

Cost-effectiveness of the Dengue Vaccine TAK-003 in Thailand

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BACKGROUND

- Dengue is a vector-borne disease that can affect infants, young children, and adults
- The TIDES study (DEN-301; NCT02747927) evaluated the efficacy of the candidate vaccine, TAK-003, in healthy children and adolescents aged 4-16 years in 8 dengue-endemic countries across Asia and Latin America¹
 - Two doses of TAK-003 were sufficient to achieve the primary endpoint (overall vaccine efficacy) and secondary endpoint (efficacy by baseline serostatus, serotype, hospitalized dengue, and severe dengue)
 - Two doses of TAK-003 also demonstrated long-term efficacy (up to 4.5 years' follow-up) against symptomatic and hospitalized dengue in >20,000 children and adolescents
- TAK-003 is approved for the prevention of dengue disease caused by any serotype in Indonesia in those aged 6-45 years,² in Brazil for those aged 4-60 years,³ and in the EU⁴ for those aged >4 years without requiring prevaccination screening

OBJECTIVE

- Assess the public health impact and cost-effectiveness of routine vaccination with TAK-003 (given as two doses 3 months apart for dengue prevention) at age 11 years as part of the national immunization program in Thailand

METHODS

- The dynamic model was developed (**Supplementary Table and Figure**) with age-structured host population, explicitly modelled vector population, age- and serotype-specific force of infection, up to 4 serotype-specific dengue infections and key elements of the dengue natural history (cross-protection, increased risk of clinical and hospitalized disease with second infections)
- The model was fitted to the age-specific incidence rate observed in Thailand over the period 2011-2020, and using Thai specific input data wherever possible
 - Under-reporting was corrected for using expansion factors for symptomatic and hospitalized cases
- Routine vaccination of 11-year-olds^a with TAK-003 (2 doses) was assessed for public health impact and cost effectiveness over a 20-year time horizon
 - Cost-effectiveness was measured as the difference in costs divided by the difference in disability adjusted life years (DALYs) compared with no vaccination
 - Payer perspective included direct medical costs as well as vaccine-related (acquisition and administration) costs
 - Societal perspective included all costs considered in payer perspective, direct non-medical costs, productivity loss, and school absenteeism

^aThe rationale for routine vaccination at age 11 years and coverage of 87% was based on the human papillomavirus (HPV) vaccination age and coverage in Thailand.⁵ For HPV vaccination, 2 doses were given at 0 and 6 months to 5th grade girls.

REFERENCES

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RESULTS

- Routine vaccination of children aged 11 years with TAK-003 at 87% coverage (among the entire population) in Thailand over 20 years (**Figure 1**) led to:
 - 41% (28-58 [95% CI]) reduction in symptomatic dengue cases
 - 50% (38-64 [95% CI]) reduction in hospitalized dengue cases
- Prevented annual incidence (among vaccinated subjects [direct and indirect effects] and unvaccinated subjects [indirect effect]) and residual incidence of symptomatic dengue among the entire population are shown in **Figure 2**
- At a discount rate of 3%, and illustrative vaccine price of \$25/dose (price may vary by country), vaccination with TAK-003 was found to result in cost savings (from both payer and societal perspectives) and lower number of DALYs compared with no vaccination over 20 years (**Table 1**)
- Vaccination with TAK-003 compared with no vaccination could lead to cost savings of US\$1.42 billion from a societal perspective or 744 million from a payer perspective (**Table 1**)
- The model results are robust, as reflected in the sensitivity analysis (**Figure 3**)
- Threshold prices for cost saving and cost-effectiveness with willingness-to-pay (WTP) of US\$5000 (160K Baht) per averted DALY, US\$7000 (1 × GDP) per averted DALY or \$14,000 (2 × GDP) per averted DALY are shown in **Table 2**
- Main drivers of threshold prices for cost-saving and cost-effectiveness at different WTP levels are shown in **Figure 4**

