EE748

Cost-effectiveness Analysis of 20-Valent Pneumococcal Conjugate Vaccination in Adults in Hong Kong

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INTRODUCTION

- Streptococcus pneumoniae infections (pneumococcal disease, PD) constitute a major global and regional public health problem
- In Hong Kong, 2 pneumococcal vaccines are available and recommended to against PD: 23-valent pneumococcal polysaccharide vaccine (PPSV23) and 13-valent pneumococcal conjugate vaccine (PCV13) in adults[1]
- Twenty-valent PCV (PCV20) was approved recently

OBJECTIVE

- The objective was to evaluate clinical, economic and cost-effectiveness of replacing one-dose of PCV13 or a sequential vaccination of PCV13 followed by PPSV23 with one-dose of PCV20 in adults with risk conditions

METHODS

- Deterministic framework and Markov-type process depicting risks and costs of invasive pneumococcal disease (IPD) and all-cause non-bacteremic pneumonia (NBP), as well as impact of vaccination, from model entry through end of life
- Model population is characterized by age and risk profile at model entry
- Persons may transition to higher risk group during model horizon
- Risk profiles, Categorized depend on numbers of chronic conditions
  - No or Low-risk
  - Moderate risk: Chronic cardiac, pulmonary, liver or renal disease Diabetes mellitus or CSF leakage
  - High-Risk: Immunocompromised states such as Asplenia, HIV /AIDS , primary immunodeficiency Immunodeficiencies related to malignancies and to use of immunosuppressive rugs / systemic steroid

Figure 1: Model structure

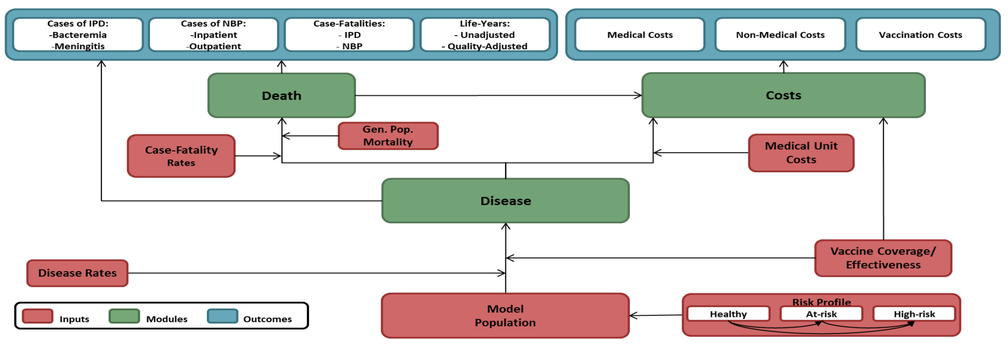


Table 1: Model Input Parameter Data Source

Parameters	Data Source
Population	Hong Kong 2021 Census Population Size Data[2]
Risk profile	Tan et al. 2021[3] (Low risk/Healthy: ≤ 2 chronic conditions (CC), At-risk: 3 or 4 CC, High-risk ≥ 5 CC)
IPD	Chan et al. 2021[4]
Clinical presentation of IPD (Percentage of meningitis of IPD); %	Subramanian et al. 2021[5]
All-cause inpatient NBP	Chan et al. 2021[4]
Proportion of non-hospitalized NBP of all-cause NBP	Konoumura et al. 2017[6]
IPD case-fatality rate	Chan et al. 2021[4]
Inpatient NBP case-fatality rate	Chan et al. 2021[4]
General mortality rate	Census2021.gov.hk[7]
Serotype coverage for IPD and NBP	Centre for Health Protection - Report on IPD (chp.gov.hk)[8]
Proportion of NBP due to pneumococcus	18% (Lansbury et al. 2022)[9]
General Utilities	Wong et al. 2019/Ara et al. 2010 [13]
Disutilities - IPD and inpatient NBP	Mangen et al. 2017 [10]
Disutilities-Outpatient NBP	Melegaro et al. 2004 [11]
Direct Medical Care (per episode)	
IPD	Mohanty et al. 2022 [12]
Inpatient NBP	Cost incurred in semi-private setting included in hospitals
Outpatient NBP	Cost incurred in semi-private setting included in outpatient specialist, outpatient lab, outpatient x-ray and outpatient medication cost
Vaccine cost per dose	PCV13: $HKD800; PPSV23: $HKD260;PCV20: $HKD880

Table 2: Vaccine effectiveness (VE)

