Cost-effectiveness and benefit-risk of rotavirus vaccination in Afghanistan: a modelling analysis informed by post-licensure surveillance

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Introduction

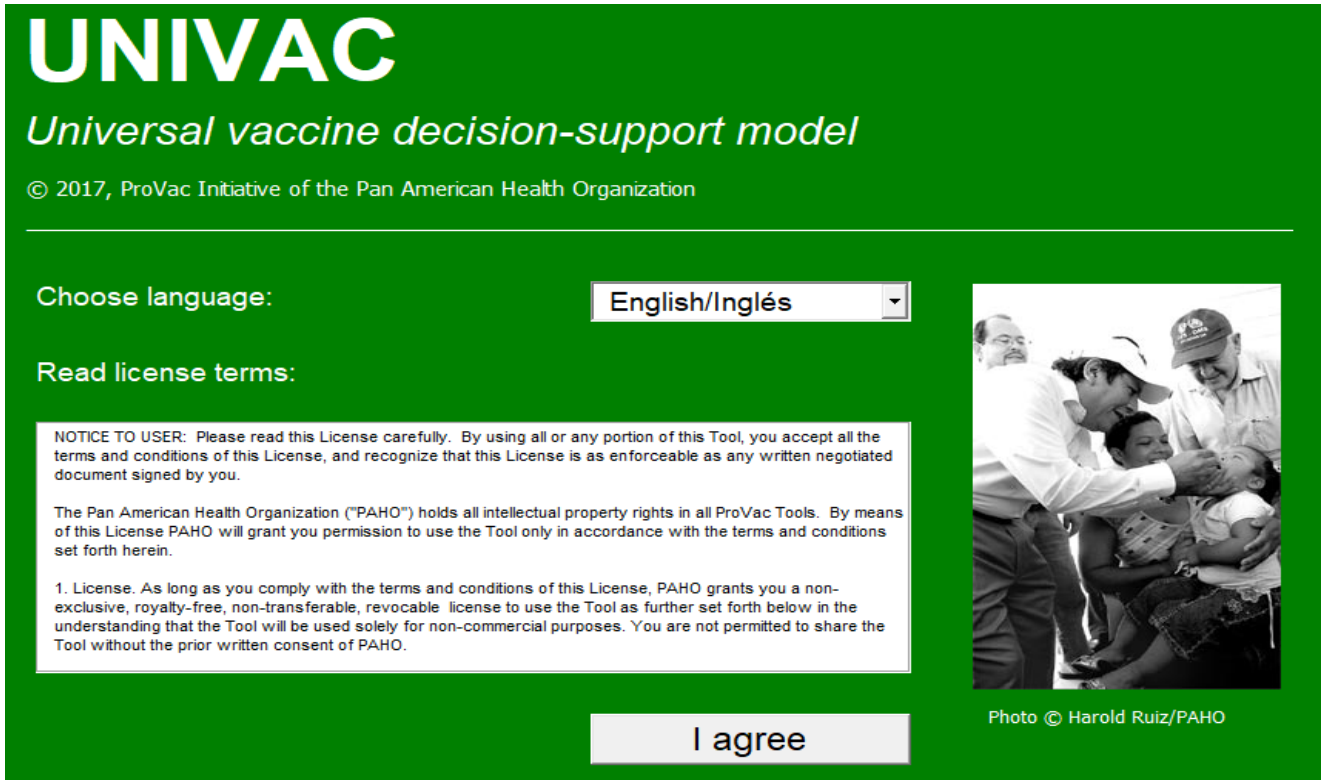
- Afghanistan introduced ROTARIX in 2018

- Post-licensure surveillance across 5 national and regional hospitals (2018-2022)
  - Moderate effectiveness: 45% VE, 39% impact
  - No substantial risk of intussusception observed

- This study aimed to assess cost-effectiveness and benefit-risk retrospectively(2018-2024) and prospectively(2025-2034)

Methods

- **Modelling approach & scenarios analysis**
  - UNIVAC v1.7.01, static cohort model
- **Periods**
  - 2018–2024: ROTARIX vs. no vaccine
  - 2025–2034: Four products comparison
- **Vaccines assessed**
  - ROTARIX (1-dose vial)
  - ROTASIIL (1 & 2-dose vial presentation)
  - ROTAVAC (5-dose vial)
- **Key metrics estimated**
  - DALYs, deaths, admissions, visits, intussusception death
- **Data sources**
  - National, regional, and global data sources
  - In consultation with national experts
  - 3% discount rate
  - All values presented in 2022 US$



