FOURTEENTH INTERNATIONAL

ROTAVIRUS SYMPOSIUM

MARCH 14–16 **2023** BALI INDONESIA

Learn more on www.sabin.org

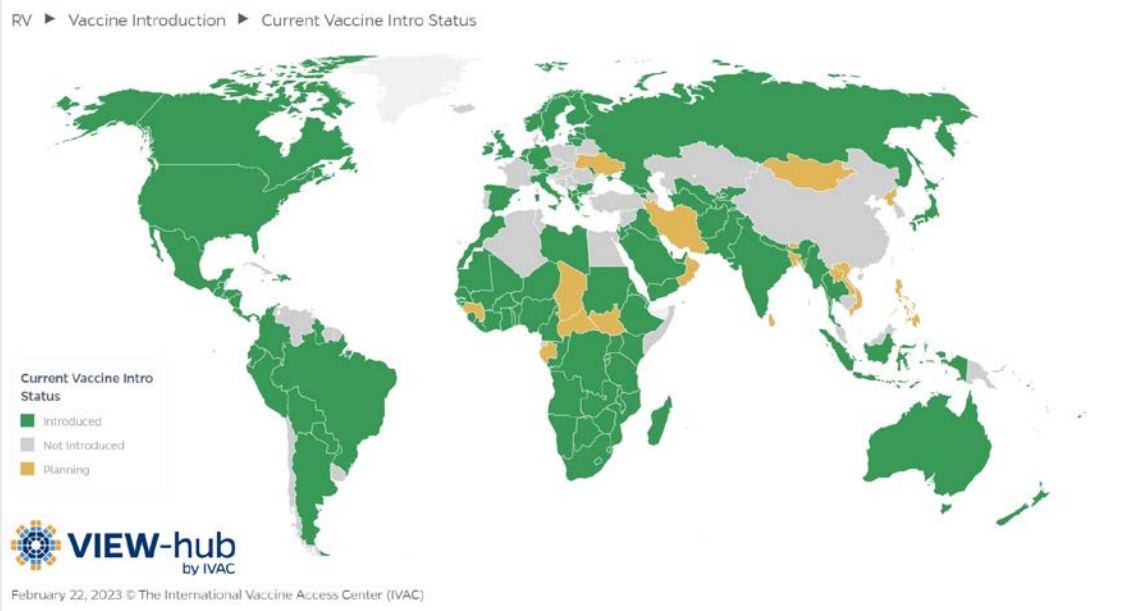
Impact and cost-effectiveness of rotavirus vaccines in 63 middle-income countries not eligible for Gavi funding

Frédéric Debellut
Senior Health Economist
PATH's Center for Vaccine Innovation and Access

