

# POLICY BRIEF

## Would a rotavirus vaccination program for children under 5 years be cost-effective for Bhutan?

In many countries, rotavirus vaccination is the most cost-effective way to prevent rotavirus diarrhea. With this in mind, the Essential Medicines and Technology Division (EMTD) in collaboration with Health Intervention Technology Assessment Program (HITAP), Mahidol Oxford Research Unit (MORU), and PATH conducted a study to assess the cost-effectiveness, budget impact, and human resource impact of a rotavirus vaccination program compared with no vaccination.

The findings projected that, at current prices, none of the evaluated rotavirus vaccines (ROTARIX, RotaTeq, ROTAVAC, and ROTASIIL) would be cost-effective in Bhutan at a willingness-to-pay (WTP) threshold of 0.5 times the gross domestic product (GDP) per capita (i.e. US\$ 1,537 = Nu. 111,908) unless there is price negotiation with manufacturers.

Among four RV vaccines, ROTASIIL has the potential of giving best value-for-money with the lowest net budget impact of US\$ 40,600 per year at the current price. ROTASIIL and ROTAVAC would be cost-effective at 0.5 GDP per capita thresholds if the vaccine price per dose were reduced below US\$ 0.76 and US\$ 0.57, respectively.

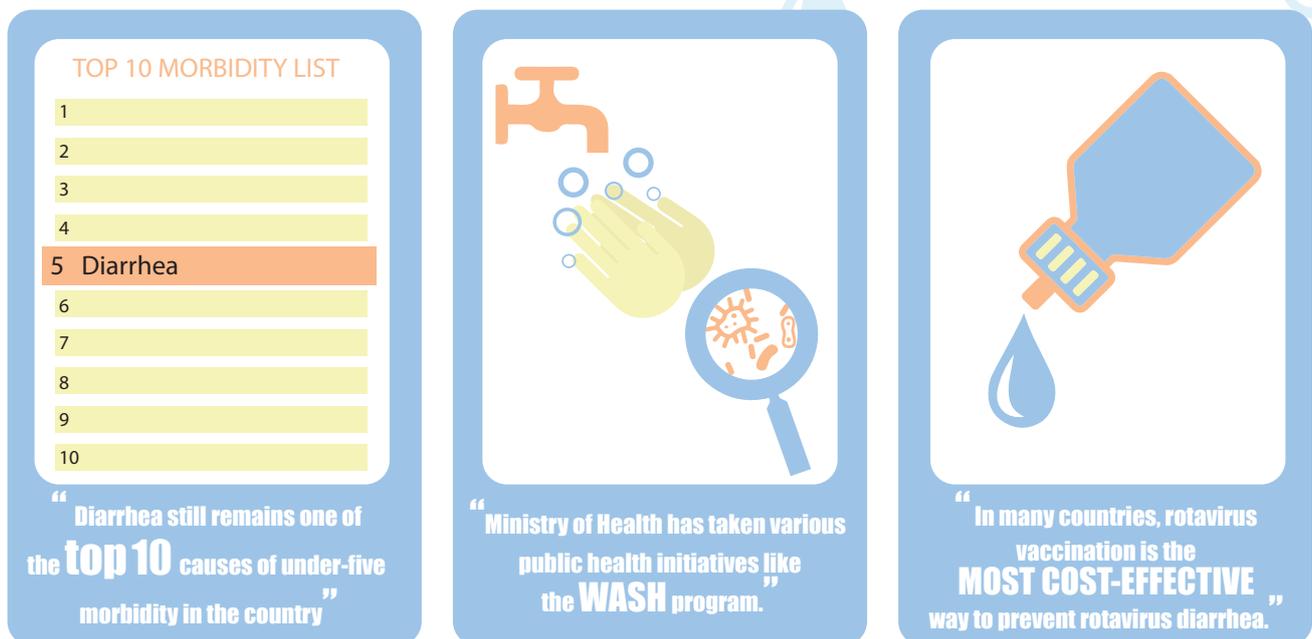


Figure 1: Challenges and interventions in tackling diarrhea in Bhutan

RESULT	ROTARIX	RotaTeq	ROTAVAC	ROTAIIL
Vaccine Program Cost	1,098,000	1,477,000	512,000	467,000
Healthcare Cost Averted	131,000	145,000	145,000	145,000
DALYs Averted	104	115	115	115
<b>ICER against No-vaccine</b> (USD per DALY Averted)	<b>9,267</b>	<b>11,606</b>	<b>3,201</b>	<b>2,803</b>

