Estimating the Potential Lifetime Health and Economic Impact of V116 on Pneumococcal Disease in Brazil

Yi Z[1], Urrego-Reyes J[2], Hirata L[3], Parellada C[3], Cossrow N[1], Johnson KD[1], Owusu-Edusei K[1]

[1]Merck & Co., Inc., Rahway, NJ, USA, [2]MSD Colombia, Bogota, Colombia, [3]MSD Brazil, São Paulo, SP, Brazil

Background

- *Streptococcus pneumoniae (S. pneumoniae)* is a gram-positive bacterium that can cause invasive pneumococcal disease (IPD) and non-bacteremic pneumococcal pneumonia (NBPP). These conditions can be life-threatening with potential long-term sequelae. Additionally, the risk of pneumococcal disease increases with age and certain medical conditions[1,2]
- Brazil's national immunization program (NIP) includes pneumococcal vaccination for children, however, there is currently no universal pneumococcal vaccination program for older adults (≥ 60 years)[3]
- The development of vaccines with broader protection could simplify guidelines, enhance coverage, and extend risk-based recommendations, optimizing protection against pneumococcal disease[4]
- V116 is a novel 21-valent pneumococcal conjugate vaccine (PCV), specifically designed for adults. It contains **21** serotypes: **3, 6A, 7F, 8, 9N, 10A, 11A, 12F, 15A, 15C, 16F, 17F, 19A, 20A, 22F, 23A, 23B, 24F, 31, 33F,** and **35B**. Eight **(15A, 15C, 16F, 23A, 23B, 24F, 31, 35B)** are unique serotypes not covered in any currently licensed vaccines

