FOURTEENTH INTERNATIONAL

ROTAVIRUS SYMPOSIUM

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ROTAVIRUS VACCINE PRODUCT SWITCH IN GHANA: AN ASSESSMENT OF SERVICE DELIVERY COSTS, PROGRAM SWITCH COSTS AND COST-EFFECTIVENESS

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UNIVERSITY OF GHANA
SCHOOL OF PUBLIC HEALTH

Outline

- Background
- Methods
- Results
- Conclusion & Policy Implications

Background

	ROTARIX	ROTAVAC
Vaccine type	RV1 (monovalent human rotavirus vaccine)	RV1 (monovalent human rotavirus vaccine)
Serotypes	RIX4414	116 E
Schedule	2-dose	3-dose
WHO PQ date	2009	January 2018
Presentation	1 dose plastic tube	5 or 10 dose vials
Shelf-life	36 months at 2 to 8°C	60 months at -20°C 6 months at 2 to 8°C post-thaw
Cold chain volume per dose	17.12 cm^3 (in 50-dose carton)	4.2 cm^3 (5-dose presentation) 3.2 cm^3 (10-dose presentation)
VVM	VVM Type 14	VVM Type 2

Switch requires resources

Product characteristics impact supply chain and service delivery costs

Vaccine price impact procurement costs

Objective

- **Project objective:** To generate evidence that will contribute to the sustainability of the Ghana immunization program and may inform other countries in the region on the potential value of switching rotavirus vaccines.

- **Main activities:**
- Assess the **introduction costs associated with the switch** from ROTARIX to ROTAVAC and the **incremental supply chain and service delivery costs** associated with each vaccine in Ghana.
- Generate data to inform an update to an earlier **impact and cost-effectiveness study** to include information on the new vaccine.

Methods - switch costs

- Used mostly existing data from the program to assess both financial and economic costs of the switch.

- Each switch-related activity was identified - planning, stakeholder engagement, training, and social mobilization and IEC and costed through interviews

Methods - supply chain and service delivery costs

- **Estimated supply chain and service delivery costs per dose for ROTARIX and ROTAVAC**

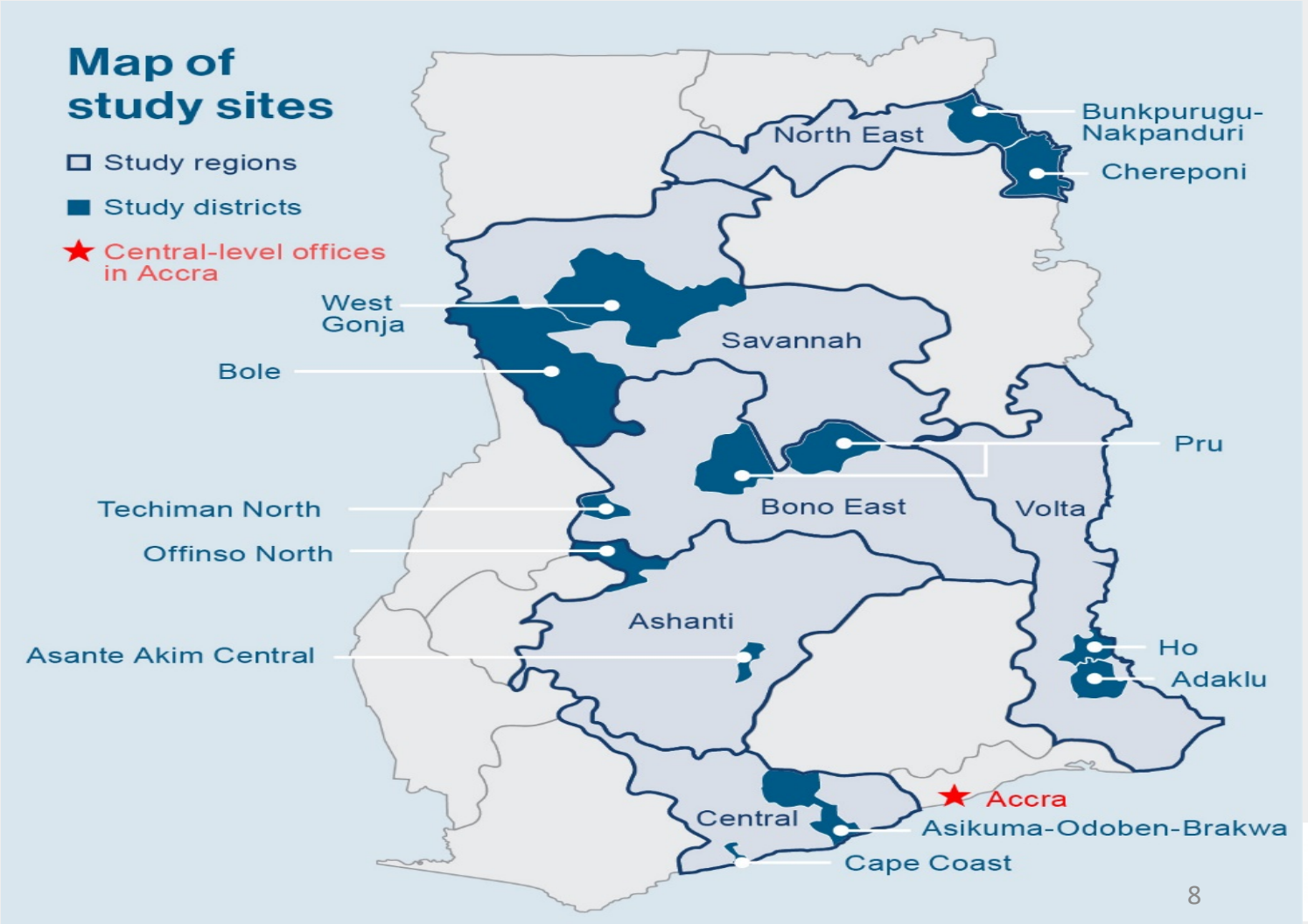
•Ingredients-based micro-costing study using mix of primary and secondary data collection.

