EE592

Cost-Effectiveness of 13-Valent Pneumococcal Conjugate Vaccine in Filipino Adults Aged ≥50 Years

Joel Santiaguel[1], Winniefer Nua[2], Mark Atwood[3], Liping Huang[4], Dhwani Hariharan[3], Josephine Guerrero[2], Ricardo Zotomayor[5,6], Aileen Wang[1], Ahuva Averin[3]

[1]Division of Pulmonary Medicine, University of the Philippines Manila College of Medicine and Philippine General Hospital, Philippines; [2]Pfizer Inc., Makati City, Philippines; [3]Policy Analysis Inc., MA, USA; [4]Pfizer Inc., Collegeville, PA, USA; [5]UERMMMC Inc., Quezon City, Philippines; [6]StLMC, Quezon City, Philippines

INTRODUCTION

- The Philippines' national immunization program (NIP) recommends use of 23-valent pneumococcal polysaccharide vaccine (PPV23) among seniors aged 60 years and again at age 65 years to protect against invasive pneumococcal disease (IPD) and non-bacteremic pneumococcal pneumonia (NBPP)[1]
- Additionally, local clinical practice guidelines in the Philippines recommend 13-valent pneumococcal conjugate vaccine (PCV13) or PPV23 among adults aged ≥50 years who are at elevated risk of pneumococcal disease due to underlying conditions[2]
- Despite recommendations, implementation of vaccination is not widespread likely due to lack of funding

OBJECTIVE

- To evaluate the impact of an alternative pneumococcal vaccination recommendation and of expanding the NIP to include select younger adults, we conducted a cost-effectiveness analysis comparing use of single-dose PCV13 vs. two doses of PPV23 (administered five years apart; "PPV23+PPV23") among adults aged 50-59 years at elevated risk of pneumococcal disease and all adults aged 60-99 years in the Philippines

METHODS

Model Overview

- Lifetime risks and costs of IPD (including bacteremia and meningitis) and NBPP were projected using a probabilistic cohort model with a Markov-type process
- Model population included adults aged 50-59 years at moderate or high risk of disease and all adults aged 60-99 years in the Philippines (N=12.8M)[3-5]:
  - Population is characterized by age (1-yr increments) and risk profile (low-risk [immunocompetent without chronic medical conditions], moderate-risk [immunocompetent with ≥1 chronic medical condition], high-risk [immunocompromised])[6,7]
- Vaccination strategies included a single dose of PCV13 or, alternatively, PPV23 at model entry; patients receiving PPV23 received a second dose of PPV23 five years later (if alive)
- Clinical and economic outcomes for each strategy are projected annually based on age, risk profile, disease/fatality rates, vaccination status/type, time since vaccination, and unit costs and include: cases of IPD and NBPP, deaths due to IPD and inpatient NBPP, life-years (LYs) and quality-adjusted LYs (QALYs), and costs of vaccination and medical treatment for IPD and NBPP, and non-medical costs

Model Parameters

- Model population comprised all adults aged 50-59 years at moderate or high-risk of disease and all adults aged 60-99 years (50-59y, n=3.4M; 60-64y, n=3.7M; 65-74y, n=3.8M; 75-84y, n=1.6M; 85-99y, n=0.3M)
- Proportion of disease that is vaccine-type (VT)[8] was assumed to remain the same over the modelling horizon due to low uptake of PCVs among children (i.e., no herd effects from pediatric vaccination)
- PCV13 effectiveness (VE-PCV13) was assumed to be durable for 5 years and to wane to 0% by year 16[9-11]
- VE-PPV23 vs. VT-IPD was assumed to wane to 0% by year 10[12]; VE-PPV23 vs. VT-NBPP assumed to wane to 0% by year 5[13]
- Utility reductions for persons with IPD, inpatient NBPP, and outpatient NBPP were 0.13, 0.13, and 0.004, respectively, in the year in which the illness occurred[14,15]
- Costs included medical care costs (bacteremia, ₱21,725; meningitis, ₱23,676; inpatient NBPP, ₱14,118; outpatient NBPP, ₱692-₱742)[16,17], vaccine price (confidential; PCV13 price=1.7x PPV23 price), and vaccine administration fee (PPV23: ₱40, PCV13: ₱65)[18]
- Vaccine uptake was assumed to be 10%[18]
- Other model inputs are summarized in Table 1

