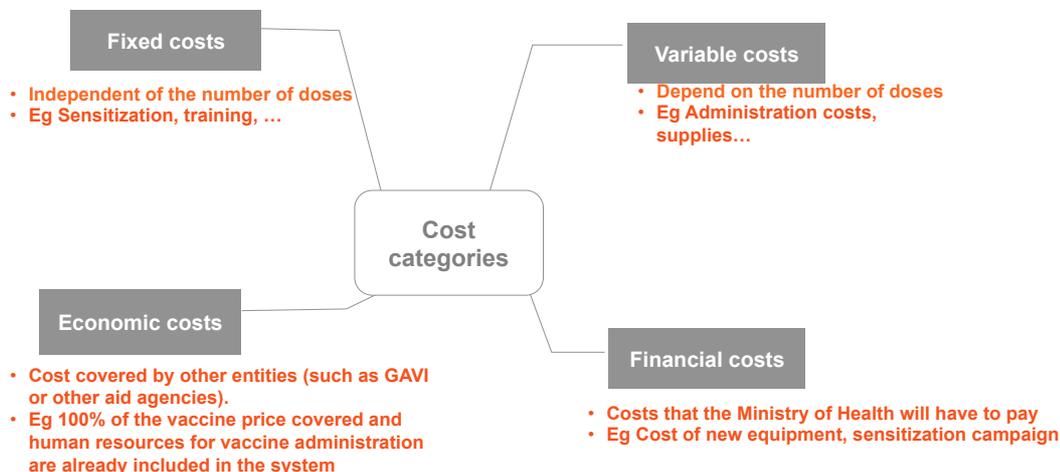
$$C_{ms} = \sum_{i=1}^n p_i * (q_i - e_i) \quad \text{if } q_i > e_i$$

Where  $i=1, \dots, n$  represents the different items to be costed per dose delivered  
Where  $s$  represents different scenarios: vaccination at the health facility or in outreach

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## Methods

Costs classification included in the analysis



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## Methods

Types of costs specific to each level

National level	<p>Additional freight based on UNICEF costs and internal transportation</p> <ul style="list-style-type: none"> <li>- Vaccine cost assumed to be US\$5 per dose [min US\$2, max US\$10]<sup>1</sup></li> <li>- Vaccine wastage</li> <li>- Training for 2 years based on average reported costs of the last training sessions on vaccination</li> </ul>
All levels	<ul style="list-style-type: none"> <li>- Sensitization campaigns for 2 years</li> <li>- Additional needs for surface (m<sup>2</sup>), cold space (m<sup>3</sup>), cars, motorbikes, cold boxes, personnel, were reported by interviewees after expressing a judgment on the current situation of resources utilization</li> <li>- Transportation: fuel, car, trucks</li> </ul>
Peripheral level of the health system (health facility)	<p>Administration of 1 dose vaccine either at the health facility or outreach</p> <ul style="list-style-type: none"> <li>- Human resources</li> <li>- Supplies (syringe, safety boxes, cotton,...) including wastage</li> <li>- Transportation costs (fuel, driver) for outreach scenario</li> </ul>

<sup>1</sup>Price range used in published analysis .e.g. Maire et al. 2006

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## Methods

Criteria for fixed costs imputation

### ANNUALIZATION

- Useful life years (WHO-CHOICE)
- Sensitization and training assumed for 10 years
- Human resources, except at peripheral level, is considered as fixed cost

### SPREAD OVER VACCINEES

- During the 1 to 10 years period based on useful life years of each resource
- At **national level**: United Nations estimates for birth adjusted for infant mortality
- At **regional and district levels**: most recent census information assuming the same proportion of births to the total population than at the national level
- At **peripheral/health facility level**: catchment population of infants for each provider

### MULTI-LEVEL AGGREGATION

- Need to account for potential double-counting of cost data across levels
- Assuming 80% of fixed costs at health facility level and 100% of fixed costs at higher levels contribute to total costs