Input parameters

- Disaggregated age structure (weeks of age <5)
- RVGE burden
- Healthcare cost
- Coverage, timeliness, effectiveness
- Vaccine price & delivery
- Intussusception burden, risk & cost

Results - Retrospective analysis

Economic evaluation of rotavirus vaccine with and without Gavi subsidy in Afghanistan over the period 2018-2024

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Results

1. Health outcome impact of ROTARIX (2018–2024)

- **1.72 million RVGE cases** prevented
- **911,337 outpatient** visits prevented
- **86,444 RVGE hospital** admissions averted
- **4,644 RVGE lives** (a 41% reduction) saved

2. Cost impact of ROTARIX (2018–2024)

- Around US$ 4.4 million/year (with Gavi subsidy)

[double the cost without Gavi subsidy]

- Saving from healthcare cost
  - **US$ 750K/year (Gov.)**
  - **US$ 2.2million (Societal)**
- Cost per DALY averted
  - **US$ 212 (Gov.) ≈ 40% GDP/capita**
  - **US$ 125 (Societal) ≈ 25% GDP/capita**

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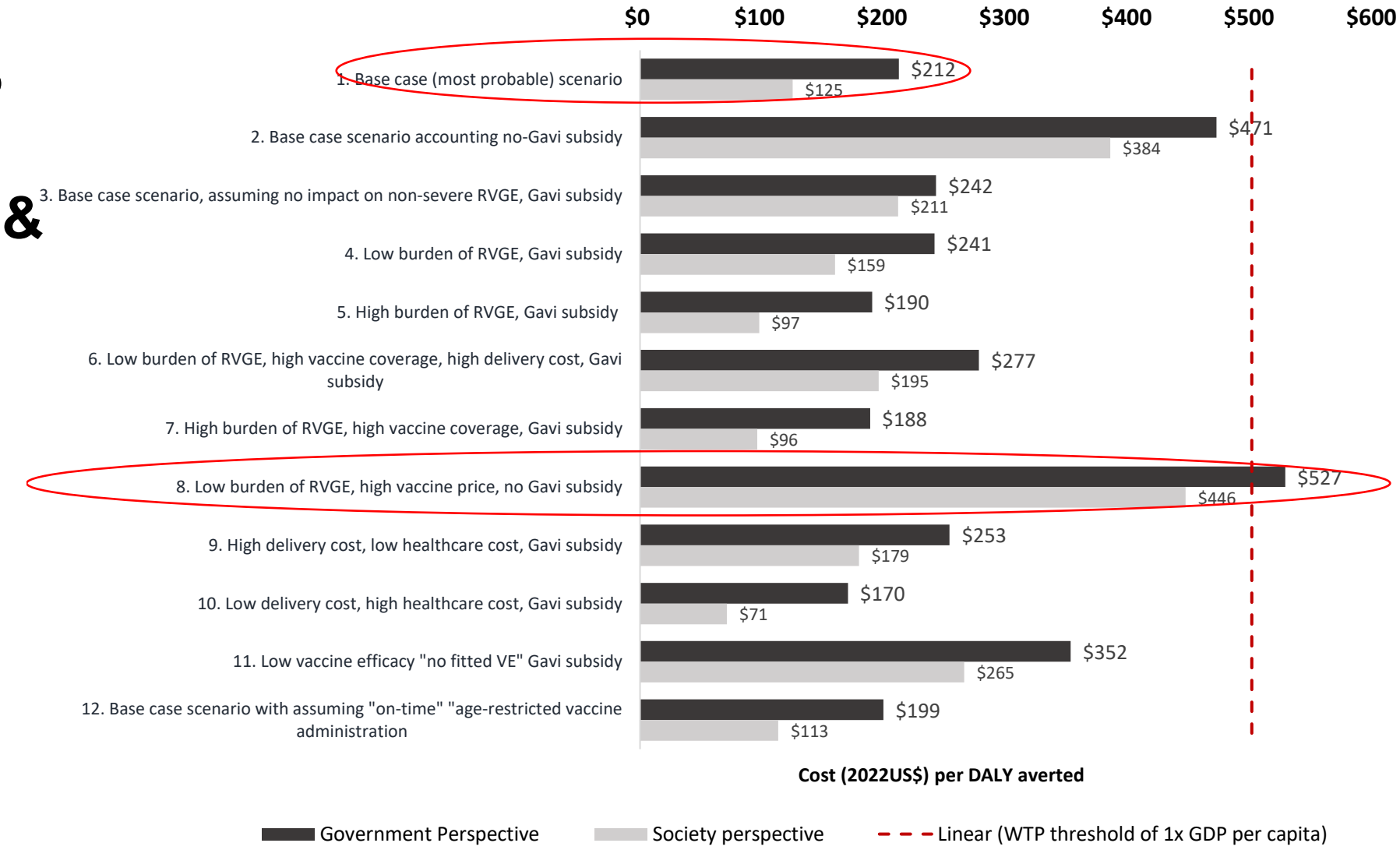
Results