Analyses

- Cost-effectiveness was calculated in terms of cost per QALY gained and evaluated using a 1x GDP per capita willingness-to-pay (WTP) threshold
- Benefits and costs were discounted at 7% annually
- Analyses were conducted from healthcare system and societal perspectives
- Probabilistic sensitivity analyses (PSA; 1,000 replications) were conducted from the societal perspective to account for uncertainty surrounding estimates of key model parameters

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

	50-64 Years		65-74 Years			75-84 Years			85-99 Years		
	Mod	High	Low	Mod	High	Low	Mod	High	Low	Mod	High
Incidence of bacteremia (per 100K)[19,20]	21.1	37.0	11.0	31.1	49.8	13.9	38.9	60.1	16.7	46.7	70.5
Incidence of meningitis (per 100K)[19,20]	5.2	9.2	2.7	7.6	12.2	3.4	9.5	14.6	4.1	11.3	17.0
Incidence of inpatient NBPP (per 100K)[3,18,20]	18.5	34.6	11.6	35.2	47.2	15.3	46.2	62.0	17.9	54.0	72.4
Incidence of outpatient NBPP (per 100K)[3,18,20,21]	12.3	23.1	7.7	23.4	31.8	10.2	30.7	41.7	11.9	35.9	48.7
General population mortality (per 100)[22]	1.5	1.9	3.4	5.1	6.7	5.0	7.4	9.7	6.3	9.5	12.4
Case-fatality rate for bacteremia (per 100)[19,23]	29.3	30.6	36.4	38.2	39.9	42.9	45.0	47.1	49.2	51.6	54.0
Case-fatality rate for meningitis (per 100)[19,23]	26.3	27.5	32.7	34.3	35.9	38.6	40.5	42.3	44.2	46.4	48.6
Case-fatality rate for inpatient NBPP (per 100)[24,25]	5.7	12.4	3.9	5.7	8.5	5.0	6.2	6.6	5.9	6.0	7.9
Yr. 1 VE-PCV13 vs. VT-IPD (%)[9,10,26,27]	79.2	63.3	75.0	75.0	60.0	75.0	75.0	60.0	75.0	75.0	60.0
Yr. 1 VE-PCV13 vs. VT-NBPP (%)[9,10,26,27]	51.3	41.1	45.0	45.0	36.0	45.0	45.0	36.0	45.0	45.0	36.0
Yr. 1 VE-PPV23 vs. VT-IPD (%)[12,28]	32.3	16.8	55.7	30.9	16.1	50.8	28.1	14.6	37.9	20.5	10.6
Yr. 1 VE-PPV23 vs. VT-NBPP (%)[13]	24.0	12.5	41.3	22.9	11.9	37.6	20.8	10.8	28.1	15.2	7.9
General population health utility[29,30]	0.76	0.64	0.72	0.72	0.55	0.67	0.67	0.53	0.51	0.51	0.48

RESULTS

- Use of single-dose PCV13 vs. two doses of PPV23 would result in fewer cases and deaths, thus reducing clinical burden of pneumococcal disease and yielding 1,058 additional QALYs (Table 2)
- From the healthcare system perspective, total costs increased by ₱33.6M (net of ₱18.1M reduction in medical care costs and ₱51.7M increase in vaccination costs); the incremental cost-effectiveness ratio (ICER) was ₱31,791/QALY
- From the societal perspective, total costs increased by ₱26.8M (net of ₱18.1M reduction in medical care costs, ₱6.9M reduction in non-medical costs, and ₱51.7M increase in vaccination costs); the ICER was ₱25,308/QALY
- In PSA, 99.2% of replications were below the cost-effective threshold of ₱190,000/QALY (Figures 1 and 2)

