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COST-EFFECTIVENESS ANALYSIS OF 15-VALENT AND 20-VALENT PNEUMOCOCCAL CONJUGATE VACCINATION VERSUS STANDARD OF CARE (13-VALENT PNEUMOCOCCAL CONJUGATE VACCINATION) IN THE PEDIATRIC POPULATION OF PARAGUAY

Thea Paoula Nassar[1], Mónica Rodríguez[2], Carolina Carballo[3], Liping Huang[4], Lucila Rey- Ares[3]

[1]Pfizer Ltd.,Tadworth, UK , City, ST; [2]Department of Pediatrics Central Hospital, Social Security Institute Asunción, Paraguay ; [3]Pfizer SRL, Villa Adelina, Argentina ; [4]Pfizer Inc., New York, NY, USA

BACKGROUND

- The 13-valent pneumococcal conjugate vaccine (PCV13) was introduced into Paraguay's pediatric national immunization program (NIP) in 2017.[1]
- PCVs have greatly reduced vaccine-type pneumococcal carriage and disease, though emerging serotypes not included in lower valent PCVs are now prevalent.[2]
- 20-valent PCV [PCV20] is available through the Pan American Health Organization (PAHO) revolving fund and 15-valent PCV [PCV15] is available in private vaccination centers for the Paraguayan pediatric population.

OBJECTIVE

- To assess the cost-effectiveness of PCV20 and PCV15 versus the current standard of care (PCV13) in Paraguayan children.

METHODS

- A Markov structure was adapted to investigate the impact of PCV13 versus PCV20 and PCV15 (all under 2+1 schedules) in the Paraguayan population over 10 years from a payer perspective, with costs and effects discounted at 3% annually.
- Health states considered in the model were: pneumococcal disease (invasive pneumococcal disease [IPD; meningitis or bacteremia], hospitalized and non-hospitalized pneumonia, otitis media), no pneumococcal disease, and an absorbing death state.
- Scenarios and sensitivity analyses were conducted to test the robustness of the model.
- Direct vaccine effects were applied to infants aged <2 years, while the unvaccinated population would benefit from indirect effects throughout the time horizon, with inputs informed by PCV13 effectiveness and impact studies, and 7-valent PCV trials. [3-12] (Table 1)
- All direct and indirect VEs assumptions (Table 1) were used as starting points and were adjusted based on serotype coverage for each PCV accordingly.[22]
- Epidemiological, utilities and serotype coverage inputs were obtained from published literature and official sources; direct medical costs (in US dollars, 2025) were obtained from a consultancy study. (Figure 1)(Table 2-3)
- Vaccination cost were based on the 2025 PAHO Revolving Fund indicative price (USD), PCV13 price was used for PCV15.[23] 84% of targeted vaccination age group was assumed to receive the booster dose.[24]

Table 1. Vaccine effectiveness assumptions for PCV13/15/20

	IPD	Hospitalized PNE	Non-hospitalized PNE	AOM
Direct effects[3-6]				
<2 years	88.7%	25.5%	6.0%	7.8%
Indirect effects[7-12]				
<18 years	83.0%	30.5%	22.5%	20.0%
18-34 years	88.0%			
35-64 years	77.0%	15.0%	-	-
65+ years	73.0%			

Figure 1. Serotype Coverage by age group[25]

