Evaluating the Potential Lifetime Health and Economic Impact of V116, an Adult-Specific 21-Valent Pneumococcal Conjugate Vaccine, on Invasive Pneumococcal Disease in Switzerland

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Background

- *Streptococcus pneumoniae* is a Gram-positive bacterium that commonly colonizes the respiratory tract and can potentially cause invasive pneumococcal disease (IPD) in adults, with those considered immunocompromised/suppressed being at highest risk[1-2]
- IPD is associated with high morbidity and mortality, which causes substantial health and economic burdens on the healthcare system[3]
- Although available vaccines have largely reduced the burden of IPD among adults, current data on IPD show substantial residual burden attributable to serotypes they do not currently cover[3]
- V116 is an investigational 21-valent pneumococcal conjugate vaccine (PCV) specifically designed for adults. It contains **21** serotypes: **3, 6A, 7F, 8, 9N, 10A, 11A, 12F, 15A, 15C[a], 16F, 17F, 19A, 20A, 22F, 23A, 23B, 24F, 31, 33F,** and **35B**. **Eight (15A, 15C[a], 16F, 23A, 23B, 24F, 31, 35B)** of the 21 serotypes are unique and are not included in any currently licensed vaccines
- The serotypes in V116 accounted for ~78% of IPD and the 8 unique serotypes accounted for ~15% of IPD in Switzerland adults ≥65 years in 2019[4]

[a]Serotype protection proposed with deOAc15B as the molecular structures for deOAc15B and 15C are similar.

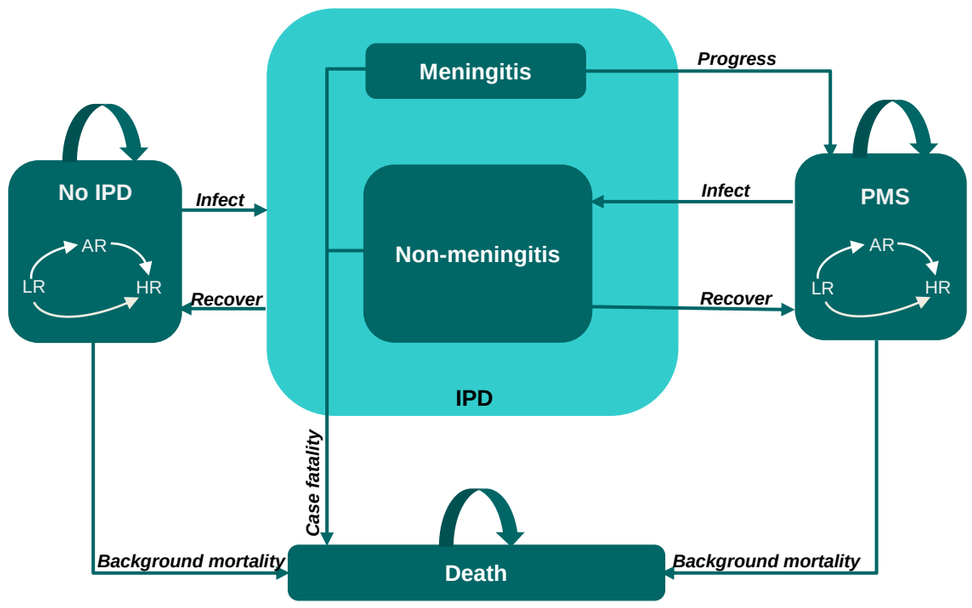
Objective

To quantify and compare the potential lifetime health and economic impact of vaccination with V116 vs PCV20 on IPD among Switzerland adults aged 50 and older.