–Cost data collected were: vaccine transport and storage, human resources, and waste management, as relevant to each level of the supply chain.

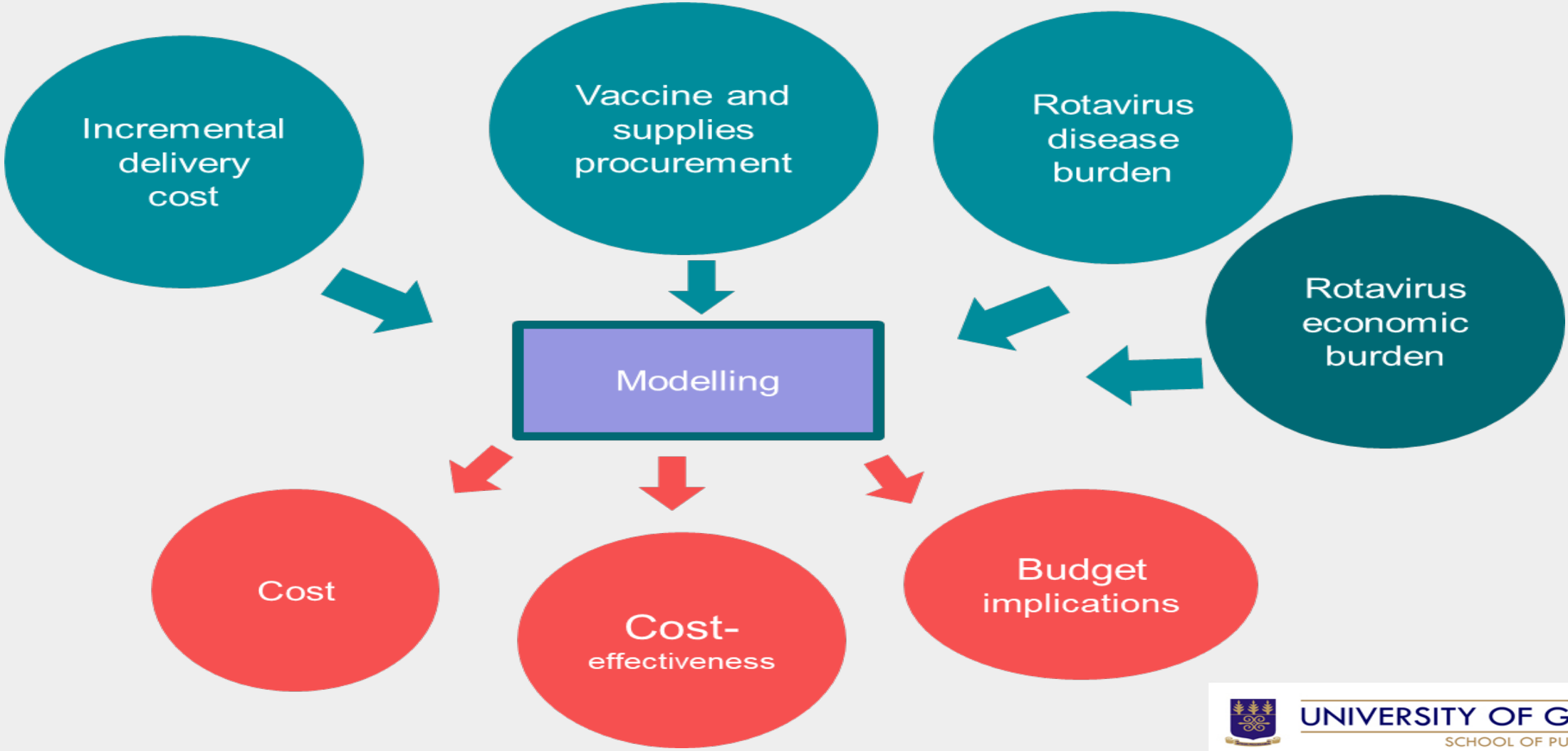
- Used cross-sectional data collection through interviewing key immunization staff at a sample of facilities and administrative offices (using structured costing questionnaires).

Methods - Supply chain and service delivery costs

- Purposive sampling of 8 regions to reflect Ghana's three ecological zones
- Random sampling of 12 districts and 36 health facilities.



