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Cost-effectiveness analysis of population wide screening for chronic kidney disease in Singapore

Authors: Qi Dong LEONG, Xi Yan OOI, Wanting WENG, Kelvin Bryan TAN, See Cheng YEO

Introduction

Chronic kidney disease (CKD) affects an estimated 13.8% of Singaporeans aged 18-74 years old and imposes a hefty SGD1.35 billion annually in terms of healthcare costs. By 2035, CKD is projected to affect a quarter of all adult Singaporeans.

The cost-effectiveness of population-wide chronic kidney disease screening in Singapore is evaluated in this study, in light of recent developments such as the availability of low-cost home-based albuminuria screening and greater appreciation of the disease-modifying effect of sodium-glucose cotransporter-2 (SGLT2) inhibitors.

Methods

• **Proposed Strategy:** Clinic-based and home-based population-wide screening for CKD in a Singapore population without known diabetes mellitus or hypertension, with a screening frequency of either once-off, 10 yearly, 5 yearly or annually.

• **Target Population:** Adults 40 to 75 years old without known diabetes mellitus, hypertension or CKD.

• **Time Horizon:** Lifetime.

• **Perspective:** Health care sector.

• **Comparator:** current standard of care of targeted screening of high-risk subpopulations of patients with diabetes mellitus and hypertension, and opportunistic screening of the rest of the general population.

• **Outcome Measures:** Primary outcome measures include costs, quality-adjusted life-years (QALYs), and incremental cost-effectiveness ratios (ICERs), all discounted at 3% annually. Secondary outcomes were increase in life expectancy and reductions in the incidence of patients on renal replacement therapy.

