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Cost-effectiveness Analysis of Continuous Positive Airway Pressure Treatment for Obstructive Sleep Apnea in Singapore from a Health System Perspective

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BACKGROUND & AIM

Obstructive sleep apnea (OSA) is a prevalent sleep disorder and represents a significant public health challenge. Continuous positive airway pressure (CPAP) therapy is the gold standard for OSA treatment. While the assessment of its cost-effectiveness is important to public health decision-making, there is a scarcity of publications in Singapore. This study aims to assess the cost-effectiveness of CPAP treatment in Singapore from a health system perspective, facilitating policy makers in making informed decisions on funding diagnosis and CPAP treatment within Singapore's healthcare system.

METHOD

A Markov model as shown in Figure 1 was used to assess the cost-effectiveness of CPAP treatment for patients with moderate to severe OSA in a 5-year care pathway with a weighted adherence rate of 74.1% and discount rate of 3%. Cost-effectiveness analysis was illustrated in Figure 2, by considering costs of treatment, health system cost savings of OSA and attributed conditions, the effectiveness measured in disability adjusted life years (DALYs). Costs are in US dollars. In analysis, we used the willingness-to-pay (WTP) threshold of US\$50,000 per DALY of the United States.

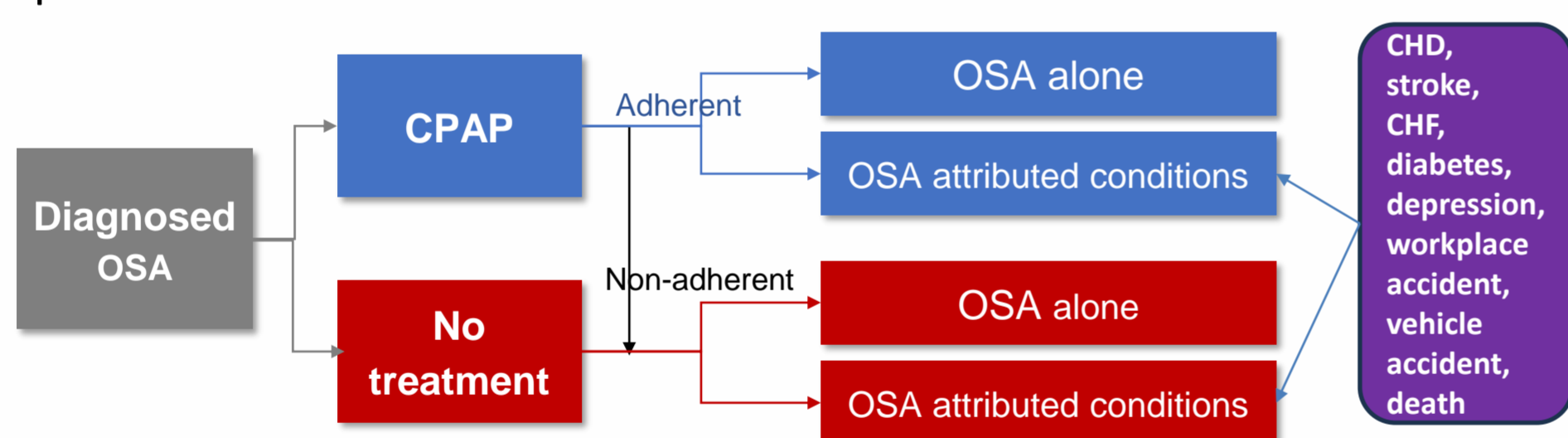


Figure 1. Markov model structure of patients with CPAP treatment and with no treatment.

