

Economic Impact of Introducing PCV20 in Colombian Pediatric Population: A Cost Utility Analysis

EE303

Authors: Maria Carrasquilla-Sotomayor¹; Juan Carlos Alvarado-Gonzalez²; Fernando Salcedo-Mejia^{1,3}; Rosmery V. Barroso-Parra¹; Nelson J. Alvis-Zakzuk^{1,4,5}.

¹ALZAK. Cartagena, Colombia. ²Universidad de Cartagena. Cartagena de Indias, Colombia. ³Universidad Tecnológica de Bolívar. Turbaco, Colombia. ⁴Universidad de la Costa. Barranquilla, Colombia. ⁵Universidade de São Paulo. São Paulo, Brazil.

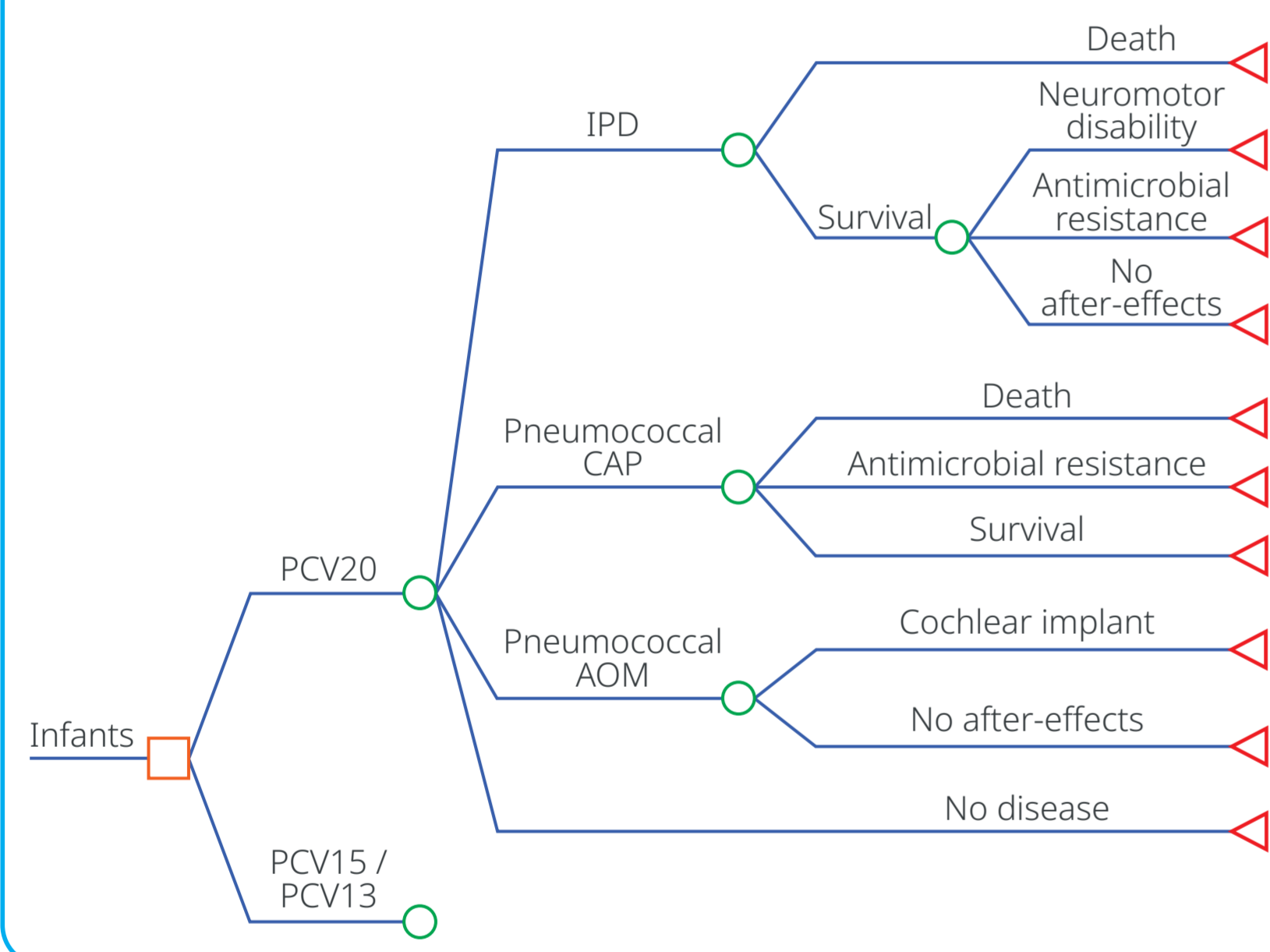
BACKGROUND

- In Colombia's National Immunization Program, PCV13 vaccine is the current strategy included for pediatric population since 2023, in a 2+1 schedule¹.
- The aim of this study is to evaluate the cost-effectiveness of PCV20 against PCV13 and PCV15 strategies for Colombian pediatric population in the prevention of pneumococcal disease.

METHODS

- A decision tree model was developed to compare PCV20 (2+1 schedule) and PCV15 (2+1 schedule) with PCV13 or PCV15 (2+1 schedules) in the pediatric population (ages 0–5 years) from the Colombian National Healthcare System perspective (Figure 1).
- The model was structured using both a fixed-cohort and a dynamic-cohort approach. In both cases, the evolution of a hypothetical cohort of annual births was modeled from the payer perspective (direct effects) and the societal perspective (including indirect effects). In the dynamic-cohort approach, 10 consecutive annual infant cohorts were projected.
- Indirect effects include society perspective and herd effect in older adults (65+).

Figure 1. Decision tree model for the cost-effectiveness analysis on vaccinating with PCV20, PCV15 or PCV13 in newborns.

