

A COST-EFFECTIVENESS ANALYSIS OF THE SWITCH TO 20-VALENT PNEUMOCOCCAL CONJUGATE VACCINE FROM LOWER-VALENT VACCINES IN THE FRENCH PEDIATRIC POPULATION

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INTRODUCTION

- Following the 7-valent pneumococcal conjugate vaccine (PCV7) introduction for use among children in 2003, the introduction of 13-valent PCV (PCV13) in 2010 led to a decrease in pneumococcal disease incidence in France.^{1, 2}
- However, a resurgence of a disease in France due to non-PCV13 serotypes has been reported by recent studies.^{3, 4}
- The PCV with valency of 20 (PCV20) was approved for pediatric use by the European Commission in 2024, but still not yet implemented into French infant National Immunization Program (NIP).⁵

OBJECTIVE

- We compared the health and economic impact of introducing PCV20 under a 3+1 schedule to the PCV13 or 15-valent PCV (PCV15), both under a 2+1 schedule, for infant vaccination in France.

METHODS

- The study adopted a multiple-cohort population-level model under the French Collective perspective over a 10-year time horizon.
- Inputs were sourced from published and unpublished studies conducted in the French population, where available (Table 1).
- Clinical outcomes included disease cases (i.e., invasive pneumococcal disease [IPD], inpatient pneumonia, and otitis media [OM]) and deaths.
- Direct effects against IPD were based on PCV13 effectiveness data (uniform across serotypes, schedule-specific) while direct effects against non-invasive disease were based on PCV7 trial efficacy data.
- Indirect effects were estimated for the additional serotypes covered by PCV15 and PCV20 vs PCV13 using French-specific data to estimate the maximum reduction in IPD incidence and accrual rates.

