

COST-EFFECTIVENESS ANALYSIS OF ROTAVIRUS VACCINATION IN CHILDREN UNDER FIVE YEARS OLD IN MOROCCO

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Background



Rotavirus vaccination was introduced into the Moroccan National Immunization Program (NIP) in 2010 to control severe and fatal rotavirus gastroenteritis (RVGE) in children¹



Objective: To compare **total vaccination costs** and the **cost-effectiveness**, from payer and societal perspectives, of implementing three different rotavirus vaccines into the Moroccan NIP for the 2022 birth cohort using a **health-economic analysis**

Methods

Two types of evaluations were reported in the health economic model:

- Cost analysis:** the costs of two or more vaccines were compared; consequences or outcomes of the vaccines were not considered
- Cost-effectiveness analysis:** a full economic evaluation, which compares two or more vaccines in terms of their costs and outcomes

Vaccines Included	Oral live attenuated human rotavirus vaccine (RIX4414; GSK, Belgium)	Live, oral, pentavalent rotavirus vaccine (PRV; Merck, USA)	Rotavirus vaccine, live attenuated oral (freeze-dried) 1-dose (RVLA-1; Serum Institute of India, India)
Form	Liquid (plastic tube)	Liquid (plastic tube)	Lyophilised powder (2-vial set)
No. doses per fully immunised child	2	3	3
Purchase price (per dose)	\$6.50 ²	\$5.20 ³	\$3.00 ²
No. vials/tubes per carton	50	25	50 active and 50 diluent
No. doses per vial	1	1	1
Storage volume (cm ³)	17.12	46.25	35.14

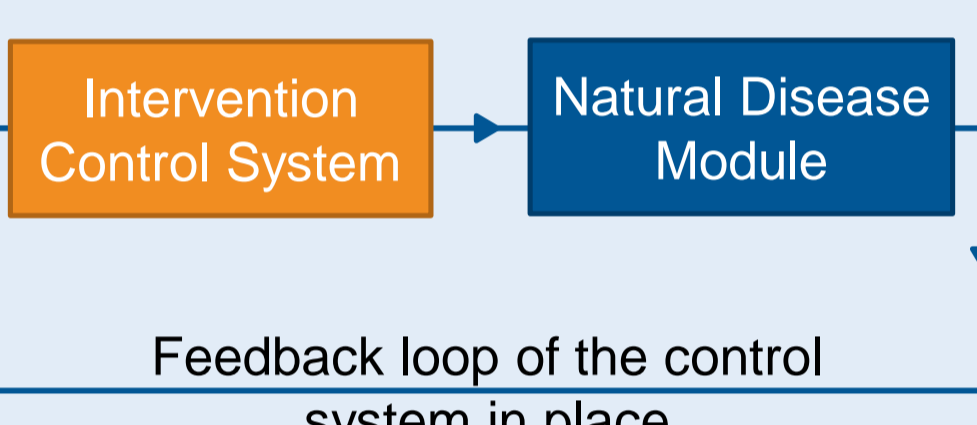
Cost-Effectiveness Model Flow Diagram

Step A: Natural disease module

Natural Disease Module

Costs:	Clinical (QALYs/DALYs):
<ul style="list-style-type: none"> Home care treatment Medical visits Hospitalisations Direct non-medical costs Productivity losses 	<ul style="list-style-type: none"> RVGE treated at home RVGE requiring medical visits RVGE requiring hospitalisations RVGE deaths

Step B: Natural disease module + intervention control system



Costs:	Clinical (QALYs/DALYs):
<ul style="list-style-type: none"> Home care treatment Medical visits Hospitalisations Direct non-medical costs Productivity costs Total vaccination costs Side-effects of vaccination 	<ul style="list-style-type: none"> RVGE treated at home RVGE requiring medical visits RVGE requiring hospitalisations RVGE deaths Side-effects of vaccination Deaths of side-effects of vaccination

Components derived from the intervention control system are highlighted in orange

