PCV20 for High-Risk Populations: A Cost-Utility Analysis from the Brazilian Public Health System Perspective

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BACKGROUND

Pneumococcal diseases (PD), caused by Streptococcus pneumoniae, include invasive infections such as meningitis and bacteremia, and non-invasive forms like pneumonia. People with chronic conditions are at higher risk of developing PD[1]. Current vaccination schemes recommended by the Brazilian National Immunization Program (NIP) involve multiple doses of pneumococcal conjugate and polysaccharide vaccines, which can lead to low vaccination coverage. For aged 5 years and older with at least one risk condition for invasive pneumococcal disease, the NIP recommends two different vaccination strategies, depending on the risk group[2] (**Table 1**).

Table 1– Pneumococcal vaccination recommendations for individuals aged ≥ 5 years with risk conditions

Risk condition	Age group	Recommended vaccination schedule
High-risk immunocompromising conditions	≥ 5 years	PCV13: 1 dose + PPSV23: 1 dose ≥ 8 weeks after PCV13 + booster PPSV23 after 5 years
Chronic and other non-immunocompromising risk conditions	≥ 5 years	PPSV23: 2 doses, 5 years apart

In this context, the 20-valent pneumococcal conjugate vaccine (PCV20) emerges as a potential strategy to simplify pneumococcal immunization, by offering broader serotype coverage in a single-vaccine regimen, which may reduce schedule complexity, facilitate implementation within the NIP, and ultimately increase vaccination coverage and protection among individuals at increased risk of invasive pneumococcal disease.

OBJECTIVES

To evaluate the cost-utility of PCV20 compared to current vaccination schemes for people aged ≥5 years with risk conditions for PD in Brazil.

METHODS

A Markov model was constructed with a 10-year time horizon and annual cycles to simulate health outcomes and costs from the Brazilian NIP perspective. The hypothetical cohort received either one dose of PCV20, one dose of PCV13 plus two doses of PPSV23, or two doses of PPSV23. Health states included Invasive pneumococcal disease (IPD – meningitis or bacteremia), pneumococcal pneumonia (hospitalized or outpatient pneumonia), and death (**Figure 1**).

A separate Markov model was developed for each age group (5–17, 18–49, 50–64, and ≥65 years). Overall results were obtained by aggregating age-specific outcomes weighted by the proportion of individuals in each age group.

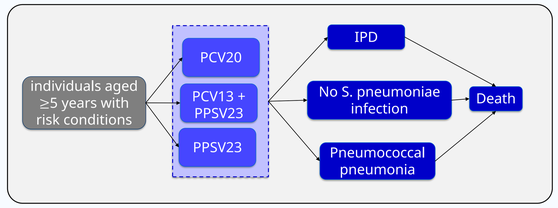

Figure 1 – Markov model structure for pneumococcal vaccination strategies

Vaccine effectiveness was derived from immunogenicity evidence and published economic models[3-5]. Transition probabilities, direct medical costs included vaccine acquisition, serotype coverage and management of PD were derived from Brazilian Ministry of Health administrative databases (DATASUS)[6,7]. Costs and QALYs were discounted at 5% annually and results were expressed as incremental cost-effectiveness ratios (ICERs) per QALY considering the BRL 40,000/QALY gained threshold adopted by Brazil. Prices (per dose) for PCV20 and for the vaccines currently available in the NIP for the immunization of populations at risk for PD (PCV13 and PPSV23), as used in the model, are as follows: PCV20: BRL 106.53; PCV13: BRL 84.22 and PPS23: BRL 50,42.

RESULTS

Compared to PCV13 + PPSV23, PCV20 yielded QALY gains (0.00042) and cost savings (-BRL 55.96), resulting in an ICER of -BRL 134,227.76/QALY (cost-saving) . Compared to PPSV23 alone, PCV20 provided QALY gains (0.0018) with an incremental cost of BRL 10.02, yielding an ICER of BRL 5,665.44/QALY - cost effective at the threshold employed in the Brazil (**Table 2**).

Table 2 – Cost-utility results of PCV20 compared with current pneumococcal vaccination strategies

Comparator	Costs (BRL)	QALYs	ICER (BRL/QALY)
PCV13 + PPSV23	BRL 194.33	5.78156	**– BRL 134,227.76 (cost-saving)**
PPSV23 (+ PPSV23 revaccination)	BRL 128.34	5.780	**BRL 5,665.44**
PCV20	BRL 138.36	5.78198	—
Incremental vs PCV13 + PPSV23	– BRL 55.96	0.00042	—
Incremental vs PPSV23	BRL 10.02	0.0018	—

ICER: incremental cost-effectiveness ratio; QALY: quality-adjusted life year

DSA and PSA confirmed the robustness of the results. In the DSA, outcomes were most sensitive to parameters related to increased incidence in high-risk populations, particularly hospitalized pneumococcal pneumonia (**Figure 2** and **Figure 3**).

