

Health and Economic Impact of 15-Valent Pneumococcal Conjugate Vaccine (V114) Serotypes in Adults 70 Years and Older in Australia

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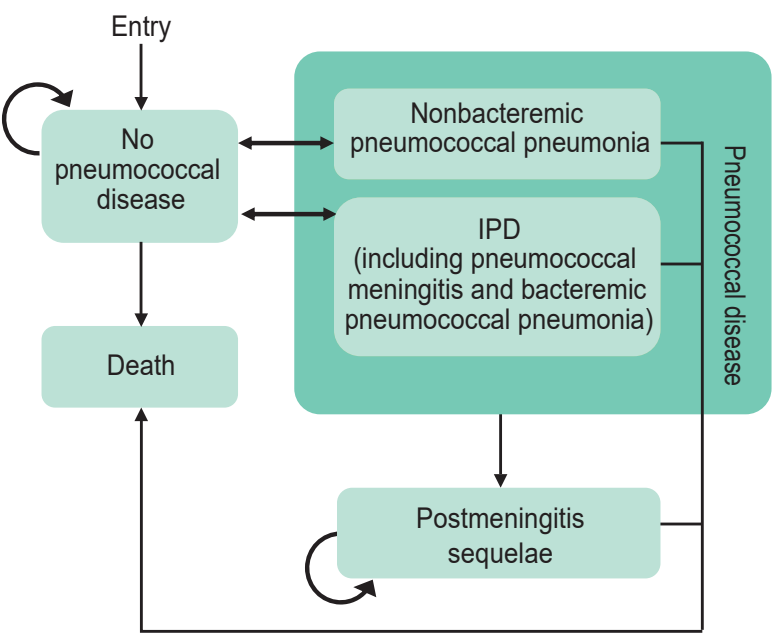
Background and Objectives

- Streptococcus pneumoniae* is a gram-positive organism that causes invasive and noninvasive pneumococcal disease
- The most common invasive syndromes are bacteremic pneumonia, meningitis, and septicemia. Nonbacteremic pneumococcal pneumonia is the most common noninvasive syndrome in adults
- Pneumococcal disease continues to cause significant morbidity and mortality in older adults in Australia
- An investigational 15-valent pneumococcal conjugate vaccine (V114) is in Phase 3 clinical trials. The vaccine contains the 13 serotypes included in PCV13 and 2 additional serotypes, 22F and 33F
- The objective of this study is to quantify the epidemiological and economic burden of pneumococcal disease attributable to V114 serotypes in the remaining lifetime of older adults 70 years and older in Australia

Methods

- A published Markov model was adapted to estimate the burden of V114 serotypes in a cohort of unvaccinated Australian adults aged 70 and older who were tracked from 2018 until death
- A cohort of eligible individuals enters the model with no pneumococcal disease and are at risk of developing IPD or NBPP. Following a hospitalization for IPD and/or NBPP, patients may recover and return to a no pneumococcal disease health state. Patients with IPD or NBPP also face a higher risk of death than individuals without pneumococcal disease
- The model has a cycle length of 1 year and, therefore, the seasonality of pneumococcal disease did not need to be reflected in the model
- Economic burden was estimated from a publicly funded health care payer perspective by multiplying the number of hospitalizations by the cost per hospitalization for IPD or NBPP
- Parameters were derived through targeted and systematic literature reviews; costs were discounted at 5%

Figure 1. Model Structure



References

- Australian Government Department of Health. IPD Surveillance Quarterly Reports: Jan to Mar, Apr to Jun, Jul to Sep, Oct to Dec 2018. <https://www1.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-ipd-reports.htm> Accessed 09/28/2020.
- Bareja C, et al. *Commun Dis Intell Q Rep*. 2015;39(2):E265-E279.
- Dirmesropian S, et al. *Vaccine*. 2017;35(34):4307-4314.
- Said Maria A., et al. *PloS One*. 2013;8(4):e60273.
- Chen C, et al. *Vaccine*. 2018;36(10):1265-1271.