Cost Components Included in the Cost Analysis and Cost-Effectiveness Analysis

Analysis	Cost Analysis		Cost-Effectiveness Analysis	
	Country payer	Societal (country payer + caregiver)	Country payer	Societal (country payer + caregiver)
Vaccination costs (waste adjusted vaccine acquisition, vaccine administration, waste disposal)	Yes	Yes	Yes	Yes
Supply chain costs (International transportation/handling and local storage/transportation)	Yes	Yes	Yes	Yes
Caregiver attending costs (transportation to receive vaccine ^a)	No	Yes	No	Yes
RVGE management costs (homecare, medical visits, hospitalisation)	No	No	Yes	Yes
Direct non-medical costs (transportation to manage RVGE)	No	No	No	Yes
Productivity losses of caregivers to manage RVGE	No	No	No	Yes

^aCaregiver attendance cost was estimated based on the conservative assumption of distributing the cost between the vaccines given together at the same session

Main Cost-Effectiveness Analysis Assumptions

- Vaccine efficacy (VE)** was assumed **equal (41.5%)¹** for all 3 vaccines in complete schedule and for all 4 RVGE health states; homecare, medical visits, hospitalisation and death
- VE decrements** were applied due to missing subsequent doses; **10.0%** relative VE reduction between first and second dose of the 2-dose vaccine; **2.4%** (between first and second dose) and **13.6%** (between second and third dose) for 3-dose vaccines⁴

Vaccine Coverage Estimates

Dose No.	Coverage
1	99.0% ^a
2	99.0% ^b
3	93.0% ^c

^aWHO and UNICEF estimates of immunization coverage of DTP1 (2021); ^bAssumed equal coverage to first dose; ^cMorocco Ministry of Health records (on file)