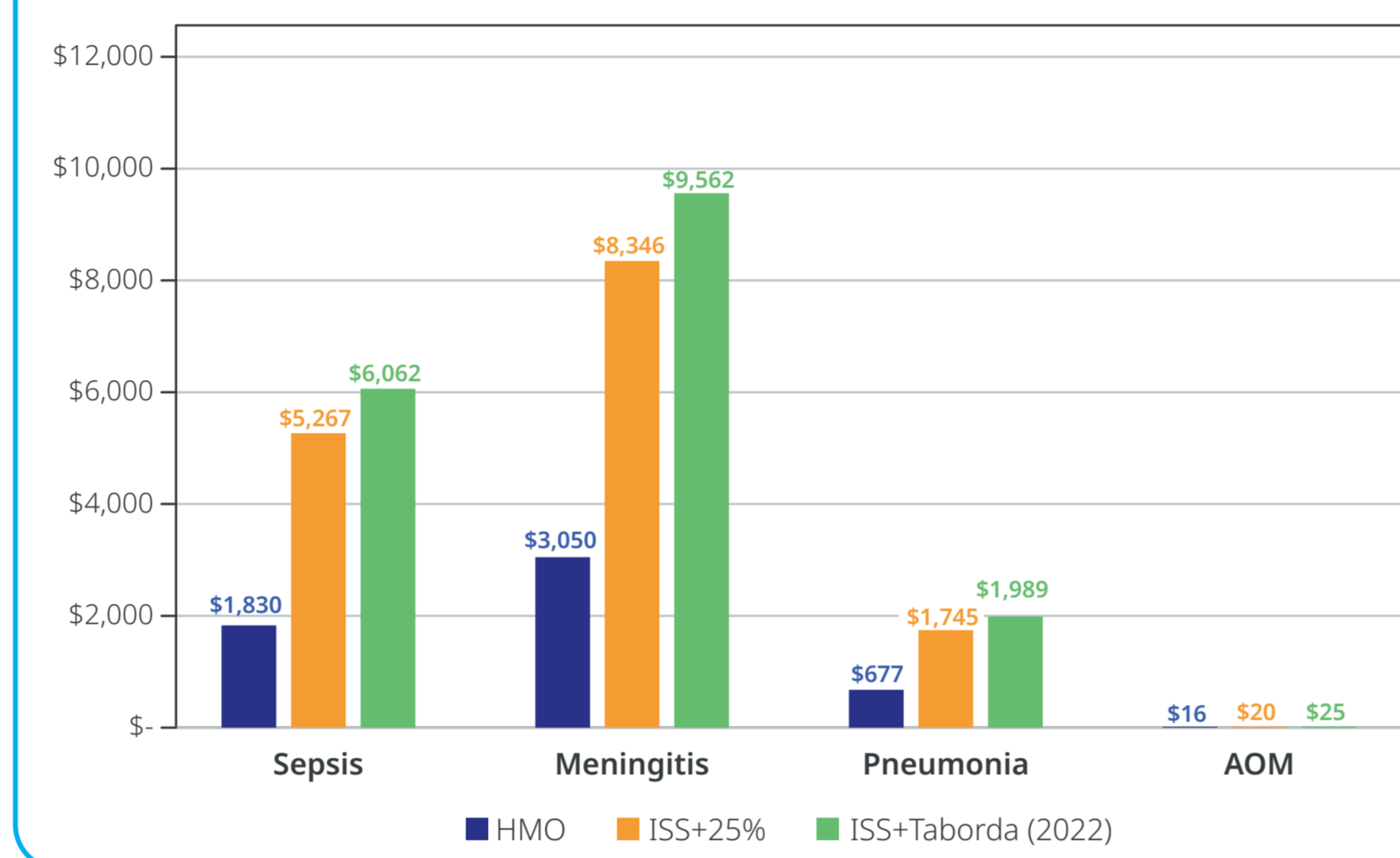


Model Inputs

- Population:** 441,709 infants in Colombia². Forecasts for the dynamic cohort are obtained from a recent study that modelled newborns³.
- Vaccine effectiveness:** The efficacies of pneumococcal conjugate vaccines were extracted from clinical trials and effectiveness studies of PCV7, developed by Black et al.⁴ and Hansen et al.⁵ and were adjusted according to serotype coverages in Colombia computed with an average from 2022 to 2024⁶. Vaccine efficacy was assumed to decline linearly at an annual rate of 3%⁷ over the specified duration of protection, in infants with 2 years or older.
- Epidemiology:** For children older than five years old, we took the incidence of IPD, bacterial CAP, pneumococcal AOM, and mortality rate by pneumococcal diseases from the control arm of PCV10 RCT, Colombia's national surveillance system and observational studies⁸⁻¹⁰. For the other age groups, we took incidence rates from Colombian Health Services Delivery Records (RIPS, acronym in Spanish)¹¹ during the vaccinal period with PCV10. In addition, we implemented mortality for all causes as age-dependent according to data from Colombia's National Administrative Department of Statistics (DANE, acronym in Spanish)¹². Herd immunity in older adults is fixed at 22.1%, according to Tsaban and Ben-Shimol (2017)¹³.
- Costs:** Expenses related to the medical management of CAP and IPD, as well as associated complications, were calculated using three approaches:
 - Costs from a Colombian HMO (base-case).
 - ISS tariff¹⁴ manual prices adjusted for inflation¹⁵.
 - ISS tariff manual prices but adjusted with a literature-based factor to reflect current prices¹⁶.
- They were adjusted to 2025 Colombian pesos according to the corresponding inflation rate³⁶ and exchange rate (COP \$4,120) (37). See Figure 2.

METHODS (cont)

Figure 2. Direct medical costs of pneumococcal disease by scenario (USD).



- Vaccine prices:** Vaccine prices were primarily obtained from the Pan American Health Organization (PAHO) vaccine price list¹⁷. For PCV15, the price was extracted from the Colombian Drug Price Information System (SISMED) as no public price was available¹⁸.
- Discount rate, perspective and horizon:** A 5% annual discount rate is applied to costs and health outcomes. The base-case is made from the payer's perspective using a lifetime horizon.
- Vaccine coverage:** 89% based on pneumococcal vaccination in infants¹⁹.