Figure 1: Proposed population-wide screening and intervention

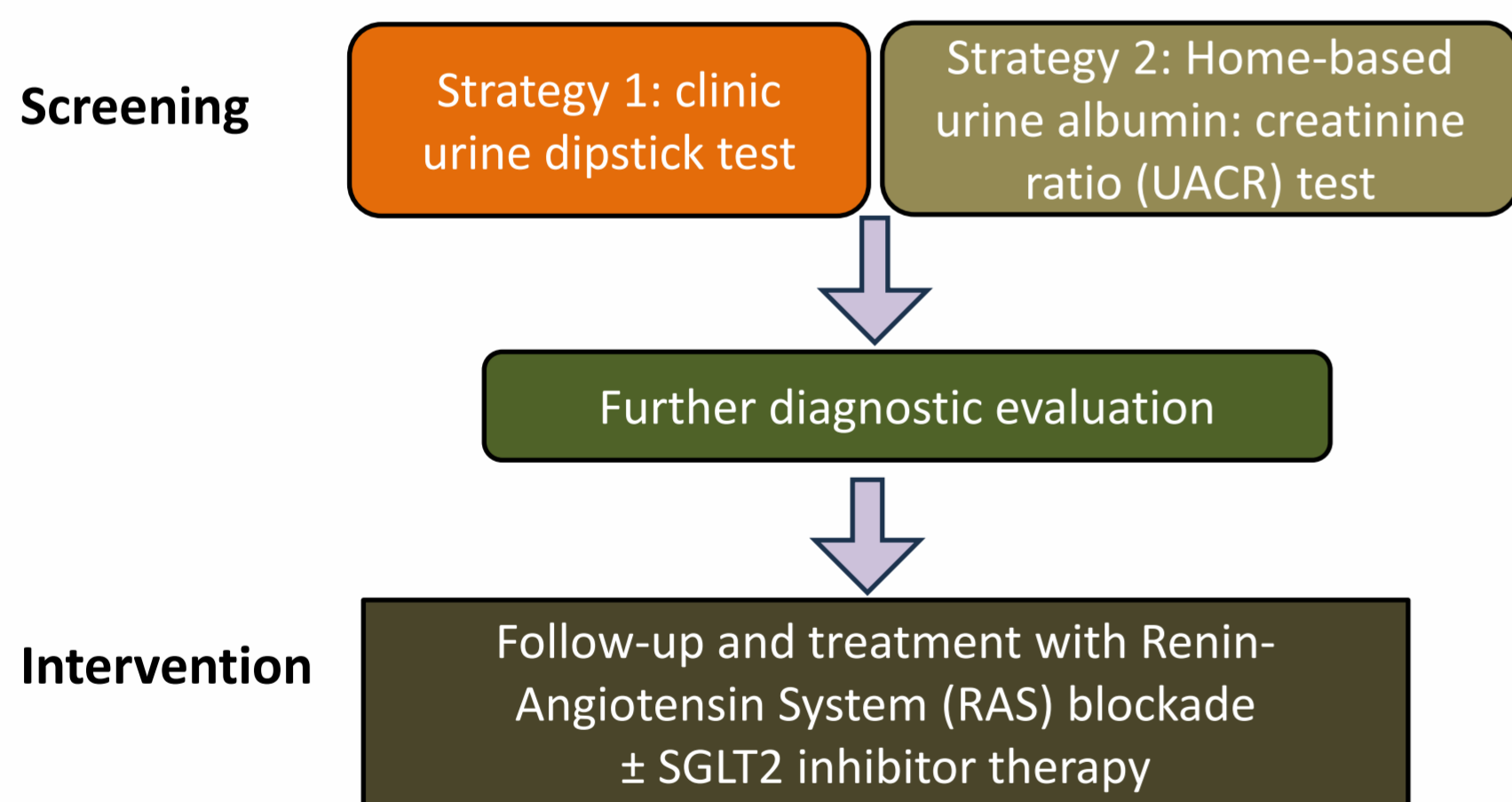
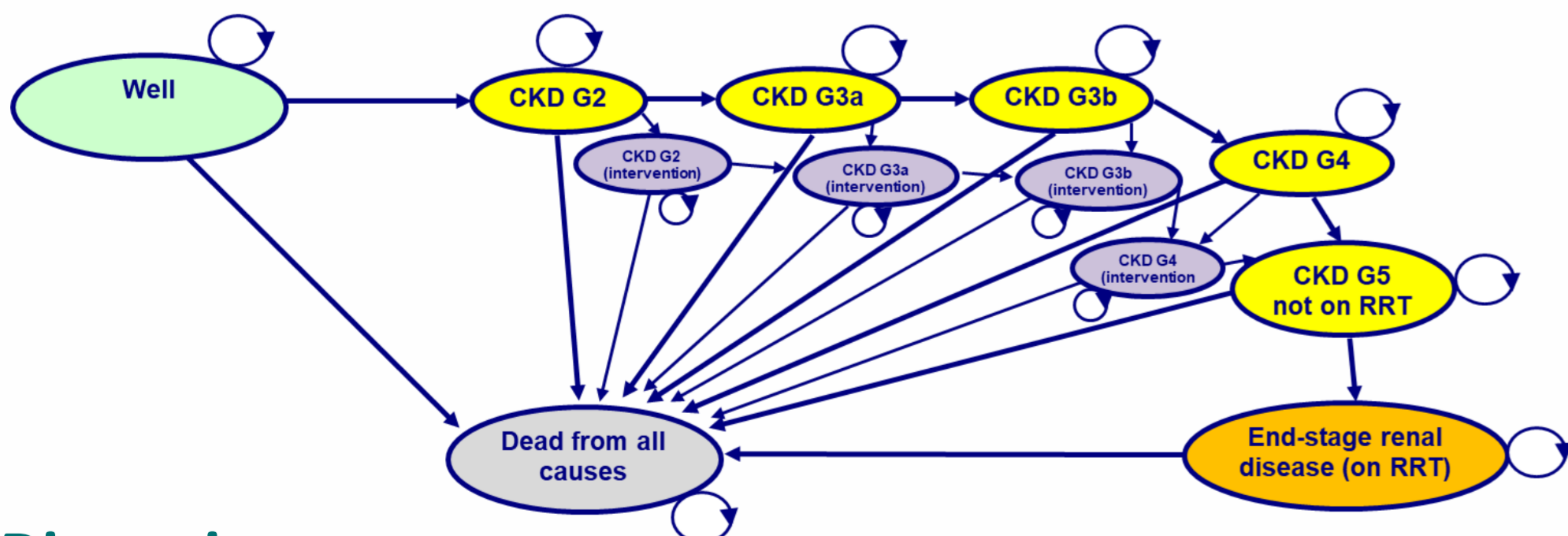


Figure 2: Markov cohort model with respective transition states



Discussion

• **Strengths:** specific focus on the general population without known CKD risk factors of diabetes and hypertension, evaluation of different modalities of screening.