Methods

- A multicohort Markov model (**Figure 1**) was built to estimate the lifetime (until death or turned 100 years old) IPD cases, post-meningitis sequelae (PMS) cases, IPD-related deaths, and the IPD-associated direct medical costs (in 2023 Swiss francs [CHF]) among Swiss adults aged 50-64 and 65+ years of no vaccination or vaccination with V116 or PCV20
- The study population was stratified into 3 mutually exclusive risk groups: low-risk (LR), at-risk (AR), and high-risk (HR) adults based on the age group–specific proportions and classifications from Pelton, et al (2019)[5]
- Risk group transitioning was implemented in the model as individuals aged, as depicted in **Figure 1**
- The same serotype-specific vaccine effectiveness was assumed for the 2 vaccines. The waning of the effectiveness was assumed to be flat for the first 5 years and then linearly declines to zero in the following 10 years[6]
- Vaccine coverage rates were the same for the 2 vaccines and for all risk groups: 60%[7]
- Discounting rate for costs was 3%. Other key model parameters are shown in **Table 1**
- One-way sensitivity analysis (OWSA) was conducted to assess the robustness of the results and to identify the most influential parameters on the total direct medical costs saved by V116 when compared to PCV20

Figure 1. A schematic diagram depicting the structure of the state-transition Markov model



AR, at risk; HR, high risk; LR, low risk; NBPP, nonbacteremic pneumococcal pneumonia.

Results

- In adults aged 50-64 years, V116 prevented 2,260 lifetime IPD cases and 213 IPD deaths—29.3% more than the IPD cases and deaths prevented by PCV20 compared with no vaccination. The averted IPD cases from V116 vaccination resulted in CHF ~23 million reduction in total lifetime direct medical costs – 29.1% higher than the CHF ~17 million costs averted by PCV20 (**Table 2**)
- Similarly, in adults aged 50-64, V116 prevented 41 cases of PMS – 29.2% higher than the 32 PMS cases prevented by PCV20 when compared to no vaccines (**Table 2**)
- In adults aged 65+ years, V116 prevented 2,033 IPD cases and 244 IPD deaths compared with no vaccination – 28.9% more than the 1,577 IPD cases and 189 IPD deaths prevented by PCV20. The averted IPD cases from V116 vaccination resulted in CHF ~20 million reduction in total direct medical costs – 28.7% higher than the CHF ~16 million costs averted by PCV20 (**Table 3**)
- Among the parameters included in the OWSA, the top sensitive parameters are PCV efficacy against IPD (AR and LR) and discount rates (**Figure 2**)
- OWSA confirmed the robustness of the results. All scenarios showed a large lifetime direct medical cost (~CHF 6.4 million–11 million) saved by V116 when compared to PCV20 (**Figure 2**)

Table 1: Key model inputs

	Low risk	At risk	High risk	Source
IPD incidence (per 100,000 person-years)				
50-59	11.2	89.0	25.0	Bundesamt für Gesundheit (2019); Deb (2022)[8,9]
60-69	41.1	82.0	57.0	
70+	41.2	82.0	57.0	
IPD case fatality rate (%)				
50-64	6.0			Bundesamt für Gesundheit (2019)[8]
65-74	10.0			
75-84	10.0			
85 -100	10			
% Meningitis of IPD cases				
50-64	7.0			Blank and Szucs (2012)[10]
65-74	5.0			
75-84	5.0			
85-100	5.0			
% of PMS out of meningitis				
	31.7			Jit M. (2010)[11]
IPD direct medical cost (CHF, 2023)				
50-59	10,537	10,537	10,537	Deb, et al. (2022)[9]
65+	12,070	12,070	12,070	

CHF, Swiss francs; IPD, invasive pneumococcal disease; PMS, post-meningitis sequelae.

Table 2. Estimated lifetime clinical and economic outcomes when vaccinating with V116 and PCV20 for ages 50-64 years

	V116	PCV20	No vaccine	Cases/costs averted, compared to no vaccine		Additional reduction by V116, compared to PCV20
				V116	PCV20	
Clinical outcomes (undiscounted)						
IPD cases	24,049	24,562	26,309	2,260	1,747	512 (29.3%)
IPD deaths	2,721	2,770	2,934	213	164	48 (29.5%)
PMS cases	362	371	403	41	32	9 (29.2%)
Economic outcomes (discounted; in million CHF)						
Direct cost, IPD	164.5	169.6	187.0	22.5	17.4	5.1 (29.13%)