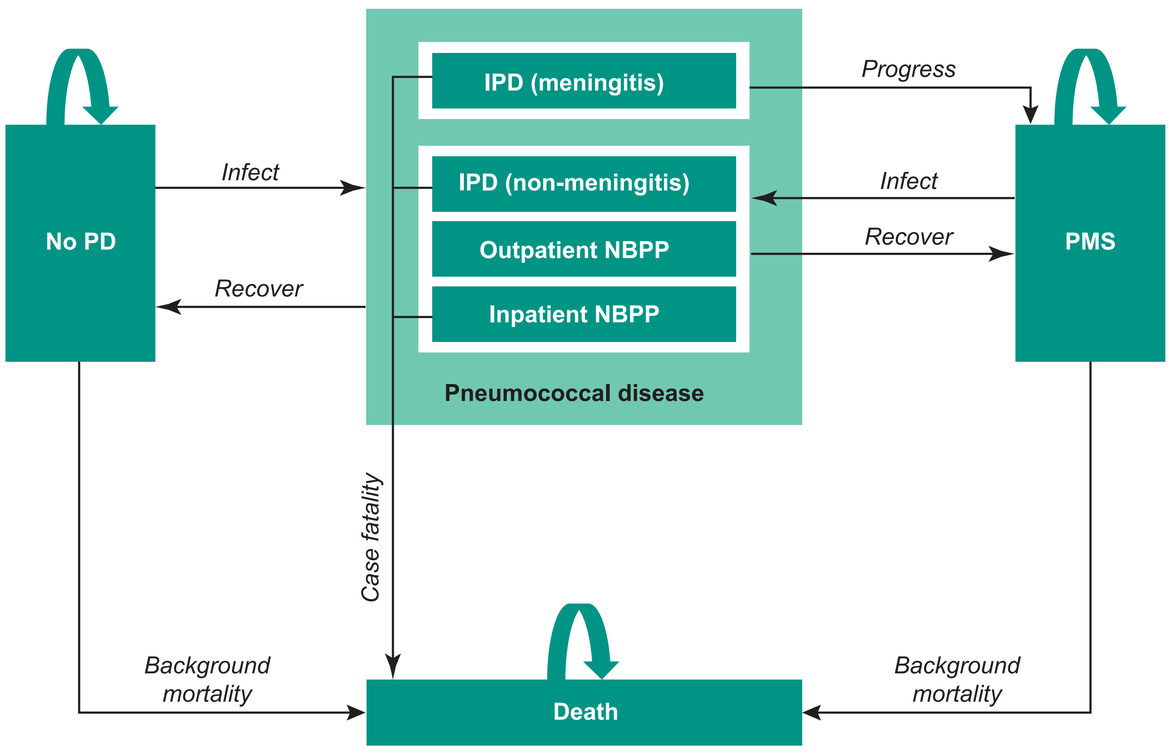
Objectives

- To estimate the potential health and economic impact of vaccination with V116 versus PCV20 on pneumococcal disease in adults aged ≥ 60 years in Brazil

Methods

- A multi-cohort Markov model was adapted to older adult Brazilian population to estimate the lifetime (until death or age 100) cases of IPD, post meningitis sequelae (PMS), NBPP, IPD and NBPP deaths, and the associated direct medical costs, comparing vaccination with V116 or PCV20 versus no vaccination (**Figure 1**)
- The study population was stratified into three risk groups for pneumococcal disease: low-risk (LR), at-risk (AR), and high-risk (HR) adults[5]
- The following assumptions were considered for both vaccines:
  - Same serotype-specific vaccine effectiveness
  - Vaccine effectiveness remained stable for the first 5 years and then declined linearly to zero over the following 10 years[6]
  - Vaccine coverage rate was 60%
  - NBPP serotype distribution was assumed to be same as IPD from 2021-2023 period[7]
- Epidemiological and cost data were obtained from literature and national databases.
- Economic outcomes were discounted at 5.0% annually and undiscounted clinical cases were reported. Costs were expressed in 2024 US Dollars (USD) using an exchange rate of 1 USD = 5.71 Brazilian Real (Oct 23rd, 2024)
- Base case results were summarized for V116 and PCV20 compared to no vaccination
- 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



PD, pneumococcal disease; IPD, invasive pneumococcal disease; NBPP non-bacteremic pneumococcal pneumonia; PMS, post-meningitis sequelae

Results

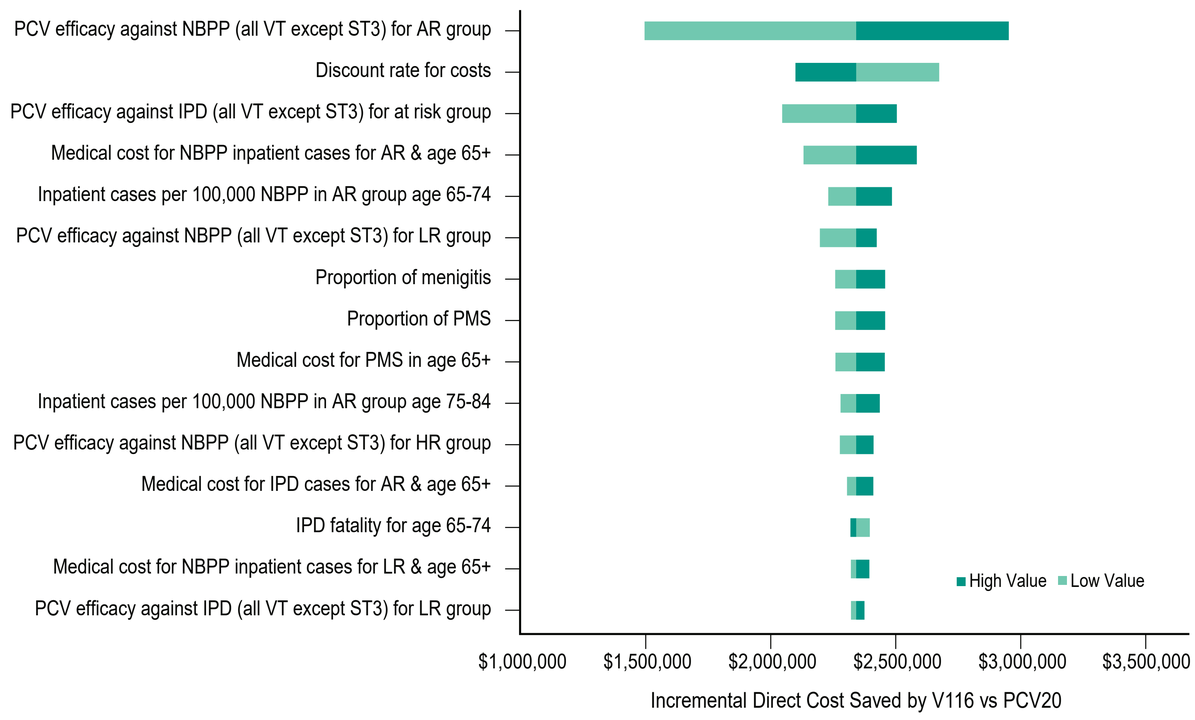
- Among adults aged ≥60 years, V116 prevented an additional 8,536 IPD cases and 3,623 IPD-related deaths compared to no vaccination. In contrast, PCV20 prevented an additional 7,939 IPD cases and 3,370 IPD-related deaths compared to no vaccination (**Table 1**)
- For non-IPD cases, V116 averted an additional 98,271 inpatient and 23,137 outpatient NBPP cases, along with 18,465 NBPP deaths compared to no vaccination. This was 8% higher than the 91,420 inpatient and 21,524 outpatient NBPP cases, and 17,178 NBPP-related deaths, prevented by PCV20
- In terms of total direct costs, V116 and PCV20 saved an additional USD 33.5 million and USD 31.1 million, respectively, in comparison to no vaccination. Furthermore, V116 saved an additional USD 2.3 million compared to PCV20 (**Table 1**)
- The OWSA consistently showed that V116 resulted in greater direct medical costs savings compared to PCV20