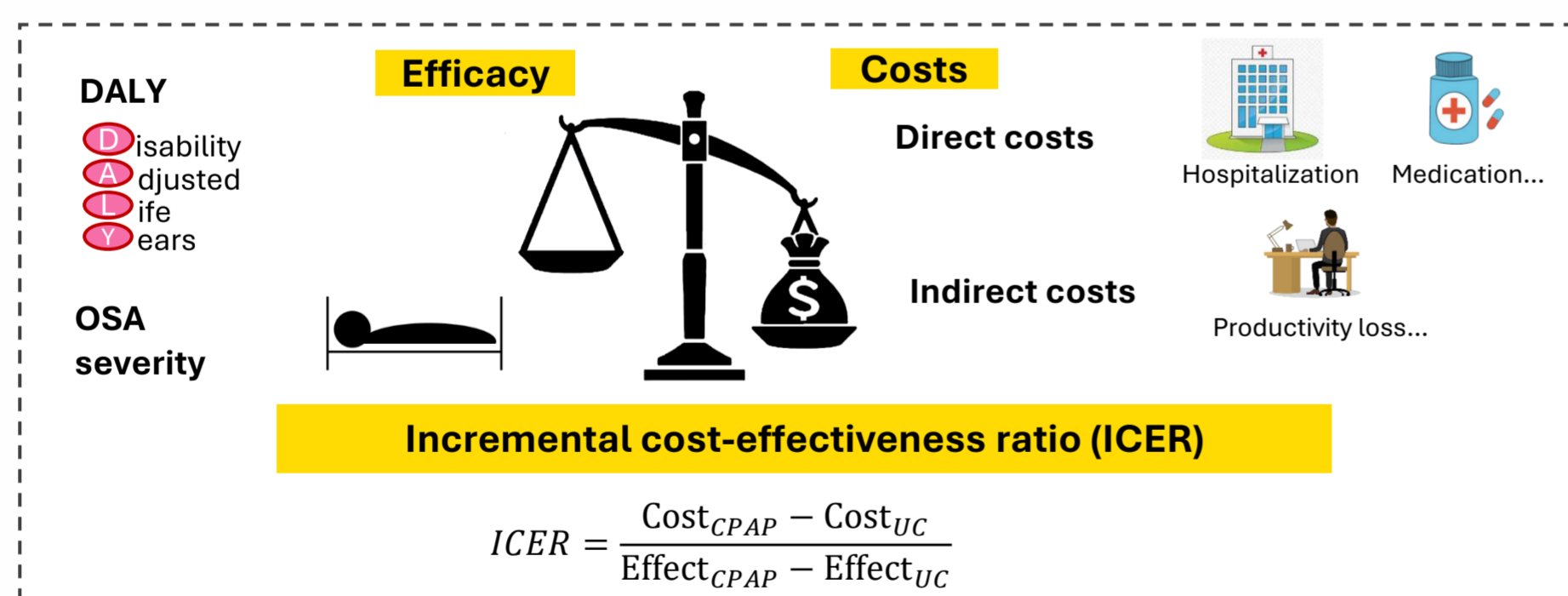


Figure 2. Cost-effectiveness analysis of CPAP treatment. UC: usual care (i.e., no treatment).

We compared the total annual costs for patients diagnosed with inpatient sleep study and with home sleep test (HST). Probabilistic sensitivity analysis and one-way sensitivity analysis were conducted to assess impacts of model parameters on ICER, such as adherence rate, discount rate, efficacy of CPAP treatment, cost of treatment, cost of health system, cost of CPAP machine, probability of attributed conditions with no treatment. What-if analysis was conducted to derive the minimum adherence required for the cost-effectiveness.

Data:

- ❖ The weighted CPAP adherence was based on two Singapore studies.
- ❖ Costs of diagnosis and treatment were from Sleep Lab of Tan Tock Seng Hospital, Singapore.
- ❖ Efficacy of CPAP treatment, health system costs, DALYs were from the literature.

RESULTS

As shown in Table 1, the estimated annual net cost (i.e., costs of treatment minus health system cost-savings) was \$577 per case, resulting in 0.0417 DALYs averted. This translated to a corresponding ICER of \$13,822 per DALY averted. According to the WTP threshold \$50,000 of the United States, CPAP treatment is highly cost-effective.

RESULTS (CONTINUED)

Item	Cost in US\$	Cost in SG\$
Weighted adherence	74.1%	74.1%
Cost of treatment per case (\$)	654	863
Health system cost savings per case (\$)	77	102
Net cost per case (\$)	577	761
DALYs averted per case	0.0417	0.0417
ICER (\$ per DALY averted)	13,822	18,245

Table 1. Cost-effectiveness analysis of CPAP treatment for patients with OSA

The annual total cost for patients diagnosed by inpatient sleep study was \$856 while the corresponding cost was \$625 for patients diagnosed by HST, resulting in a remarkable 27% reduction. Figure 3 shows cost of treatment, efficacy of CPAP treatment, and adherence had higher impacts on the cost-effectiveness. Discount rate and cost of health system had the least impacts on the cost-effectiveness, amongst major parameters. The greater improvement on ICER was achieved with a 15% reduction in cost of treatment, or a 15% increase in efficacy of CPAP treatment, or a 15% increase in adherence. As illustrated in Figure 4, the higher the CPAP compliance, the lower the ICER, the greater cost-effective. The minimum adherence rate of 16.1% is required to ensure the cost-effectiveness of CPAP treatment.