FIGURE 1. PROPORTION OF INFECTIONS AVOIDED AMONG THE ENTIRE POPULATION OVER 20 YEARS

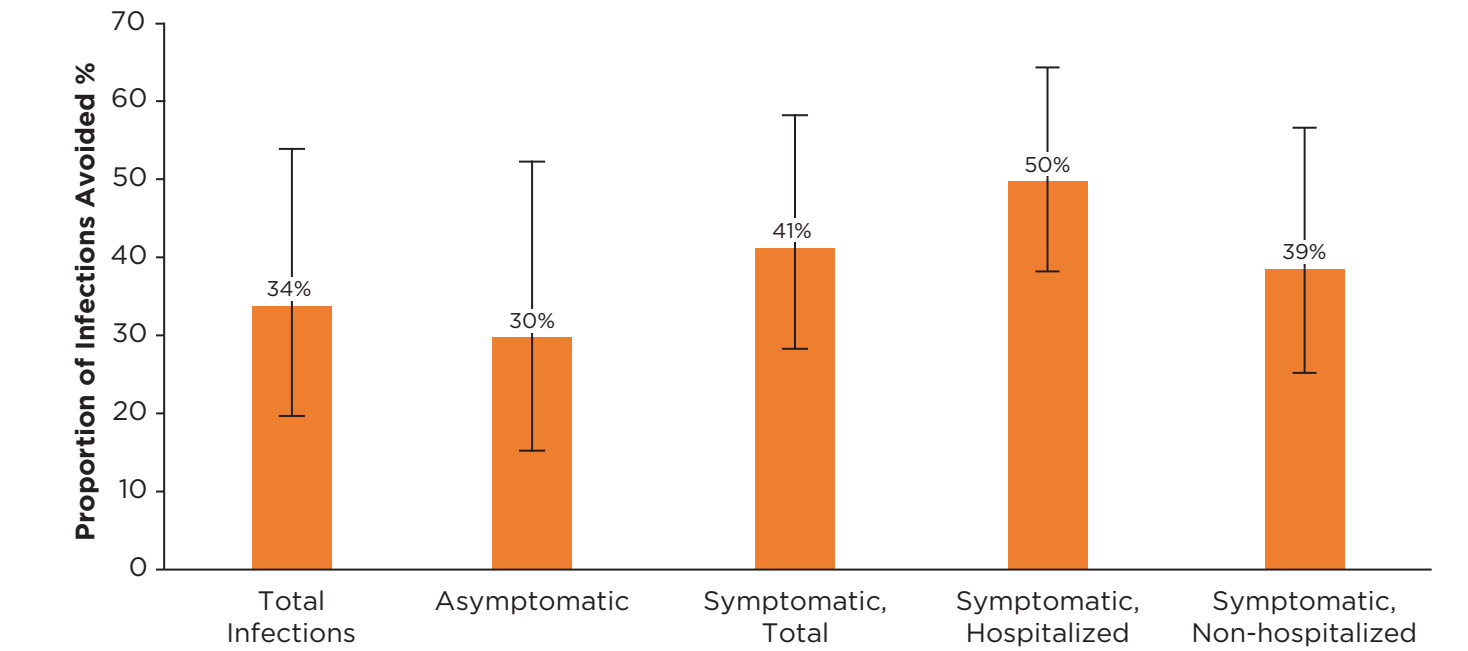
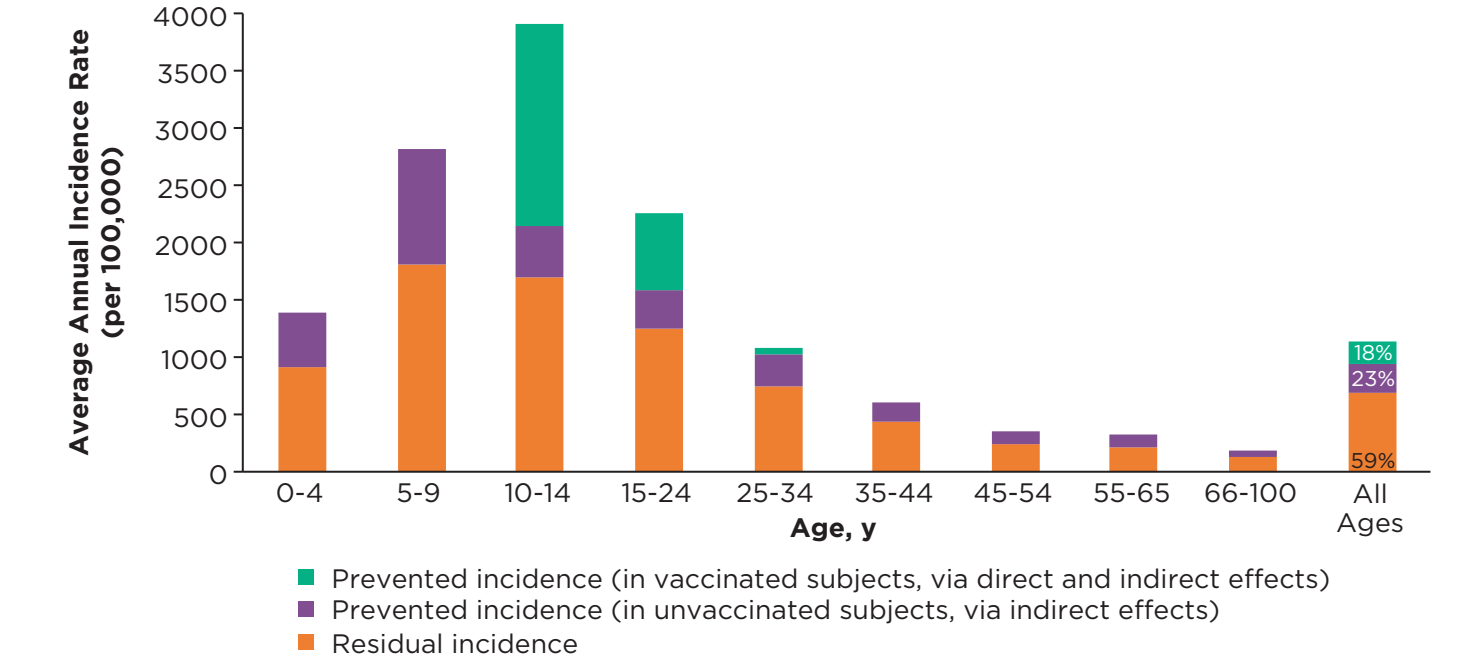


