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COST-UTILITY ANALYSIS OF 13-VALENT PNEUMOCOCCAL CONJUGATE VACCINE IN THE IMMUNIZATION OF CHILDREN UNDER FIVE YEARS FOR THE PREVENTION OF INVASIVE PNEUMOCOCCAL DISEASE AND PNEUMONIA IN THE BRAZILIAN PUBLIC HEALTHCARE SYSTEM

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INRODUCTION

Streptococcus pneumoniae (or *pneumococcus*) infections are still important causes of morbidity and mortality. In 2015, despite the decrease in the burden of pneumococcal disease due to the use of conjugate vaccines, including Brazil's successful experience since 2010 with 10-valent pneumococcal conjugate vaccine (PCV10), an estimated 393,000 deaths worldwide in children under 5 years old were due to pneumonia. This can be explained by the trend towards serotype substitution worldwide, as seen by the increased prevalence of serotypes not covered by PCV10 (1–4). Among these, 19A stands out, a pneumococcal serotype associated with the high incidence of invasive pneumococcal diseases (IPD) and, mainly, the increase to strains resistant to penicillin and to multiple antimicrobials in the scenario of IPD (5–7). In this context, the 13-valent pneumococcal conjugate vaccine (PCV13) covers the pneumococcal serotypes that have increased incidence after the implementation of immunization programs with PCV10, including 19A (8).

OBJECTIVE

The aim of this analysis is to compare utility and costs between 13-valent pneumococcal conjugate vaccine versus the 10-valent for children under five years old.

METHODS

A cost-utility analysis was developed, with a decision tree modeling, considering local data for the prevalence of IPD and pneumonia, and data from the literature for effectiveness of the evaluated technologies, for the incorporation of PCV13 in the Brazilian public healthcare system (Figure 1) The model simulates a cohort of newborns vaccinated at birth with PCV13 or PCV10. Each year, a new cohort with the same characteristic is vaccinated, up to a five-year horizon.

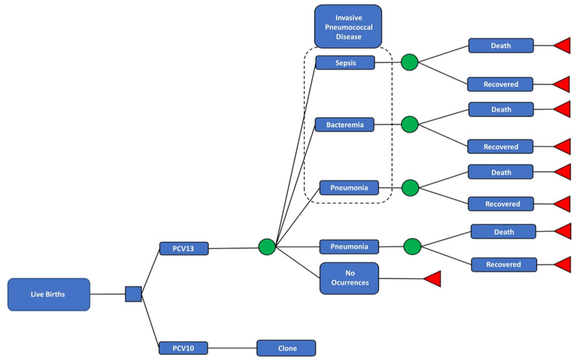

Figure 1. Representation of the decision tree model used in the cost-utility analysis of the PCV13 for immunization of children up to five years old.

Each year, a new cohort of newborns starts in the model up to the time horizon, whose size is shown in Table 1.

Table 1. Hospitalization time of children up to five years old, due to pneumonia, sepsis and meningitis.

	Mean (days)	Standard Deviation	Source
Pneumonia			SIH-SUS
2009	4.9	5.5	
2010 - 2019	5.1	5.4	
Sepsis			
2009	7.2	9.0	
2010 - 2019	5.3	6.0	
Meningitis			
2009	-	-	
2010 - 2019	13.4	12.0	

Hospital Information System (*Sistema de Informações Hospitalares* – SIH) from Brazilian public healthcare System (*Sistema Único de Saúde* - SUS)

Effectiveness measures were QALY (quality-adjusted life years), LY (years of life lost), number of events prevented (DPI) and pneumonia.

RESULTS

The analysis showed that the PCV13 was able to reduce costs with significant gains in QALY, in addition to significantly reducing the number of events related to IPD and, especially, to pneumonia. The model indicated a reduction of 26,420 cases of hospitalization due to pneumonia, reducing 146 years of life lost due to this event (Table 2), and a reduction of BRL 118,174,807.51 for the management of these hospitalizations. The average cost saving of using the PCV13 vaccine was - BRL 121,054,625.60, translated into an incremental effectiveness of 164 QALYs over five years.

The incremental cost-effectiveness ratio was dominant at

- BRL 737,368.53/QALY.

Table 2. Results of the cost-utility analysis of the PCV13 versus PCV10 over five years.

		PCV10	PCV13
Total cost		BRL 925,867,032.61	BRL 804,812,407.01
Effectiviness	Years of life lost	287	141
	QALY	11,401,493	11,401,657
Incremental	Cost		- BRL 121,054,625.60
	Years of life lost		-146
	QALY		164
ICER/	Years of life lost		- BRL 29,141.27 (cost saving)
	QALY		- BRL 737,368.53 (cost saving)

QALY: quality-adjusted life years gained; ICER: Incremental cost-effectiveness ratio.

CONCLUSION

The clinical evidence and the favorable result of the cost-utility analysis for PCV13, are consistent with the current WHO recommendation, published in 2019, which highlights that the choice of a type of vaccine in a country it must consider the conditions of the vaccination program, guarantee of supply, prices sustainable to the local reality, the local prevalence of the serotypes and the pattern of antimicrobial resistance of these serotypes.

In this context, the data presented in analysis may contribute to justify the expansion of the use of PCV13.

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