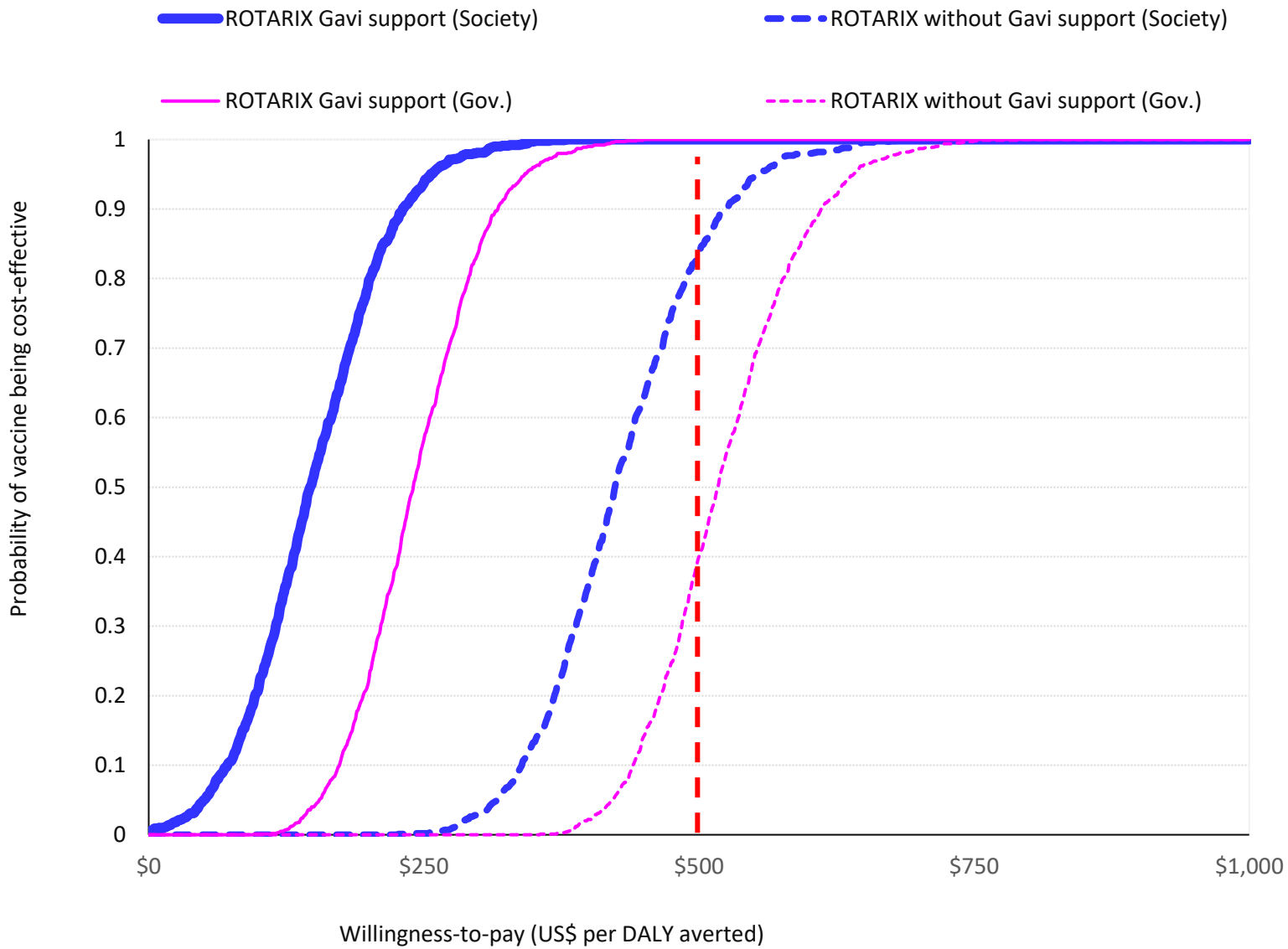
3. Scenario & sensitivity analysis



Results

4. Probabilistic analysis

Probability that ROTARIX cost-effective at different level of willingness-to-pay (2018-2024)