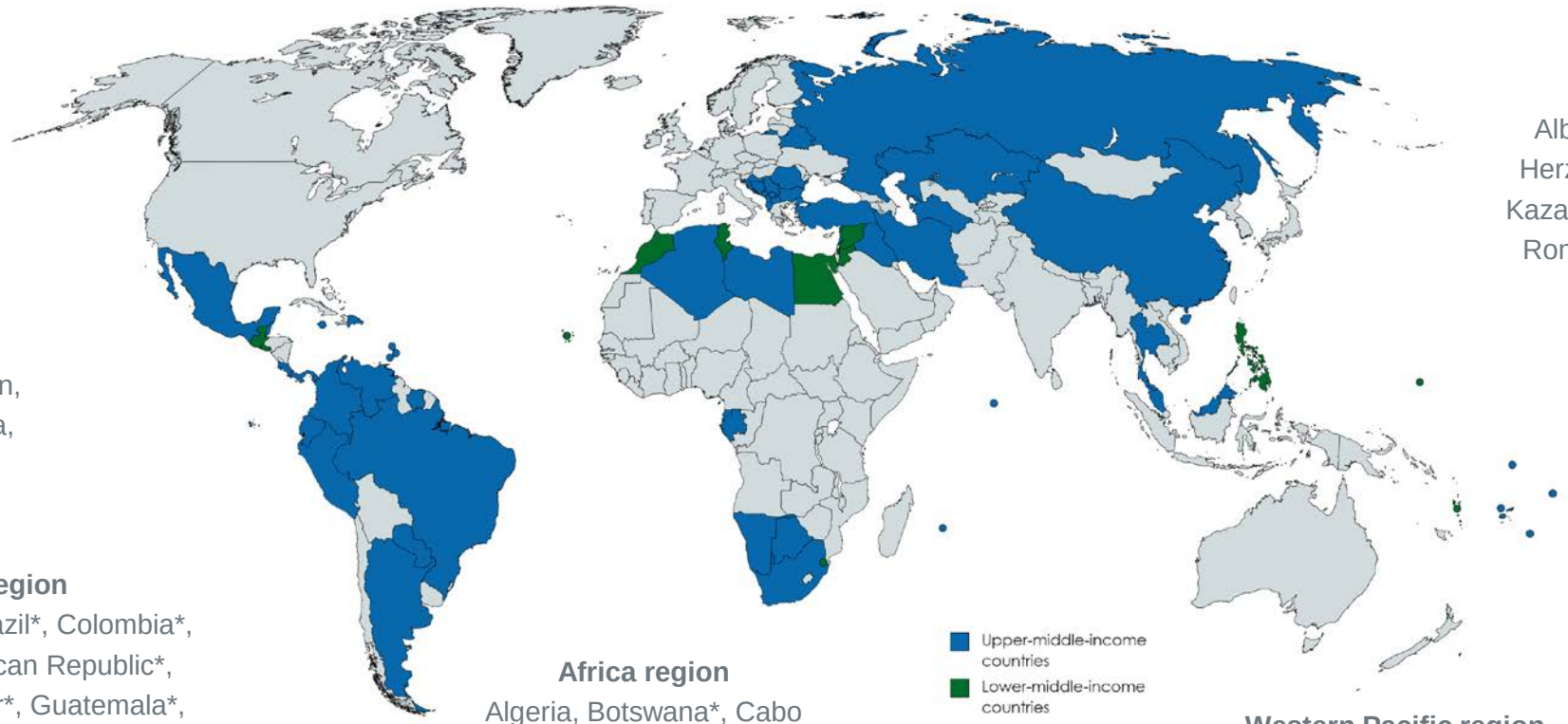
PATH

Introduction

- 120+ countries using rotavirus vaccines (RVV) worldwide.
- Middle-income countries (MICs) have been slower to introduce RVV, in particular countries not eligible for support from Gavi, the Vaccine Alliance.
- Additional products provide an opportunity to reassess decision or current use of RVV.
- COVID-19 pandemic has led to:
  - Increased financial pressure on health systems.
  - Shifting immunization priorities.



Countries included in the analysis



Eastern Mediterranean region
Egypt, Iran, Iraq*, Jordan*, Lebanon, Libya*, Morocco*, Palestine*, Syria, Tunisia

Americas region
Argentina*, Belize, Brazil*, Colombia*, Costa Rica*, Dominican Republic*, Ecuador*, El Salvador*, Guatemala*, Grenada, Jamaica, Mexico*, Panama*, Paraguay*, Peru*, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Venezuela*

Africa region
Algeria, Botswana*, Cabo Verde, Equatorial Guinea, Eswatini*, Gabon, Mauritius*, Namibia*, South Africa*

Europe region
Albania*, Belarus, Bosnia and Herzegovina, Bulgaria*, Croatia, Kazakhstan, Kosovo, Montenegro, Romania, Russia, Serbia, North Macedonia*, Turkey, Turkmenistan*

Southeast Asia region
Maldives, Thailand*

Western Pacific region
China, Fiji*, Malaysia, Micronesia*, Philippines, Samoa, Tonga, Tuvalu, Vanuatu

** Countries using rotavirus vaccine as part of their national immunization program as of July 9, 2020*

PATH

Objectives of the analysis

Estimate impact and cost-effectiveness (and benefit-risk) of rotavirus vaccination in 63 MICs not eligible for Gavi funding.

Accounting for newly available data on:

- Rotavirus vaccine efficacy and duration of protection.
- Rotavirus disease age distribution.
- Rotavirus mortality estimates.
- Updated timeliness of vaccination coverage (DHS/MICS survey analysis).
- Background incidence and age distribution of intussusception, increased risk of intussusception after vaccination.
- Immunization delivery costs.

As well as:

- Additional vaccine products available (ROTAVAC, ROTASIIL).
- Updated prices.

Methods

Calculated in each MIC:

- Number of rotavirus gastroenteritis (RVGE) cases, visits, hospitalizations, deaths, and disability-adjusted life-years (DALYs) averted in children younger than five years old.
- Healthcare costs averted.
- Vaccination program costs.
- Incremental cost-effectiveness ratios ($ per DALY averted).

