The cost-effectiveness of Prostate Health Index for prostate cancer detection in Chinese men

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HMRF Research Fellowship Scheme

- Training proposal
  - Part One:
    TreeAge Healthcare Modeling and Advanced Training Courses
  - Part Two:
    Clinical attachment at the HEHTA, the University of Glasgow
  - Part Three:
    York Summer Workshops in health economic evaluation

- Research proposal
  - The cost-effectiveness of prostate health index for prostate cancer detection in Chinese men

Background

- Prostate-specific antigen (PSA) and Prostate health index (PHI) have been used as a biomarker to decide on the need of prostate biopsy for prostate cancer detection.

- Whether the use of PHI is cost-effective in our locality is unknown.

Aims and objectives

- To evaluate the cost-effectiveness of PHI for prostate cancer detection in Chinese men.

Study Design

- We developed a Markov model for Chinese male patient aged 50-75 years old with elevated PSA of 4-10ng/mL and normal DRE.
- The PSA strategy was to offer TRUS-PB for all patients with elevated PSA of 4-10ng/mL.
- The PHI strategy was to offer PHI for patients with elevated PSA of 4-10ng/mL.
  - For patients with PHI >35.0, TRUS-PB would be offered.
  - For patients with PHI ≤35.0, TRUS-PB would not be offered and they would be followed-up withannual PSA testing.