FIGURE 2. PREVENTED ANNUAL INCIDENCE IN VACCINATED (DIRECT AND INDIRECT EFFECTS) AND UNVACCINATED SUBJECTS (INDIRECT EFFECTS) AND RESIDUAL INCIDENCE OF SYMPTOMATIC DENGUE OVER 20 YEARS



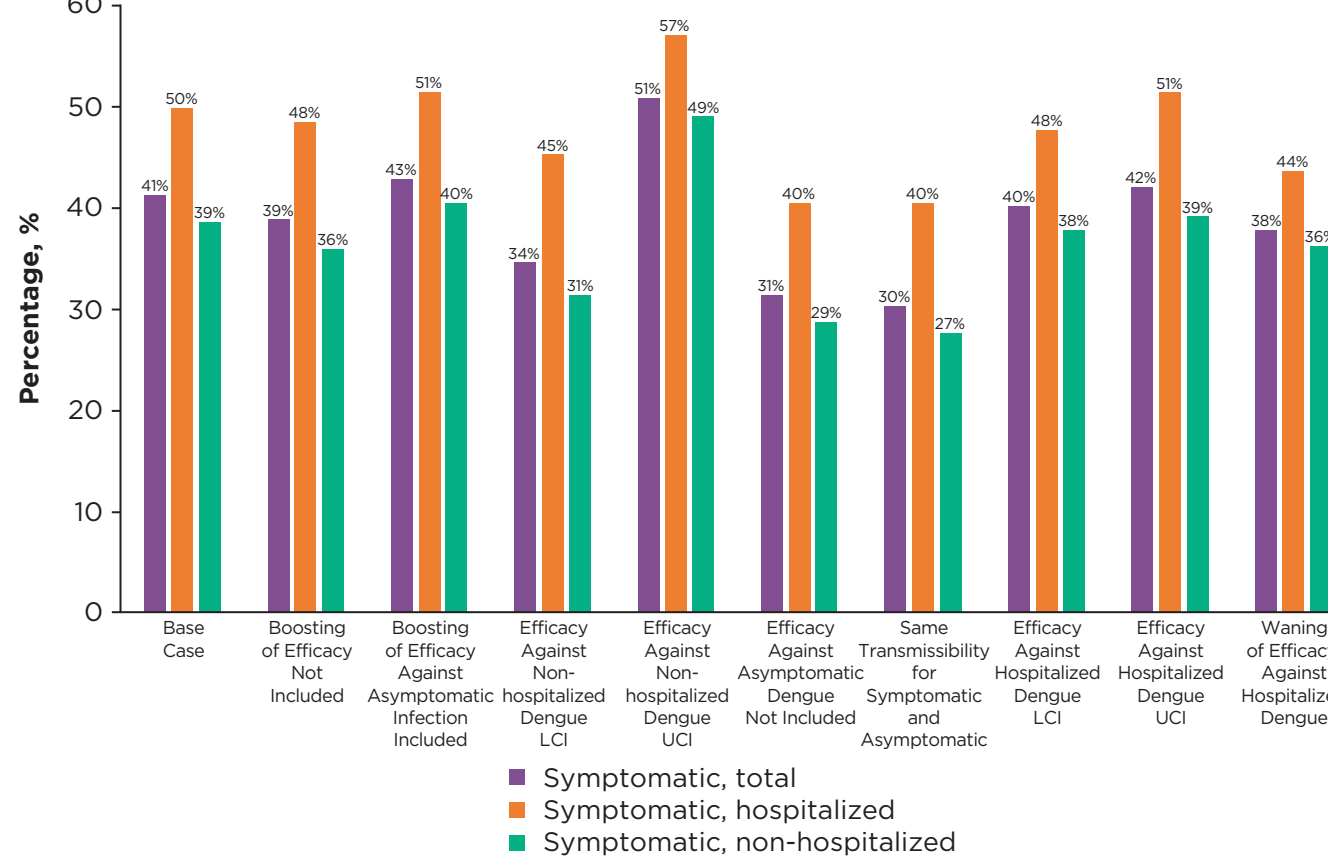
Figures 1 and 2 have been adapted with permission from the poster "Disease Impact of a New Dengue Vaccine (TAK-003) in Thailand", presented at the International Society for Infectious Diseases 2022 congress.

TABLE 1. COST SAVINGS FOR VACCINATION OF 11-YEAR-OLDS VERSUS NO VACCINE AT 20-YEAR TIMEFRAME (DISCOUNT RATE 3%, US\$25/DOSE)

	Vaccination of 11-year-olds
DALYs averted	74,798
 Societal perspective	
Total cost savings, US\$	1423.8 million
Direct medical costs	1371.5 million
Direct non-medical costs	169.0 million
Income lost	483.0 million
School absenteeism	28.0 million
Vaccine-related cost administration	-627.7 million
 Payer perspective	
Total cost savings, US\$	743.8 million
Direct medical costs	1371.5 million
Vaccine-related cost administration	-627.7 million

DALY, disability-adjusted life year.