Table 1: Cost-effectiveness of each vaccine option (ICER = Incremental Cost-effectiveness Ratio, Currency: USD (1USD = Nu.72.8))

Diarrhea cases and deaths have decreased over the last decade in Bhutan. This improvement could be attributable to various public health initiatives taken by Ministry of Health (MOH) like the water, sanitation, and hygiene program (WASH). However, diarrhea still remains one of the top 10 causes of under-five (U5) morbidity in the country. Based on the rotavirus positivity rate (27.4% in hospitalized diarrhea and 11.7% in OPD diarrheal visit) from the surveillance data, the incidence of non-severe Rotavirus Gastroenteritis (RVGE) visit and severe RVGE hospitalization was 2,122 and 269 per 100,000 U5 population per year, respectively. Likewise, in the last few years, there was only one diarrheal death reported each year in the Health Management and Information System (HMIS) database, which is Bhutan's national database of health information collected from all the health facilities. However, the Royal Government of Bhutan needs to carefully weigh the costliness of the vaccine against the cost of treating the morbidity due to diarrhea.

## Evaluation of Rotavirus Vaccines for Routine Immunization Program in Bhutan

To assess the cost-effectiveness, the budget impact, and human resource impact of a rotavirus vaccination program compared with no vaccination, a cost-effectiveness analysis was performed from the government perspective. The analysis used UNIVAC (version 1.3.41), a deterministic static cohort model developed at the London School of Hygiene and Tropical Medicine. The vaccines evaluated were ROTARIX, RotaTeq, ROTAVAC, and ROTASIIL. The costs and health outcomes were followed for 10 cohorts of U5 starting in 2020. The outcome was in terms of cost per disability-adjusted life-year (DALY) averted and the result was presented in terms of the incremental cost-effectiveness ratio (ICER). The cost-effectiveness thresholds of 0.5 (US \$1,537 = Nu.111,908) and 1.0 (US \$3,074 = Nu.223,815) times the GDP per capita were used for the base case analysis and sensitivity analysis, respectively.

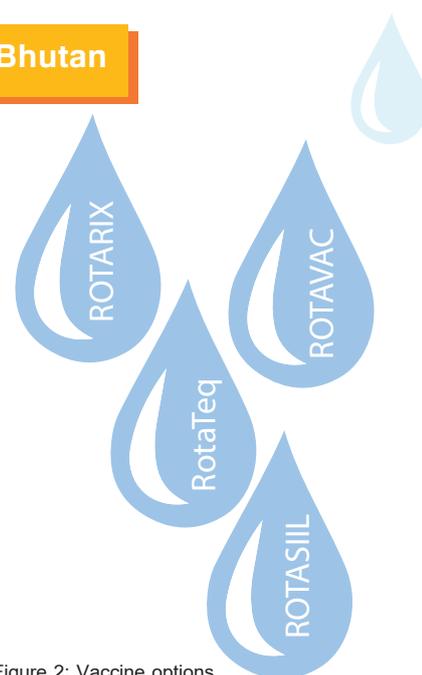


Figure 2: Vaccine options

## Key Findings

At current vaccine prices, none of the available rotavirus vaccines would be cost-effective in Bhutan at a threshold of 0.5 times the GDP per capita. ROTASIIL and ROTAVAC would be cost-effective options at the threshold of 1 time GDP per capita.