Analyses

- Cost-effectiveness analysis was developed using costs per LY gained, using 1 GDP per capita as the WTP threshold (USD 7,170)²⁰. The base case analysis was conducted without indirect effects and under the cost scenario derived from the HMO.
- Sensitivity analysis was performed through probabilistic sensitivity analysis with 1,000 Monte Carlo simulations.
- Scenario analysis is included to assess the results in the fixed and dynamic cohorts, across the three cost scenarios and when including indirect effects as sequelae and benefits in older population by herd effect.

RESULTS

Base-case

Table 1. Summary of Cost-Effectiveness Results by Strategy (USD 2025)

Model outcomes	PCV-20	PCV-15	PCV-13	PCV-20 - PCV-15	PCV-20 - PCV-13
Total cases of pneumococcal disease	43,452	45,068	45,123	-1,617	-1,671
Averted cases of BSI	259	405	410	-146	-151
Averted cases of meningitis	65	101	102	-36	-38
Averted cases of pneumonia	29,794	30,850	30,886	-1,057	-1,092
Averted cases of OM	11,581	11,884	11,894	-303	-313
Averted disease-related deaths	1,753	1,828	1,830	-75	-78
Years of life lost (YLLs) and life years gained (LYGs)	115,997	120,999	121,168	5,002	5,171
Vaccination program costs	\$ 39,822,316	\$ 66,792,239	\$ 27,496,361	-\$ 26,969,924	\$ 12,325,955
Direct cost of disease	\$ 30,525,710	\$ 31,818,858	\$ 31,862,523	-\$ 1,293,148	-\$ 1,336,813
Total costs	\$ 70,348,026	\$ 98,611,098	\$ 59,358,884	-\$ 28,263,072	\$ 10,989,142
ICER per LY				Dominante	\$ 2,125

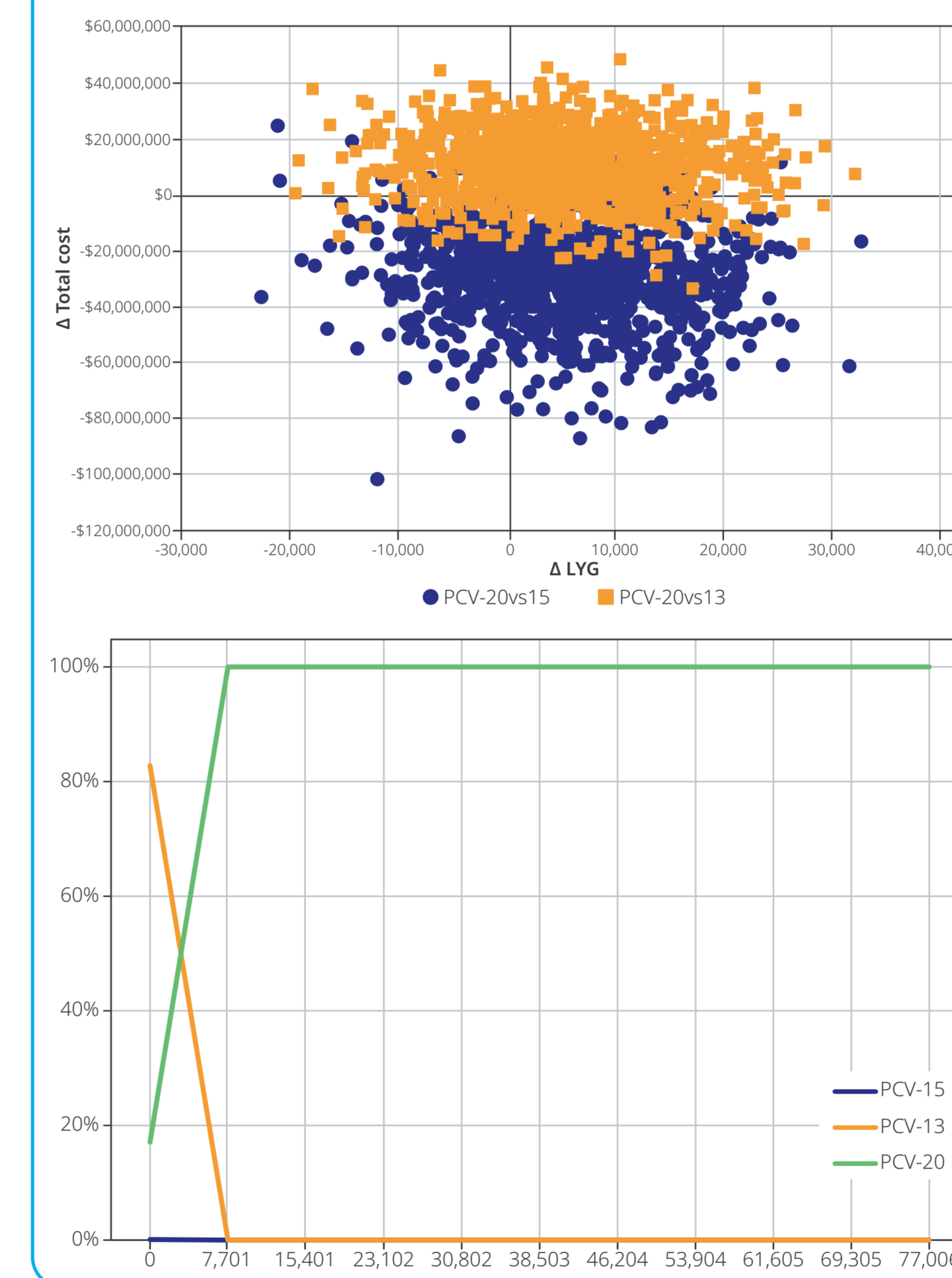
Note: Totals may differ slightly due to rounding