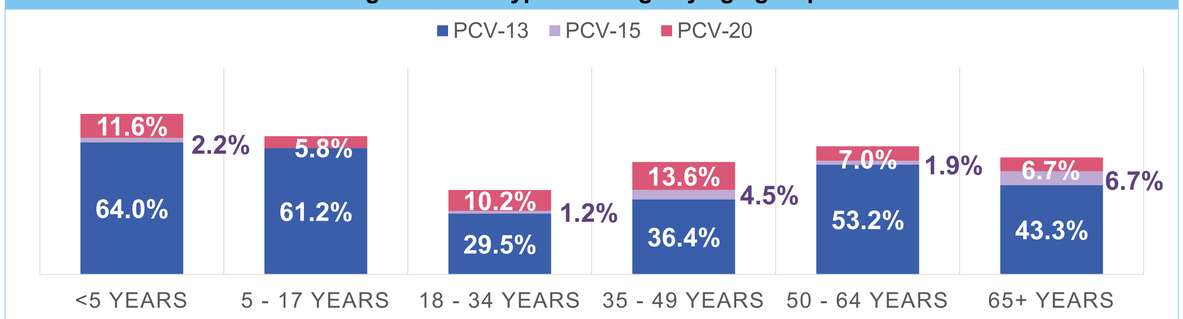


Table 2. Epidemiological model inputs

Age group	Disease incidence per 100,000: IPD [1,13]	Hospitalized PNE[14]	Non-hospitalized PNE[14]	AOM[15]	Proportion of IPD cases, that were meningitis, %[1,16]	Case fatality rates: Meningitis [17,18]	Bacteremia [17-19]	Hospitalized PNE [15,20,21]
<12 months	6.7	4,417	1,650	8,944	30.61%	18.0%	5.9%	3.5%
12-23 months	0.0	3,899	1,457	8,944	30.61%	10.8%	3.5%	3.5%
24-35 months	1.42	3,381	1,263	7,691	30.61%	2.2%	0.7%	1.5%
36-47 months	4.3	2,863	1,070	7,691	30.61%	3.6%	1.2%	1.5%
48-59 months	7.1	2,345	876	7,691	30.61%	3.6%	1.2%	1.5%
5-17 years	2.1	1,126	421	-	31.48%	3.6%	1.2%	1.0%
18-34 years	1.7	524	247	-	31.48%	15.0%	3.2%	0.4%
35-49 years	1.2	394	186	-	31.48%	15.0%	9.0%	3.8%
50-64 years	3.1	657	309	-	27.27%	15.0%	15.2%	8.4%
65+ years	3.4	2,213	1,041	-	27.27%	15.0%	26.6%	14.1%

Table 3. Medical costs per disease episode

	Meningitis	Bacteremia	Hospitalized PNE	Non-hospitalized PNE	AOM
<18 years	$ 3,948	$ 4,123	$ 3,048	$ 133	$ 368
18-64 years	$ 3,820	$ 5,041	$ 1,425	$ 103	$ 368
65+ years	$ 4,572	$ 5,793	$ 1,989	$ 103	$ -

Vaccination cost : PCV13/15 = $13.5 per dose, PCV20 = $20.0 per dose. Administration cost: $8.83 per dose

Abbreviations: IPD = invasive pneumococcal disease, AOM = acute otitis media, PCV = Pneumococcal conjugate vaccine, PNE = pneumonia

RESULTS

- PCV20 averted 156 additional IPD cases, 48,452 non-invasive PD cases, and 1,196 deaths compared to PCV13. These reductions in disease cases and deaths translated into significant cost savings of $55.01 million versus PCV13.
- PCV20 vs. PCV13 was estimated to result in greater clinical outcomes and cost savings compared to PCV15 vs. PCV13 (i.e. averting 63 additional IPD cases, 27,120 additional non-invasive PD cases and 427 additional deaths).
- Over 1,000 iterations, both PCV20 2+1 and PCV15 2+1 were less costly and more effective. The mean result demonstrated that PCV20 2+1 saved the healthcare system $55 million dollars and provided clinical benefits with a mean QALY of 28,765.
- From the DSA for costs and QALY, the PCV20 maximum indirect effects on hospitalized pneumonia and the current overall serotype coverage by vaccine were key parameters. (Figure 3)

Table 4. Base case results of cost-effectiveness of switching from PCV13 2+1 to PCV15 2+1 or PCV20 2+1 in Paraguay's pediatric NIP over 10 years

	PCV15 2+1 vs PCV13 2+1	PCV20 2+1 vs PCV13 2+1
Clinical Outcomes (Cases)		
IPD (meningitis and bacteremia)	- 34	- 156
Non-invasive PD*	- 8,737	- 48,452
Deaths due to PD	- 403	-1,196
Utilities		
Total QALYs	6,393	28,765
Economic Outcomes (millions $USD)		
Cost of vaccination	-	13.01
Cost of disease	- 12.30	- 68.03
Total Costs	- 12.30	- 55.01
ICER cost per QALY	- 1,924	- 1,913
	Dominant	Dominant

Abbreviations: PCV, pneumococcal conjugate vaccine; IPD, invasive pneumococcal disease; PD, pneumococcal disease; QALY, quality-adjusted life year; ICER, incremental cost-effectiveness ratio.
*Includes hospitalised pneumonia, non-hospitalized pneumonia and acute otitis media cases.