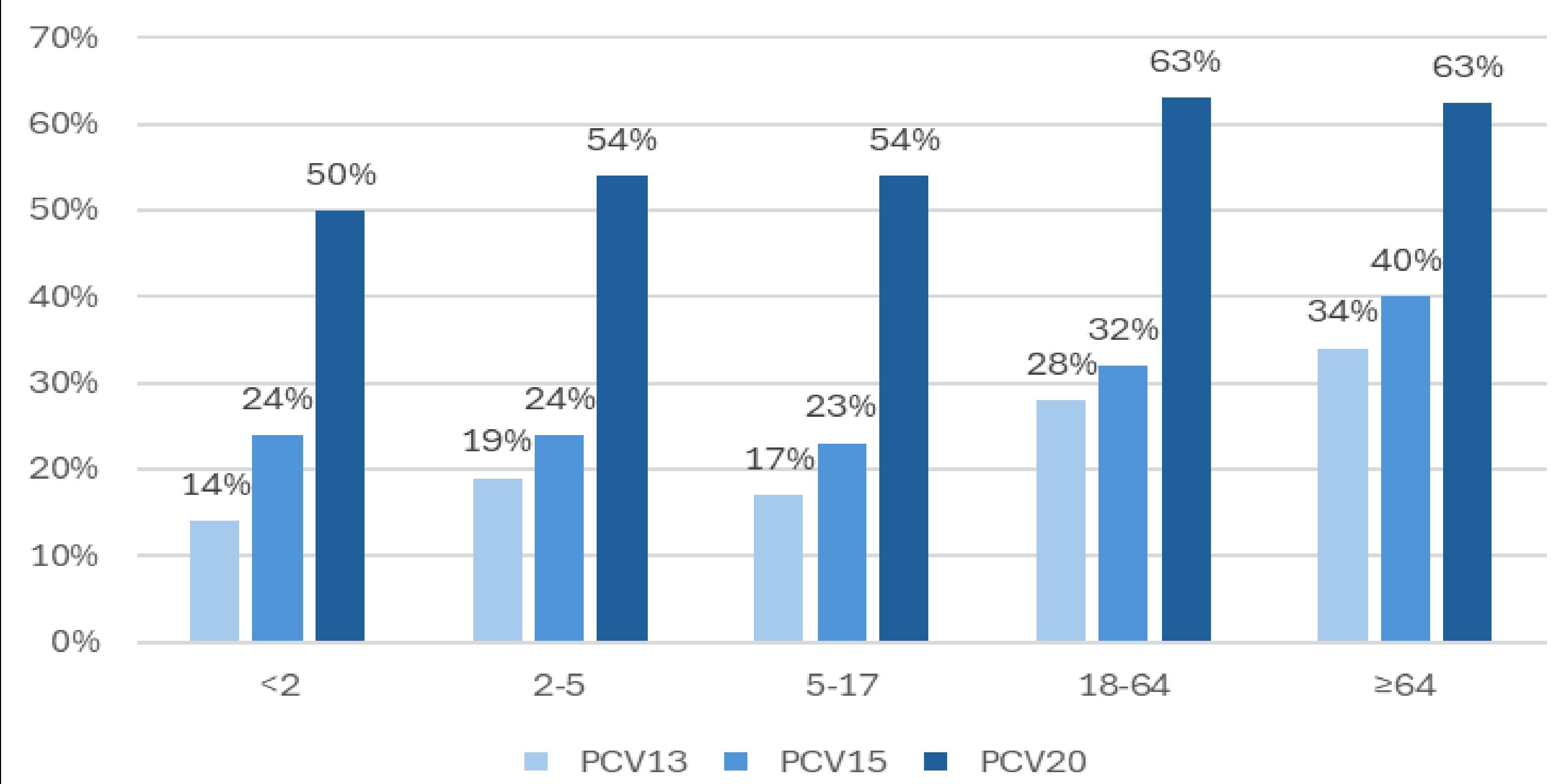
Table 1. Model inputs

Age	<1	1	2	3	4	5-17	18-49	50-64	≥64
Population ⁶	713k	685k	703k	704k	730k	10.8M	26.2M	13.2M	14.7M
Disease incidence per 100k individuals									
IPD ⁴	14.5	14.5	4.6	4.6	4.6	1.7	3.9	3.9	15.2
Inpatient pneumonia ^{7, 8}	967.0	634.1	337.4	337.4	337.4	76.9	117.9	395.3	1,916.7
Inpatient OM ⁷	847.0	2,099.0	1,731.0	1,731.0	1,731.0	-	-	-	-
Proportion of IPD cases, % ⁴									
Meningitis	40.5	40.5	19.4	19.4	19.4	35.8	41.7	41.7	23.5
Disease fatality rate, % ^{7, 8}									
Meningitis	6.0	6.0	6.0	6.0	6.0	6.0	12.2	16.6	27.3
Bacteremia	1.5	1.5	1.5	1.5	1.5	1.5	8.4	15.7	21.4
Inpatient pneumonia	0.8	0.8	0.8	0.8	0.8	0.8	4.7	11.2	15.2
Direct medical costs per episode, EUR ⁶⁻⁸									
Meningitis	14,105	10,544	10,522	10,522	10,522	11,731	17,115	19,550	17,904
Bacteremia	10,229	8,001	8,273	8,273	8,273	12,352	13,402	13,774	11,677
Inpatient pneumonia	7,213	3,576	3,357	3,357	3,357	9,255	8,943	9,791	3,129
Inpatient OM	2,154	1,115	746	746	3,002	-	-	-	-
Sequelae lifetime medical costs for all ages ⁹									
Age	0-24	25-34	35-44	45-54	55-64	65-74	≥75		
Baseline utilities ¹⁰	0.92	0.93	0.92	0.90	0.89	0.91	0.85		
QALY decrements									
Meningitis	0.023		0.008		0.006		0.005		
0-17 years ¹¹	0.023		0.008		0.006		0.005		
≥18 years ¹¹⁻¹⁶	0.130		0.130		0.130		-		
Maximum direct vaccine effect against pneumococcal disease									
	IPD ¹⁷		Inpatient pneumonia ¹⁸		Inpatient OM ¹⁹				
	Year 1	Year 2+	Year 1	Year 2+	Year 1	Year 2+			
PCV13/15	52.4%	78.2%	17.1%	25.5%	8.2%	12.3%			
PCV20	67.8%	89.7%	19.3%	25.5%	9.3%	12.3%			
Indirect vaccine effect - accrual data									
Year	Year 1	Year 2	Year 3	Year 4	Year 5-6	Year 7-10			
Accrual rates ²⁰⁻²²	19.4%	26.8%	54.9%	71.7%	91.9%	100%			
Indirect vaccine effect - maximum reduction in disease incidence									
Age	IPD ²⁰⁻²²		Inpatient pneumonia ²³⁻²⁵		Inpatient OM ^{24, 26}				
<17 years	99.4%		30.5%		20.0%				
18-64 years	96.9%		15.0%		-				
≥65 years	80.8%		15.0%		-				

IPD: invasive pneumococcal disease; OM: otitis media; PCV: pneumococcal conjugate vaccine; EUR: Euro; QALY: quality-adjusted life years.

METHODS (continued)

Figure 1. Serotype coverage by vaccine⁴



RESULTS

- Versus PCV13 and PCV15 (2+1), PCV20 3+1 was estimated to be dominant, resulting in better public health and economic outcomes.
- PCV20 was predicted to prevent more disease cases versus PCV13 (IPD: 13,510; inpatient pneumonia: 317,136; inpatient OM: 66,579) and PCV15 (IPD: 11,187; inpatient pneumonia: 255,790; inpatient OM: 53,733) and provide cost-savings of €1,567,052,379 and €1,134,653,266 versus PCV13 and PCV15, respectively.

Table 2. Base-case results

Vaccine	PCV13 2+1	PCV15 2+1	PCV20 3+1	PCV20 vs PCV13	PCV20 vs PCV15
Disease cases	46,257	43,934	32,747	-13,510	-11,187
IPD					
Meningitis	14,180	13,478	9,840	-4,340	-3,637
Bacteremia	32,077	30,456	22,906	-9,171	-7,550
Inpatient pneumonia	4,392,997	4,331,651	4,075,861	-317,136	-255,790
Inpatient OM	573,633	560,788	507,055	-66,579	-53,733
Disease deaths	538,572	531,255	501,346	-37,226	-29,909
Total QALYs	1,906,321,757	1,906,466,221	1,907,103,470	781,713	637,249
Total LYs	1,992,383,090	1,992,457,979	1,992,783,920	400,830	325,941
Total costs, EUR	32,465,849,214	32,033,450,101	30,989,796,835	-1,567,052,379	-1,134,653,266
ICER, EUR per QALY	-	-	-	PCV20 dominant	PCV20 dominant

IPD: invasive pneumococcal disease; OM: otitis media; PCV: pneumococcal conjugate vaccine; QALY: quality-adjusted life years; LY: life years; EUR: Euro; ICER: incremental cost-effectiveness ratio.

CONCLUSIONS

- This study predicted that infant immunization with PCV20 in France was more cost-effective option vs PCV13 and PCV15.
- These results could help decision-makers in implementation of the optimal PCV strategy in French pediatric NIP.

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