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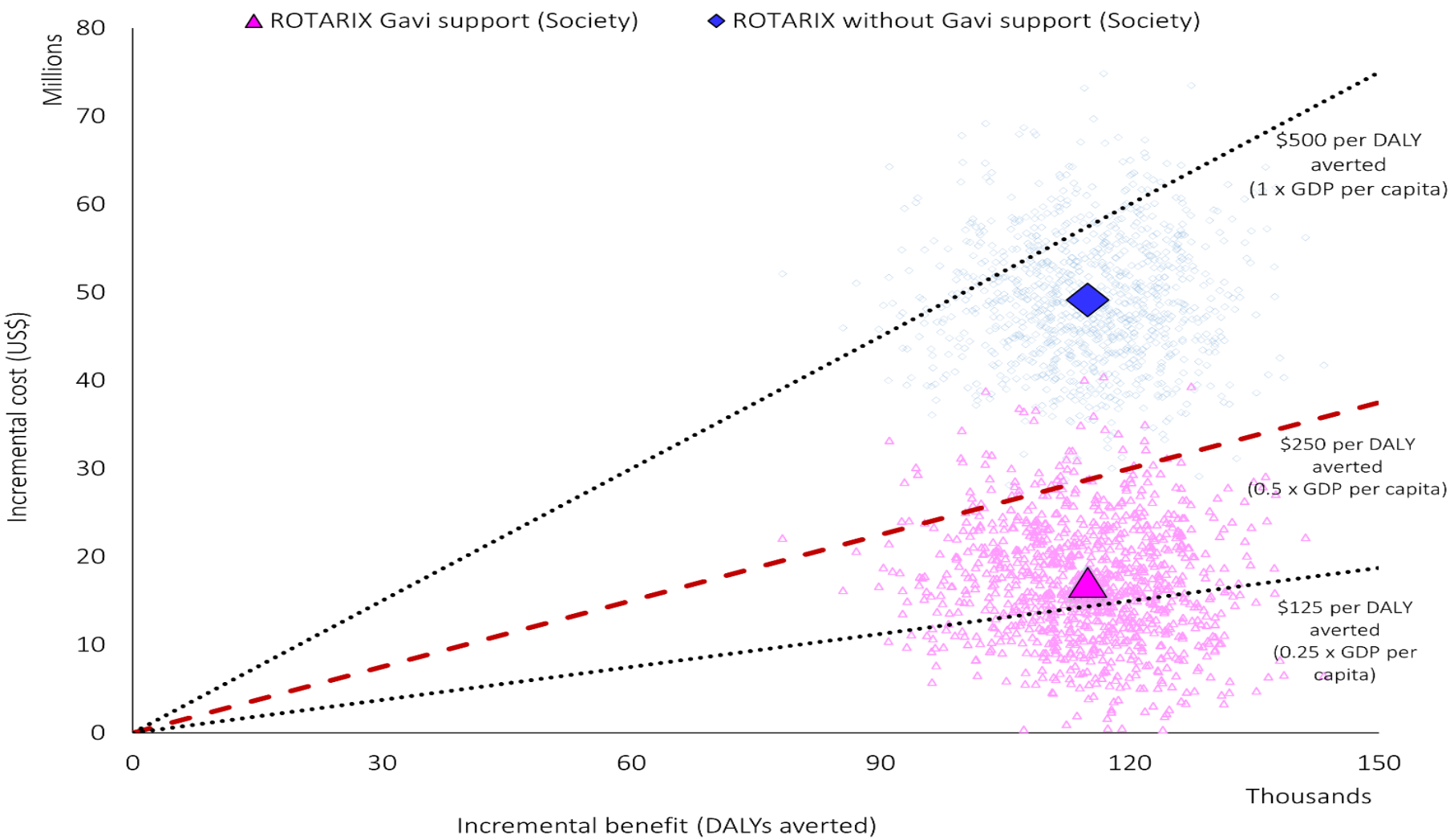
Results

