COST-EFFECTIVENESS OF THE 20-VALENT PNEUMOCOCCAL CONJUGATE VACCINE VS 15-VALENT PNEUMOCOCCAL CONJUGATE VACCINE FOR ADULTS IN ARGENTINA

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BACKGROUND

Streptococcus pneumoniae (S. pneumoniae) is a leading cause of morbidity and mortality among adults at a global level. The clinical spectrum of disease caused by pathogen this ranges from pneumonia to invasive pneumococcal disease (IPD) which includes bacteremia and meningitis.[1-3]
Since 2017 the Ministry of Health (MoH) of Argentina recommends a sequential 13-valent pneumococcal conjugate vaccine (PCV13) - pneumococcal polysaccharide vaccine (PPSV23) regimen for adults over 65 years old and inviduals up to 64 years who are at risk of severe bacterial infections.[4, 5]
Studies carried out in Argentina have determined that the PCV13-PPSV23 sequential regimen was cost-saving in the elderly population.[4] With two higher value pneumococcal polysaccharide vaccines (PCVs) being developed: PCV15 and PCV20, which cover 2 and 7 additional serotypes respectively, this study aims to assess the cost-effectiveness (C-E) of these new vaccines in Argentina.

OBJECTIVE

To assess the cost-effectiveness of a single dose of PCV20 versus sequential administration PCV15 followed by PPV23 in the adult population of Argentina.

METHODS

Model structure

•A Markov-type model was used to estimate the clinical an economic impact of disease associated with *S. pneumoniae* infection, as well as the impact of vaccinating the adult population, with each of the proposed strategies from a Helathcare System perspective.
•The model uses a deterministic framework to depict lifetime risks and costs of IPD–including bacteremia and meningitis–and inpatient all-cause community acquired pneumonia (AC-CAP) among the adult population.
•Outcomes were projected for each person based on age, risk profile, vaccination status, vaccine type, and time since vaccination.

Model parameters

•Vaccine effectiveness for PCVs against IPD and non bacteriemic pneumonia (NBP) caused by vaccine serotypes and risk adjustment were taken from published literature.[6-9] PCVs were assumed to be durable for 5 years and to wane to 0% by year 16.[7]
•Vaccine effectiveness for PPSV23 against IPD caused by vaccine serotypes was taken from published literature.[10] Effectiveness against NBP was assumed to be 0%. PPSV23 was assumed to wane to 0% by year 10.[10]
•Costs associated with the treatment of bacteriemia, meningitis, inpatient NBP, outpatient NBP and vaccine administration costs for each Healthcare system subsectors were estimated using a micro costing approach and are shown on Table 1. Costs were adjusted by risk profile based on Weycker et al. (2016). A weighted average was then calculated based on the distribution of the population in the different subsectors. Based on data provided by Pfizer we assumed 47,4% of the population used the Social Security, 10,8% used PAMI, 37,1% used the public subsector and 4,7% used the private subsector. Costs are expressed on 2021 US-Dollars.
•Utility reduction for IPD and inpatient NBP was 0.13 (annual) and reduction for outpatient NBP was 0.004 (annual).[11,12]
•Vaccine coverage for population over 65 years was assumed to be invariant across age and risk groups and to be 65%. For population between 18 and 64 we assumed 17% of the high-risk population was vaccinated. These assumptions were made based on data provided by Pfizer.
•Costs and future benefits were discounted 3% annually.

Scenario analysis

•Scenario analyses were conducted using alternative input values for key parameters in one way sensitivity analysis and probabilistic sensitivity analysis.

