

Cost-effectiveness of Dengvaxia in Puerto Rico

Guido España, Alex Perkins

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1 Introduction

The latest results of the CYD-TDV vaccine show an increased risk of severe dengue upon infection among vaccinees without previous exposure to dengue virus (DENV) [1]. The World Health Organization (WHO) recommends a pre-vaccination screening to ensure that only those with previous exposure to DENV are vaccinated [2]. However, rapid diagnostic tests with high sensitivity and specificity are not currently available. We have previously discussed the benefits and cost-effectiveness of pre-screening vaccination for economic scenarios of the Philippines and Brazil [3]. Here, we discuss the implications of this strategy for Puerto Rico in terms of epidemiological benefits and cost-effectiveness.

2 Methods

We updated our assumptions of treatment of dengue for ambulatory cases and hospitalizations, based on estimates from 2002 to 2010 [4]. Using the consumer price index for Puerto Rico, we projected these costs to 2019 USD. Similarly, we took the GDP per-capita for Puerto Rico in 2016 [5] and projected it's value to 2019.

We then calculated the Incremental Cost-Effectiveness Ratio (ICER) as in equation 1. As others have, we deemed the intervention cost-effective if the ICER was below 3

	Cost (USD)	Cost Projected (2019 USD)
Ambulatory	239 (2010)	311
Hospitalization	1615 (2010)	2107
GDP per-Capita	30,833 (2016)	30,833

Table 1: Costs for dengue burden in Puerto Rico

GDP per-Capita, and very cost-effective if the ICER fell below 1 GDP per-Capita. We assumed a baseline scenario of costs.

$$ICER = \frac{Cost_{intervention} - Cost_{no-intervention}}{QALY_{intervention} - QALY_{no-intervention}} \quad (1)$$

3 Results

3.1 Epidemiological benefits from vaccination

The benefits are outlined in Fig. 1. At $PE_9 = 0.5$ there are several scenarios where the vaccine is beneficial from the public health perspective.

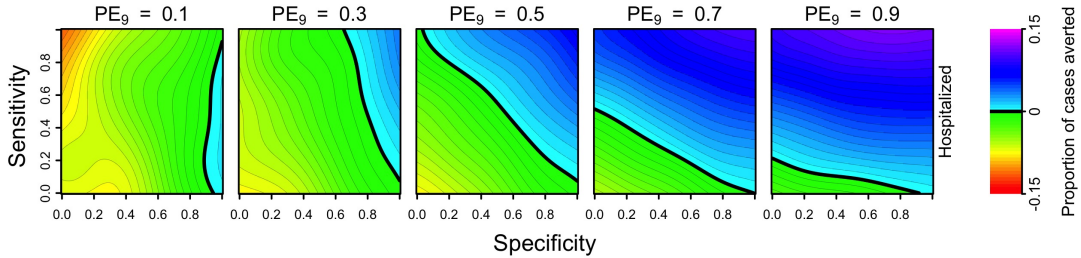


Figure 1: Proportion of cases averted with pre-vaccination screening strategy with CYD-TDV over 10 years

3.2 Cost-effectiveness of pre-vaccination screening strategies

Our cost-effectiveness analysis suggests that the intervention would be cost-effective in Puerto Rico at the assumed price of the vaccine (70 USD) (Fig. 2). Below 200 USD per fully vaccinated person, pre-vaccination screening would be cost-effective from a public payer perspective ($ICER < 3$ GDP per Capita). Very cost-effective scenarios could be achieved with a vaccine price below 95 USD per vaccinated individual. Also, at 18 USD per vaccinated individual, the costs of the intervention are equal to the costs without intervention ($ICER = 0$). Nonetheless, these cost-effectiveness thresholds depend on our assumptions of specificity and sensitivity of screening.