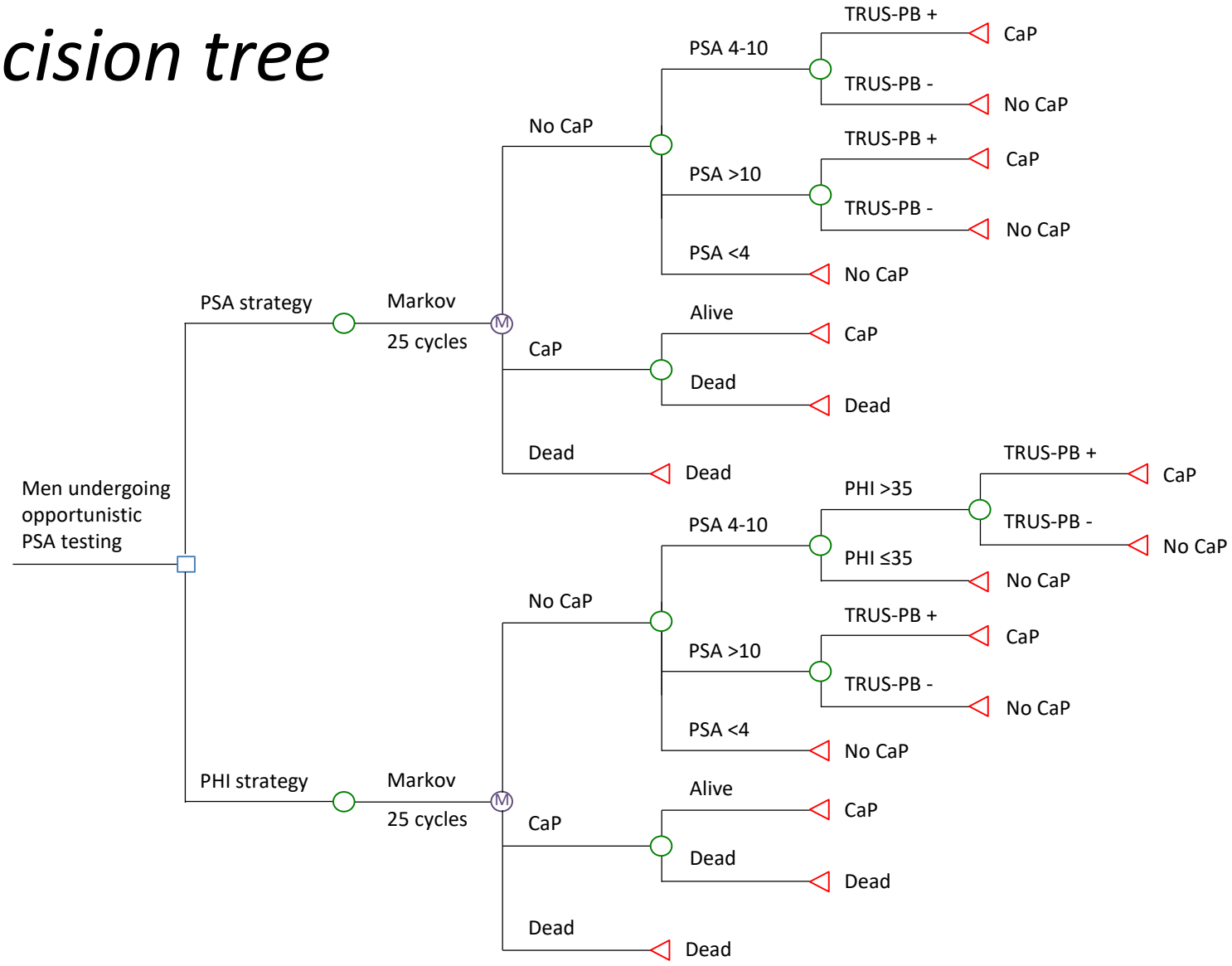
Methods

- The cost per quality-adjusted life years (QALYs) gained for both the PSA and PHI strategies were calculated.
- A willingness-to-pay threshold of three-fold the gross domestic product per capita in Hong Kong was used.
- The incremental cost-effectiveness ratio in relation to the willingness-to-pay threshold of the PSA and PHI strategies were compared.

Methods

- One-way sensitivity analysis and probablistic sensitivity analysis were performed.
- Cost-effectiveness acceptability curves were also constructed.

Decision tree



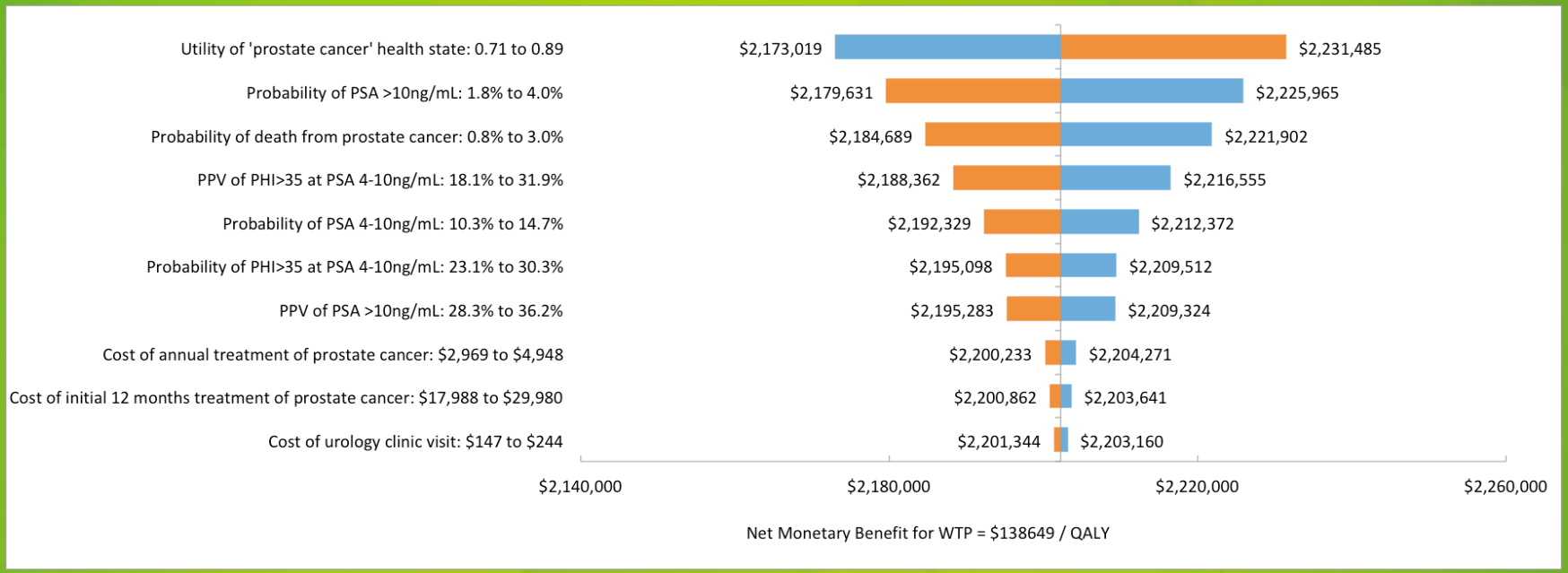
Model parameter	Base-case estimate (SD)	Data source
Probabilities of PSA /PHI and biopsy results		
Probability of PSA 4-10ng/mL	0.125 (0.011)	CUHK cohort
Probability of PSA >10ng/mL	0.029 (0.006)	CUHK cohort
Probability of PHI >35 in men with PSA 4-10ng/mL	0.267	Chiu *et al.*[10]
Probability of positive biopsy for PSA 4-10ng/mL	0.134 (0.009)	Teoh *et al.*[7]
Probability of positive biopsy for PSA >10ng/mL	0.322 (0.020)	Teoh *et al.*[7]
Probability of positive biopsy for PHI >35 when PSA is PSA 4-10ng/mL	0.250 (0.035)	Chiu *et al.*[10]
Transition probabilities		
Probability of transitioning from 'no prostate cancer' to 'prostate cancer' for the PSA strategy	0.026	Chiu *et al.*[10], Teoh *et al.*[7], CUHK cohort
Probability of transitioning from 'no prostate cancer' to 'prostate cancer' for the PHI strategy	0.018	Chiu *et al.*[10], Teoh *et al.*[7], CUHK cohort
Probability of dying from prostate cancer	0.019 (0.006)	CUHK cohort
Utilities		
'No prostate cancer' health state	1.0	
'Prostate cancer' health state	0.800 (0.300)	Bremner *et al.*[20], Stewart *et al.*[21]
Disutility due to biopsy procedure	-0.027	Krahn *et al.*[22]