THE LANCET
Global Health

Volume 9, Issue 7, July 2021, Pages e942-e956

Articles

Evaluating the potential economic and health impact of rotavirus vaccination in 63 middle-income countries not eligible for Gavi funding: a modelling study

Frédéric Debellut MSc [a], Andrew Clark PhD [b], Clint Pecenka PhD [c], Jacqueline Tate PhD [d], Ranju Baral PhD [c], Prof Colin Sanderson PhD [b], Umesh Parashar MD [d], Deborah Atherly PhD [c]

PATH

Methods (continued)

- Analysis from both government and societal perspectives.
- Analysis with or without age restrictions.
- 10-year time horizon 2020 to 2029.
- Study comparator: no vaccination.
- 3 percent discount rate on costs and outcomes. Costs in 2018 USD.
- Cost-effectiveness interpretation based on:
  - Willingness-to-pay thresholds (0.5 and 1 times each country's GDP per capita).
  - Cost-effectiveness acceptability curves (probability of cost-effectiveness at different thresholds).

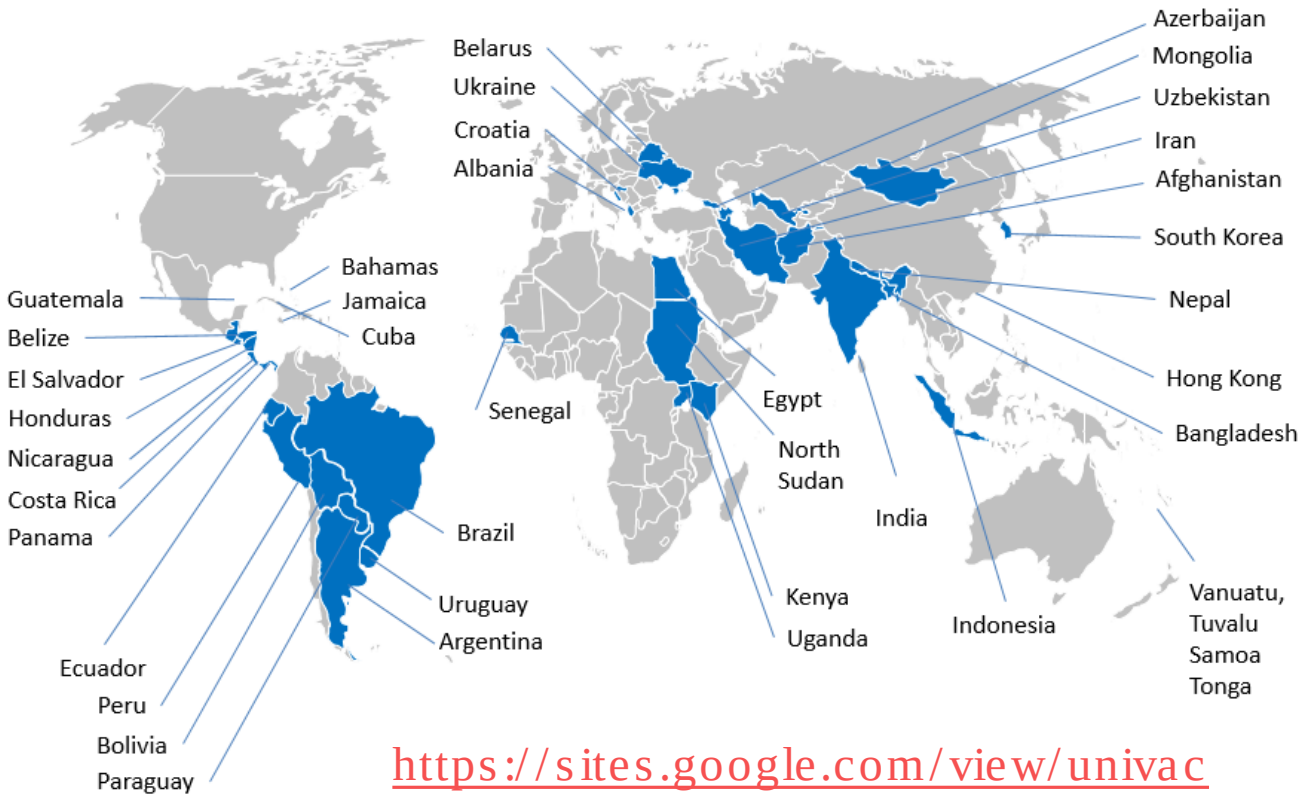
PATH

UNIVAC model

UNIVAC is a universal framework for evaluating vaccine policy options in low- and middle-income countries.