Probabilistic cloud



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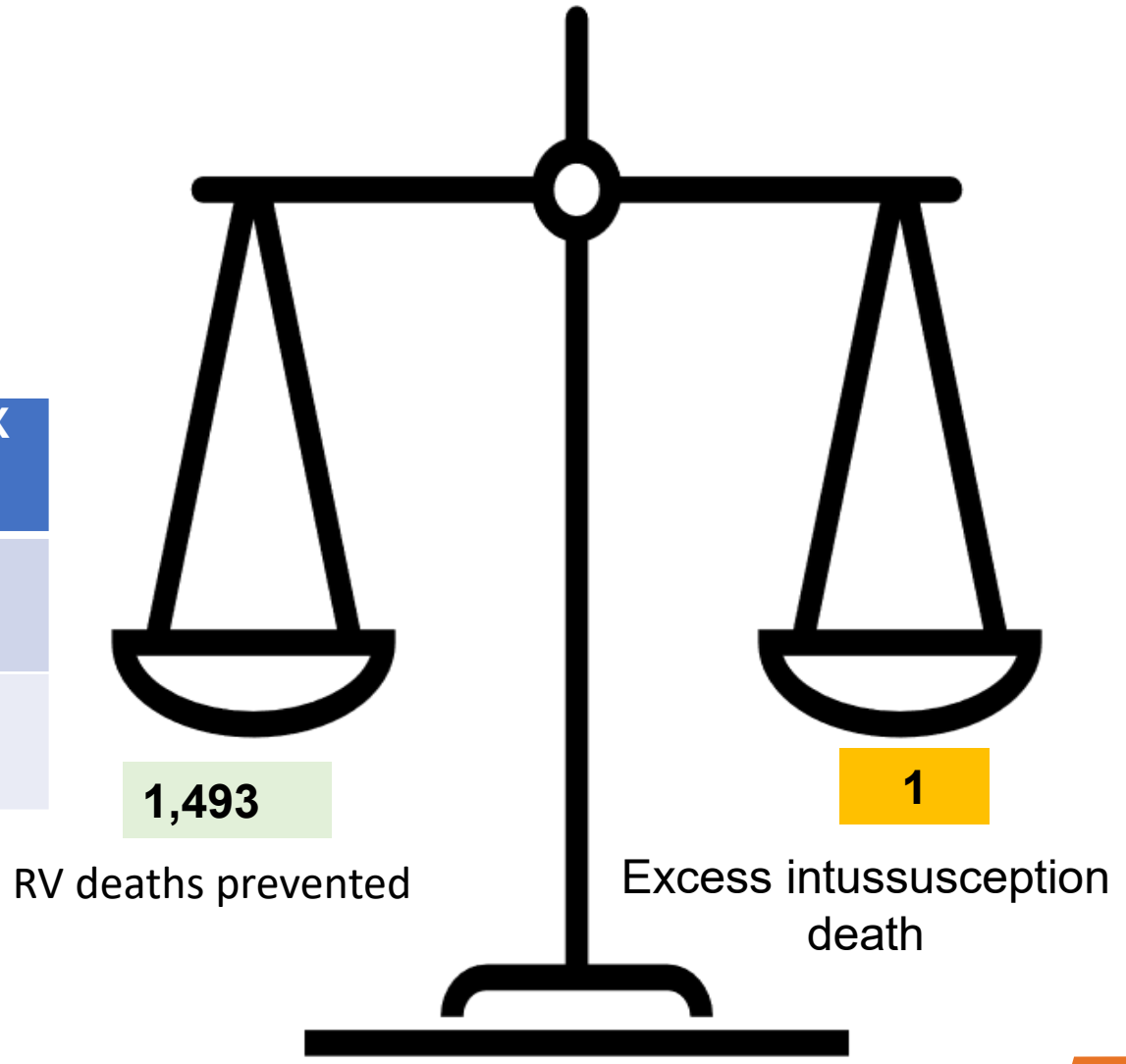
Results

5. Benefit-risk analysis

Parameter	No vaccine	ROTARIX
Intussusception cases <5yrs	14,179	14,193
Intussusception deaths <5yrs	3,034	3,037



Results - Prospective analysis

Economic evaluation of rotavirus vaccine products with and without Gavi subsidy in Afghanistan over the period 2025-2034