Methods – Cost-effectiveness Analysis

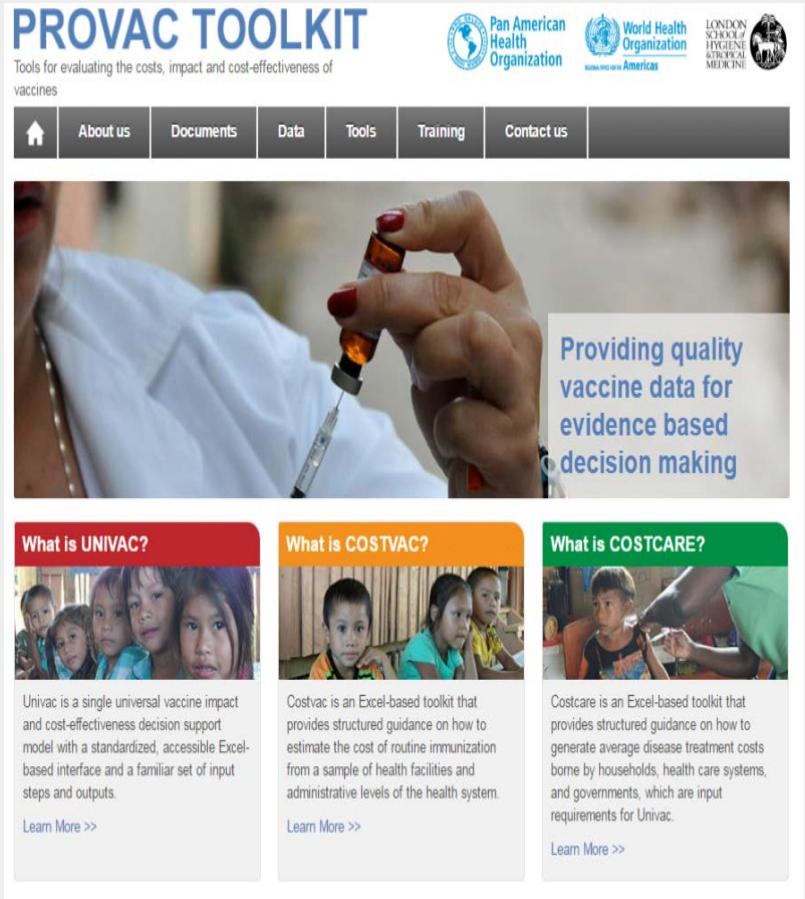


Methods – Cost-effectiveness Analysis

- UNIVAC model (version 1.4.29)

Study characteristics

- 10-year time horizon from the switch to ROTAVAC in 2020.
- Government and societal perspectives.
- Comparing ROTARIX, ROTAVAC 5-dose, and ROTAVAC 10-dose to no vaccination and to each other.



Methods – CEA - Vaccine prices

- Base-case scenario reflects Ghana co-financing based on last Gavi projection of Ghana transition, Ghana price fraction, and recently published RVV prices from UNICEF.
  - *Ghana entered accelerated transition phase in 2022.*
- Low scenario assumes Ghana would slide back and remain in preparatory transition phase over the entire analysis period.
- High scenario uses full vaccine prices.

Average vaccine "price" per course over analysis period*

Vaccine	Base	Low	High
ROTARIX	$3.54	$3.28	$5
ROTAVAC 5-dose	$1.59	$1.47	$2.34
ROTAVAC 10-dose	$1.17	$1.11	$1.8

Methods – CEA – Wastage rate

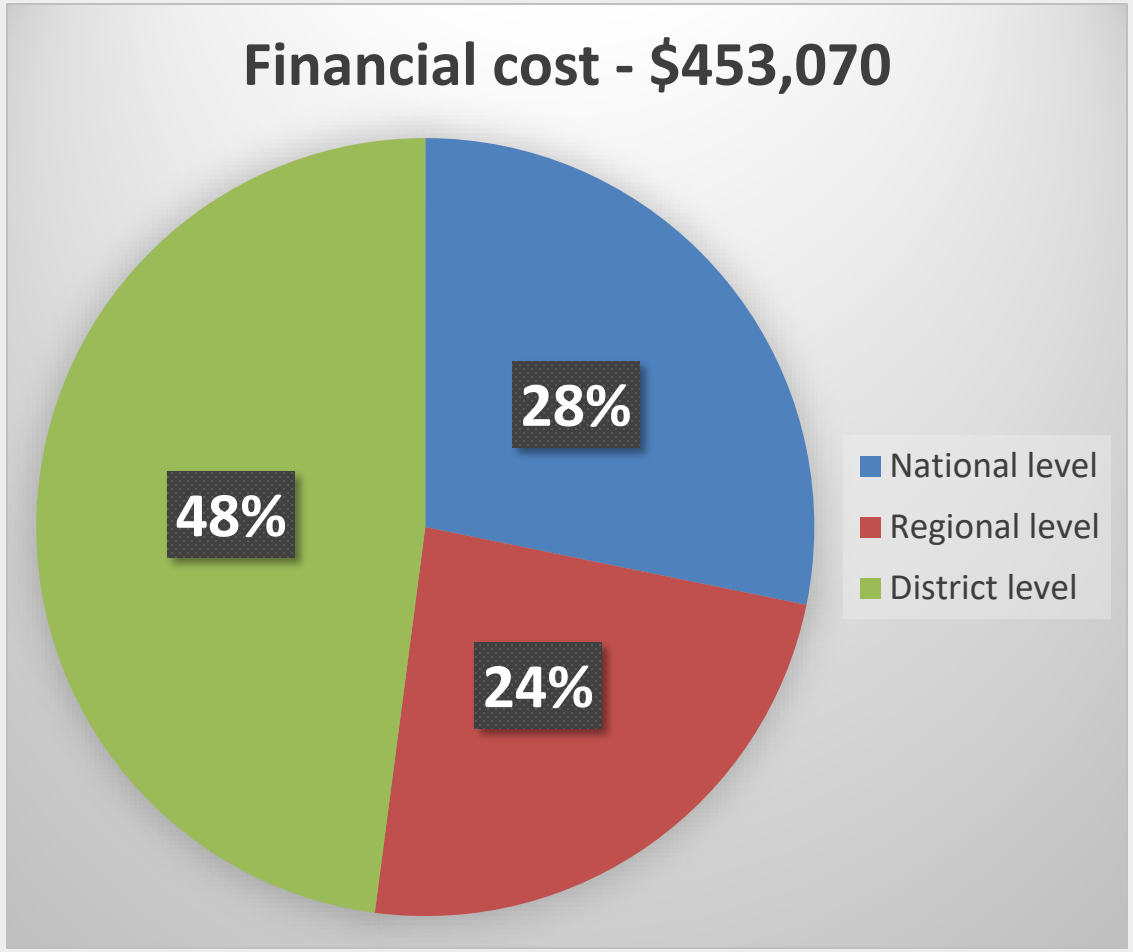
- Wastage rates informed by:
  - –Each vaccine presentation.
  - –EPI communication.
  - –PATH/Gavi wastage study.