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## Methods

Costs aggregation

- ❑ **Costs for vaccine administration** based on average costs of administration for all other injectable vaccines distinguishing two scenarios:
  - 1. Health facility**: all 4 doses administered at the health facility
  - 2. Outreach**: the first three doses administered at the health facility and the fourth administered in an outreach manner.
- ❑ **Total costs per fully immunized child** calculated by summing up the general costs at all levels imputed to every child to be vaccinated (fixed costs). Costs of administration and price of the vaccine (variable costs) are expressed in 2014 US\$
- ❑ Average, minimum and maximum costs are presented

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## Results

Summary of information on EPI

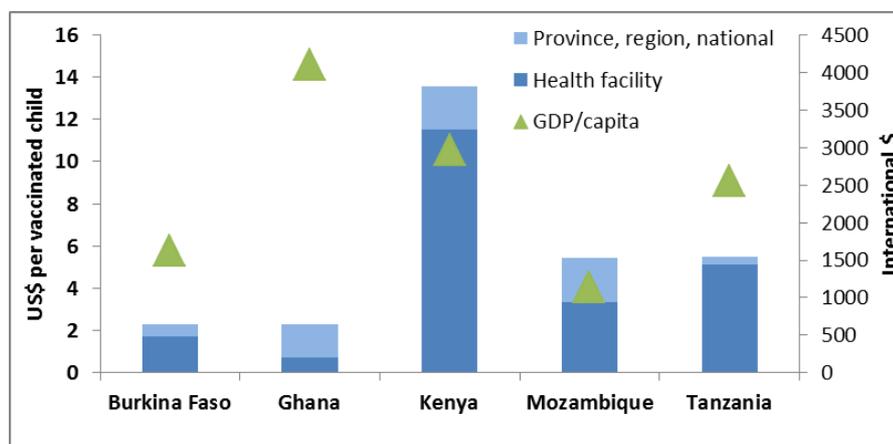
1. In all countries vaccination is performing well, resulting in close to 100% vaccination coverage
2. Recently EPI was stretched following the introduction of a number of new vaccines: e.g., pneumococcal, rotavirus and demonstration of pilot projects of human papillomavirus vaccines
3. Vitamin A administration is not performing well; vaccination is rather helping Vit A programme. Also oral administration requires different skills of the health care personnel than injectable vaccines
4. All countries, except Tanzania, already deliver a large part of the vaccination programme via outreach vaccination (more than 50% for some vaccines in Ghana)

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## Results

Fixed costs per vaccinated child

- Fixed costs in general higher at the health facility level than for other levels, except for Ghana
- No specific correlation with the Gross Domestic Product per capita (GDP/capita) in current international \$ (right axis on the graph)

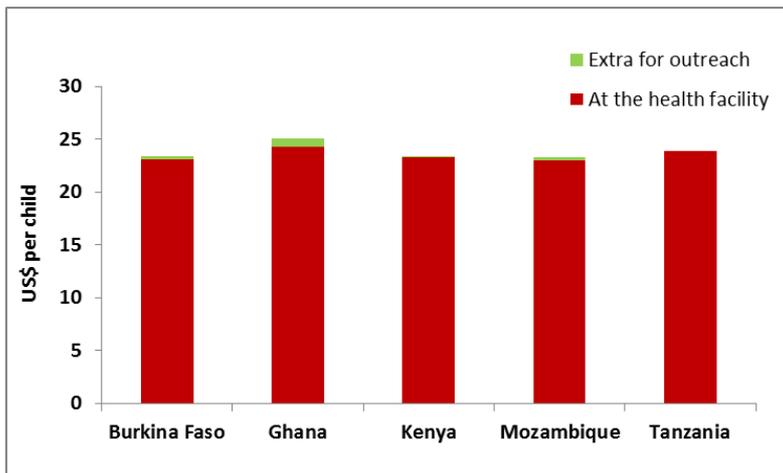


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### Results

Variable costs per fully vaccinated child inclusive a US\$5 vaccine price per dose