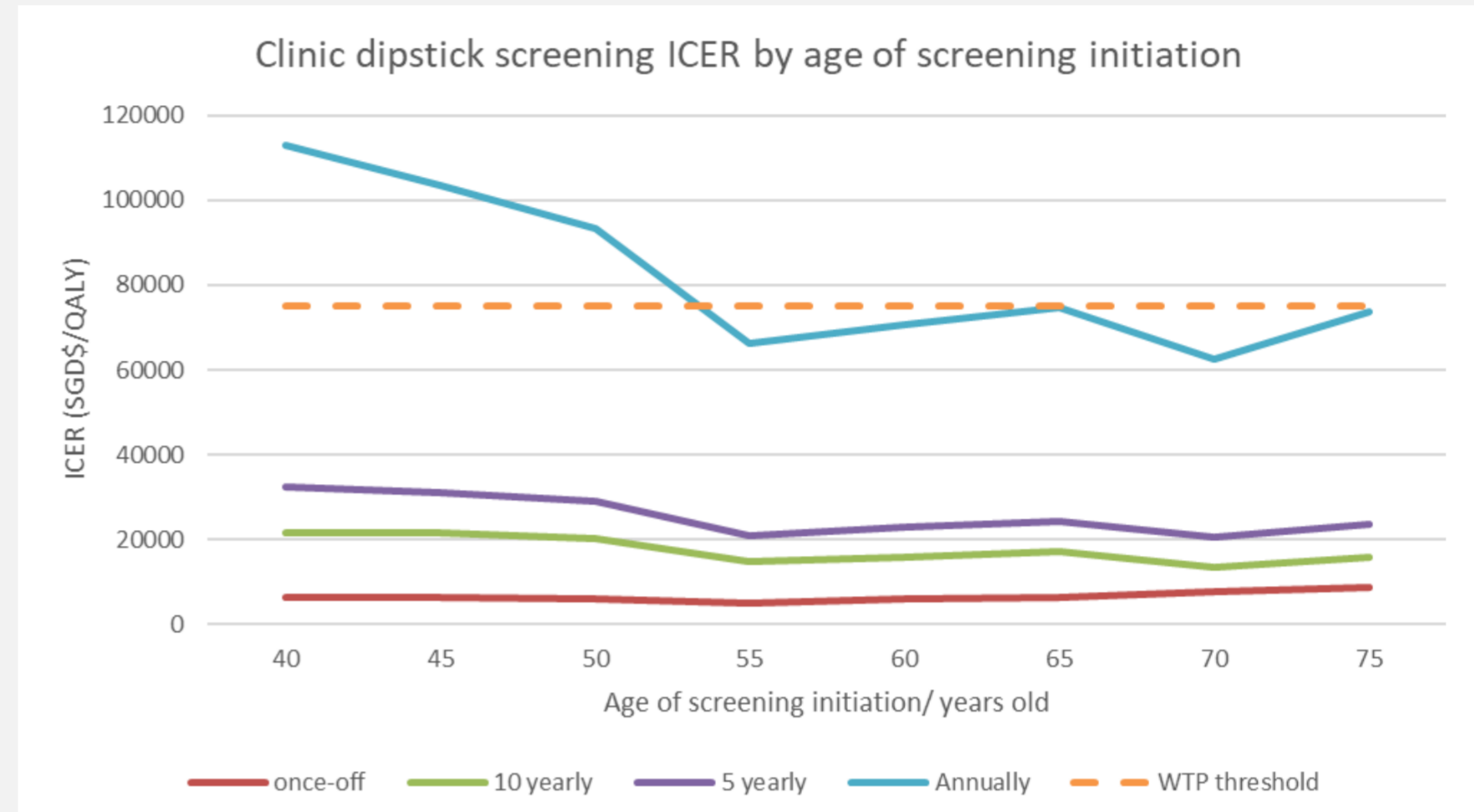
• **Robustness to sensitivity analysis:** Results from this study were robust to both univariate and multivariate sensitivity analysis. The efficacy of RAS blockade and SGLT2 inhibitor therapy were the most impactful variables affecting the analysis.

