INVESTMENTS IN RTS,S VACCINATION PROGRAMS IN SUB-SAHARAN AFRICA YIELD A POSITIVE RETURN-ON-INVESTMENT

Return-on-investment for RTS,S Vaccination in 20 sub-Saharan African Gavi Counties, 2021-2030

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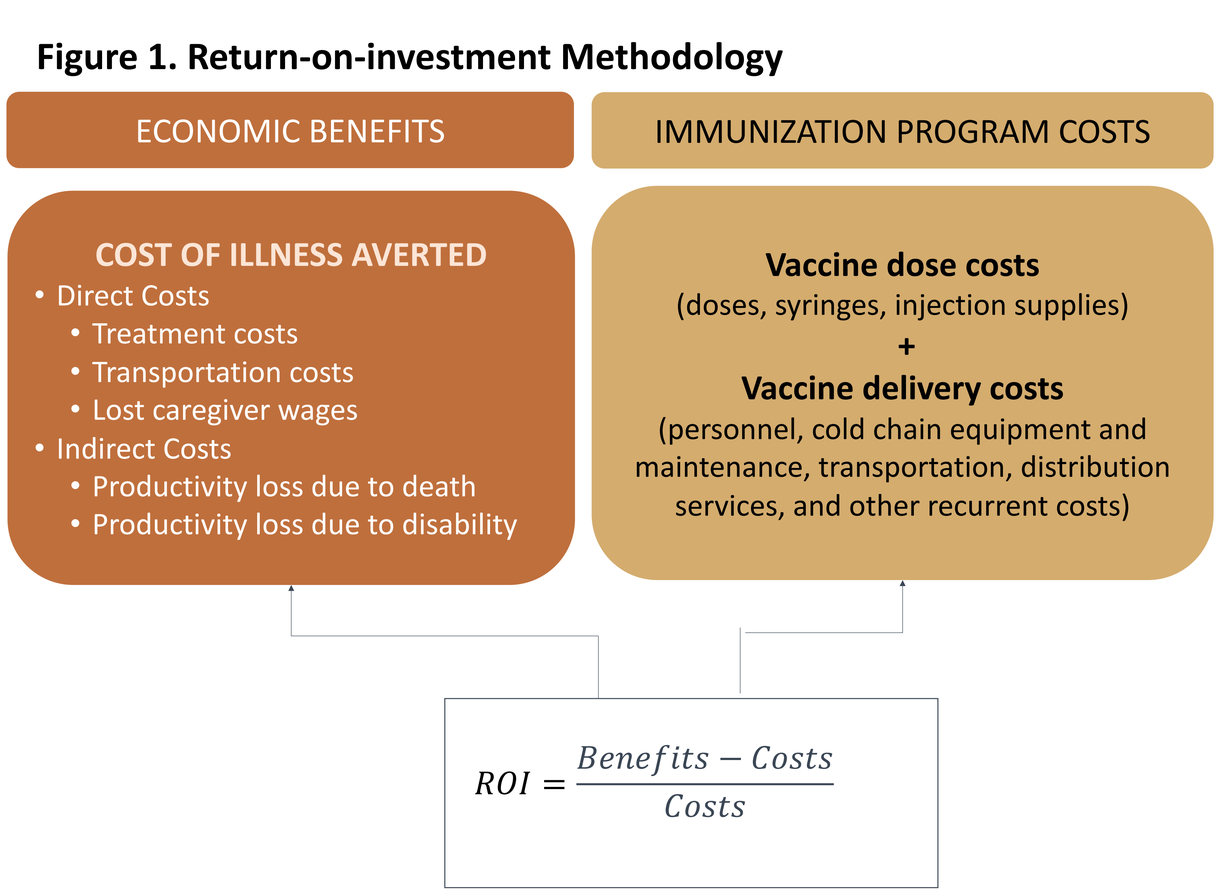
BACKGROUND: In 2021, the World Health Organization recommended the use of the four-dose RTS,S/AS01 malaria vaccine (RTS,S) in settings with frequent transmission of *P. falciparum*, equipping the global public health community with a valuable tool for malaria prevention. Economic evidence on malaria immunization programs was scarce, limited to pilot studies in a few countries: Kenya, Malawi, and Ghana. Therefore, to inform its investment case, Gavi, The Vaccine Alliance contracted health economists at the Johns Hopkins Bloomberg School of Public Health's International Vaccine Access Center (IVAC), in collaboration with disease dynamics modelers with the Vaccine Impact Modeling Consortium, to develop a return-on-investment (ROI) model for RTS,S introduction and continuation in Gavi-supported, sub-Saharan African countries for 2021-2030.

