# The cost-effectiveness of starting pneumococcal and influenza vaccination at 50 vs. 65 years: a comparative modelling study

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## Background Information

- Pneumococcal infection leads to 1.6 million deaths annually.
- 23-valent polysaccharide vaccine (PPV23) are available for prevention.
- People often receive pneumococcal vaccination + influenza vaccine.

## Project Objectives

- To evaluate the cost-effectiveness of pneumococcal vaccination with or without influenza vaccination in adults starting from 50 years vs. 65 years, when compared with no vaccination programmes in Hong Kong.

## Materials and Methods

### Model design

- A hypothetical population of 100,000 older adults was included in the decision model from 50 years to 85 years.
- Cost-effectiveness threshold: 24,302 USD.

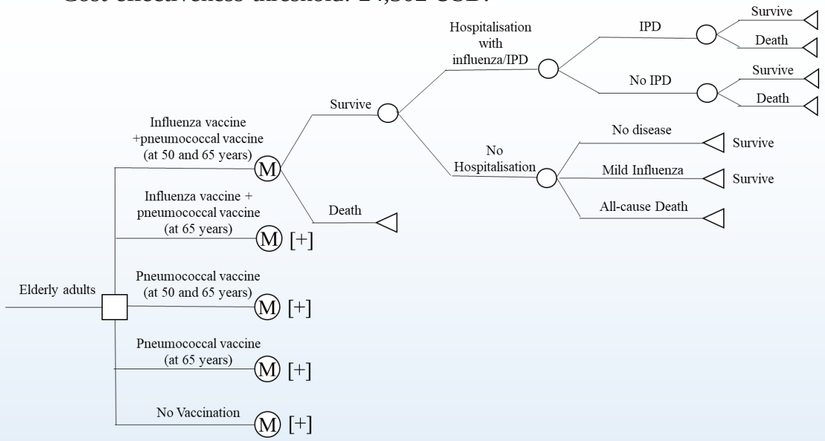


**Figure 1 A simplified Markov model of pneumococcal vaccine with or without pneumococcal vaccine in elderly adults**. [+] These arms followed the same subtree as the influenza vaccine + pneumococcal vaccine arm. IPD: Invasive pneumococcal disease.

### Cost-effective analysis and sensitivity analysis

- The main outcome: incremental cost-effectiveness ratio (ICER)
- One-way sensitivity analyses: threshold value or ±25%
- Probabilistic sensitivity analysis: Monte Carlo simulation.

## Results

- In comparison with strategy 5, all four were cost-effective with ICERs less than US$24,302 per QALY gained.

**Table 1. Results of base-case analysis**

| | IPD number | Costs (1,000 USD) | | Effects (1000 QALYs) | Incremental cost (1,000 USD) | Incremental effects (1000 QALYs) | ICER |
|---|---|---|---|---|---|---|---|
| | | Vaccination | Treatment | | | | |
| **Strategy 1 PV (50+65) + IV** | 2,246 | 72,014.0 | 101,341.2 | 1,572.3 | -3,228.2 | 56.9 | -56.8 |
| **Strategy 2 PV (65) + IV** | 2,492 | 67,898.3 | 101,396.2 | 1,565.0 | -7,288.9 | 49.5 | -147.1 |
| **Strategy 3 PV (50+65)** | 3,822 | 6,054.0 | 175,777.4 | 1,529.8 | 5,247.9 | 14.3 | 367.4 |
| **Strategy 4 PV (65)** | 4,272 | 2,239.6 | 176,044.8 | 1,523.4 | 1,701.1 | 7.9 | 214.3 |
| **Strategy 5 No vaccination** | 5,564 | 0.0 | 176,583.4 | 1,515.5 | - | - | - |

PV: pneumococcal vaccine; IV: influenza vaccine; IPD: invasive pneumococcal disease; QALYs: quality-adjusted life-years; ICER: incremental cost-effectiveness ratio

- One-way sensitivity analyses: All ICERs remained cost-effective in all scenarios with the threshold values or ±25% inputs.
- Probabilistic sensitivity analysis
  - ✓ strategy 1 (100%)
  - ✓ strategy 2 (100%)
  - ✓ strategy 3 (93.3%)
  - ✓ strategy 4 (92.1%)