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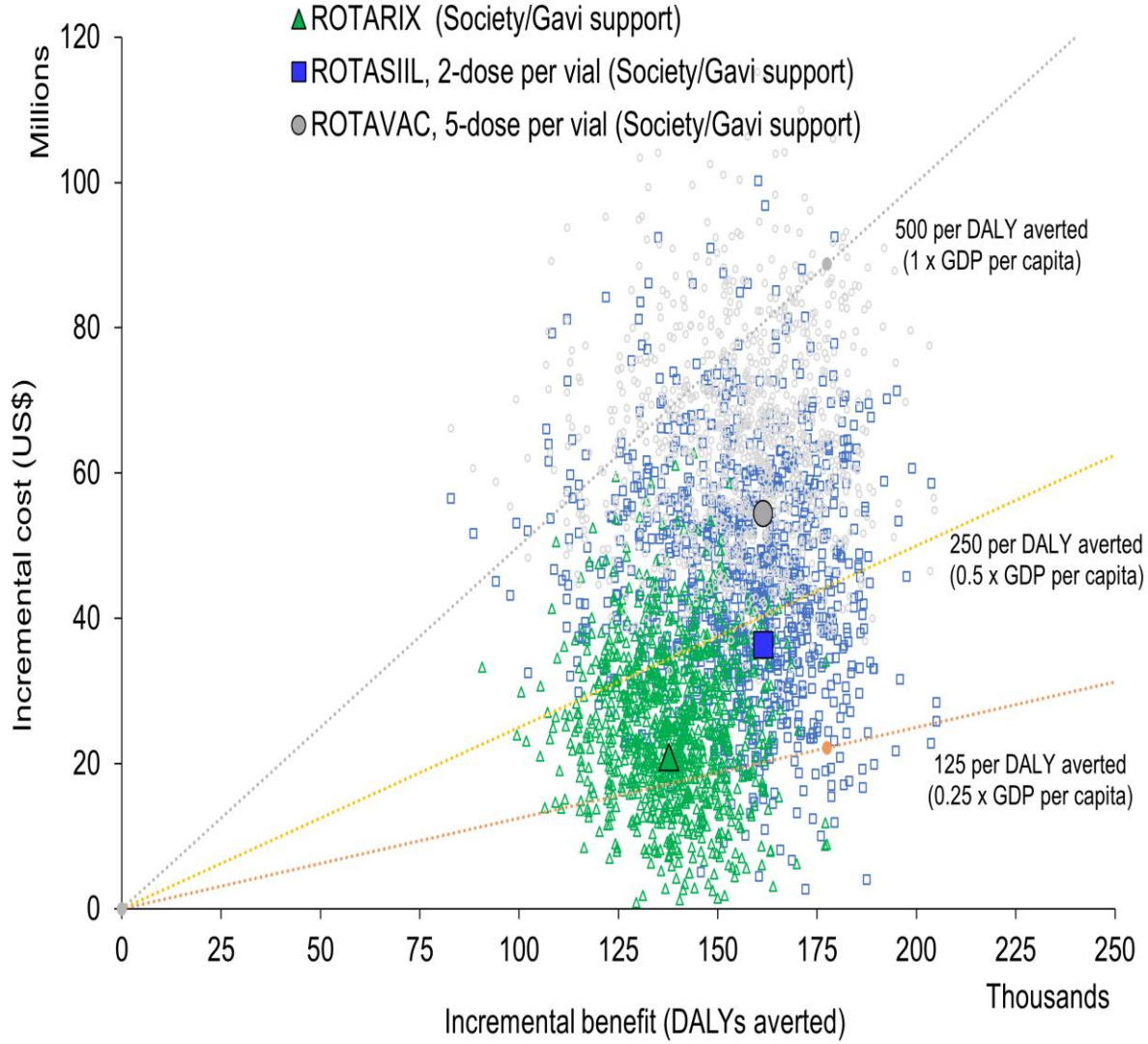

