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Title:

Cost-Effectiveness Analysis of Personalized Diabetic Retinopathy Screening Recommendations

Abstract Body:

Purpose : Personalized screening policies for diabetic retinopathy (DR) can be effective in detecting DR while incorporating more accessible screening technologies such as teleretinal imaging (TRI) as a precursor to clinical screening (CS). This study conducts cost-effectiveness analysis comparing personalized and standardized screening policies for an urban, safety-net hospital system.

Methods : A partially observable Markov decision process model (POMDP) determined semi-annual personalized recommendations of either wait and watch (WW), TRI, or CS based on a patient's risk of having proliferative DR and screening compliance. A Monte Carlo discrete event simulation model was then utilized to compare the model-based personalized policy to standardized policies including annual CS (ACS), biennial CS (BCS) and annual TRI (ATRI) for a hypothetical cohort over their lifetimes. DR progression rates and patient-specific CS compliance were obtained from literature while patient-specific TRI compliance was derived from the TRI screening program at the Harris Health System, Houston, TX. Sensitivity analysis was conducted to examine cost-effectiveness of the screening policies across different A1C levels.

Results : For a base case population with an A1C level of 7% and TRI and CS compliance rates of 68.4% and 35%, respectively, the model-based personalized policy included 3.65% WW, 86.72% TRI and 9.62% CS (95% CI +/- 0.02%) on average during a patient's lifetime. The personalized policy was found dominant in 57.23%, 80.02%, and 67.75% (95% CI +/- 0.04%) for patients who followed them compared to ACS, BCS and ATRI, respectively (See Fig 1). At an A1C level of 13%, the personalized policy on average included 0.23% WW, 64.67% TRI, and 35.10% CS (95% CI +/- 0.03%). For this cohort, the personalized policy was found dominant for 71.99%, 94.53%, and 83.36% (95% CI +/- 0.04%) of patients compared to ACS, BCS and ATRI, respectively (See Fig 2).

Conclusions : For the majority of patients, following the model-based personalized screening policy provided more QALYs and was less costly when compared to other standardized policies, highlighting the potential benefit of personalized screening recommendations. This benefit increases for more at-risk patients, such as those with high A1C levels.

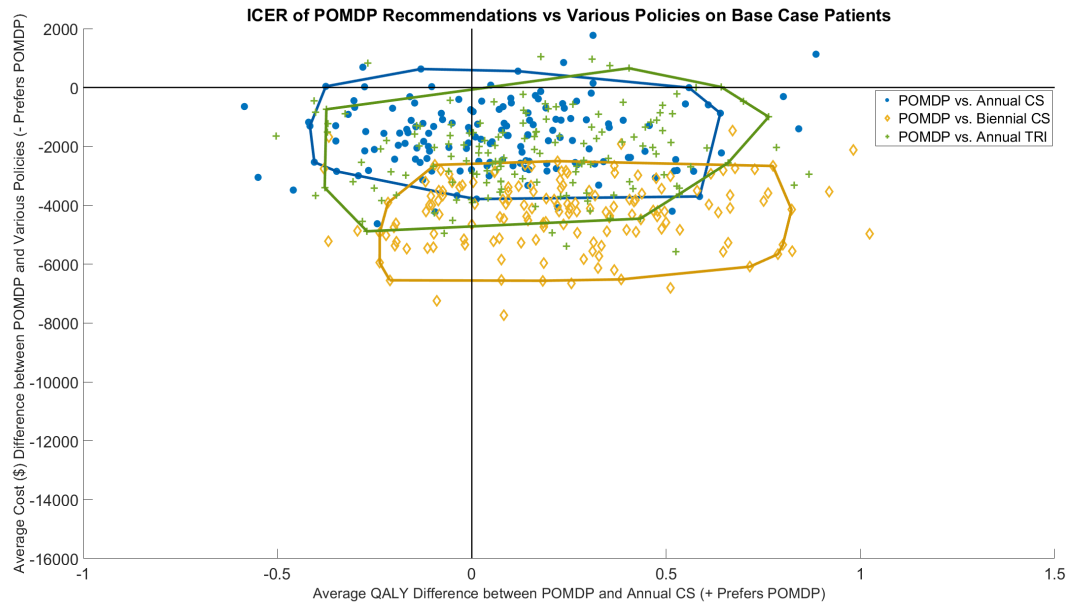


Figure 1. Cost-effectiveness analysis for base case patients

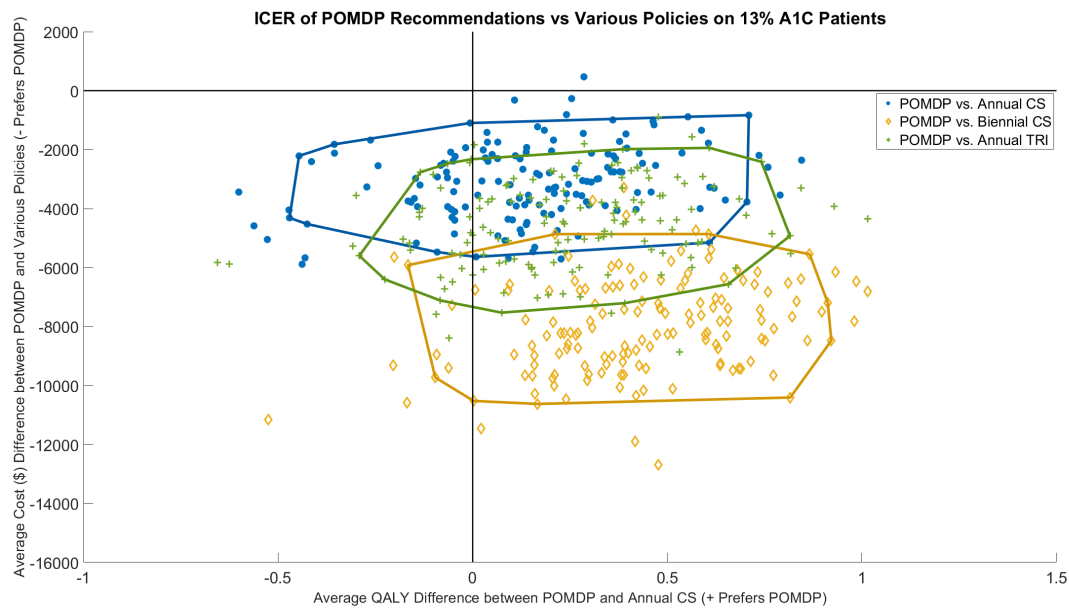


Figure 2. Cost-effectiveness analysis for patients with 13% A1C level