Results

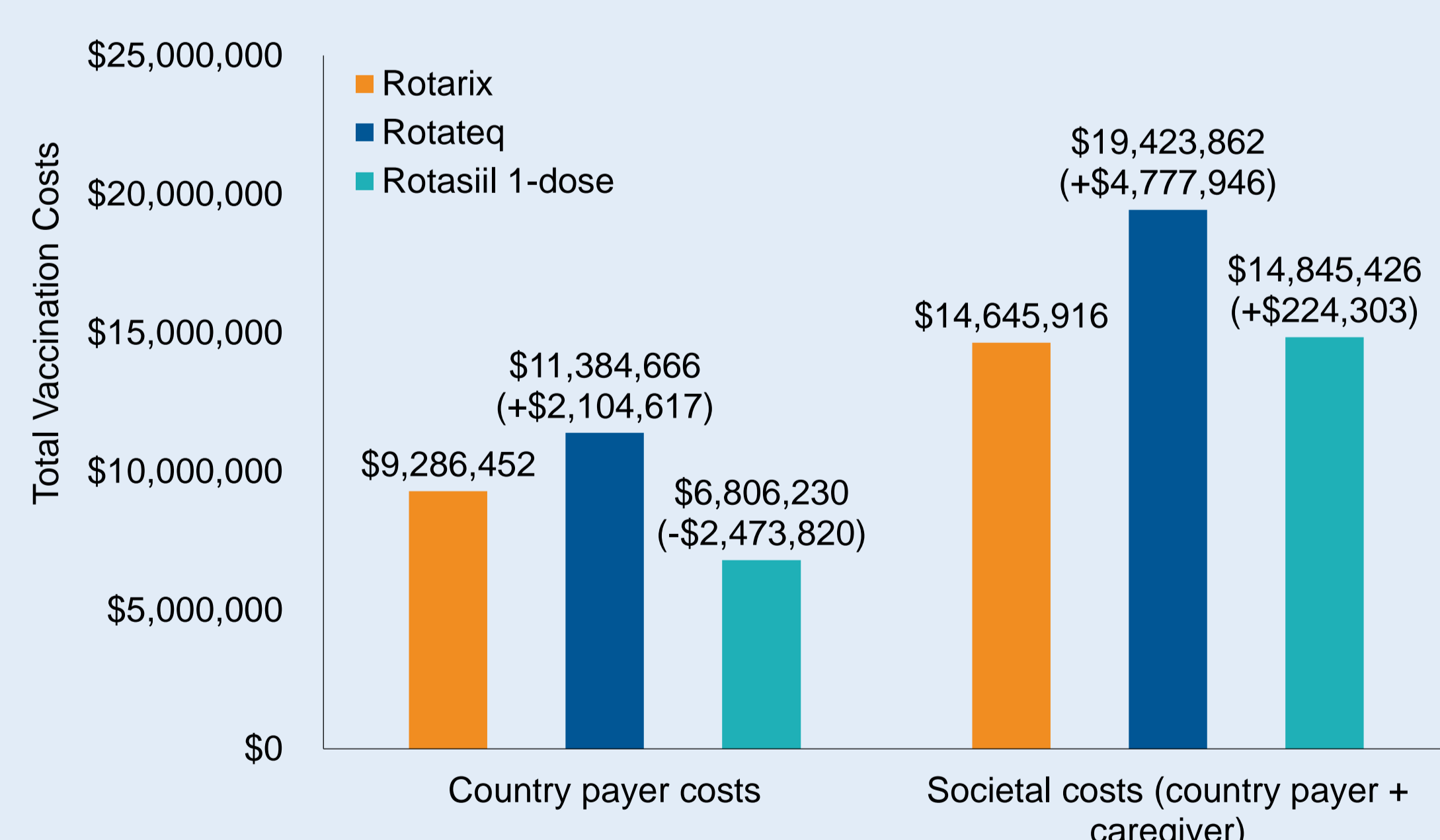


Estimated 2022 Moroccan birth cohort: **670,000⁵**

Estimated number of infants to receive ≥ 1 dose rotavirus vaccine: **663,300^a**

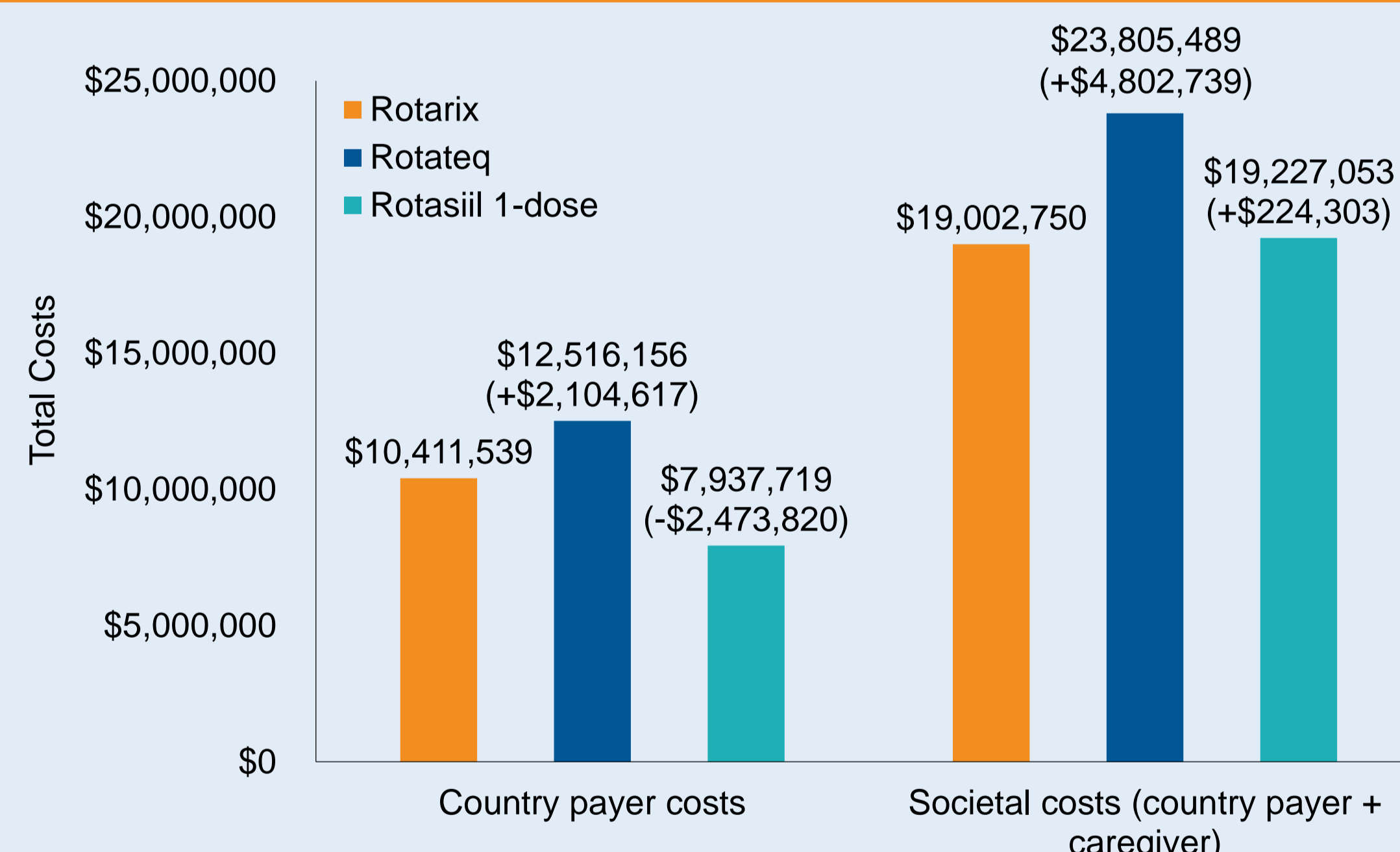
^aBased on the WHO/UNICEF estimates of immunisation coverage of DTP vaccine, which were used as a proxy for first dose coverage of the rotavirus vaccine since both vaccines are usually administered during the same session