Excel-based, deterministic proportionate outcomes model.

Country-led studies using decision-support model



https://sites.google.com/view/univac

ProVac Tools for evidence-based decisions on new vaccines

Pan American Health Organization
Regional Office of the World Health Organization

London School of Hygiene & Tropical Medicine

PATH

Selected model inputs

Input	Value	Source
Incidence	10,000 cases per 100,000 children <5	Bilcke et al. 2009
Mortality	Country-specific Average for 9 countries in AFR: 25 deaths per 100,000 Average for 14 countries in EUR: 1.4 deaths per 100,000	Median value from IHME, MCEE, WHO/CDC
Vaccine efficacy	Varies per mortality settings: • Low mortality: 98% after 2 weeks, 94% after 12 months • Med. mortality: 82% after 2 weeks, 70% after 12 months • High mortality: 81% after 2 weeks, 36% after 12 months	Clark et al. Efficacy of live oral rotavirus vaccines by duration of follow-up: a meta-regression of randomised controlled trials. *Lancet Infect Dis.* 2019.
Healthcare costs	Country-specific 63 MIC averages (government; societal): • Clinic visit ($14 ; $23) • hospitalization ($276 ; $352)	Baral et al. Cost of illness for childhood diarrhea in low- and middle-income countries: a systematic review of evidence and modelled estimates. *BMC Public Health.* 2020.
Immunization delivery costs	$2.05 ($1; $2.50)	Extracted from online ICAN cost catalogue https://immunizationeconomics.org/ican-idcc

PATH

Vaccine costs

	ROTARIX	ROTAVAC	ROTASIIL
Price per dose	$10.25 ($7.18; $13.33)	$1.25 ($0.88; $1.63)	$1 ($0.70; $1.30)
Doses in schedule	2	3	3
Doses per vial	1	5	2
Presentation			

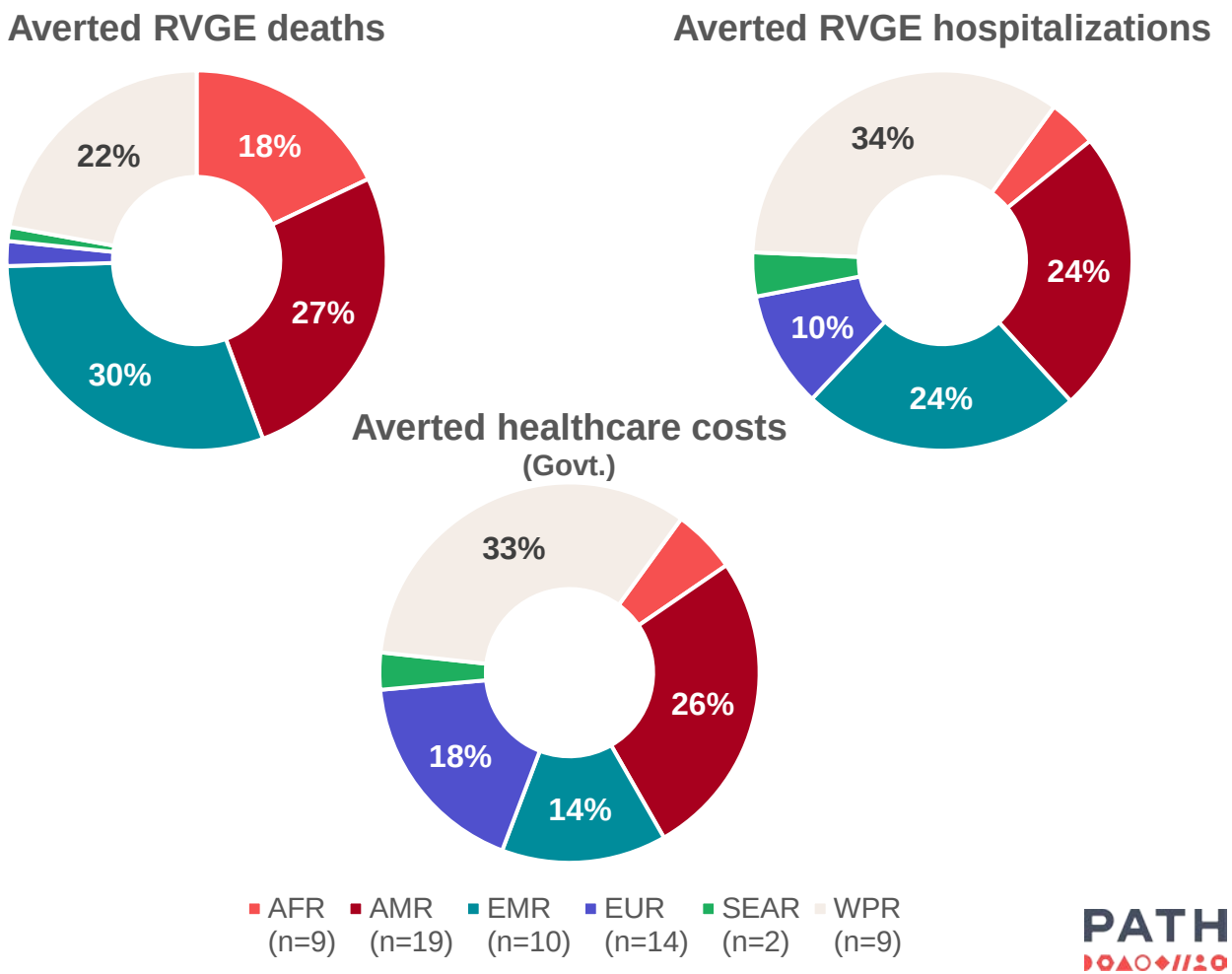
- Vaccine price informed by manufacturers, cross-checked with WHO vaccine purchase database.
- Other vaccine-related costs include international handling, transportation, vaccine wastage, and safety boxes/bags.