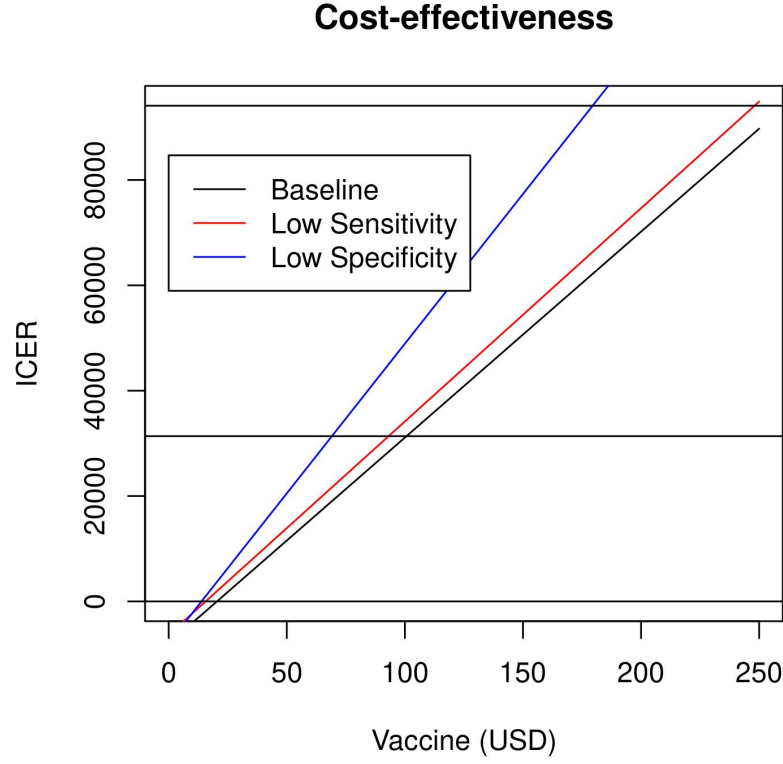


Figure 2: ICER of pre-vaccination screening strategy in Puerto Rico at different cost of vaccination (3 doses per person).

3.3 Tornado diagram and sensitivity analysis

We varied the baseline value of five parameters of the cost-effectiveness analysis: sensitivity, specificity, PE9, vaccine cost for a fully vaccinated individual, and screening unit cost. The ranges of the parameter values are summarized in table 2.

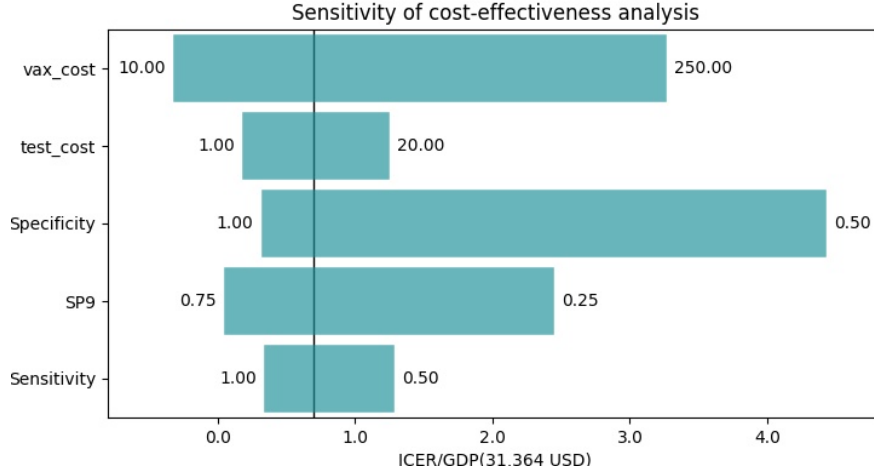


Figure 3: ICER of pre-vaccination screening strategy in Puerto Rico at different cost of vaccination (3 doses per person).

parameter	min	max	ICER_min	ICER_max	ICER_default	GDP
Sensitivity	0.50	1.00	32622.40	18452.13	22012.70	31364.60
SP9	0.25	0.75	69042.20	9161.02	22012.70	31364.60
Specificity	0.50	1.00	131214.40	17682.60	22012.70	31364.60
test_cost	1.00	50.00	13438.97	60118.17	22012.70	31364.60
vax_cost	10.00	250.00	-2279.54	94889.41	22012.70	31364.60

Table 2: Sensitivity analysis of cost-effectiveness

4 Discussion

Assuming a moderate transmission intensity in Puerto Rico, we found that this intervention could be beneficial from the public health and individual perspective, conditioned to moderate values of sensitivity and high values of specificity. Compared to our previous simulation analysis for the Philippines and Brazil [3], the main differences of this analysis are the costs of treatment of dengue fever and severe dengue cases, which are based on studies from 2010. More recent estimates of this type of costs would refine the estimates of cost-effectiveness of pre-vaccination screening with CYD-TDV in Puerto Rico.

References

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- [3] España G, Yao Y, Anderson KB, Fitzpatrick MC, Smith DL, Morrison AC, et al. Model-Based Assessment of Public Health Impact and Cost-Effectiveness of Dengue Vaccination Following Screening for Prior Exposure. *bioRxiv*. 2019;.
- [4] Halasa YA, Shepard DS, Zeng W. Economic Cost of Dengue in Puerto Rico. *The American journal of tropical medicine and hygiene*. 2012;86(5):745–752.
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