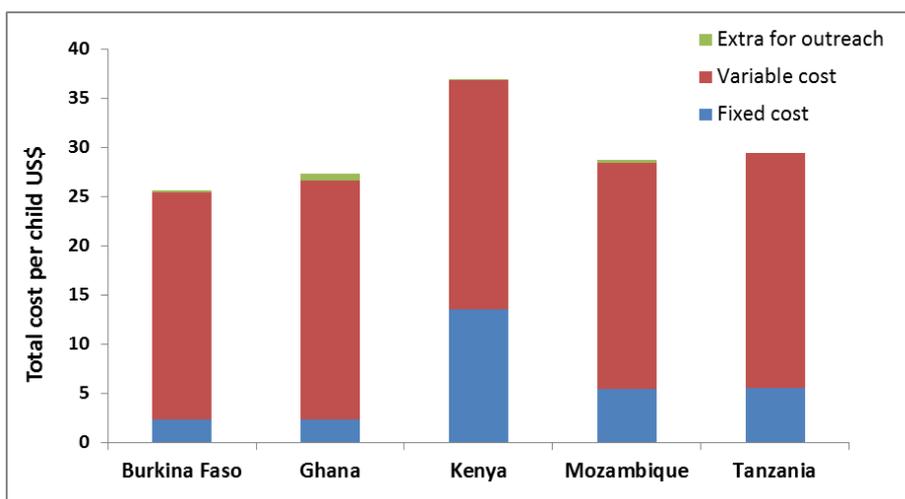
- Small variations in variable costs across countries which are mostly composed of the vaccine cost



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### Results

Total cost per fully immunized child based on a US\$5 vaccine price per dose

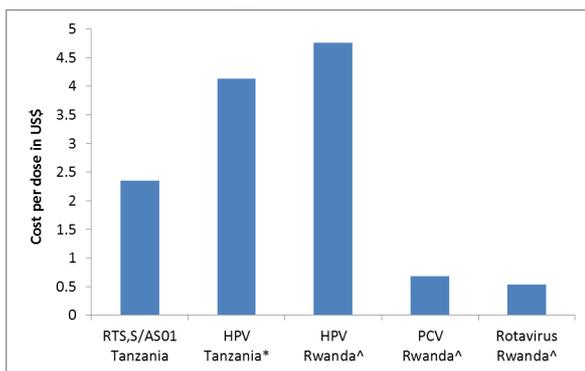


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## Discussion

Comparison with other vaccines delivery costs

1. Total costs for delivering one dose exclusive vaccine cost
2. As an example the cost estimate of RTS,S/AS01 administration in Tanzania falls in the range of other antigens
3. In Rwanda PCV costs might be underestimated as stated by the authors



HPV: Human papillomavirus  
PCV: Pneumococccal vaccine

\* Hutubessy et al. (BMC Med 2012).10:136. doi: 10.1186/1741-7015-10-136.; ^ Ngabo et al. (Vaccine. 2015) 33(51):7357-63. doi: 10.1016/j.

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## Discussion and Conclusions

1. Average incremental (marginal) costs for the introduction of the RTS,S/AS01 vaccine into the vaccination programs of 5 sub-Saharan African countries ranges from US\$25.42 (Burkina Faso) to US\$36.79 (Kenya) per fully immunised child;
2. The major share of costs is economic, thus, potentially not directly incurred by the Ministries of Health. Small variation of this cost is observed across countries;
3. Difficult to compare with other studies due to methodological differences;
4. Strengths of the study: primary data collection and contextualisation of the collected data;
5. Limitations of the study:
  - Self reported estimates with some potential bias;
  - Multilevel data with difficulties to identify double counting particularly for wastage
  - Potential effect of exchange rates variations not included in this presentation

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**Disclosures**

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