The prices of ROTASIIL and ROTAVAC would have to be reduced below US\$ 0.76 and US\$ 0.57 per dose, respectively, in order for them to be cost-effective at threshold of 0.5 GDP per capita. ROTASIIL and ROTAVAC would also be cost-effective at 0.5 GDP per capita if the disease burden were higher. On average, the vaccination program costs (including cost of vaccine, international handling charges and vaccine wastage) for ROTASIIL and ROTAVAC are projected to be US\$ 58,000 and US\$ 63,000 per year, respectively. Refer Table 1 on Page 1

## Impact on Budget and Human Resource

The study analyzed the projected five-year budgetary requirements and impacts on human resources for implementation of a rotavirus vaccination program. The analysis showed that the vaccination program would require a budget of around US\$ 310,000 for ROTAVAC and US\$ 290,000 for ROTASIIL. On average, the net budget impact is US\$ 45,600 and US\$ 40,600 per year for ROTAVAC and ROTASIIL, respectively.

BUDGET IMPACT ANALYSIS	ROTARIX	RotaTeq	ROTAVAC	ROTASIIL
Year 1	147,000	192,000	66,000	68,000
Year 2	114,000	159,000	42,000	36,000
Year 3	112,000	56,000	41,000	34,000
Year 4	109,000	151,000	40,000	33,000
Year 5	105,000	147,000	39,000	32,000
<b>TOTAL</b>	<b>587,000</b>	<b>805,000</b>	<b>228,000</b>	<b>203,000</b>

Table 2: Budget Impact Analysis over a period of five years (Currency: USD (1USD= Nu. 72.8))

The study also analyzed the impact of rotavirus vaccination program on human resources in the health sector. It was determined that the program's resulting reduction in illness has the potential to reduce the workload of health workers like pediatricians, medical officers, nurses, dieticians, and pharmacists; however, administering the vaccines would increase the workload of health assistants.

Health personnel	HR for vaccination	HR for treatment (No vaccine)	Displaced HR (FTE)
Dietician	-	0.02	-0.01
General Doctor	-	0.35	-0.14 - 0.16
Health Assistant	2.01 - 2.98	0.25	1.87 - 2.85
Nurse	-	0.09	-0.04
Pediatrician	-	0.35	-0.14 - 0.16
Pharmacist/Pharmacy Technician	-	0.06	-0.02 - 0.03

Table 3: Human Resource Impact Analysis (HR: Human resources; Unit: Full-time equivalent (FTE))

## STRENGTHS AND LIMITATIONS

The main strengths of this study are its insights on cost-effectiveness, choice of vaccine product, financial feasibility, and impact on human resources. Other strengths are the usage of local data and meta-analysis results with a validated analytical tool (UNIVAC), evaluation of all available WHO pre-qualified rotavirus vaccines, and validation of input parameters and results by a group of local experts through stakeholder consultation meeting. However, some of the limitations are;

1. High probability of underreporting of rotavirus diarrhea due to poor surveillance and low number of samples.
2. Lack of laboratory confirmation for diarrhea deaths included as rotavirus deaths.
3. The indirect benefits of vaccination such as herd protection and societal costs were not accounted for in the analysis.

## Policy Recommendations

- At current price, the government should not pursue rotavirus vaccination program because none of the vaccines appear to be cost-effective at the threshold used in the study unless there is a price reduction through negotiation with manufacturers.
- ROTASIIL has the most potential value-for-money followed by ROTAVAC based on the estimated ICER. However, ROTASIIL requires an additional step to reconstitute the vaccine which may require additional training, and ROTAVAC requires -20°C cold chain storage at central and regional walk-in cooler.

## Acknowledgement

This Policy Brief is a part of the collaboration between Essential Medicines and Technology Division, Ministry of Health, Bhutan and Health Intervention and Technology Assessment Program (HITAP). HITAP is funded by the Thailand Research Fund under a grant for Senior Research Scholar (RTA5980011). HITAP's international unit has been supported by the iDSI (funded by the Bill & Melinda Gates Foundation and the Department for International Development, United Kingdom), and the Rockefeller Foundation to provide technical assistance on health intervention and technology assessment for governments of low- and middle- income countries. This study has been supported by the Royal Government of Bhutan, WHO Country Office of Bhutan, the International Decision Support Initiative (iDSI), and PATH, Seattle. The findings, interpretations, and conclusions expressed in this article do not necessarily reflect the views of the funding agencies.

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