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Cost-effectiveness Analysis of Diabetic Foot Screening for Ulcerations: AI-Enhanced Risk Tailored Screening vs. Routine Annual Screening

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Background and Aims

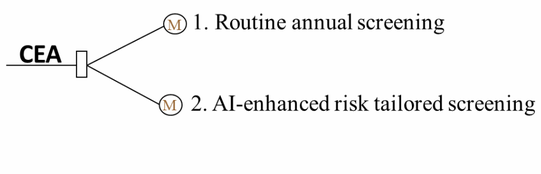
DFUs are serious complications of long-standing diabetes, often leading to severe consequences, including amputations and premature death. Current screening guidelines recommend quarterly screening for patients at high risk, biannual screening for patients at moderate risk, and annual screening for those at low risk. This approach may result in over-screening for low-risk patients.

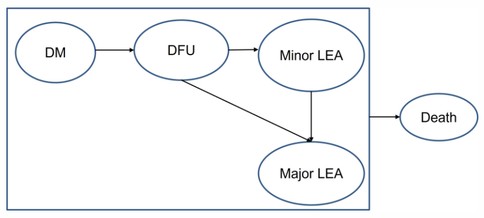
An AI model was developed to predict a low-risk patient' risk of developing DFU in 3-year and proposed an AI-enhanced risk tailored screening approach: patients predicted not to develop DFU in 3-year to be screened every 3 years; otherwise still screened annually.

This study aimed to evaluate the cost effectiveness of replacing **routine annual screening** with the **AI-enhanced risk-tailored screening** strategy for DFUs.

Methods

A cost-effectiveness analysis was conducted using the below Markov state-transition model to compare the lifelong cost and effectiveness of a simulated cohort consisted of 500,000 patients with diabetes who were at low risk of developing DFUs.



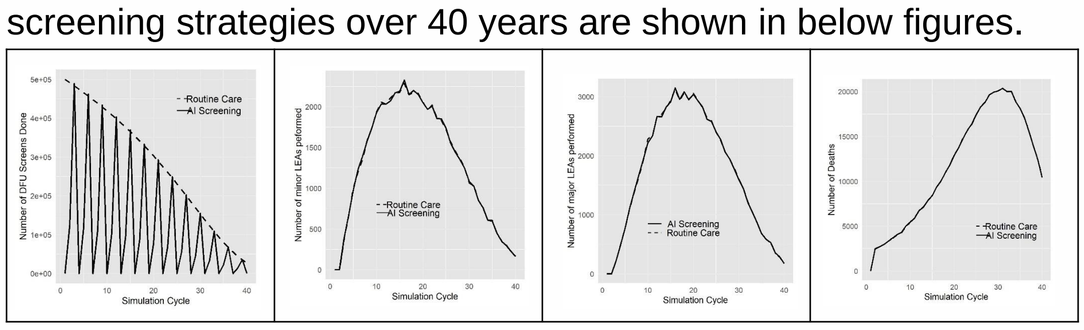


Probabilistic sensitivity analysis (PSA) using microsimulation was also applied to address the variances in model parameters and heterogeneity in patients. Model parameters like transition probabilities and costs were derived from NHG data.

The cost analysis was conducted from the payer's perspective. Only direct medical costs were included. Costs for individual disease stages were defined as the gross charge to patients/payers before subsidy. The incremental cost-effectiveness ratio (ICER) was calculated to identify the most cost-effective strategy. The decision uncertainty in PSA was then assessed by Cost-effectiveness Acceptability Curve (CEAC) to determine the best DFU screening strategy.

Results

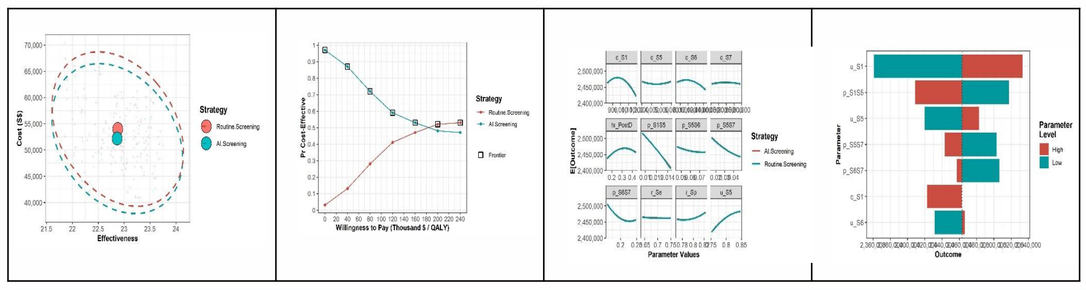
The lifelong cost, effectiveness and clinical outcomes of the two screening strategies over 40 years are shown in below figures.



The results were also summarized in the table. AI-enhanced screening demonstrated a cost saving of **S$1,315** per patient with a negligible loss of **0.004 QALYs** over 40 years. The ICER was calculated at **S$292,181 per QALY gained**.

Screening strategy	Total cost per patient	Total QALYs per patient	Total number of screening sessions	Total DFUs	Total minor LEAs	Total major LEAs	Total Deaths
Annual screening	S$55,587	23.154	11,178,861	134,043	52,689	68,710	469,946
AI-enhanced screening	S$54,272	23.150	4,372,523	120,370	52,720	68,646	469,972
Difference in 0.5Mil patients with diabetes	**↓S$657.5Mil (total cost)**	↓200	**↓6,806,338**	↓13,673	↑31	↓64	↑26

Results of probabilistic sensitivity analysis were visualized in the below figures. The average cost and effectiveness summarized over the 1000 PSA samples were S$53,993 (SD: S$6,007) and 22.876 (SD: 0.519) for the routine annual screening and S$52,178 (SD: S$5,831) and 22.866 (SD: 0.516) for the AI-enhanced screening. The average ICER was **S$174,572 (SD: S$13,296) per QALY gained**, which also indicates that AI screening is more cost effective than routine annual screening.



Conclusion

AI-enhanced, risk-tailored screening for DFUs can reduce healthcare cost and improve resource allocation without significantly compromising patient outcomes. It's a cost-effective alternative to routine annual screening, optimizing healthcare resource use and improve clinical outcomes.

Key Findings

- ✓ The AI-enhanced screening can potentially save **6,806,338** unnecessary DFU screenings and reduce healthcare costs by **S$657.5 million** compared to routine annual screening for half a million diabetes population over a 40-year period, without compromising the quality of care, which translates to an annual saving of S$16.4 million healthcare cost.
- ✓ Implementing AI-enhanced risk-tailored screening could save significant healthcare costs by reducing unnecessary screenings and focusing on patients at higher risk.

MINISTRY OF HEALTH SINGAPORE