Table 1. Estimated lifetime clinical and economic outcomes with V116 and PCV20 vaccination in adults aged ≥60 years

	V116	PCV20	No vaccination	Cases/costs averted, compared to no vaccination		Additional reduction by V116, compared to PCV20	
				By V116	By PCV20	Number	%
Clinical Outcomes (Undiscounted)							
IPD	56,212	56,809	64,748	8,536	7,939	597	8%
PMS	2,117	2,140	2,442	325	302	23	8%
NBPP-IP	1,107,844	1,114,695	1,206,115	98,271	91,420	6,851	7%
NBPP-OP	259,507	261,120	282,644	23,137	21,524	1,613	7%
IPD deaths	23,931	24,185	27,555	3,623	3,370	253	8%
NBPP IP deaths	208,164	209,451	226,629	18,465	17,178	1,287	7%
Economic Outcomes (discounted) in 2024 USD							
Total direct costs	**$256,993,087**	**$259,333,249**	**$290,520,351**	**$33,527,264**	**$31,187,102**	**$2,340,162**	**8%**
IPD	$24,960,478	$25,300,507	$29,821,797	$4,861,319	$4,521,290	$340,029	8%
PMS	$31,390,605	$31,874,672	$38,308,443	$6,917,838	$6,433,772	$484,067	8%
NBPP IP	$196,360,427	$197,844,002	$217,642,458	$21,282,031	$19,798,456	$1,483,576	7%
NBPP OP	$4,281,577	$4,314,068	$4,747,653	$466,076	$433,585	$32,491	7%

V116, 21-valent pneumococcal conjugate vaccine; PCV20, 20-valent pneumococcal conjugate vaccine; IPD, invasive pneumococcal disease; PMS, post-meningitis sequelae; NBPP-IP, non-bacteremic pneumococcal pneumonia inpatient; NBPP-OP, non-bacteremic pneumococcal pneumonia outpatient.

Figure 2. Sensitivity analysis–estimated lifetime direct medical cost for adults aged ≥60 years saved by V116, compared with PCV20 (2024 USD); discounted



PCV, pneumococcal conjugate vaccine; NBPP, non-bacteremic pneumococcal pneumonia; AR, at-risk; IPD, invasive pneumococcal disease; VT, vaccine type; LR, low-risk; PMS, post-meningitis sequelae; HR, high-risk.

