The Cost-Effectiveness of Rotavirus Vaccination in Bangladesh

Considerations for the Asian Region

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Overview

- Background
- Overview of Bangladesh cost-effectiveness analysis
- Key model inputs
- Results
- Sensitivity analysis
- Implications
- Questions, suggestions, concerns?

Rotavirus Burden

- 518,000 global RV deaths in 2000 (WHO/CDC)
- 215,000 global RV deaths in 2013
  - 121,000 in Sub Saharan Africa
  - 89,000 in Asia

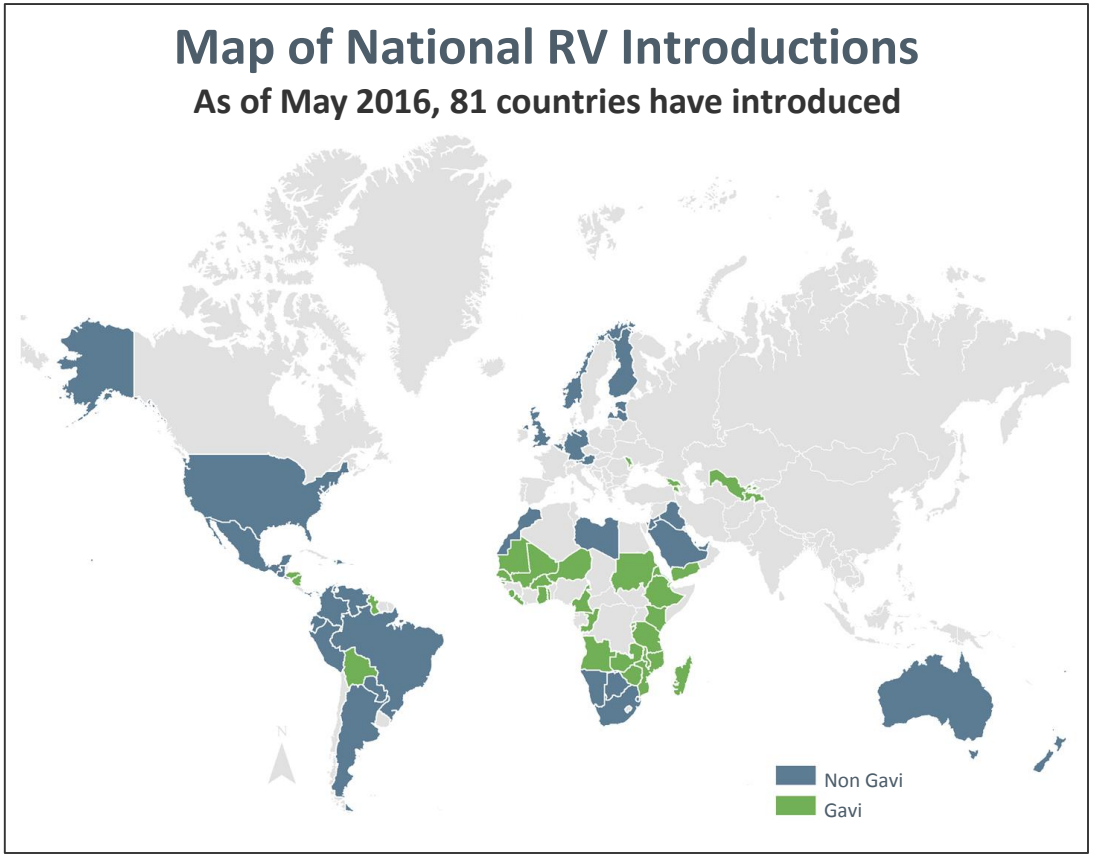
- RV mortality estimates for Bangladesh range from ~200 (IHME) to ~2,700 (WHO/CDC) per year

- Large declines in global mortality, but substantial morbidity and economic burden remains

Sources: Tate et al. Global, Regional, and National Estimates of Rotavirus Mortality in Children <5 Years of Age, 2000-2013. CID. 2016.; IHME.

Is Asia Different than Other Regions?

- Gavi eligibility
- Rotavirus mortality
- Utilization of formal care
- Cost of treatment
- Vaccine efficacy
- Others…



What do these potential differences imply for the cost-effectiveness and financing of RV vaccination in Asia?