1 Base-Case Cost Analysis Results



Vaccine	RIX4414	PRV	RVLA-1
Country payer costs			
Per fully immunised child	\$14.00	\$17.16	\$10.26
Societal costs (country payer + caregiver)			
Per fully immunised child	\$22.08	\$29.28	\$22.38

2 Base-Case Cost-Effectiveness Analysis Results



- The **2-dose vaccine** was associated with **fewer RVGE cases** compared with **3-dose vaccines**; **-284** homecare, **-84** medical visits; and **-12** hospitalisations
- RVGE cases avoided** translated into **10 QALYs** (discounted) gained for RIX4414 (1,679 discounted QALYs) compared with PRV (1,689 discounted QALYs) and RVLA-1 (1,689 discounted QALYs) over the model time horizon



Vaccine comparisons	Discounted ICER	
	RIX4414 vs. PRV	RIX4414 vs. RVLA-1
Country payer perspective	RIX4414 was dominant	\$258,872
Societal perspective (country payer + caregiver)	RIX4414 was dominant	RIX4414 was dominant

^a'Dominant' demonstrates higher benefit at lower cost

Conclusion

The 2-dose rotavirus vaccine was demonstrated to be a cost-saving option compared with 3-dose vaccines, especially when societal costs were considered

Abbreviations: DALY: disability adjusted life year; ICER: incremental cost-effectiveness ratio; NIP: National Immunization Programme; PRV: Live, oral, pentavalent rotavirus vaccine; QALY: quality-adjusted life year; RIX4414: Oral live attenuated human rotavirus vaccine; RVGE: rotavirus gastroenteritis; RVLA-1: Rotavirus vaccine, live attenuated oral (freeze-dried) 1-dose; UNICEF: United Nations Children's Fund; VE: vaccine efficacy; WHO: World Health Organization. **References:** 1. Benhafid M et al. J Med Virol 2015;87:944–53; 2. PAHO Revolving Fund Prices. 2021. <https://www.paho.org/en/revolvingfund> [Accessed 18 May 2022]; 3. Loganathan T et al. Health Policy Plan. 2018;33(2):204–214; 4. Tilson L et al. Vaccine. 2011;29:7463–73. 5. Le Maroc en chiffres 2019. 2019. 58th edition. Accessible from <https://www.hcp.ma/> [Accessed 18 May 2022] **Acknowledgements:** The study reported was funded by GlaxoSmithKline Biologicals SA. The authors acknowledge Bella Dragova-Maurin, GSK, for publication management. The authors also thank Costello Medical for editorial assistance and publication coordination, on behalf of GSK, and acknowledge Samuel Shields and Megan Thomas, Costello Medical, UK for medical writing and editorial assistance based on authors' input and direction. **Disclosures:** The economic evaluation was conducted by adapting a GSK-sponsored health economic model. **AB** is an employee of GSK. **YL**, **JG** and **AM** are employees and shareholders of GSK. **MB** received consultation fees from GSK for this study.