Table 1. Epidemiologic Model Parameters for Elderly Adults (≥70 y) in Australia

Model Parameters	Base Case Values	Reference
Model Parameters for IPD		
Incidence of IPD (all types)	17 per 100,000	1
Incidence of 22F+33F IPD	2.0 per 100,000	
Incidence of serotype 3 IPD	2.2 per 100,000	
Incidence of V114 IPD	5.1 per 100,000	
Case fatality rate of IPD	17.7%	2
Model Parameters for NBPP		
Incidence of hospitalized NBPP (all types) ^{a,b}		3,4
70 – 74y	146 per 100,000	
75 – 84y	346 per 100,000	
85+y	956 per 100,000	
Incidence of 22F+33F hospitalized NBPP ^{a,b}		
70 – 74y	17.4 per 100,000	
75 – 84y	41.2 per 100,000	
85+y	113.8 per 100,000	
Incidence of serotype 3 hospitalized NBPP ^{a,b}		
70 – 74y	18.9 per 100,000	
75 – 84y	44.7 per 100,000	
85+y	123.3 per 100,000	
Incidence of V114 hospitalized NBPP ^{a,b}		3
70 – 74y	43.9 per 100,000	
75 – 84y	103.9 per 100,000	
85+y	286.8 per 100,000	
Case fatality rate of hospitalized NBPP ^{a,b}		
70 – 74y	9.1%	
75 – 84y	12.9%	
85+y	23.1%	

^aSerotype distribution for NBPP was assumed similar to IPD.

^bTo derive the incidence for NBPP from all-cause CAP, we assumed that 27% of all CAP cases were attributable to pneumococcus and 75% of pneumococcal pneumonia was NBPP. This estimates were based on a previously published meta-analysis by Said et al.

Table 2. Economic Model Parameters for Elderly Adults (≥70 y) in Australia

Model Parameters	Costs in 2019 AUD	Reference
Cost per IPD hospitalization	\$39,120	5
Cost per NBPP hospitalization	\$8,970	

Results

- The cohort model simulated the health and economic burden of a cohort of 2.7 million unvaccinated Australian adults 70 years and older in 2018 through life expectancy (or until age 100). **Figure 2** to **Figure 5** present the lifetime IPD and NBPP hospitalizations, deaths, and medical costs attributable to V114 serotypes
- An estimated 1,822 cases of IPD; 313 cases of IPD-related deaths; 68,437 cases of NBPP hospitalizations and 13,569 cases of NBPP-related deaths were attributable to V114 serotypes in adults aged ≥70 years in Australia
- Total lifetime discounted healthcare costs attributable to V114 serotypes were estimated to be approximately \$432.1 million and the total number of pneumococcal disease related deaths were 13,882
- 39.8% of these cases, deaths, and costs were attributable to serotypes 22F and 33F and 43.1% were attributable to serotype 3
- Scenario analyses were conducted to assess the impact of uncertainties around IPD and NBPP incidence. **Table 3** presents the remaining lifetime discounted medical care costs attributable to V114 serotypes under the assumption of IPD and NBPP incidence increasing or decreasing by 20% from reported values

Conclusions

- V114 serotypes contribute to substantial health and economic burden of pneumococcal disease among older adults (aged ≥70 years) in Australia, the majority of which is attributable to the serotypes 3, 22F, and 33F
- The addition of V114 to the national vaccination schedule could reduce the hospitalization, costs, and deaths associated with pneumococcal disease among unvaccinated adults aged ≥70 years in Australia

Figure 2. Remaining Lifetime IPD Hospitalizations and Deaths Attributable to V114 Serotypes in Elderly Adults (≥70 y)

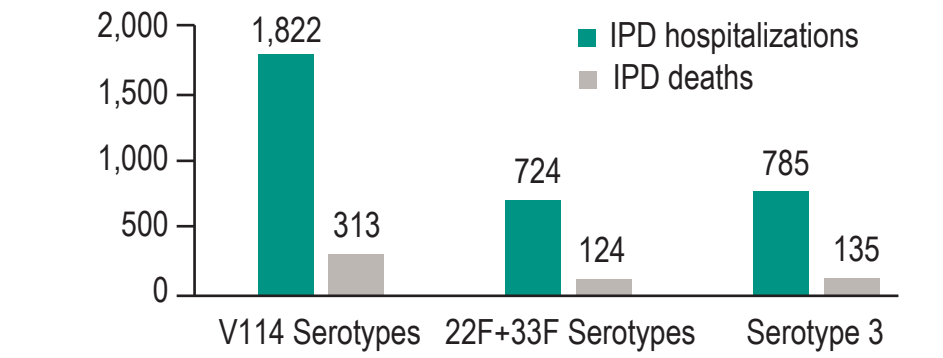


Figure 3. Remaining Lifetime NBPP Hospitalizations and Deaths Attributable to V114 Serotypes in Elderly Adults (≥70 y)