Table 1: Base case model input values by age risk and group

	18-49 years			50-64 years			65-74 years			75-84 years			≥85 years		
	Low	Mod	High	Low	Mod	High	Low	Mod	High	Low	Mod	High	Low	Mod	High
Number of adults (100K)[14]	161.7	42.5	6.5	37.7	23.8	3.3	14.1	13.2	3.8	7.0	6.1	4.1	2.5	2.1	1.7
Incidence of bacteremia (per 100K)[4,15]	6.4	25	50.1	23.7	93.8	145.4	64.6	203	275.2	79.1	189.7	209.4	109.2	193.4	153.2
Incidence of meningitis (per 100K)[15,16]	0.02	0.08	0.17	0.05	0.19	0.29	0.07	0.23	0.31	0.11	0.25	0.28	0.15	0.26	0.21
Inpatient NBP[17,18]	60	355	1,204	243	1,183	3,382	513	2,527	5,704	830	2,382	3,463	806	2,311	3,360
Outpatient NBP[4,17,19]	134	483	904	489	1,763	3,302	1,318	3,980	5,403	1,203	3,633	4,931	1,170	3,535	4,797
CFR general population (per 100K)[20,¥]	0.10	0.10	0.20	0.50	0.80	1.00	1.50	2.30	3.00	5.60	8.40	11.10	5.50	8.20	10.90
CFR bacteremia[15,21]	6.40	8.30	11.10	14.60	16.30	17.30	10.00	18.80	17.50	36.30	46.70	36.30	37.10	45.40	38.20
CFR meningitis[22-24]	12.20	15.80	21.10	13.70	15.30	16.20	8.90	16.80	15.60	13.30	17.10	13.30	13.60	16.60	14.00
CFR inpatient NBP[17,25]	1.80	2.50	8.00	1.80	4.40	9.50	11.20	16.60	24.60	15.30	18.90	20.20	16.20	16.40	21.70
General Population Health-State Utilities[26]	0.94	0.94	0.86	0.88	0.88	0.75	0.86	0.86	0.68	0.80	0.80	0.61	0.77	0.77	0.73
Medical care costs of bacteremia (per case)	$ 4,467	$ 3,975	$ 3,923	$ 4,564	$ 4,061	$ 4,008	$ 3,513	$ 4,602	$ 3,679	$ 3,617	$ 4,739	$ 3,789	$ 3,644	$ 4,774	$ 3,816
Medical care costs of meningitis (per case)	$ 3,353	$ 2,983	$ 2,945	$ 3,426	$ 3,048	$ 3,009	$ 2,637	$ 3,454	$ 2,762	$ 2,715	$ 3,557	$ 2,844	$ 2,735	$ 3,583	$ 2,865
Medical care costs of inpatient NBP (per case)	$ 1,017	$ 1,217	$ 1,743	$ 1,004	$ 1,202	$ 1,721	$ 1,155	$ 1,258	$ 1,384	$ 1,153	$ 1,256	$ 1,382	$ 1,146	$ 1,249	$ 1,374
Medical care costs of outpatient NBP (per case)	$ 92	$ 93	$ 116	$ 91	$ 92	$ 115	$ 96	$ 99	$ 112	$ 94	$ 97	$ 110	$ 93	$ 96	$ 109

¥ Assumption. Mortality assumed to be 1.5 and 2.0 for at-risk and high-risk, respectively, vs. healthy.

RESULTS

From a payer's perspective, PCV20 results in a dominant strategy compared to PCV15+PPV23 (WTP = $8,441/QALY). The model estimated that PCV20 reduces bacteremia cases by 681, all-cause NBP by 7,305 and deaths due to acute disease by 780. Medical costs were reduced by $6.96M and vaccination costs by $19.83M for the PCV20 strategy.

Scenario analysis

•PCV20 was cost-saving in all scenario analyses.
•In the PSA 97% of the replications PCV20 was dominant and in 98% was below the WTP (1 GDP per capita = $ 8,842).

Table 2: Base case results

	PCV15+PCV23	PCV20	Difference
No. Cases			
Bacteremia	828,920	828,238	-682
All-cause NBP	12,401,849	12,398,679	-3,170
No. Deaths due to accute disease	2,012,218	2,011,438	-780
LYs (discounted)	20.1049	20.1051	0.00020
QALYs (discounted)	17.4959	17.4960	0.00010
Medical care costs (millions)	$10,187,945	$10,180,986	-$6,959
Vaccination costs (millions)	$55,813	$35,983	-$19,830
Total costs (millions)	$10,243,759	$10,216,969	-$26,790
Cost per QALY	$585,495	$583,960	-$1,535

Figure 1. probabilistic sensitivity análisis – ICER scatterplot

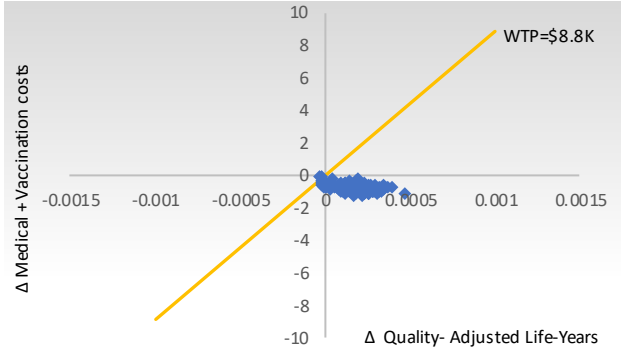
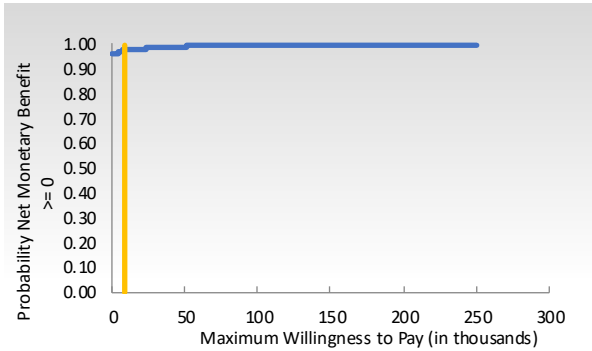


Figure 2. Acceptability curve – Cost per Quality-Adjusted Life-Year gained



CONCLUSIONS

From a healthcare perspective PCV20 could be a dominant strategy compared to PCV15+PPV23 in Argentina. PCV20 would avert more cases of IPD, all-cause NBP and deaths with a higher number of LYG and QALYs at a lower cost.
Results were robust to alternative parameter estimates considered in scenario and sensitivity analyses

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ISPOR Europe 2022. Poster EE390, 8 November 2022
Disclosure: this Study was funded by Pfizer