METHODS: The ROI model consisted of two sub-models based on the Decade of Vaccine Economics (DoVE) project, which calculated the economic benefits and programmatic costs of routine RTS,S introduction and continuation within 20 Gavi-supported countries in sub-Saharan Africa for years 2021-30. Benefits were estimated using a cost-of-illness (COI) approach with malaria case and death data provided by Swiss Tropical and Public Health Institute (STPH) and Imperial College London (ICL). Costs were calculated from Gavi vaccine and vaccination material prices, Gavi dose demand forecasting data, and delivery costs per dose from the IVAC DoVE project. To account for variability in Gavi's pricing strategy, we considered the following vaccine dose price scenarios: a base case of 7 USD per dose, a minimum price of 2 USD per dose, a median price of 5 USD per dose, and a maximum price of 10 USD per dose. This analysis also included an additional "upper-bound" scenario at a vaccine dose price of 7 USD in which PATH-collected delivery cost per dose values from the pilot programs in Kenya, Malawi, and Ghana (and were higher than those estimates from the DoVE project) were applied to all modeled countries. Additionally, we considered the inclusion of a fifth seasonal RTS,S dose, delivered via supplementary immunization activity (SIA), with the four-dose routine delivery of RTS,S for 10 sub-Saharan African countries that experience particularly high seasonal malaria transmission (not included in poster).

Figure 1. Return-on-investment Methodology



RESULTS:

Table 1. Cost-of-illness averted breakdown by model for standard routine delivery of RTS,S, 2021-30

	STPH Model		ICL Model	
Cost of illness category	**Uncomplicated malaria (%)**	**Severe malaria (%)**	**Uncomplicated malaria (%)**	**Severe malaria (%)**
Treatment costs	$95,985,658 (7.76%)	$239,083,561 (8.52%)	$119,008,070 (5.39%)	$641,599,199 (8.91%)
Transportation costs	$36,871,836 (2.98%)	$746,813 (0.03%)	$81,321,469 (3.68%)	$3,731,186 (0.05%)
Caregiver wages	$58,440,669 (4.72%)	$6,331,140 (0.23%)	$158,966,599 (7.2%)	$35,432,451 (0.49%)
Productivity loss due to disability	$1,045,937,794 (84.54%)	$12,540,970 (0.45%)	$1,848,733,404 (83.73%)	$42,786,508 (0.59%)
Productivity loss due to death	--	$2,547,707,994 (90.78%)	--	$6,475,954,046 (89.95%)

Table 2. Cost-of-illness, programmatic costs, and return-on-investment for all price scenarios by model for standard routine delivery of RTS,S, 2021-2030

	Base case scenario: $7 vaccine price	$7 vaccine price (upper-bound scenario)	$2 minimum vaccine price	$5 median vaccine price	$10 maximum vaccine price
STPH Model					
Cost of illness	$4,043,646,438	$4,043,646,438	$4,043,646,438	$4,043,646,438	$4,043,646,438
Vaccine program costs	$2,853,353,356	$4,009,631,786	$1,201,734,520	$2,192,705,821	$3,844,324,658
Return-on-investment	0.42	1.01	2.36	0.84	0.05
ICL Model					
Cost of illness	$9,407,532,932	$9,407,532,932	$9,407,532,932	$9,407,532,932	$9,407,532,932
Vaccine program costs	$2,853,353,356	$4,009,631,786	$1,201,734,520	$2,192,705,821	$3,844,324,658
Return-on-investment	2.30	2.35	6.83	3.29	1.45

CONCLUSION: Integration of RTS,S vaccines into the immunization systems of sub-Saharan African Gavi-supported countries is expected to yield substantial ROIs, assuming mid- and low- vaccination price per dose estimates. Despite higher costs, ROIs were higher when including a seasonal 5th dose in high seasonal transmission settings compared to a 4-dose schedule alone. Estimates from this study may help decision makers understand the potential benefits of widescale malaria vaccine implementation in comparison to other health investments with calculated ROIs.

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