PATH

Results

Results for 10 cohorts vaccinated (2020-2029), with age restriction

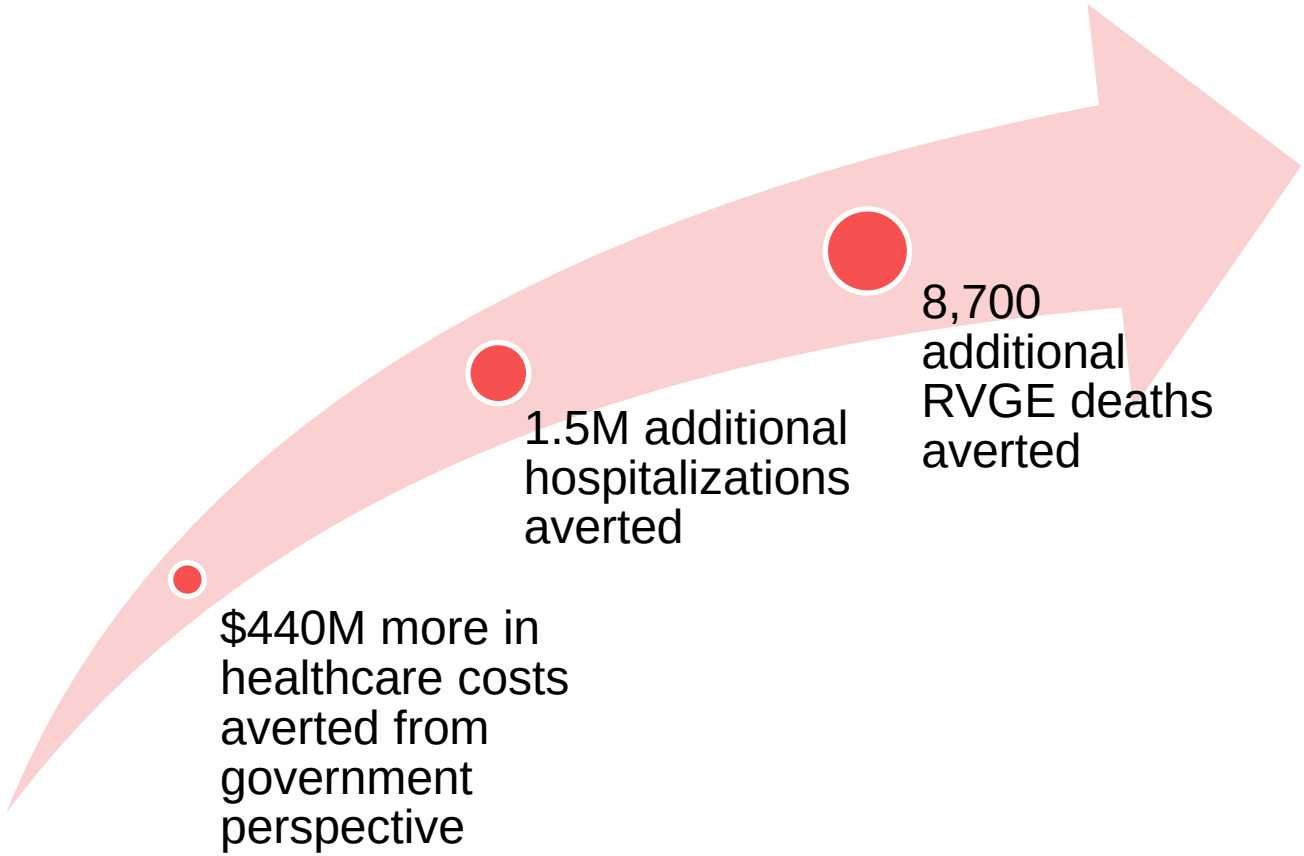
Averted outcomes over 10 years	63 MICs
RVGE deaths	37,900
RVGE hospitalizations	3.0M
Healthcare costs *Government* *Society*	 $826M $1,182M