Cost parameter	Base-case estimate, USD (SD)	Data source
Urology clinic visit		
Cost of one urology clinic visit	195.60 (24.95)	PWH finance record
Investigations		
Cost of one PSA test	84.74 (10.81)	PWH finance record
Cost of one PHI test	369.54 (47.13)	PWH finance record
Cost of one prostate biopsy	1257.70 (160.42)	PWH finance record
Cycle cost		
Cost of one cycle in the 'no prostate cancer' state for the PSA strategy	544.58	PWH finance record
Cost of one cycle in the 'no prostate cancer' state for the PHI strategy	580.10	PWH finance record
Prostate cancer-related treatment costs		
Initial 12 months	23984 (3059)	Stokes *et al.*[23]
Annual treatment	3958 (505)	Stokes *et al.*[23]
Terminal phase	14227 (1815)	Stokes *et al.*[23]

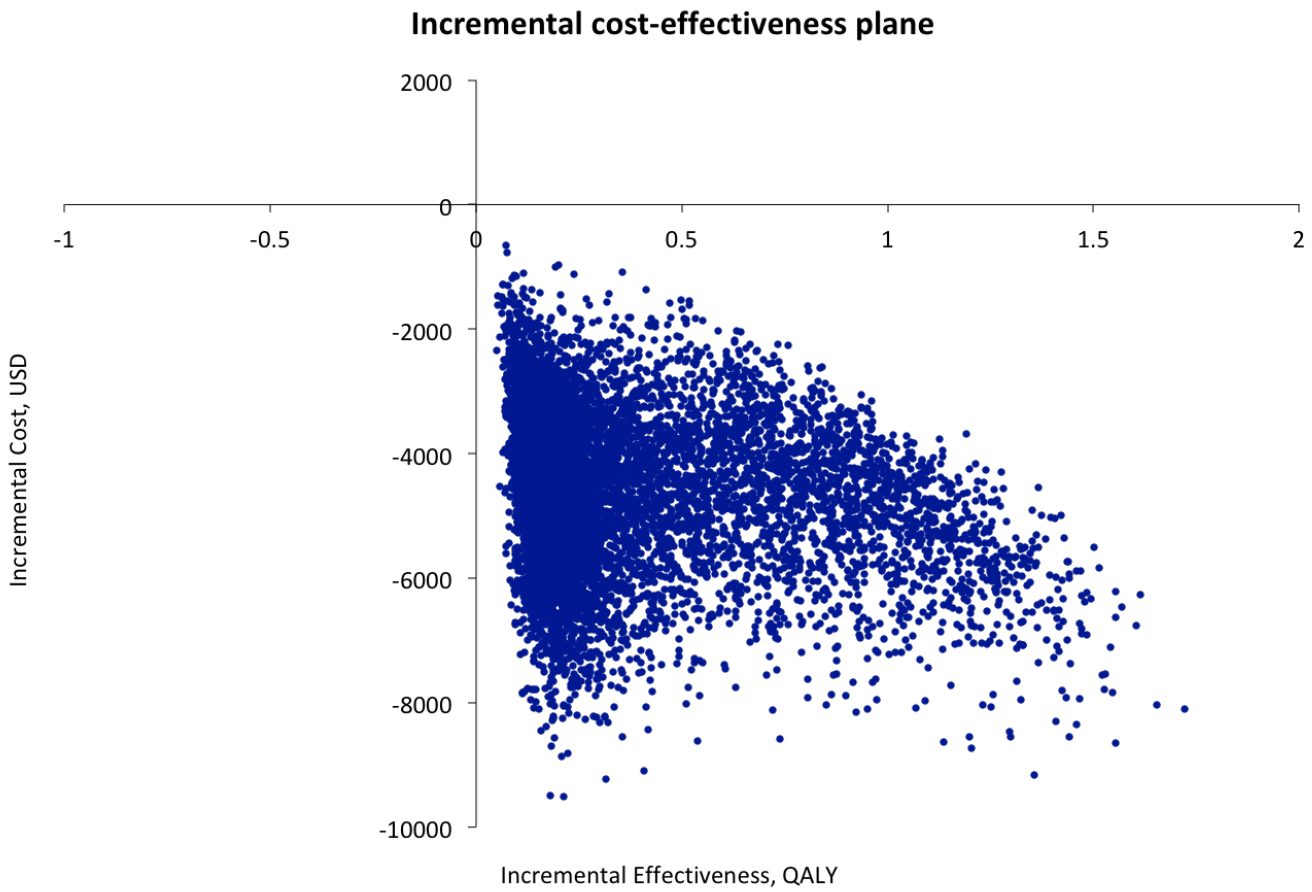
Results

- With a Markov model of 25 screening cycles from age 50 to 75 years, the total costs were estimated to be USD 27439 in the PSA strategy and USD 22877 in the PHI strategy.
- The PHI strategy was associated with an expected decrease in cost of USD 4562 and an expected gain of 0.35 QALY, resulting in an ICER of USD -13056.56.
- With a lower cost and a higher QALY, the PHI strategy demonstrated dominance over the PSA strategy.