Overview of Cost-Effectiveness Analysis

- Performed analysis using ProVac Initiative's TRIVAC model
- Examined nationwide (Bangladesh) introduction of two dose RV vaccination of infants starting in 2016; compared to no vaccination
- Used societal perspective and 10 year horizon with a 3% discount rate
- Examined several scenarios that varied:
  - Baseline mortality
  - Vaccine price paid

Key Model Inputs

Input	Value	Source
RV Incidence	10k/100k under fives	Bilcke et al. 2009
Severe cases	27%	Unpublished data based on Platts-Mills et al. 2015
Mortality	1,500 (base scenario)	Midpoint of IHME and WHO/CDC estimates
Vaccine coverage (DTP3)	95%	DHS
Vaccine efficacy (severe; non-severe; waning)	48%; 45%; 36% per year	Zaman et al. 2010 and unpublished analysis
Vaccine price per dose	$0.15-$0.54 with subsidy; $2.5 per dose w/o subsidy	Calculations based on Gavi co-financing policy
Delivery cost per dose	$1.02	Estimate based on cMYP
Treatment seeking (overall; formal care)	88%; 36%	Das et al. 2013; DHS
Treatment costs (informal; outpatient; inpatient)	$1.16; $3.24; $62.19	Das et al. 2015; Ahmed et al. unpublished analysis.

Results-Base Scenario

Output	Value (over 10 vaccinated cohorts)
Deaths averted	3,200
DALYs averted	111,000
Inpatient visits averted	460,000
Outpatient visits averted	1.2 million
Informal "visits" averted	1.8 million
Cases averted	3.9 million
Health costs averted (including household)	$7.2 million
Cost of vaccination program (subsidy; no subsidy)	$70.9 million; $193.4 million
Cost/DALY averted (subsidy; no subsidy)	$330; $1,438
Cost-effectiveness relative to current WHO threshold (income per capita)	Highly cost-effective with Gavi subsidy; cost-effective w/o subsidy

Results-Additional Scenarios

RV vaccination is cost-effective or highly-cost effective in 5 of 6 scenarios examined, and results are robust to sensitivity analysis

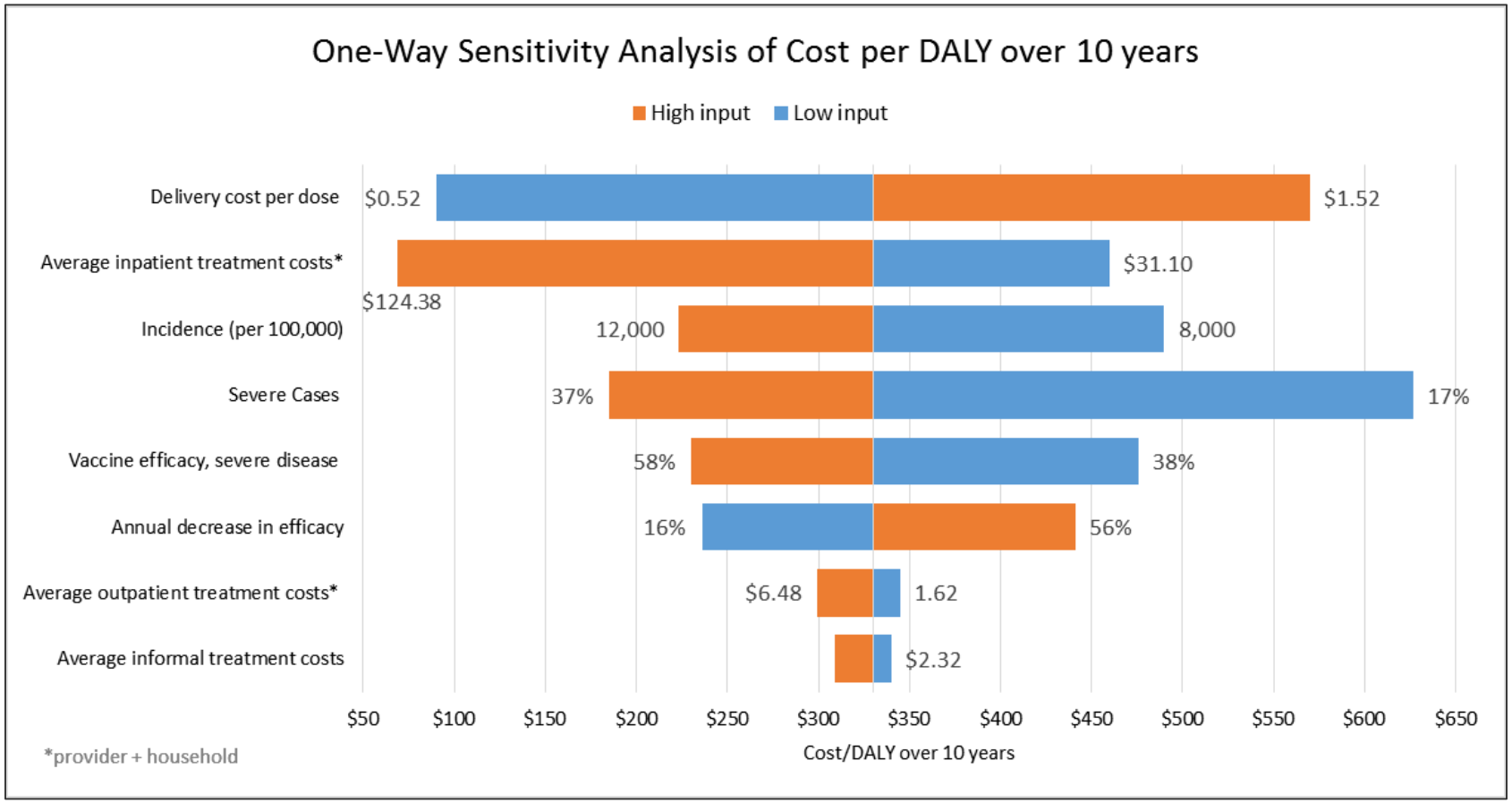
Gavi Subsidy?	Low Mortality	Midpoint Mortality	High Mortality
No	Not cost-effective	Cost-effective	Highly cost-effective
Yes	Cost-effective	Highly cost-effective	Highly cost-effective