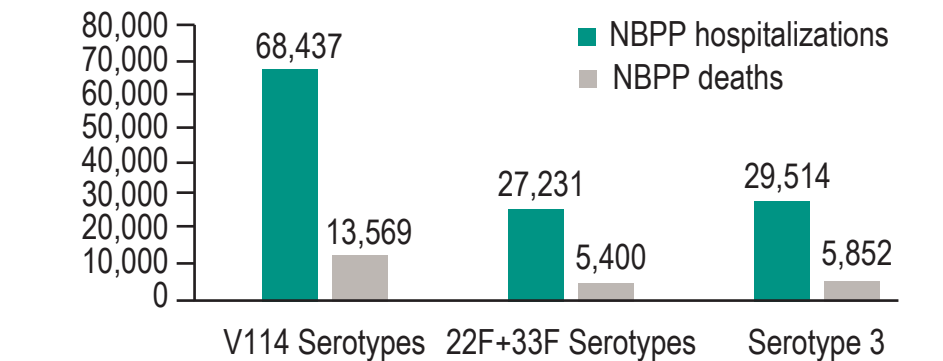


Figure 4. Remaining Lifetime Direct Medical Costs of IPD (2018 AUD, in millions) Attributable to V114 Serotypes in Elderly Adults (≥70 y)

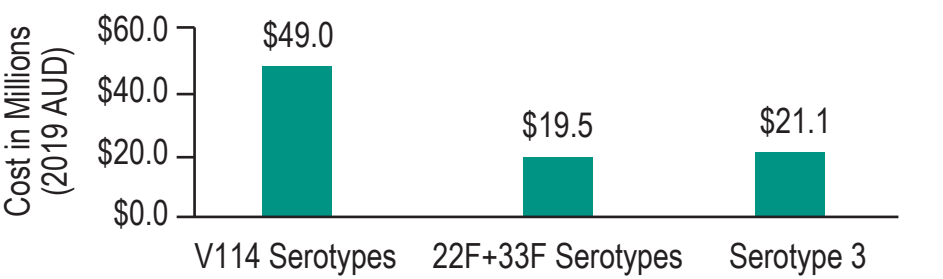


Figure 5. Remaining Lifetime Direct Medical Costs of NBPP (2019 AUD, in millions) Attributable to V114 Serotypes in Elderly Adults (≥70 y)

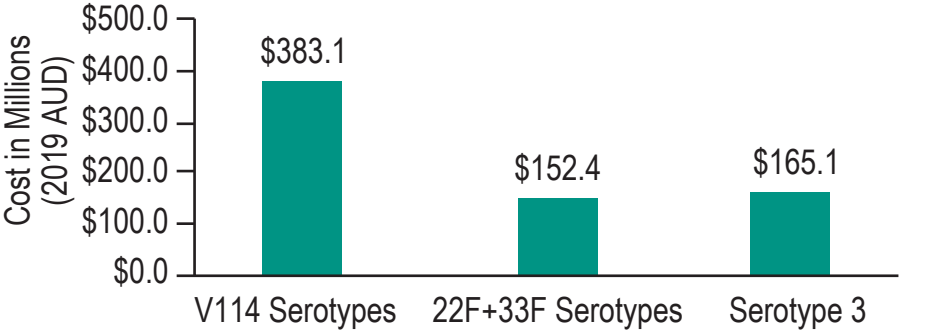


Table 3. Scenario Analysis Results – Lifetime Total Direct Medical Costs (2019 AUD, in millions) Attributable to V114 Serotypes in Elderly Adults (≥70 y)

	Base Case	Incidence -20%	Incidence +20%
V114	\$432.1	\$345.7	\$518.5
22F+33F	\$171.9	\$137.5	\$206.3
Serotype 3	\$186.2	\$149.0	\$223.4

Limitations

- The analysis assumed a healthcare payer perspective (direct medical costs) and did not include indirect costs associated with pneumococcal disease
- Estimates did not account for hospitalizations reduced by direct protection from PCV13 or PPSV23 use in adults
- The analysis did not include outpatient NBPP cases and costs, and cases of postmeningitis sequelae and associated costs