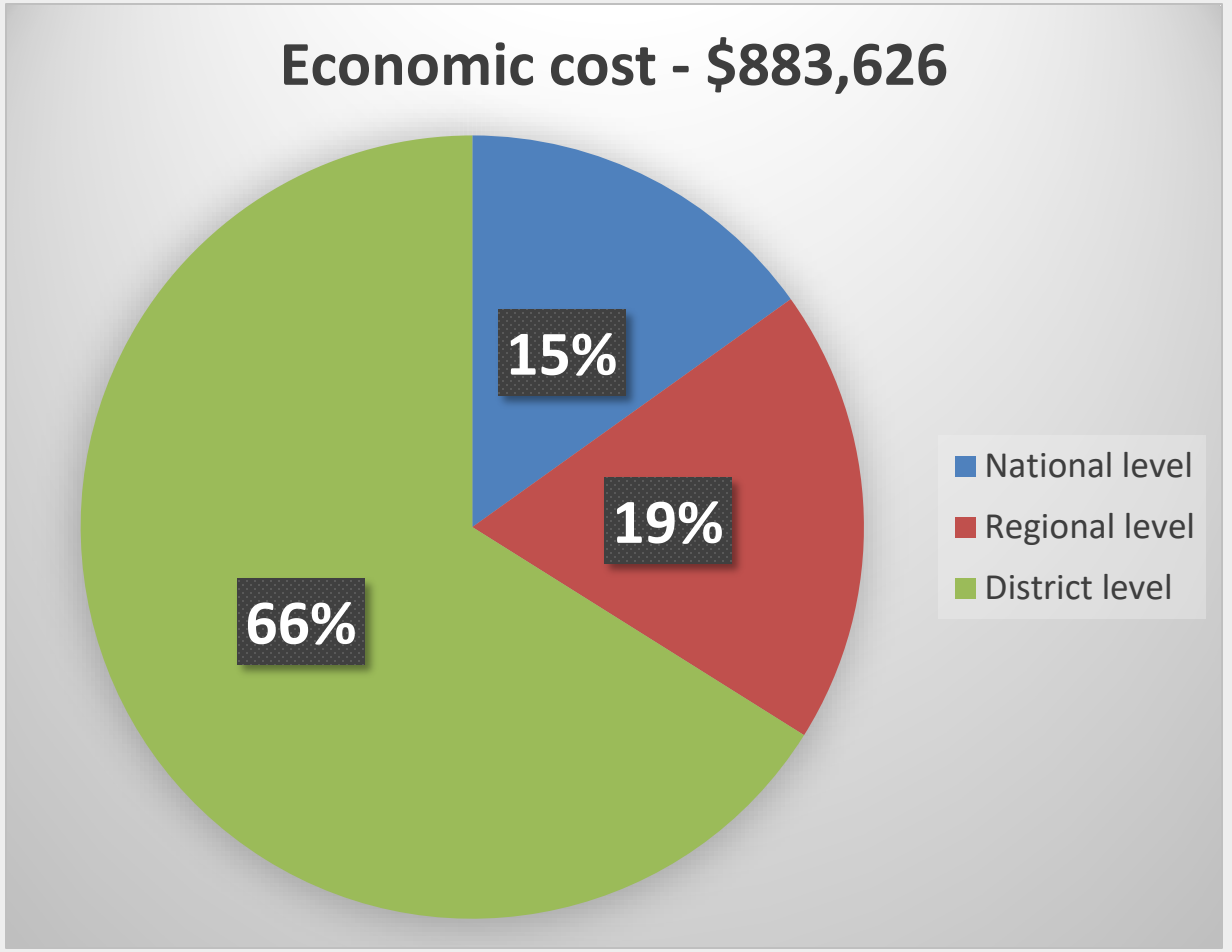
- Ghana not yet implementing the open vial policy for which ROTAVAC is now approved.

Vaccine wastage

Vaccine	Base	Low	High
ROTARIX	5%	2%	8%
ROTAVAC 5-dose	15%	5%	20%
ROTAVAC 10-dose	20%	10%	30%