Note:

- Comparison made to WHO income per capita thresholds
  - Cost-effective if cost per DALY < 3 times income per capita
  - Highly cost-effective if cost per DALY < 1 times income per capita
- Thresholds are a useful screen but not the only consideration
- Budget impact, affordability, feasibility, equity, alternative interventions, and other local considerations also matter

Sensitivity Analysis

RV vaccination remains highly cost-effective with varying input values in the base scenario



Implications for Bangladesh

RV vaccination

- Likely to be highly cost-effective or cost-effective for Bangladesh even without Gavi support or “high” mortality

Key variables influencing cost-effectiveness results

- Underlying mortality, vaccine costs, delivery costs, and inpatient treatment (including household) costs
- Outpatient and informal care costs do not dramatically impact results, even with high rates of treatment seeking

Implications for Asia

RV vaccination

- Can be (highly) cost-effective outside of “high” mortality contexts
- Can be (highly) cost-effective absent Gavi support

Costs likely to have greater impact on cost-effectiveness than in higher mortality regions

- Inpatient, vaccine, delivery and household costs may prove most important

Demonstrating cost-effectiveness is critical; budget impact, affordability, and political will may be more challenging and deserve attention

Next Steps

- Engage more deeply with colleagues in Bangladesh to refine inputs and analysis
- PATH and partners to host workshop this fall to help inform rotavirus vaccine introduction decisions in Asia
  - Health economic analysis important component
  - Will work with select countries to undertake country-led cost-effectiveness analyses following workshop
- Additional workshop planned in 2017 with focus on Eastern Europe

Questions, suggestions, concerns?

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Back up slides

Results-High Mortality Scenario

Output	Value (over 10 vaccinated cohorts)
Deaths averted	5,800
DALYs averted	185,000
Cases averted	3.9 million
Inpatient visits averted	460,000
Outpatient visits averted	1.2 million
Informal “visits” averted	1.8 million
Health costs averted (including household)	$7.2 million
Cost of vaccination program (subsidy; no subsidy)	$70.9 million; $193.4 million
Cost/DALY averted (subsidy; no subsidy)	$197; $857
Cost-effectiveness relative to current WHO threshold (income per capita)	Highly cost-effective with Gavi subsidy; Highly cost-effective w/o subsidy

Results-Low Mortality Scenario

Output	Value (over 10 vaccinated cohorts)
Deaths averted	450
DALYs averted	28,000
Cases averted	3.9 million
Inpatient visits averted	460,000
Outpatient visits averted	1.2 million
Informal “visits” averted	1.8 million
Health costs averted (including household)	$7.2 million
Cost of vaccination program (subsidy; no subsidy)	$70.9 million; $193.4 million
Cost/DALY averted (subsidy; no subsidy)	$1,312; $5,721
Cost-effectiveness relative to current WHO threshold (income per capita)	Cost-effective with Gavi subsidy; Not cost-effective w/o subsidy

Cost-Effectiveness Analysis (CEA)

- CEAs compare the costs and benefits of different interventions to determine which is a better value

- Main interpretation metric is the Incremental Cost-Effectiveness Ratio (ICER), e.g. Cost/DALY
  - Always compare to another option (could be no action)
  - Smaller ICERs imply an intervention is more cost effective
  - ICERs are often compared to thresholds, e.g. income per capita

- A cost-effective intervention is a good value; it may not be affordable