Figure 2. Probabilistic Sensitivity Analysis (PSA)

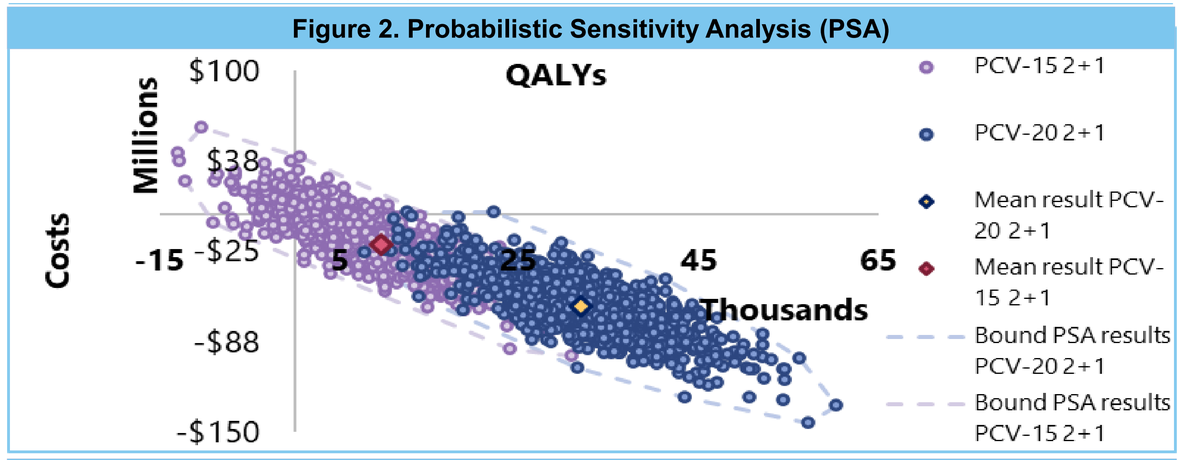
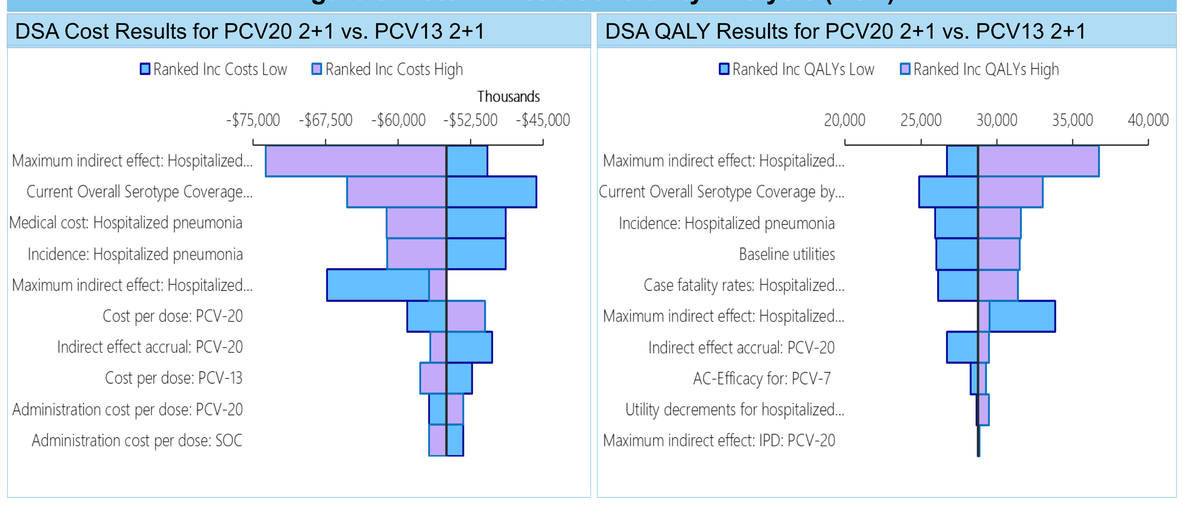


Figure 3. Deterministic Sensitivity Analysis (DSA)



CONCLUSIONS

- **PCV20 offers broader serotype coverage and was estimated to avert more PD cases and deaths compared to PCV13 and PCV15.**
- **Replacing lower-valent PCVs with PCV20 in the NIP was the most cost-saving and effective (dominant) option in Paraguay.**

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Disclosures
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For more information please contact:
Liping Huang
Phone: +1 (484) 8653979
Email: liping.huang@pfizer.com
www.pfizer.com

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