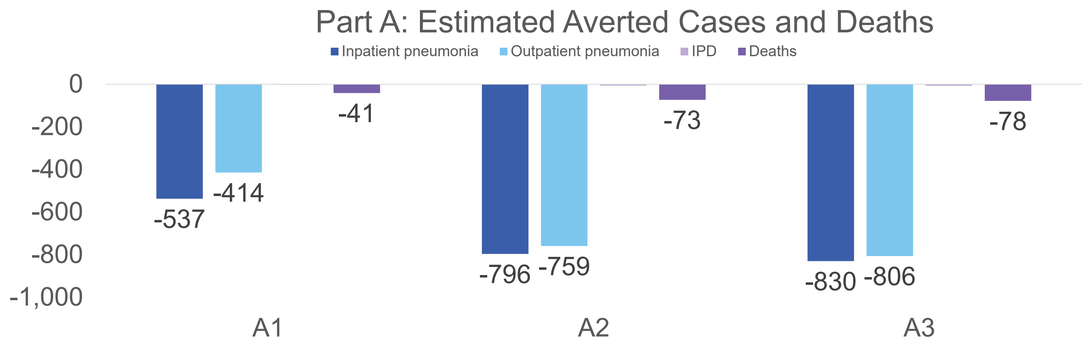
	PCV20/PCV13	PPSV23
Initial VE vs. VT-IPD	Immunocompetent: Aged ≥65y: 75% based on CAPiTA[14,15]; 18-64y: varied based on CAPiTA post-hoc analyses[16] High-risk: 80% of healthy/at-risk[14, 15]	Immunocompetent: Aged ≥65y: 455% based on Denned et al. 2018[18]; 18-64y: varied based on age group and risk group; High-risk: 80% of healthy/at-risk
Initial VE vs. VT-NBP	Immunocompetent: Aged ≥65y: 45% based on CAPiTA; 18-64y: varied based on CAPiTA post-hoc analyses High-risk: 80% of healthy/at-risk	VE >0%, varied by age and risk groups (Suzuki et al 2017) [17]
Herd effect	Herd effects observed from PCV13 peds were not incorporated	

METHODS (Cont.)

Costs:
- All costs from the source data were apportioned across risk groups based on relative cost from Weycker et al. 2016
- All costs were inflated to 2023 HK$

Perspective: Bass-case analyses were conducted from Hong Kong healthcare system perspective.
Uptake rate: The uptake rate of the primary dose for age 18-49 years: 10%, 50-64 years: 20%, 65-99 years: 40%. The uptake rate for the follow-up dose is the same of the primary dose
Discounting: Benefits and costs were discounted at 4% per year
Willingness to pay threshold: Based on a GDP of USD 60,051 per capita for Hong Kong in 2021 [Hong Kong GDP per capita - 2022 Data - 2023 Forecast - 1961-2021 Historical - Chart (tradingeconomics.com)27], we set the willingness-to-pay threshold at $HKD 471,390/QALY
Analyses:
- **Part A:** Replacing PCV13+PPSV23 with PCV20 CE in ***A1***: all ≥65 years ***A2***: A1+ Age 50-64 with moderate or high-risk ***A3***: A2+ Age 18-49 with moderate- or high-risk
- **Part B:** Same as Part A but only in Moderate- or High-risk populations (***B1***: ≥65 years with moderate- or high-risk; ***B2***: B1+ Age 50-64 with moderate or high-risk ***B3***: B2+ Age 18-49 with moderate- or high-risk
- **Part C:** Replacing PCV13 or PPSV23 with PCV20 in all ≥65 years (***C1***: replacing PCV13; ***C2***: replacing PPSV23)

RESULTS



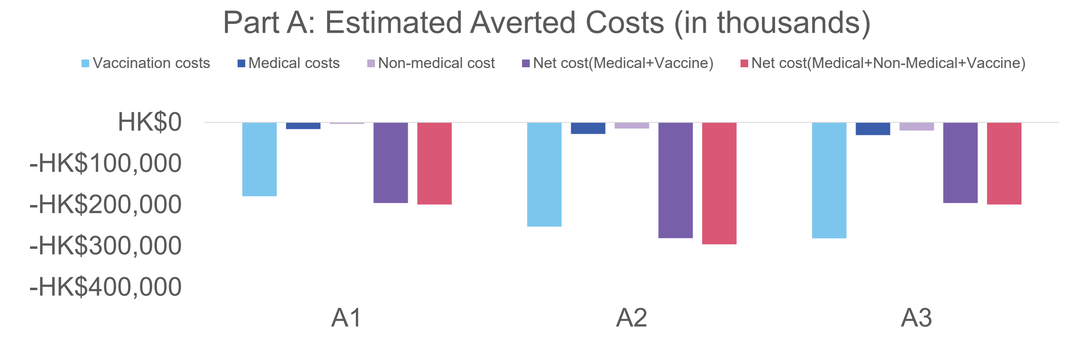


Table 3: Incremental Cost Effectiveness Ratio Per QALY or LY

	A1	A2	A3	B1	B2	B3	C1	C2
Cost/QALY	D	D	D	D	D	D	HK$114,151	HK$89,612
Cost/LY	D	D	D	D	D	D	HK$111,494	HK$88,138

Abbreviations: IPD, invasive pneumococcal disease; LY, life year; PCV, pneumococcal conjugate vaccine; QALY, quality-adjusted life year; SoC, standard of care

CONCLUSIONS

- Based on the current epidemiology, replacing PCV13 or PPSV23 with PCV20 in adults aged 65 and above could be cost effective in Hong Kong.
- For adults who are at moderate or high risk and require a follow-up dose of PPSV23 after the primary dose, remove the follow up dose and only use one-dose of PCV20 could be cost saving compared the current recommendation
- Overall, one-dose of PCV20 can be either cost effective or cost saving depending on the vaccination strategies.

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