Results

Results for 10 cohorts vaccinated (2020-2029), without age restriction

Averted outcomes over 10 years	63 MICs
RVGE deaths	46,600
RVGE hospitalizations	4.5M
Healthcare costs *Government* *Society*	 $1,265M $1,814M



Results

Results for 10 cohorts vaccinated (2020-2029), with age restriction

	63 MICs	AFR (n=9)	AMR (n=19)	EMR (n=10)	EUR (n=14)	SEAR (n=2)	WPR (n=9)
Vaccination program costs (in million US$)							
ROTARIX	**$6,168**	$316	$1,620	$1,400	$609	$138	$2,085
ROTAVAC	**$2,428**	$127	$610	$544	$233	$52	$862
ROTASIIL	**$2,075**	$109	$523	$464	$199	$44	$736
Number of countries (%) with at least 1 RVV with ICER below CE threshold							
0.5 x GDP p.c.	**48 (77%)***	8 (89%)	18 (95%)	6 (67%)*	8 (57%)	2 (100%)	6 (67%)
1 x GDP p.c.	**60 (97%)***	9 (100%)	19 (100%)	9 (100%)*	13 (93%)	2 (100%)	5 (83%)

* Syria excluded as no data on GDP per capita available at the time of the study.

PATH

Results

Results for 10 cohorts vaccinated (2020-2029), with age restriction

	63 MICs	AFR (n=9)	AMR (n=19)	EMR (n=10)	EUR (n=14)	SEAR (n=2)	WPR (n=9)
Vaccination program costs (in million US$)							
ROTARIX	**$6,168**	$316	$1,620	$1,400	$609	$138	$2,085
ROTAVAC	**$2,428**	$127	$610	$544	$233	$52	$862
ROTASIIL	**$2,075**	$109	$523	$464	$199	$44	$736
Number of countries (%) with at least 1 RVV with ICER below CE threshold							
0.5 x GDP p.c.	**48 (77%)***	8 (89%)	18 (95%)	6 (67%)*	8 (57%)	2 (100%)	6 (67%)
1 x GDP p.c.	**60 (97%)***	9 (100%)	19 (100%)	9 (100%)*	13 (93%)	2 (100%)	5 (83%)

* Syria excluded as no data on GDP per capita available at the time of the study.

PATH

Results

Results for 10 cohorts vaccinated (2020-2029), with age restriction

	63 MICs	AFR (n=9)	AMR (n=19)	EMR (n=10)	EUR (n=14)	SEAR (n=2)	WPR (n=9)
Vaccination program costs (in million US$)							
ROTARIX	**$6,168**	$316	$1,620	$1,400	$609	$138	$2,085
ROTAVAC	**$2,428**	$127	$610	$544	$233	$52	$862
ROTASIIL	**$2,075**	$109	$523	$464	$199	$44	$736
Number of countries (%) with at least 1 RVV with ICER below CE threshold							
0.5 x GDP p.c.	**48 (77%)***	8 (89%)	18 (95%)	6 (67%)*	8 (57%)	2 (100%)	6 (67%)
1 x GDP p.c.	**60 (97%)***	9 (100%)	19 (100%)	9 (100%)*	13 (93%)	2 (100%)	5 (83%)

* Syria excluded as no data on GDP per capita available at the time of the study.