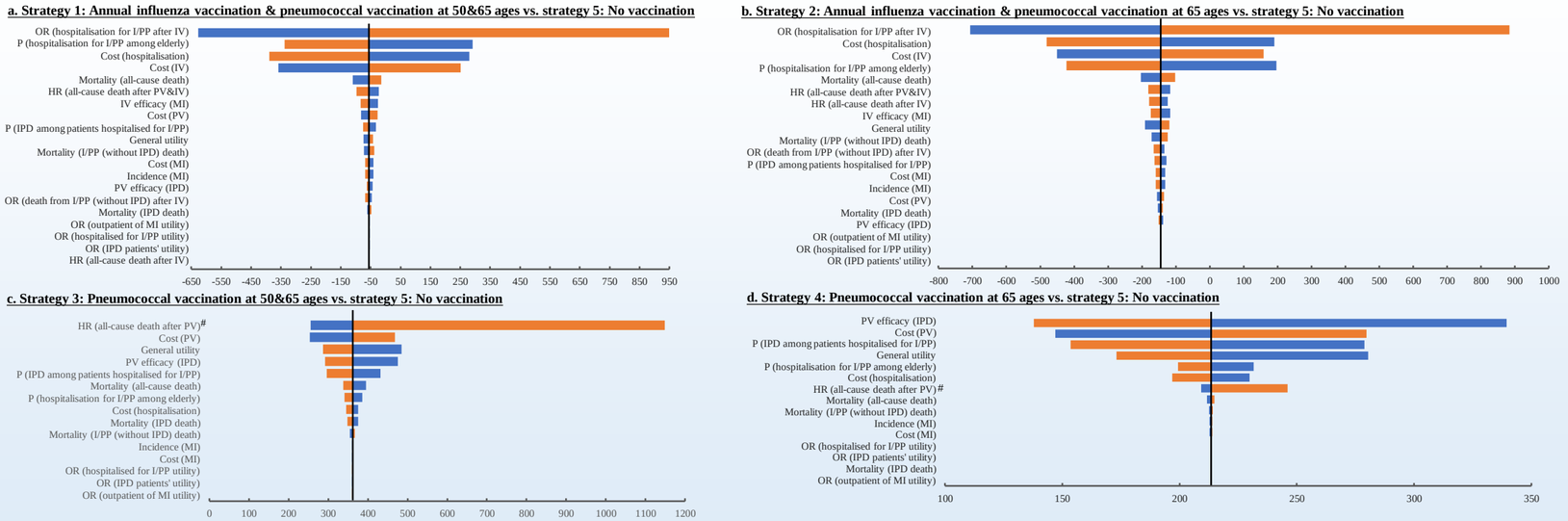


**Figure 2. Sensitivity analysis (tornado diagram) of all parameters on incremental cost per quality-adjusted life-year gained**. # Since HR >1 suggests an increased risk, we adopted the 0.77-1.00 as the threshold for HR (all-cause death after PV). P: Probability; PV: pneumococcal vaccine; IV: influenza vaccine; HR: hazard ratio; OR: odds ratio; IPD: invasive pneumococcal disease; I/PP: influenza/pneumococcal pneumonia; IM: mild influenza.

## Conclusion

- The strategy with annual influenza vaccine and PPV23 at 50 and 65 years gained the most QALYs with an acceptable ICER.
- These findings could help inform design of vaccination strategies.

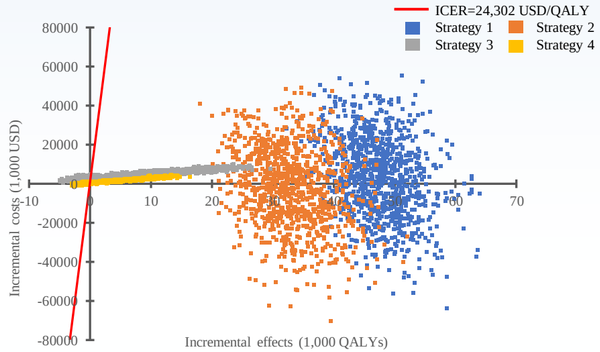


**Figure 3. The incremental cost-effectiveness plane of the probabilistic sensitivity analysis.**