RESULTS (cont)

- In the fixed cohort, PCV20 was cost-effective against PCV13 (ICER: USD\$2,125 per QALY), and dominant against PCV15.
- PCV20 could prevent the greatest number of pneumococcal disease cases and deaths in the fixed cohort, averting up to 1,092 pneumonia cases compared to PCV13 and 1,057 compared to PCV15, resulting in 5,171 and 5,002 life-years gained respectively.
- PCV20 provides considerable cost-savings due in medical direct costs, vs both PCV13 (savings of \$1.34M) and PCV15 (savings of \$1.29M) (Table 1).

Sensitivity analysis

Figure 3. Scatterplots of Markov simulations and willingness-to-pay curves for PCV20 versus PCV13 and PCV15 in infants in Colombia



- According to the cost-effectiveness plane, PCV20 demonstrated a 65% probability of being cost-effective compared with PCV15 and 69% compared with PCV13, indicating robustness of the results across simulations.
- Based on the cost-effectiveness acceptability curves, PCV20 showed a 100% probability of being the most favorable strategy among the three alternatives at 1 GDP per capita or more.

Scenario analysis

Table 2. Incremental Cost-Effectiveness Ratios by Strategy across cost scenario, indirect effects and type of cohort

Cost scenario	PCV20 vs PCV13 (ICER)			
	Without indirect effect		With indirect effects	
	Fixed Cohort	Dynamic cohort	Fixed Cohort	Dynamic cohort
EAPB	2,125	2,079	529	908
ISS+25%	1,762	1,698	Dominant	31
ISS+Taborda (2022)	1,667	1,598	Dominant	Dominant

RESULTS (cont)

- Without indirect effects, PCV20 remains cost-effective with PCV13 across all three cost scenarios and in both cohorts. ICER values decrease under the ISS+25% and ISS+Taborda (2022) costs scenarios, as higher costs increase the estimated savings.
- With indirect effects, savings in direct medical costs increase, leading to lower ICERs. PCV20 was dominant under the ISS+Taborda (2022) cost scenario in the dynamic cohort, and under both the ISS+Taborda (2022) and ISS+25% scenarios in the fixed cohort.
- When comparing PCV20 with PCV15 the strategy was dominant across all scenarios.

CONCLUSION

- PCV20 offers a highly efficient alternative for the prevention of pneumococcal diseases, compared to PCV13 and PCV15, with greater clinical impact in terms of prevented cases and it's also associated with lower total costs from the societal perspective. This evidence supports the inclusion of PCV20 as a preferred option in national immunization programs.

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