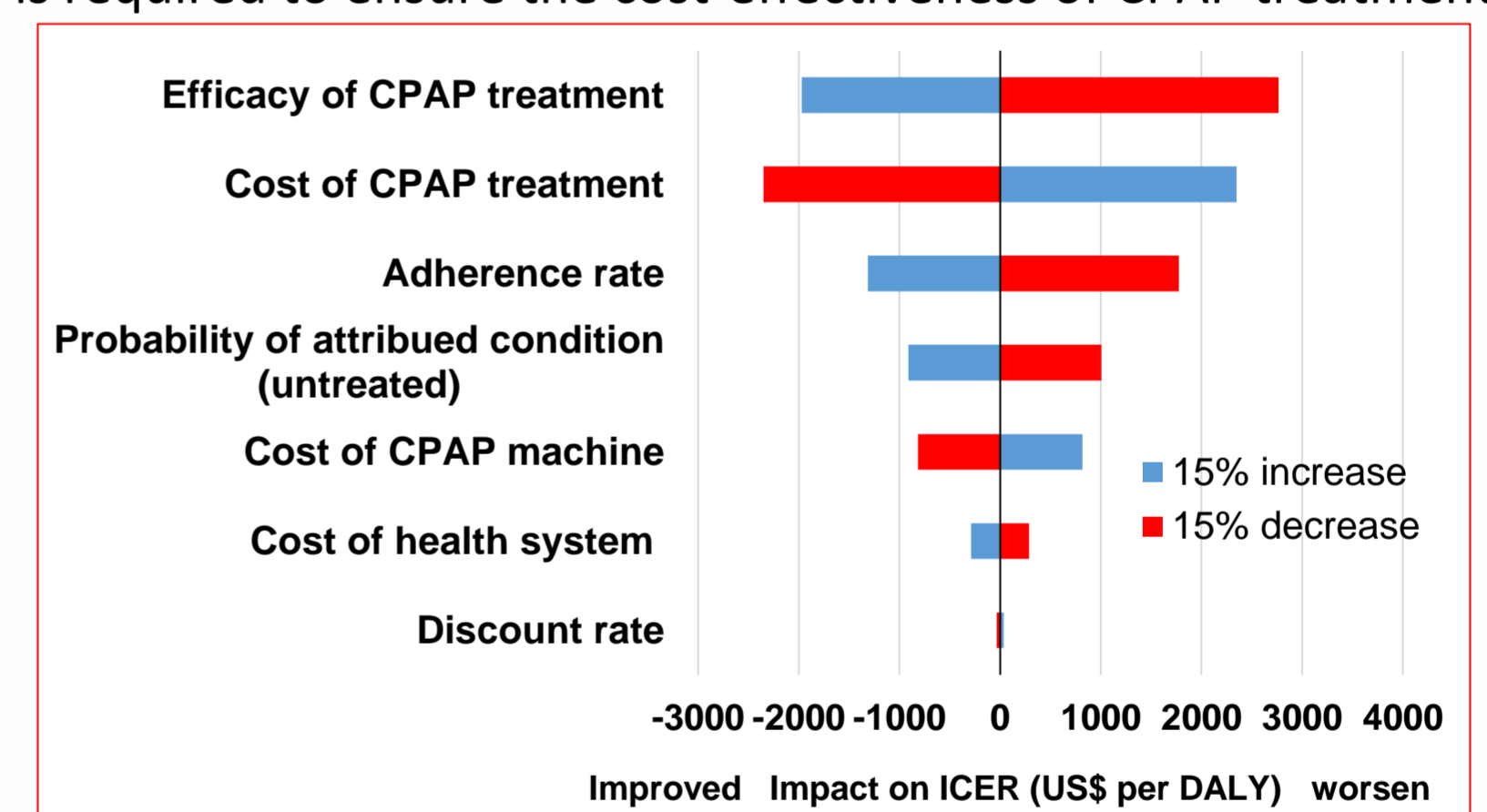


Figure 3. Tornado diagram of one-way sensitivity analysis.