• **Concordance of findings:** the findings of this study agree with the findings of cost-effectiveness studies in the United States and the Netherlands that population-wide CKD screening is likely effective.

• **Main limitation:** significant reliance on inferred data from cross-sectional prevalence studies and international data rather than actual data from local cohort studies due to limited availability.

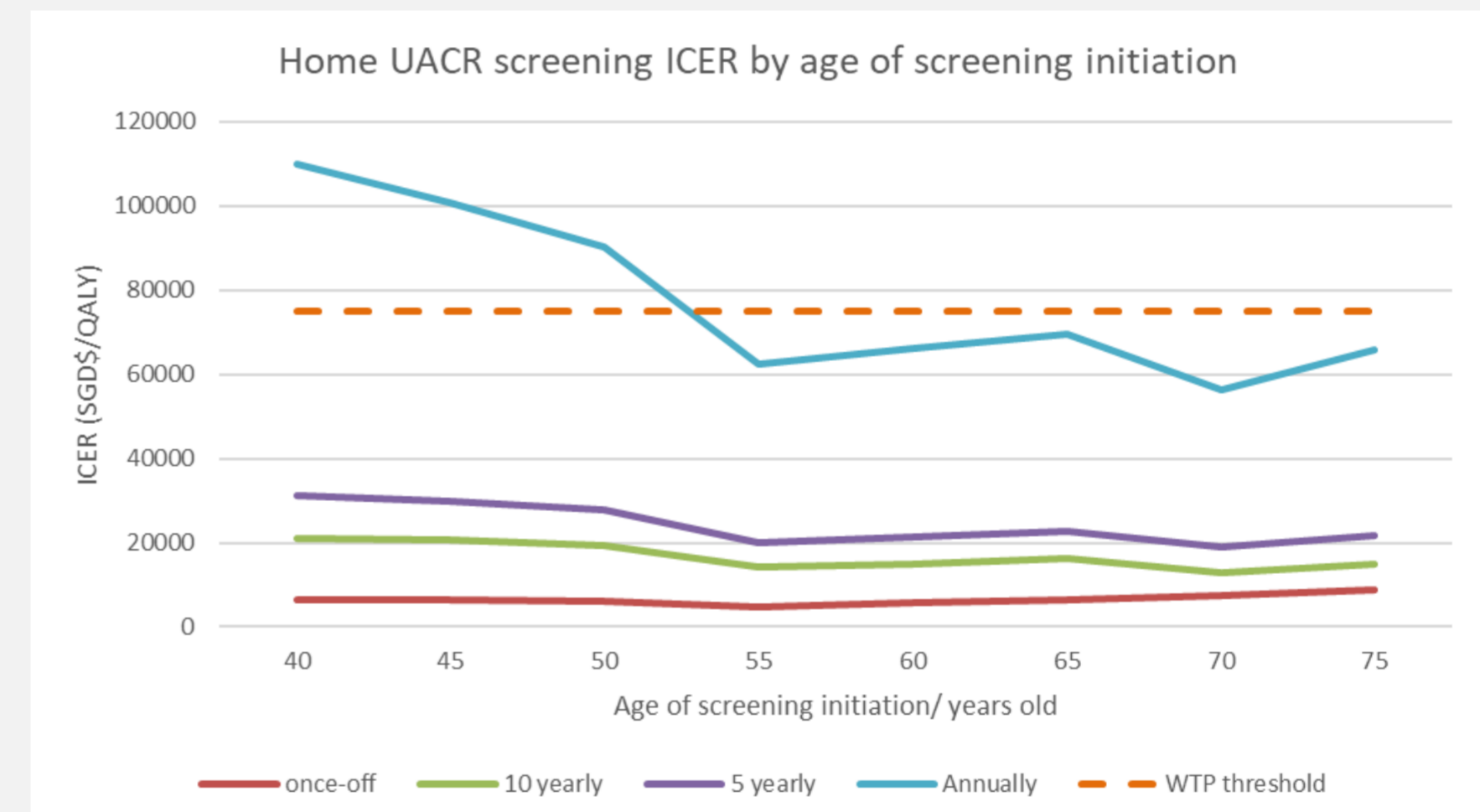
Results

Figure 3A. Cost-effectiveness of clinic urine dipstick screening at various screening frequencies



• Once-off CKD screening with clinic dipstick testing at age 40 years resulted in a 0.015 increase in QALYs for an additional SGD\$94.52 in costs for an ICER of SGD\$6,278/QALY.