PATH

Results

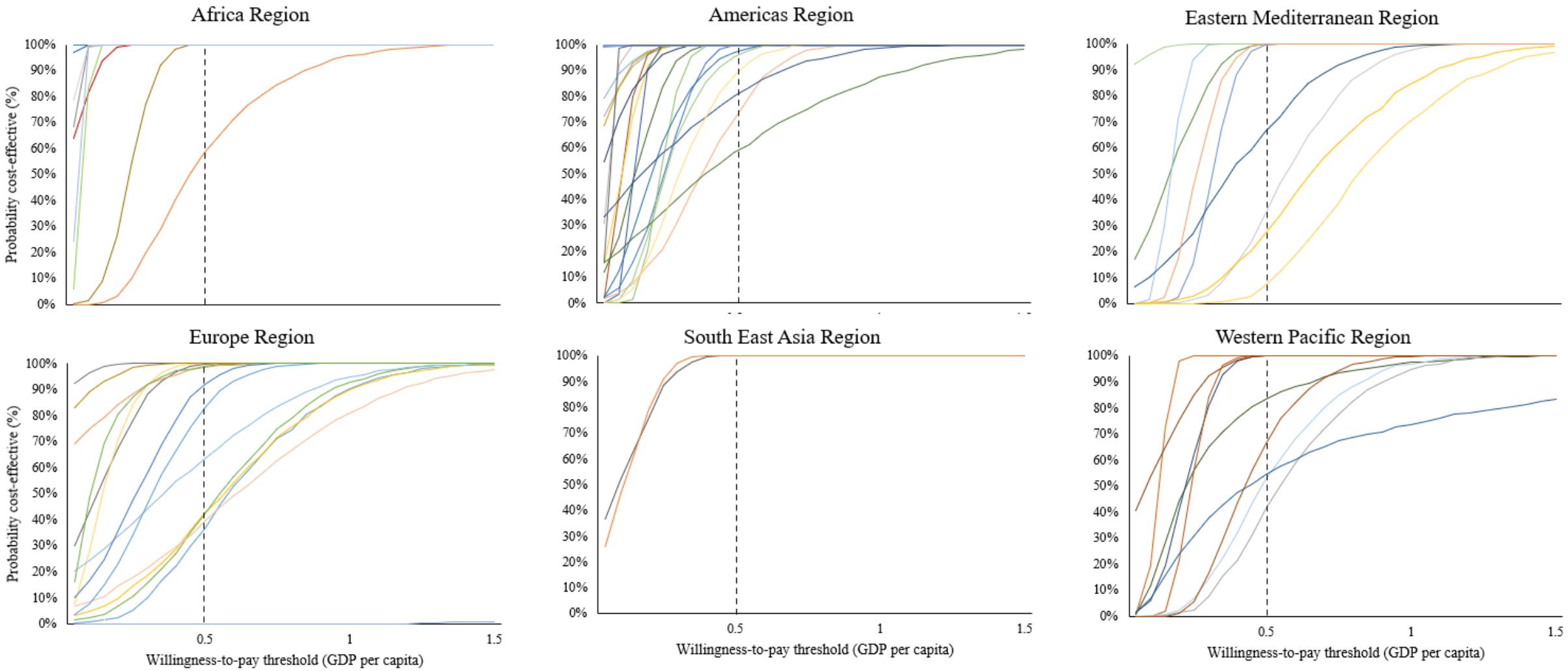
Results for 10 cohorts vaccinated (2020-2029), with age restriction

	63 MICs	AFR (n=9)	AMR (n=19)	EMR (n=10)	EUR (n=14)	SEAR (n=2)	WPR (n=9)
Vaccination program costs (in million US$)							
ROTARIX	**$6,168**	$316	$1,620	$1,400	$609	$138	$2,085
ROTAVAC	**$2,428**	$127	$610	$544	$233	$52	$862
ROTASIIL	**$2,075**	$109	$523	$464	$199	$44	$736
Number of countries (%) with at least 1 RVV with ICER below CE threshold							
0.5 x GDP p.c.	**48 (77%)***	8 (89%)	18 (95%)	6 (67%)*	8 (57%)	2 (100%)	6 (67%)
1 x GDP p.c.	**60 (97%)***	9 (100%)	19 (100%)	9 (100%)*	13 (93%)	2 (100%)	5 (83%)