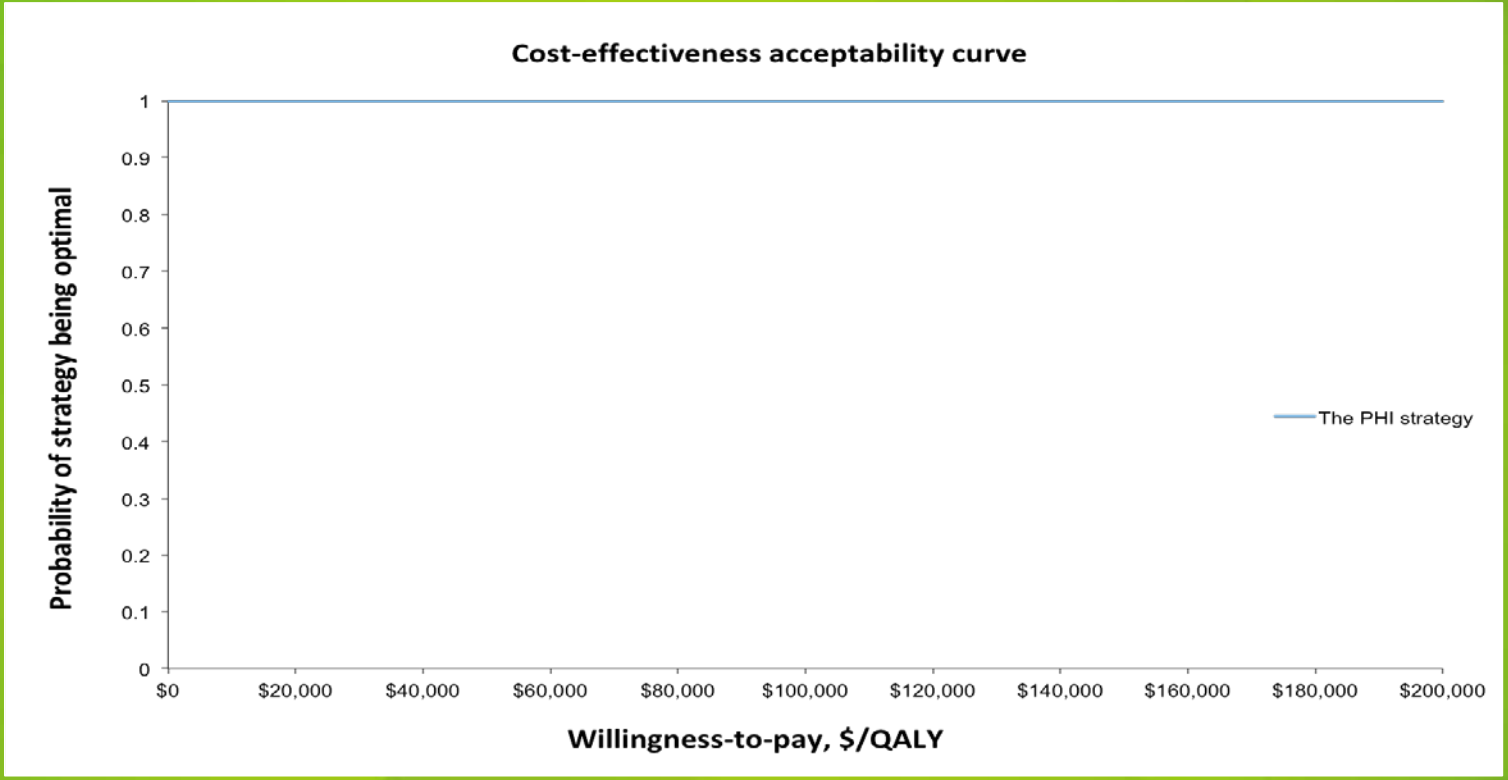
Tornado diagram



Cost-effectiveness plane



Cost-effectiveness acceptabiity curve



Conclusions

- We concluded that the PHI strategy is more cost-effective than the PSA strategy for prostate cancer detection in Chinese men.
- The PHI strategy should be adopted into our routine clinical practice as the standard of care.
- Whether the utility of PHI can be extended to the primary care setting should be explored.

Conference presentations

- Conference presentation at the 16th Urological Association of Asia (UAA) Congress
  - Awarded the Best Abstract Award

- Conference presentation at the 23rd Annual Scientific Meeting of the Hong Kong Urological Association.

Full publications

- Teoh JY, Leung CH, Wang MH, Chiu PK, Yee CH, Ng CF, et al. The cost-effectiveness of prostate health index for prostate cancer detection in Chinese men. Prostate Cancer Prostatic Dis. 2020.

- Bouttell J, Teoh J, Chiu PK, Chan KS, Ng CF, Heggie R, Hawkins N. Economic evaluation of the introduction of the Prostate Health Index as a rule-out test to avoid unnecessary biopsies in men with prostate specific antigen levels of 4-10 in Hong Kong. PLoS One 2019; 14(4):e0215279.

Thank you!