Results – Switch costs



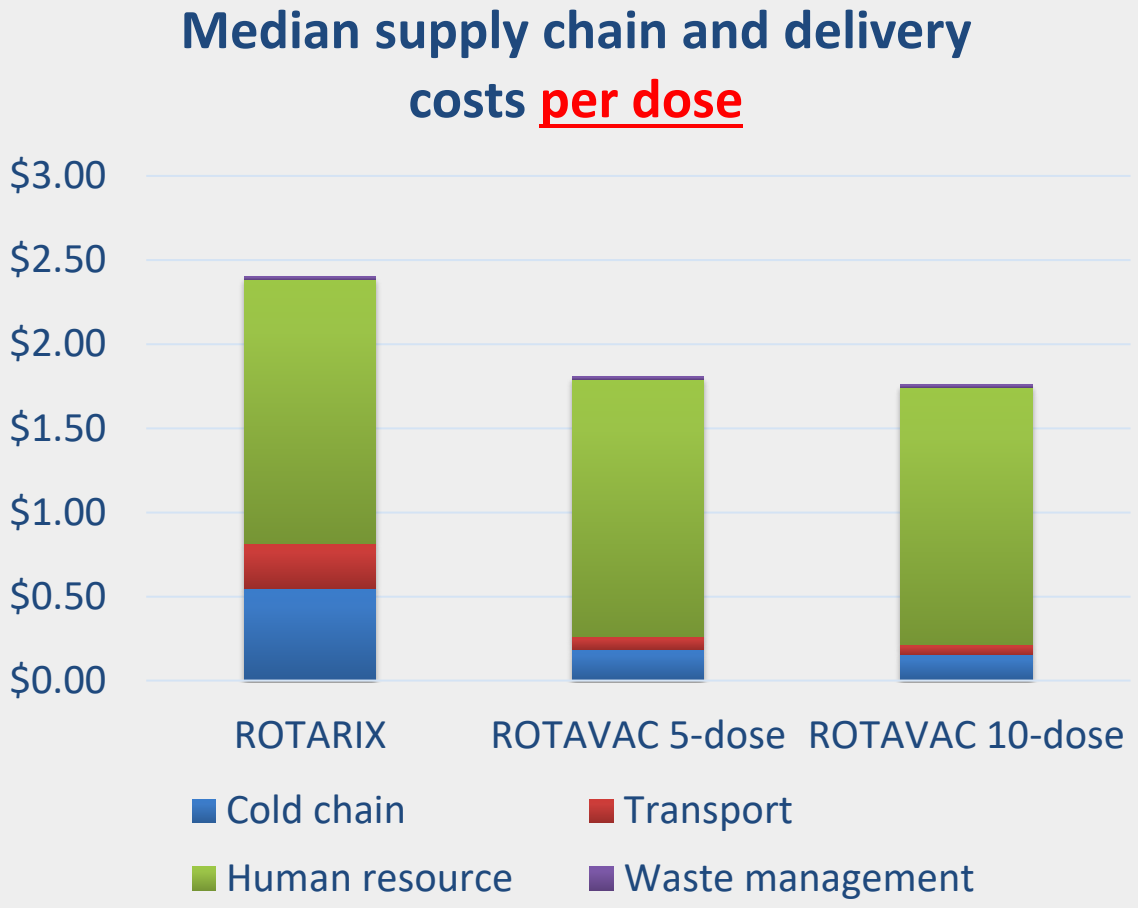


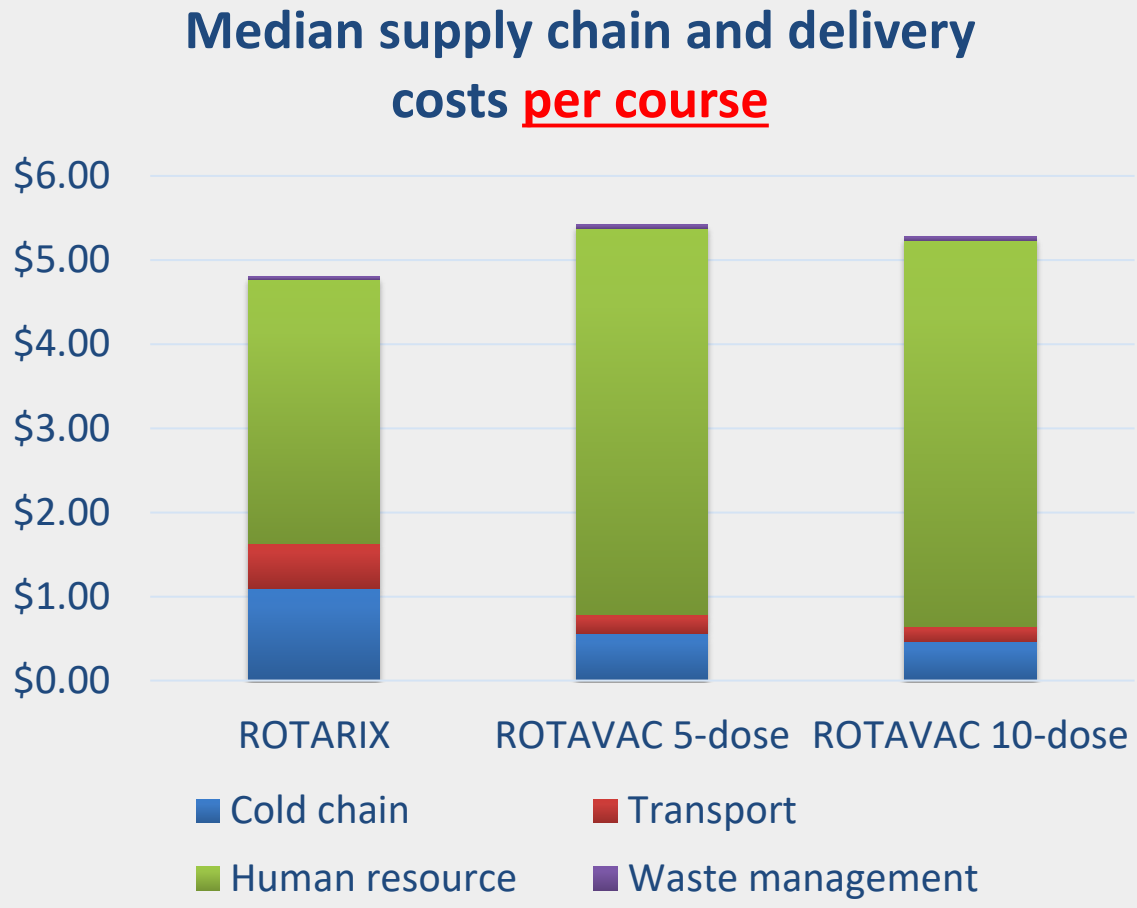
Results – Supply chain & service delivery costs

- Incremental cost per dose for supply chain and service delivery for rotavirus vaccines