Table 2: Base case results

	PCV13	PPV23+PPV23	Difference
No. cases			
IPD	76,317	77,149	-832
Inpatient NBPP	66,322	66,978	-656
Outpatient NBPP	44,225	44,662	-437
No. deaths	36,683	37,059	-376
No. LYs/QALYs (discounted)			
LYs	111,377,592	111,375,999	1,593
QALYs	75,327,963	75,326,905	1,058
Costs (millions)			
Medical care	₱1,240.5	₱1,258.5	-₱18.1
Vaccination	₱969.3	₱917.6	₱51.7
Non-medical	₱466.5	₱473.3	-₱6.9
Total healthcare costs (medical + vaccination)	₱2,209.8	₱2,176.1	₱33.6
Total societal costs (medical + vaccination + non-medical)	₱2,676.2	₱2,649.5	₱26.8
Healthcare system perspective			
Cost per LY	--	--	₱21,108
Cost per QALY	--	--	₱31,791
Societal perspective			
Cost per LY	--	--	₱16,804
Cost per QALY	--	--	₱25,308

Figure 1: PSA scatterplot

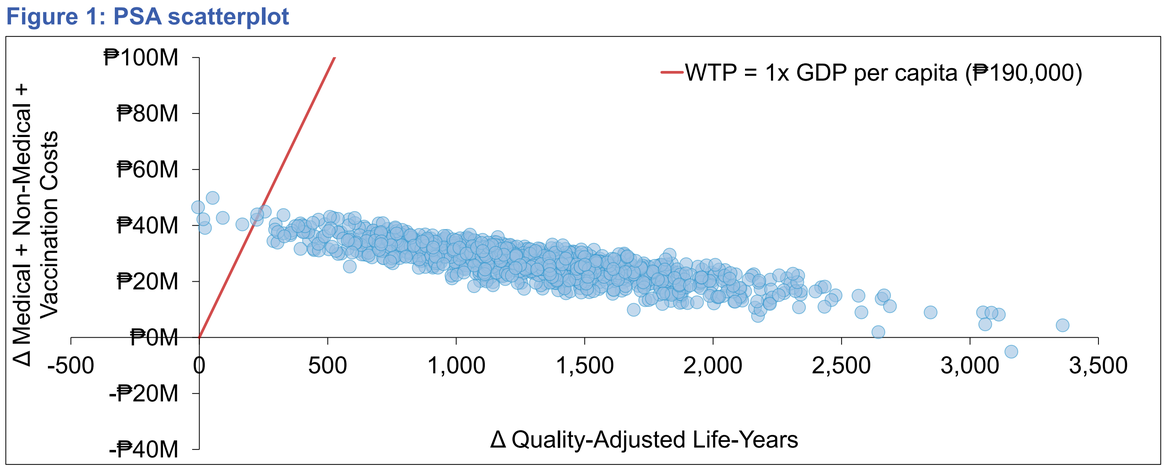
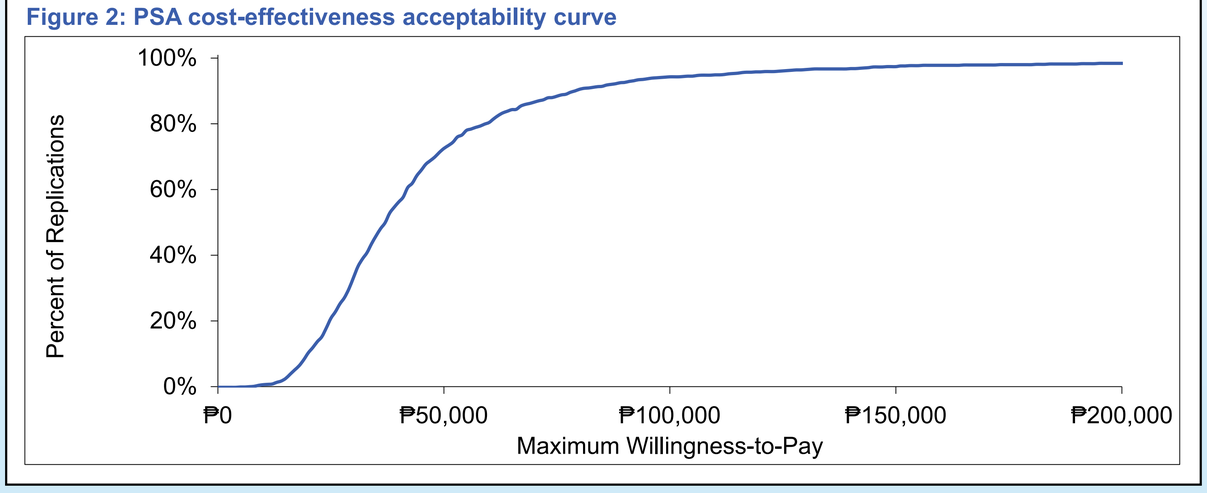