FIGURE 3. PERCENTAGE OF INFECTIONS AVOIDED AMONG THE ENTIRE POPULATION - SCENARIO ANALYSIS



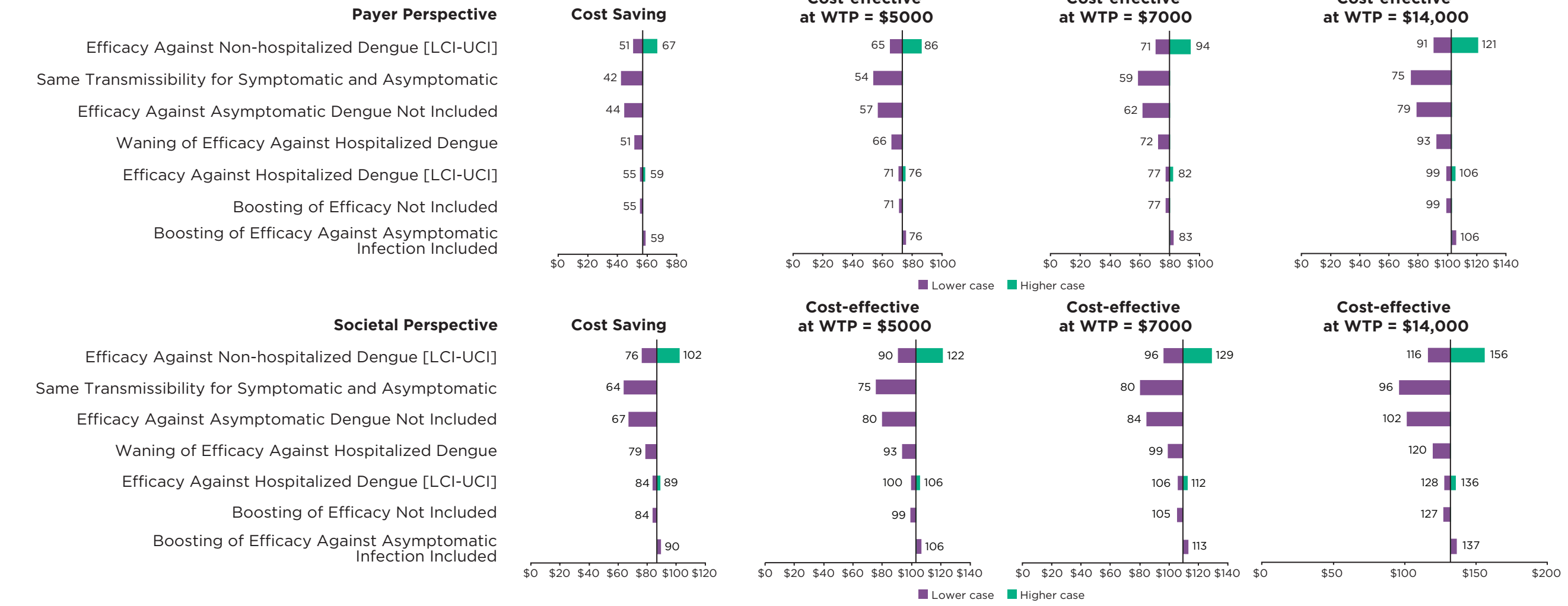
LCI, lower confidence interval; UCI, upper confidence interval.

TABLE 2. THRESHOLD PRICING ANALYSES FOR COST SAVING AND COST-EFFECTIVENESS OF TAK-003 AT DISCOUNT RATE OF 3% OVER 20 YEARS FOR ROUTINE VACCINATION OF CHILDREN AGED 11 YEARS

THRESHOLD PRICES				
Perspectives	Cost saving	Cost-effective at WTP = \$5000 ^{6,7}	Cost-effective at WTP = \$7000 ^{7,8} (1 × GDP)	Cost-effective at WTP = \$14,000 ^{7,8} (2 × GDP)
 Societal perspective	\$87/dose	\$103/dose	\$110/dose	\$132/dose
 Payer perspective	\$57/dose	\$74/dose	\$80/dose	\$103/dose

WTP, willingness to pay.

FIGURE 4. MAIN DRIVERS OF THRESHOLD PRICES FOR COST-SAVING AND COST-EFFECTIVENESS AT DIFFERENT WTP LEVELS - SCENARIO ANALYSIS



LCI, lower confidence interval; UCI, upper confidence interval; WTP, willingness to pay.

CONCLUSIONS

- This study shows that routine vaccination of children aged 11 years with 2 doses TAK-003 in Thailand (assuming 87% coverage) will lead to:
 - Significant reduction in symptomatic and hospitalized dengue
 - Considerable cost savings from both societal and payer perspectives
- Threshold prices demonstrate high returns of vaccination with TAK-003, considering the averted economic costs and quality of life burden of dengue to the society
- Sensitivity analyses demonstrate the robustness of the model findings
- Further economic impact of dengue, such as loss in tourism revenue, is not considered in the model, therefore, the financial return of dengue vaccination in Thailand can be much higher

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DISCLOSURES

JS, RH, SB, MS, and PT: employees of Takeda and hold stock/stock options in Takeda. JZ and AT: employees of Putnam PHMR. EK and SA: external consultants for Putnam PHMR

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DISCLAIMER

This poster is intended for healthcare professionals only

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