Cost category	ROTARIX (1-dose)		ROTAVAC (5-dose)		ROTAVAC (10-dose)	
	Median	25th and 75th percentile	Median	25th and 75th percentile	Median	25th and 75th percentile
National	$0.024	NA	$0.017	NA	$0.016	NA
Regional	0.01	$0.007; $0.011	$0.005	$0.004; $0.006	$0.005	$0.004; $0.005
District	$0.14	$0.08; $0.21	$0.10	$0.06; $0.14	$0.09	$0.06; $0.14
Health facility	$2.23	$1.10; $4.51	$1.69	$0.84; $3.04	$1.65	$0.82; $2.93
Incremental cost per dose	$2.40	$1.21; $4.74	$1.81	$0.92; $3.20	$1.76	$0.90; $3.09
Incremental cost per course	$4.80	$2.42; $9.48	$5.43	$2.76; $9.60	$5.28	$2.70; $9.27

Results – Cost Profile for supply chain & service delivery costs





Results – Health Impact (2020 – 2029)

- Assume similar health impact for all vaccines

	Without vaccine	With vaccine	Difference
RVGE cases	4.4 million	2.7 million	1.7 million
RVGE visits	1.9 million	1.1 million	800,000
RVGE hospitalizations	251,000	135,000	116,000
RVGE deaths	14,000	7,500	6,500
Discounted DALYs lost	360,000	192,000	167,000

- RVGE = rotavirus gastroenteritis
- DALY = disability-adjusted life year

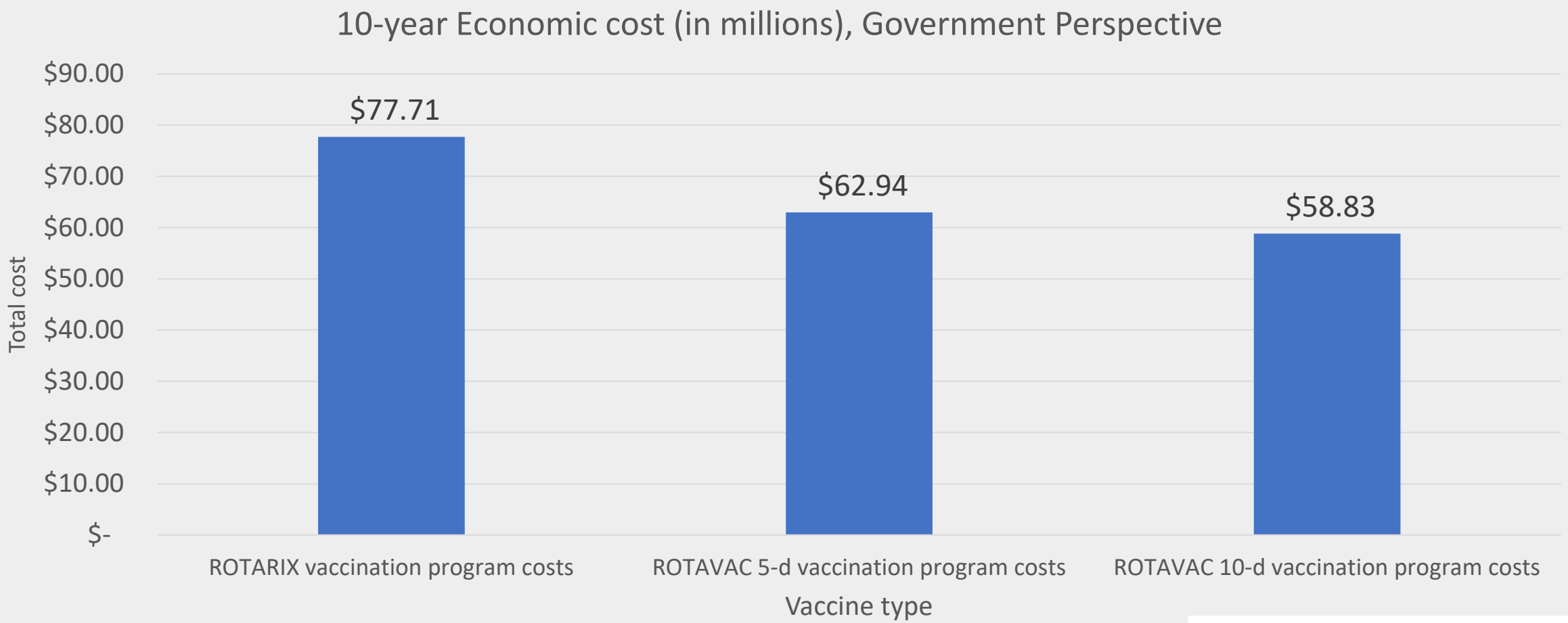
Results – Budgetary implications

Base scenario 2020-2029, government perspective, all cost undiscounted

Year	Fully vaccinated children	Averted healthcare costs	ROTARIX vaccine and supplies procurement costs (in millions)	ROTAVAC 5-d vaccine and supplies procurement costs (in millions)	ROTAVAC 10-d vaccine and supplies procurement costs (in millions)
2020	785,630	$0.49	$2.26	$1.21	$1.43
2021	791,490	$0.49	$2.27	$1,21	$1.43
2022	799,781	$0.50	$2.70	$1.31	$0.98
2023	809,423	$0.50	$3.12	$1.54	$1.16
2024	819,238	$0.51	$3.52	$1.77	$1.34
2025	827,544	$0.51	$3.92	$1.56	$1.19
2026	833,905	$0.51	$4.33	$1.75	$1.34
2027	838,892	$0.52	$4.71	$1.92	$1.48
2028	843,040	$0.52	$4.74	$1.93	$1,48
2029	847,359	$0.52	$4.76	$1.93	$1.48
10-year total	**8,196,301**	**$5.07**	**$36.33**	**$16.13**	**$13.32**