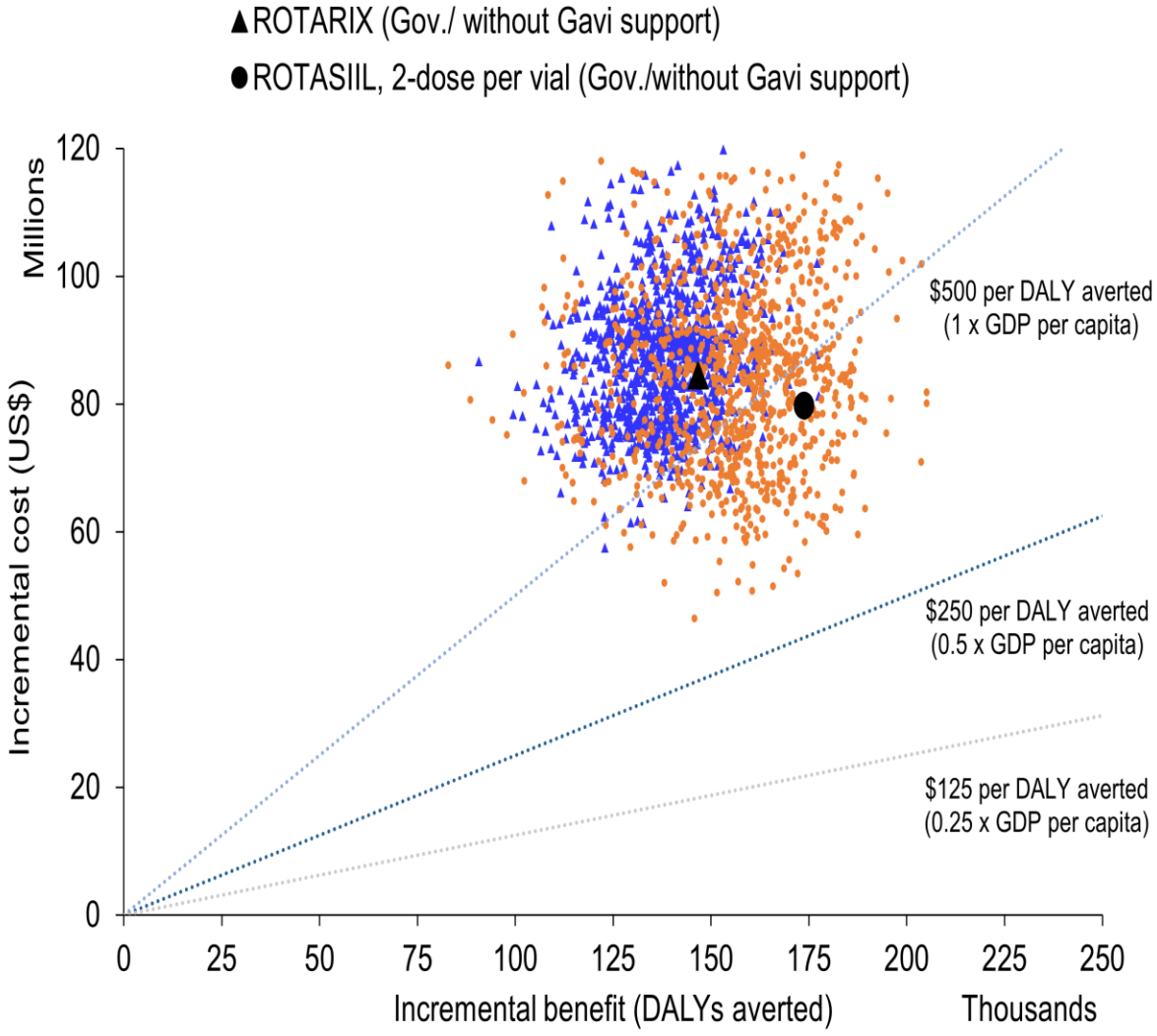

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Discussion

- Benefiting from Gavi support, Rotarix continues to be the cost-effective product

- **41% drop** in RVGE hospitalizations (2018–2024)
  - Closely matches **39% decline** in real-world data
  - Concern: **high-risk children** may be missed

- Lower coverage may **overestimate mortality gains**

- **Benefit outweighs risk** of intussusception
  - **1,493 RV** deaths prevented per **1 excess risk**
  - Comparable to 1,503:1 ratio in LMIC models

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Conclusion

- Vaccination with ROTARIX continues to be cost-effective and prevents cases of RVGE and saves lives in Afghanistan
- Vaccine benefits far outweigh risks
- Continued Gavi support critical for affordability