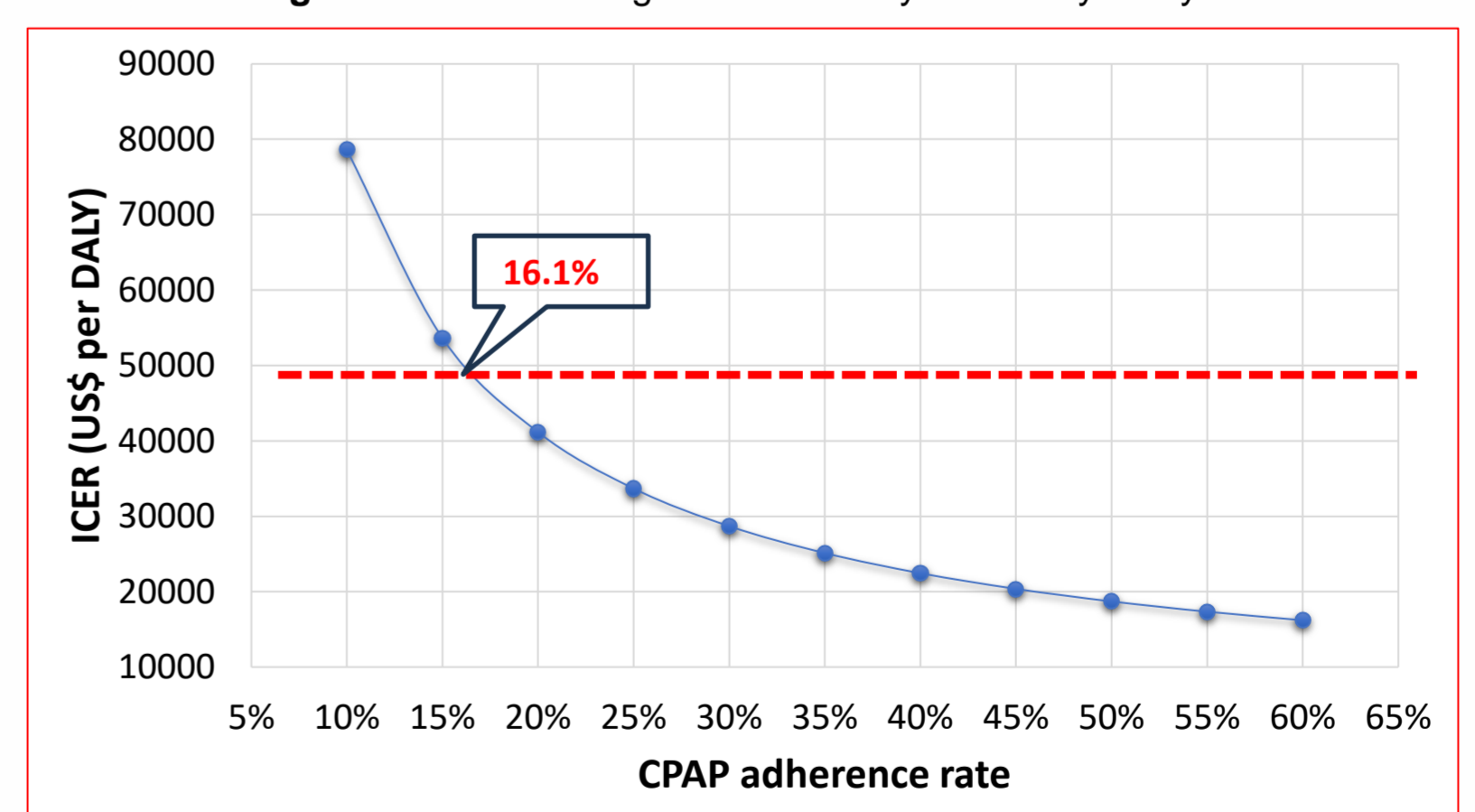


Figure 4. ICERs associated with different CPAP adherence rates.

CONCLUSION

- ❖ According to the WTP threshold of the United States, CPAP treatment was highly cost-effective with ICER of \$13,822 per DALY.
- ❖ The total annual cost for patients diagnosed with HST can reduce by 27%, compared to those diagnosed with inpatient sleep study.
- ❖ The obtained results may be helpful to health policy makers to make informed decision on funding OSA diagnosis and CPAP treatment.