Results – Economic cost

Base scenario 2020-2029, government perspective, all cost undiscounted

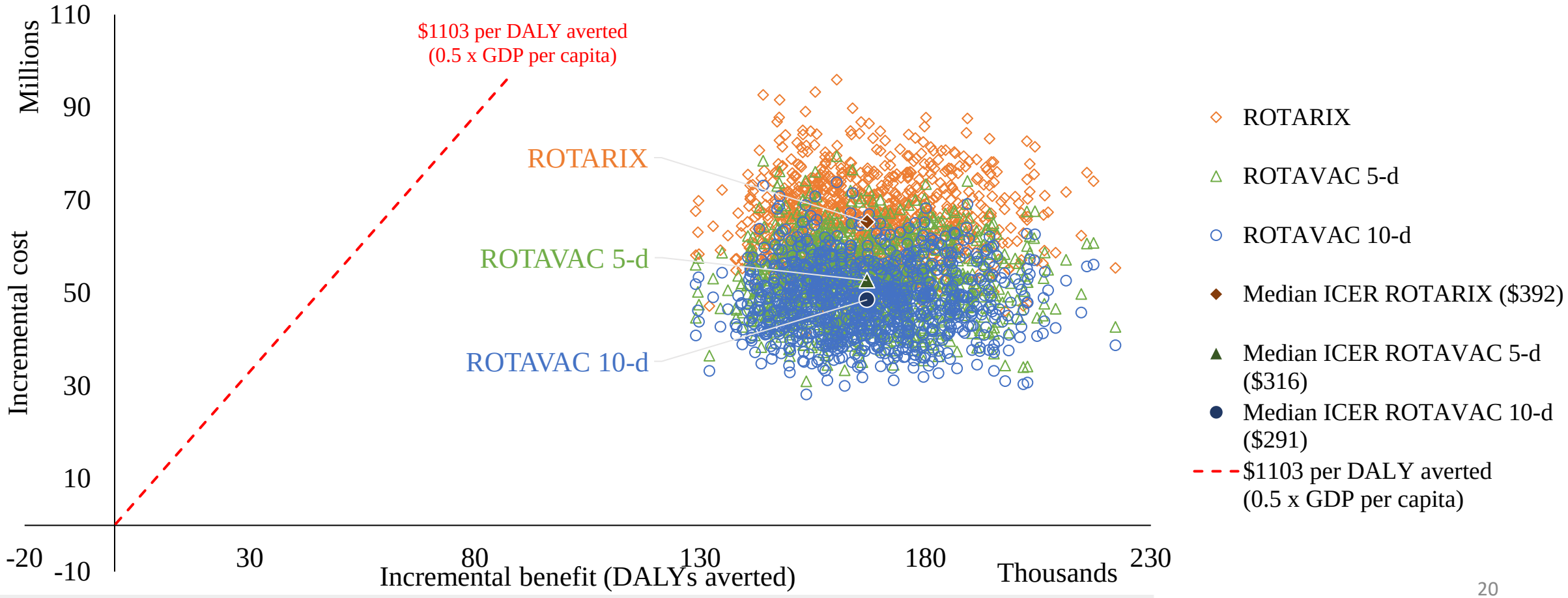


Results – Incremental cost-effectiveness ratios
Base scenario, 2020-2029

Vaccine evaluated	Cost per DALY averted Comparator: No vaccination (2020-2029)	Cost per DALY averted Comparator: ROTARIX (2020-2029)
ROTARIX		
Government perspective	$370	-
Societal perspective	$360	-
ROTAVAC 5-dose		
Government perspective	$309	Cost-saving
Societal perspective	$298	Cost-saving
ROTAVAC 10-dose		
Government perspective	$283	Cost-saving
Societal perspective	$273	Cost-saving

Results – Probabilistic analysis

Incremental cost-effectiveness ratio of ROTARIX, ROTAVAC 5-d and ROTAVC 10-d from the government perspective



Conclusion & Policy Implications

- 2020 rotavirus vaccine switch costs in Ghana amounted to ~$450,000 (financial costs) or ~$880,000 (economic costs).

- The incremental supply chain and service delivery cost per dose with ROTARIX was $2.40, with ROTAVAC 5-dose was $1.81, and with ROTAVAC 10-dose was $1.76.

- Rotavirus vaccination remains cost-effective in Ghana, even in absence of Gavi support.

Conclusion & Policy Implications

- Ghana's switch from ROTARIX to ROTAVAC is cost-saving assuming the health impact remains the same.
  - Accounting for lower incremental delivery cost per dose and vaccine procurement, vaccine program cost is about $15 million lower with ROTAVAC 5-dose ($19 million lower with ROTAVAC 10-dose).
- Vaccine and supplies procurement for the government is $20 million less costly with ROTAVAC 5-dose and $23 million less costly with ROTAVAC 10-dose.
- Implementation of the open-vial policy with ROTAVAC will further reduce vaccine wastage and increase the economic advantage provided by this product.

Acknowledgement

Thank you!

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PATH

BILL & MELINDA GATES foundation

https://www.path.org/resources/switch-rotarix-rotavac-ghana-answers-four-key-questions/

Methods – Ethical Considerations

- Research project was determined as non-Human Subject Research by the PATH Research Determination Committee (July 2020).
- Research protocol approved by ethics committees in Ghana:
  - Ghana Health Service Ethics Review Committee: January 2, 2021.
  - Noguchi Memorial Institute for Medical Research Institutional Review Board (NMIMR IRB): January 14, 2021.
  - All ethics and approvals received by February 12, 2021.
- Adherence to national guidelines on the prevention of COVID-19 for research conduct.

Methods – CEA Main Parameters

- Rotavirus incidence pre-vaccine era similar to originally published analysis.
- Rotavirus mortality updated to account for estimates from different groups (WHO/CDC, MCEE, IHME).
- Disease age distribution updated with Ghana data from the Global RV surveillance network.
- Population projection data updated with UNWPP 2019.
- Incremental delivery cost uses supply chain and service delivery cost data generated by costing study.