Figure 3B. Cost-effectiveness of home-based UACR screening at various screening frequencies



• Once-off CKD screening with home-based UACR testing at age 40 years resulted in a 0.022 increase in QALYs for an additional SGD\$137.69 for an ICER of SGD\$6,278/QALY.

• This was accompanied by a decrease in the incidence of end-stage renal failure requiring renal replacement therapy (RRT) by 11.8%, and an increase in life expectancy from 22.20 to 22.22 years.

Figure 4. Cost-effectiveness acceptability curve with a willingness-to-pay threshold (green line) of \$75,000/QALY gained

Results from multivariate analysis show that once-off screening in the 40-year-old cohort is cost-effective across all 1000 iterations (Figure 4).

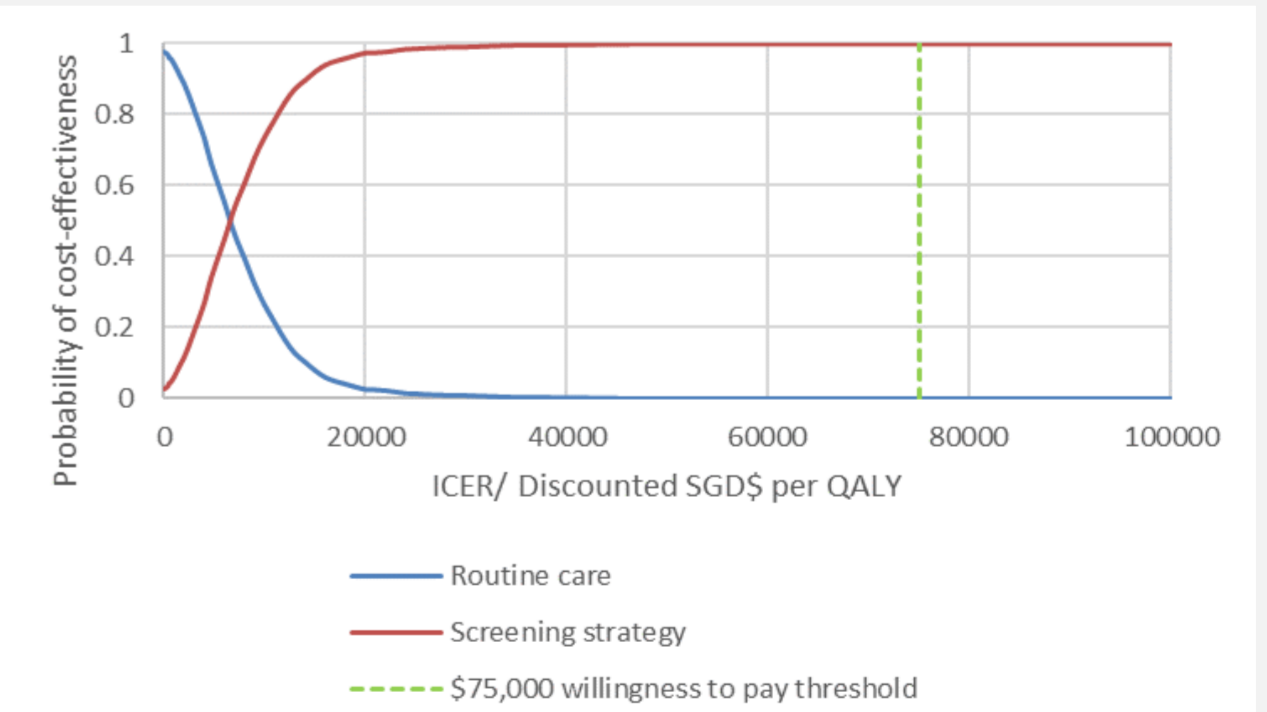
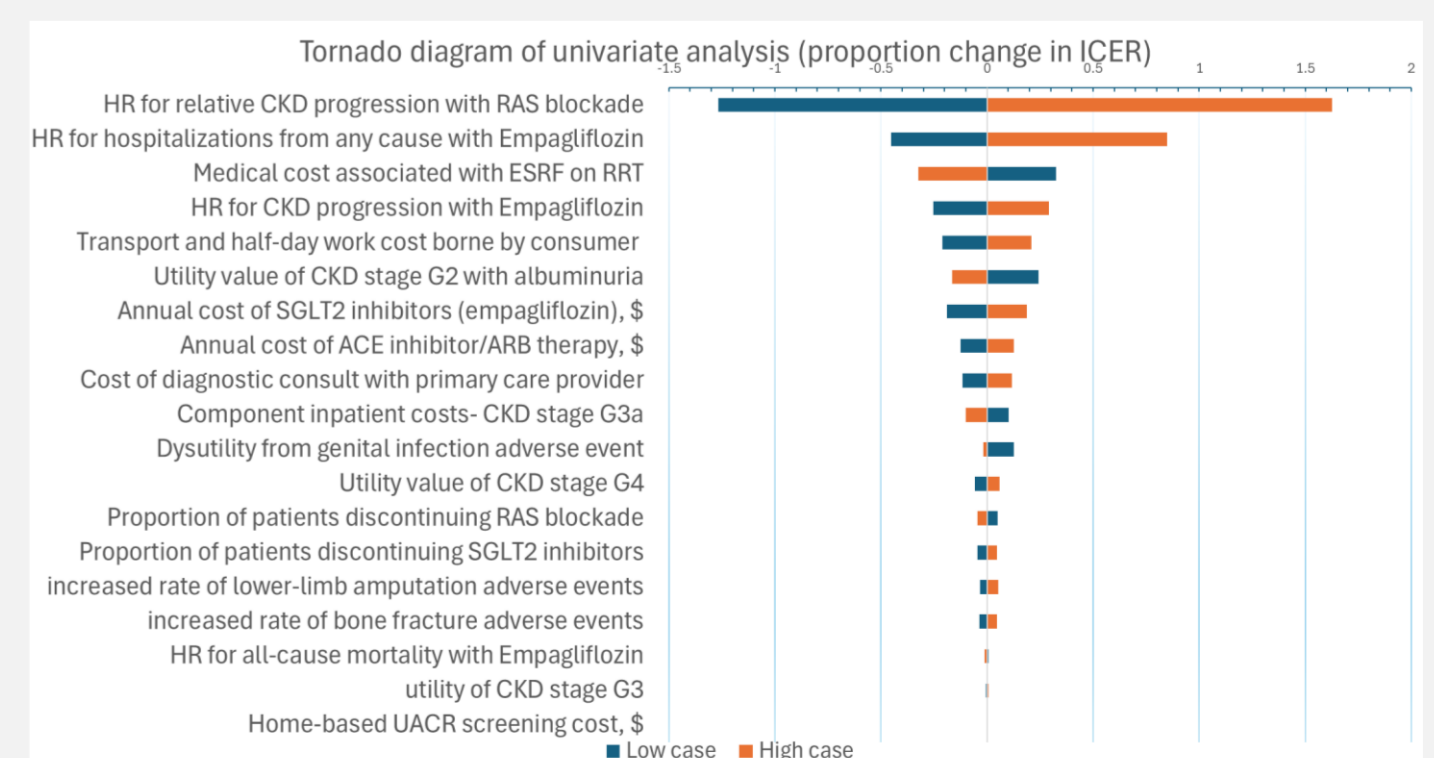


Figure 5. Tornado diagram of top parameters in univariate analysis and proportion change of ICER

Univariate sensitivity analysis reveal that the efficacy of RAS blockade in slowing CKD progression is the most important variable influencing the ICER.



Conclusion

Both clinic-based and home-based albuminuria screening for adults without known diabetes or hypertension to identify patients with CKD is likely cost-effective in Singapore.