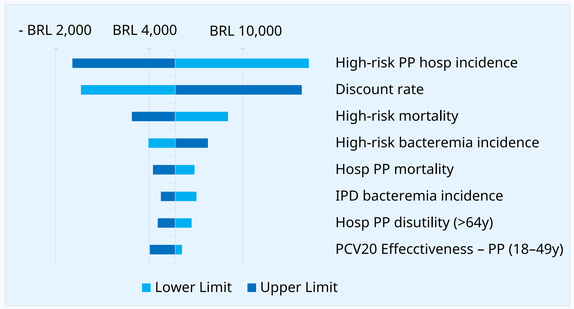

Figure 2 – Deterministic sensitivity analysis (tornado diagram): PCV20 vs. PCV13 + PPSV23

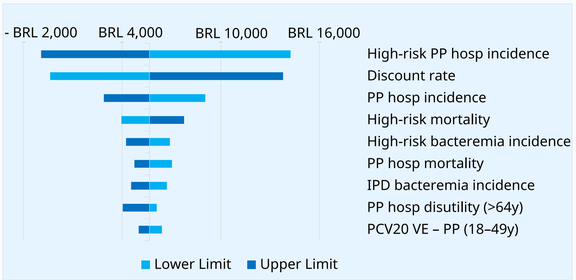

Figure 3 – Deterministic sensitivity analysis (Tornado diagram): PCV20 vs. PPSV23

In the PSA, PCV20 remained below the Brazilian cost-effectiveness threshold in more than 99% of simulations in both comparisons, being cost-saving versus PCV13 + PPSV23 and cost-effective versus PPSV23 (**Figure 4** and **Figure 5**).

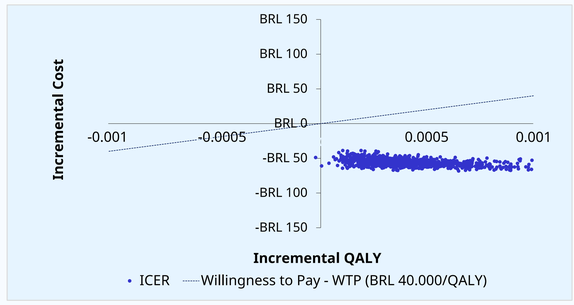

Figure 4 – Probabilistic sensitivity analysis (cost-utility plane): PCV20 vs. PCV13 + PPSV23

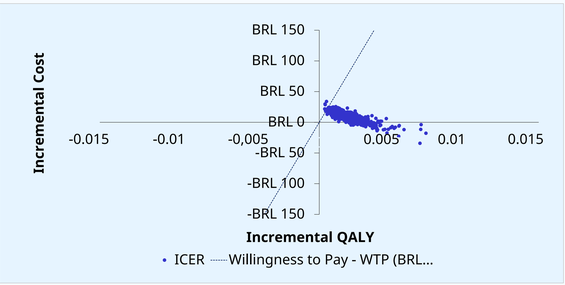

Figure 5 – Probabilistic sensitivity analysis (cost-utility plane): PCV20 vs. PPSV23

DISCUSSION

PCV20 demonstrated favorable cost-utility compared with current pneumococcal vaccination strategies for individuals aged ≥ 5 years with risk conditions in Brazil. The model showed that PCV20 was dominant over the sequential PCV13 + PPSV23 schedule and cost-effective when compared with PPSV23 alone, remaining below the Brazilian cost-effectiveness threshold. These results are mainly driven by the broader serotype coverage and the simplified single-dose regimen of PCV20, which avoids revaccination and complex schedules. Sensitivity analyses confirmed the robustness of findings across a wide range of assumptions. Additionally, although not explicitly modeled, simplification of vaccination schedules may improve adherence and coverage in real-world settings.

CONCLUSIONS

PCV20 is a cost-effective and simplified strategy for preventing PD among people aged ≥ 5 years with risk conditions in Brazil. Its incorporation into the NIP has the potential to improve health outcomes while optimizing resource use.

DISCLOSURES

Authors are current employees from Pfizer Brazil.

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