Results – Switch costs

	USD	
	Financial	Economic
District level	**$217,140**	**$583,933**
Planning and coordination committees	$0	$73,797 (13%)
Stakeholders' engagement workshops	$20,124 (9%)	$129,069 (22%)
Training	$160,580 (74%)	$344,630 (59%)
Social mobilization and IEC	$36,436 (17%)	$36,436 (6%)

- Results: Switch costs (3/4)

	GHS		USD	
	Financial	Economic	Financial	Economic
Regional level	**636,083**	**977,385**	**$108,134**	**$166,156**
Regional planning committees	18,609	63,203	$3,163 (3%)	$10,745 (6.5%)
Stakeholders' engagement workshop	0	4,525	$0	$769 (0.5%)
Regional training	412,194	627,780	$70,073 (65%)	$106,723 (64%)
Social mobilization and IEC	205,281	281,878	$34,898 (32%)	$47,919 (29%)

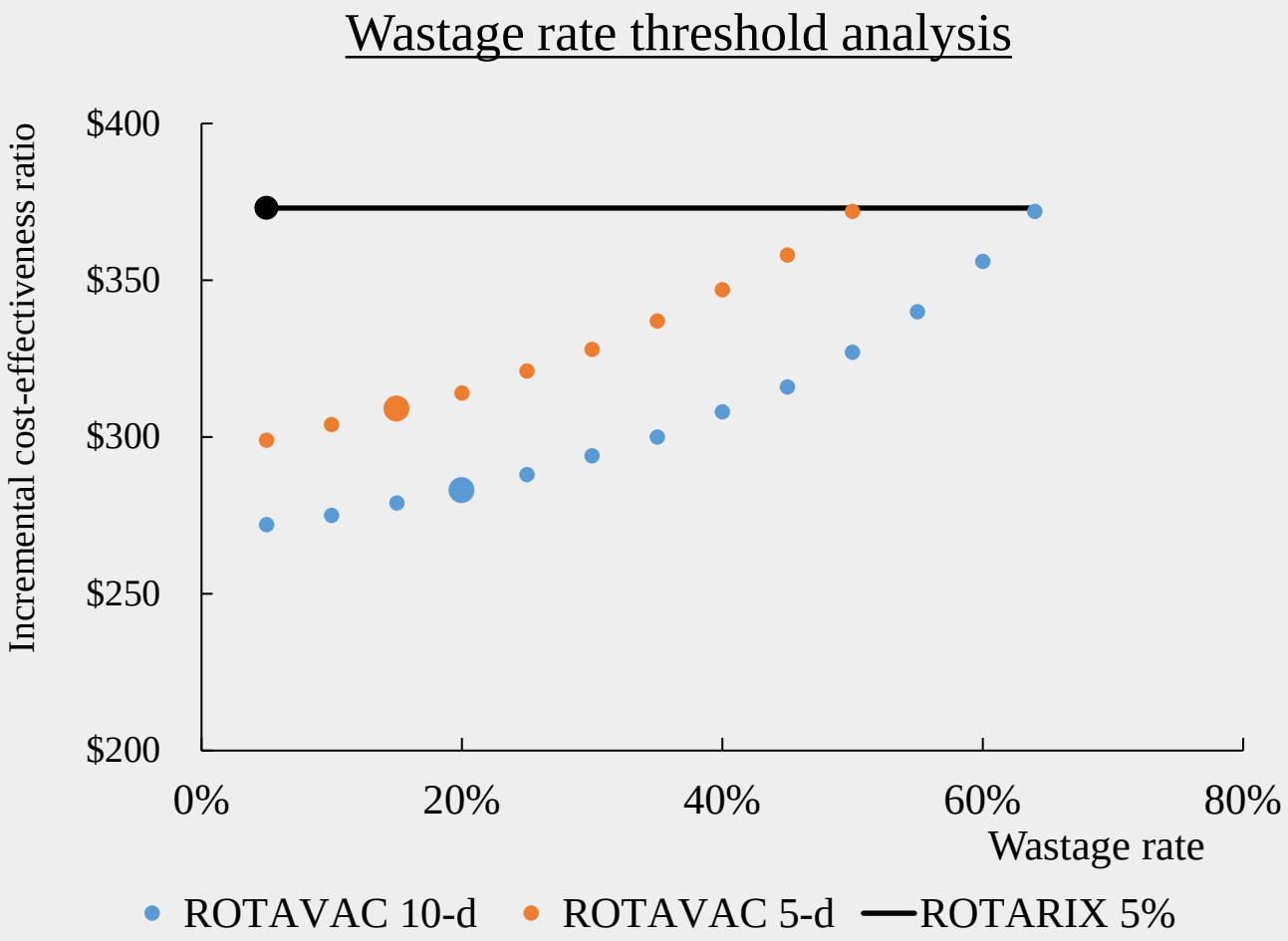
GHS = Ghanaian Cedi
All USD values are 2020 USD

- Results: Switch costs (4/4)

	GHS		USD	
	Financial	Economic	Financial	Economic
District level	**1,277,295**	**3,434,898**	**$217,140**	**$583,933**
Planning and coordination committees	0	434,100	$0	$73,797 (13%)
Stakeholders' engagement workshops	118,374	759,230	$20,124 (9%)	$129,069 (22%)
Training	944,589	2,027,236	$160,580 (74%)	$344,630 (59%)
Social mobilization and IEC	214,332	214,332	$36,436 (17%)	$36,436 (6%)

GHS = Ghanaian Cedi
All USD values are 2020 USD

Results – Wastage rate sensitivity analysis



- ROTAVAC 5-dose ICER equals ROTARIX ICER at 50% wastage rate.
- ROTAVAC 10-dose ICER equals ROTARIX ICER at 64% wastage rate