Discussion & Conclusions

- In comparison to no vaccination, V116 significantly reduced the health and economic burden of pneumococcal disease (PD) in older adults in Brazil, showing greater clinical and economic benefits than PCV20
- The study´s findings should be evaluated within the context of Brazil's immunization policies, vaccination coverage, and the prevalent serotypes. Data from 2021-2023 indicate that the 8 unique serotypes in V116 accounted for 13.4% of cases, with overall serotype coverage of 60% for PCV20 and 65% for V116. However, pre-pandemic data indicated these serotypes represented 17% of cases, with V116 offering 12% greater coverage compared to PCV20 (68% vs 56%)[7]. This underscores the need for ongoing surveillance
- Previous studies in Brazil have shown a substantial burden of PD in older adults, particularly pneumonia and bacteremia, with high case-fatality rates[8]
- Based on the current epidemiological situation and the significant impact of PD on the healthcare system among older adults in Brazil, the inclusion of V116 in the NIP could reduce the health and economic burden associated with PD in adults aged ≥60 years, with greater impact than PCV20 in comparison to no vaccination

References

1. US Centers for Disease Control and Prevention. ABCs Surveillance Report: Streptococcus pneumoniae, 2019. https://www.cdc.gov/abcs/downloads/SPN_Surveillance_Report_2019.pdf. Accessed October 9, 2024.
2. US Centers for Disease Control and Prevention. Active Bacterial Core surveillance. https://www.cdc.gov/abcs/. Accessed October 9, 2024.
3. World Health Organization. Vaccination schedule for Pneumococcal disease, 2024. https://immunizationdata.who.int/global/wiise-detail-page/vaccination-schedule-for-pneumococcal-disease?ISO_3_CODE=BRA&TARGETPOP_GENERAL=. Accessed October 11, 2024.
4. Kobayashi M, Pilishvili T, Farrar JL, et al. Pneumococcal Vaccine for Adults Aged ≥19 Years: Recommendations of the Advisory Committee on Immunization Practices, United States, 2023. *MMWR Recomm Rep.* 2023;72(No. RR-3):1–39. DOI: http://dx.doi.org/10.15585/mmwr.rr7203a1
5. Nunes BP, Batista SRR, Andrade FB, et al. *Multimorbidity: The Brazilian Longitudinal Study of Aging (ELSI-Brazil). Rev Saude Publica.* 2018;52Suppl 2(Suppl 2):10s.
6. Stoecker C. Economic assessment PCV15 & PCV20. Presented at ACIP. June 15, 2021. https://www.cdc.gov/vaccines/acip/meetings/downloads/slides 2021 06/03 Pneumococcal Stoecker 508.pdf.
7. Instituto Adolfo Lutz. Informação da vigilância das pneumonias e meningites bacterianas. Available on: http://www.ial.sp.gov.br/ial/publicacoes/boletim . Accessed on June 13 2024.
8. Parellada CI, Webster JL, Pungartnik P, et al. *Clinical and economic burden of syndromes associated with pneumococcal disease in Brazil, 2019.* Poster presented at SLIPE 2023; San José, Costa Rica; October 30th – November 2nd, 2023.

Corresponding author

Zinan Yi; email: zinan.yi@merck.com

https://bit.ly/3YGiCJZ

Disclosure

Juan Urrego-Reyes is an MSD Colombia employee. Cintia Parellada and Luciana Hirata are MSD Brazil employees. Zinan Yi, Nicole Cossrow, Kelly Johnson and Kwame Owusu-Edusei are employees of Merck Sharp & Dohme LLC, a subsidiary of Merck & Co., Inc., Rahway, NJ, USA. All may hold stock or stock options in Merck & Co., Inc., Rahway, NJ, USA. V116 was developed by Merck & Co., Inc., Rahway, NJ, USA

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