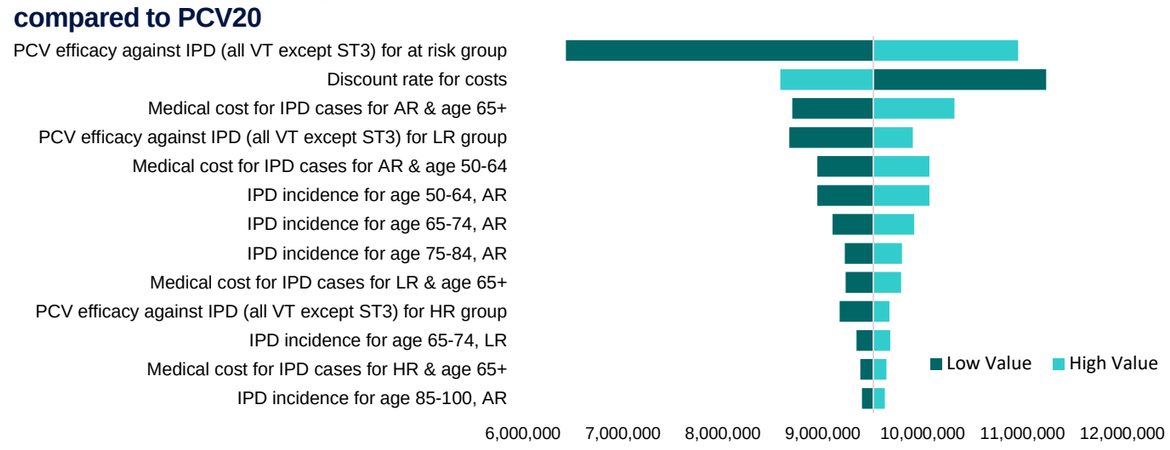
IPD, invasive pneumococcal disease; PCV20, 20-valent pneumococcal conjugate vaccine; PMS, post-meningitis sequelae; V116, an investigational 21-valent pneumococcal conjugate vaccine.

Table 3. Estimated lifetime clinical and economic outcomes when vaccinating with V116 and PCV20 for ages 65+ years

	V116	PCV20	No vaccine	Cases/costs averted, compared to no vaccine		Additional reduction by V116, compared to PCV20
				V116	PCV20	
Clinical outcomes (undiscounted)						
IPD cases	10,600	11,056	12,633	2,033	1,577	456 (28.91%)
IPD deaths	1,272	1,327	1516	244	189	55 (28.91%)
PMS cases	148	154	176	28	22	6 (28.91%)
Economic outcomes (discounted; in million CHF)						
Direct cost, IPD	89.8	94.2	109.7	19.9	15.5	4.4 (28.74%)

IPD, invasive pneumococcal disease; PCV20, 20-valent pneumococcal conjugate vaccine; PMS, post-meningitis sequelae; V116, an investigational 21-valent pneumococcal conjugate vaccine.

Figure 2. Sensitivity analysis – estimated lifetime clinical and economic outcomes of V116, compared to PCV20



PCV, pneumococcal conjugate vaccine; AR, at-risk; IPD, invasive pneumococcal disease; VT, vaccine type; LR, low-risk; HR, high-risk.

Conclusions

- In both age groups, comparing with PCV20, V116 led to a greater reduction of both the lifetime health and economic burden associated with IPD
- The addition of V116 to the national vaccination recommendations has the potential to substantially reduce the health and economic burden associated with PD among adults in the Switzerland, compared to PCV20

Conflict of interest disclosure:

MS, NC, KJ and KOE are employees of Merck Sharp & Dohme LLC, a subsidiary of Merck & Co., Inc., Rahway, NJ, USA. AFB and TM are employed by MSD Switzerland. V116 is being developed by Merck & Co., Inc., Rahway, NJ, USA.

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Presented at ISPOR Europe; Barcelona, Spain; 17-20 November 2024