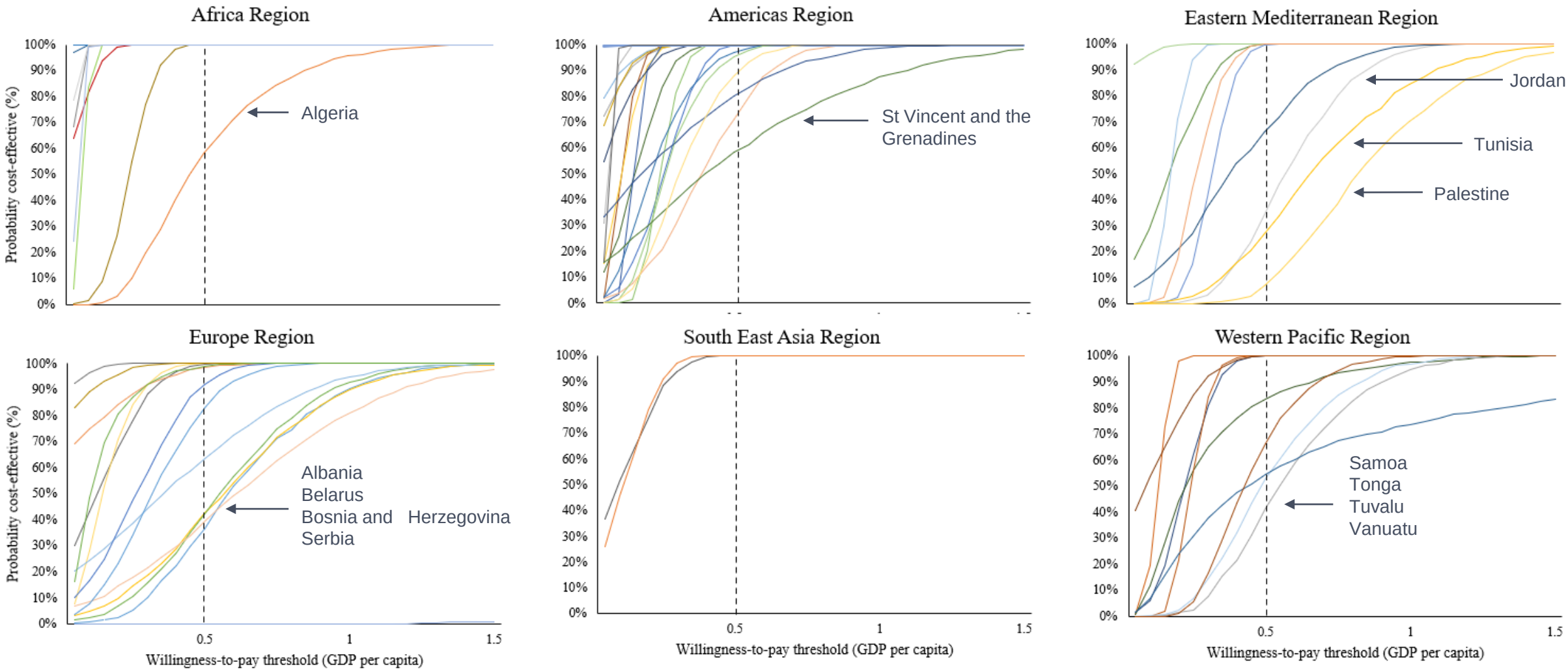
* Syria excluded as no data on GDP per capita available at the time of the study.

PATH

Cost-effectiveness acceptability curves



Cost-effectiveness acceptability curves



Conclusion

- ROTASIIL was the least costly and most cost-effective choice for all countries, followed closely by ROTAVAC.
- From the **government** perspective, 77% of MICs had at least one cost-effective RVV option (ICER lower than 0.5 x country's GDP per capita).
- From the **societal** perspective, 87% of MICs had at least one cost-effective RVV option.
- At 1 x GDP per capita threshold, RVV was considered cost-effective in all but two MICs.
- For 17 countries not yet using rotavirus vaccines nationally, at least one RVV had a 90% or higher chance of being cost-effective at the 0.5 GDP per capita threshold. If these 17 countries were to introduce RVV, they would prevent 16,759 (95% UI 11,920–22,086) additional RVGE deaths over 10 years.

PATH

Thank you!

Study collaborators

Clint Pecenka
Andrew Clark
Jacqueline Tate
Ranju Baral
Prof. Colin Sanderson
Umesh Parashar
Deborah Atherly

Frédéric Debellut
fdebellut@path.org

BILL & MELINDA GATES foundation