Figure 2: PSA cost-effectiveness acceptability curve



CONCLUSIONS

- **Use of single-dose PCV13 (vs. two doses of PPV23) among adults aged 50-59 years with underlying medical conditions and all adults aged 60-99 years in the Philippines would reduce pneumococcal disease burden and be cost-effective (under 1x GDP per capita threshold) from the healthcare system and societal perspectives**

References:

1. Philippine Department of Health (2018).
2. Philippine Society for Microbiology and Infectious Diseases (2020).
3. Cabotaje et al. FHSIS 2019 Annual Report.
4. Cabotaje et al. FHSIS 2018 Annual Report.
5. World Population Review. https://worldpopulationreview.com/countries/philippines-population.
6. US CDC. NHIS 2018.
7. FNRI-DOST (2015).
8. Antimicrobial Resistance Surveillance Program Annual Report (2019).
9. Bonten et al. *NEJM.* 2015;372(12):1114-1125.
10. Mangen et al. *Eur Respir J.* 2015;46(5):1407-1416.
11. Patterson et al. *Trials in Vaccinology.* 2016;5:92-96.
12. Djennad et al. *EClinicalMedicine.* 2018;6:42-50.
13. Suzuki et al. *Lancet Infect Dis.* 2017;17(3):313-321.
14. Mangen et al. *BMC Infect Dis.* 2017;17(1):208.
15. Melegaro et al. *Vaccine.* 2004;22(31-32):4203-4214.
16. PhilHealth 2019 Cost per Disease State.
17. Philippine Society for Microbiology and Infectious Diseases (2018).
18. Pfizer Philippines. Data on File.
19. Avanceña et al. *BMJ Open.* 2019;9(12):e033455.
20. Weycker et al. *BMC Health Serv Res.* 2016;16(1):182.
21. Haasis et al. *PLoS One.* 2015;10(7):e0131156.
22. Epidemiology Bureau Department of Health 2018.
23. Stoecker et al. *Vaccine.* 2020;38(7):1770-1777.
24. Azmi et al. *Int J Infect Dis.* 2016;49:87-93.
25. Averin et al. *Respir Med.* 2021;185.
26. Klugman et al. *NEJM.* 2003;349(14):1341-1348.
27. French et al. *NEJM.* 2010;362(9):812-822.
28. van Hoek et al. *J Infect.* 2012;65(1):17-24.
29. Kim S-H et al. *Health Qual Life Outcomes.* 2014;12(1):145.
30. Sisk et al. *Ann Intern Med.* 2003;138(12):960-968.

Disclosures: Winniefer Nua, Josephine Guerrero, and Liping Huang are employees of Pfizer Inc. Ahuva Averin, Dhwani Hariharan, and Mark Atwood are employed by PAI, which received funding from Pfizer Inc. for this study. Ricardo Zotomayor receives honorarium as a member of the advisory and speakers group for Shingrix GSK.

For more information please contact:
Winniefer Nua, RPh, MSc
Pfizer Inc., Makati City, Philippines
Email: winniefer.nua@pfizer.com
www.pfizer.com

Presented at ISPOR Europe; 14 November 2023; Copenhagen, Denmark