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Thank you

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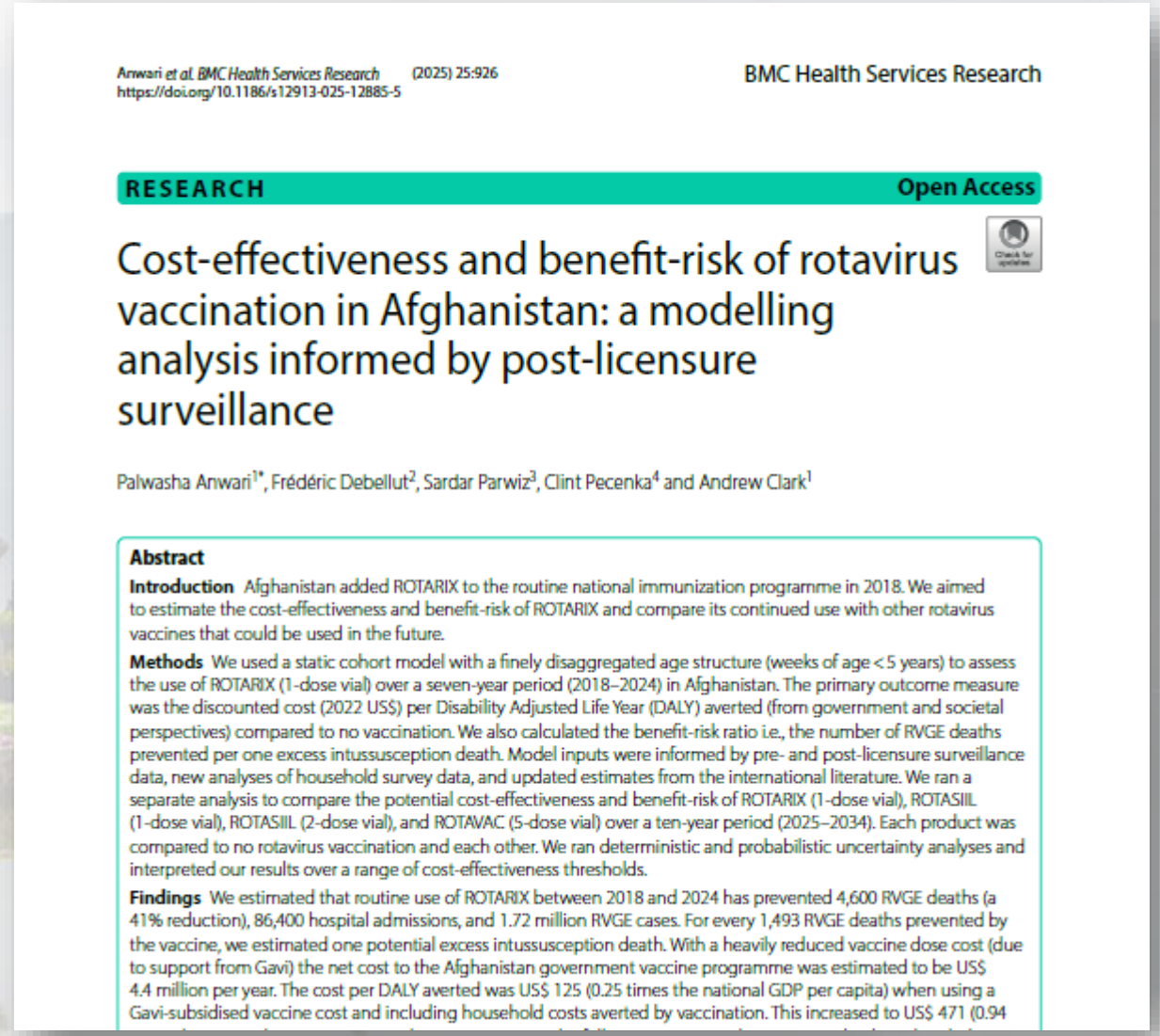

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RESEARCH Open Access

Cost-effectiveness and benefit-risk of rotavirus vaccination in Afghanistan: a modelling analysis informed by post-licensure surveillance

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Abstract

Introduction Afghanistan added ROTARIX to the routine national immunization programme in 2018. We aimed to estimate the cost-effectiveness and benefit-risk of ROTARIX and compare its continued use with other rotavirus vaccines that could be used in the future.

Methods We used a static cohort model with a finely disaggregated age structure (weeks of age < 5 years) to assess the use of ROTARIX (1-dose vial) over a seven-year period (2018–2024) in Afghanistan. The primary outcome measure was the discounted cost (2022 US$) per Disability Adjusted Life Year (DALY) averted (from government and societal perspectives) compared to no vaccination. We also calculated the benefit-risk ratio i.e., the number of RVGE deaths prevented per one excess intussusception death. Model inputs were informed by pre- and post-licensure surveillance data, new analyses of household survey data, and updated estimates from the international literature. We ran a separate analysis to compare the potential cost-effectiveness and benefit-risk of ROTARIX (1-dose vial), ROTASIIL (1-dose vial), ROTASIIL (2-dose vial), and ROTAVAC (5-dose vial) over a ten-year period (2025–2034). Each product was compared to no rotavirus vaccination and each other. We ran deterministic and probabilistic uncertainty analyses and interpreted our results over a range of cost-effectiveness thresholds.

Findings We estimated that routine use of ROTARIX between 2018 and 2024 has prevented 4,600 RVGE deaths (a 41% reduction), 86,400 hospital admissions, and 1.72 million RVGE cases. For every 1,493 RVGE deaths prevented by the vaccine, we estimated one potential excess intussusception death. With a heavily reduced vaccine dose cost (due to support from Gavi) the net cost to the Afghanistan government vaccine programme was estimated to be US$ 4.4 million per year. The cost per DALY averted was US$ 125 (0.25 times the national GDP per capita) when using a Gavi-subsidised vaccine cost and including household costs averted by vaccination. This increased to US$ 471 (0.94