Cost-Effectiveness Analysis of Prostate-Specific Antigen-Based Risk-Adapted Screening in Germany: An Early Economic Evaluation Study

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BACKGROUND AND OBJECTIVES

- Prostate cancer (PCa) is a significant health challenge; in 2021, it accounted for 12% of male cancer deaths in Germany.
- Early detection guidelines currently include **digital rectal examination (DRE) and prostate-specific antigen (PSA) testing**. While PSA testing reduces mortality, it can also result in overdiagnosis and overtreatment.
- Rising interest in **PSA-based risk-adapted** screening and **Multiparametric Magnetic Resonance Imaging (mpMRI)** techniques aims to target men at higher risk and potentially minimize screening-associated harm.
- Despite **its wide uptake in Germany,** mpMRI for PCa diagnosis lacks conclusive economic evidence.
- We aimed to **recalibrate the Swedish Prostata model to the German context** and assess the cost-effectiveness of eight PCa screening strategies from **the German statutory health insurance funder** perspective.

METHODS

- The Prostata model (**Figure 1A)** was recalibrated using 2014-2019 German age-specific PCa incidence and Gleason score distributions (**Figure 1B**) and validated against observed age-specific PCa mortality (**Figure 1C**).
- We simulated lifetime histories for **10 million men** with and without screening **starting at the age of 35.**
- Model input parameters were informed by publicly available German sources, literature, and expert opinion.
- Primary outcomes were lifetime costs, quality-adjusted life years (QALYs) and incremental cost-effectiveness ratios (ICERs).
- **3% discounting for costs and health** was employed in the base case.
- **Probabilistic and deterministic sensitivity analyses (DSA)** focused on utility values, discount rates (0 and 5%), screening periods, age, costs and test characteristics, using distributions informed from the literature.

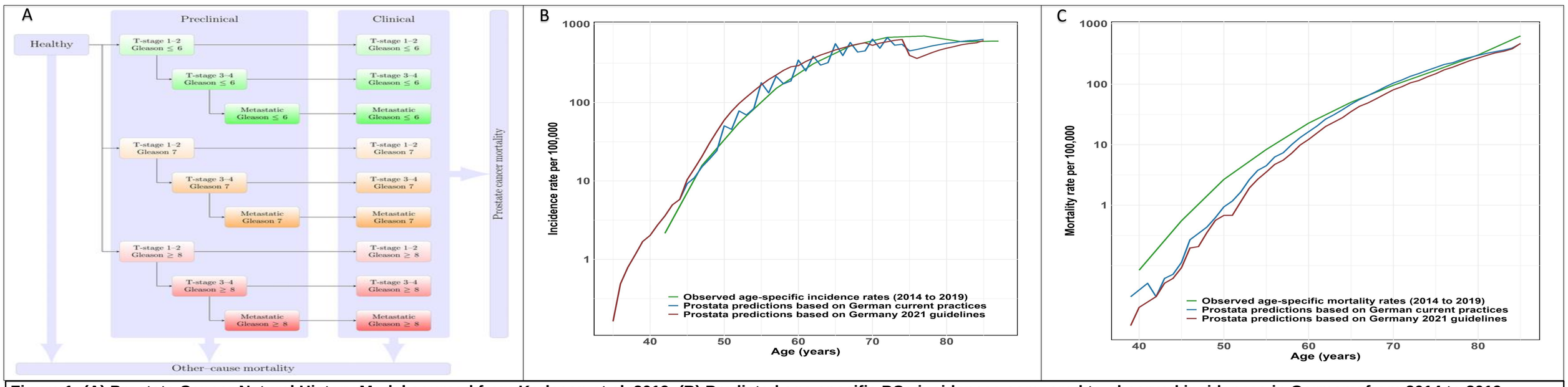

Figure 1: (A) Prostate Cancer Natural History Model sourced from Karlsson et al. 2019. (B) Predicted age-specific PCa incidences compared to observed incidences in Germany from 2014 to 2019. (C) Predicted age-specific PCa-specific mortality contrasted with observed mortality rates

RESULTS

Base case analysis

- **Figure 2** illustrates the incremental costs and QALYs accumulated from each of the seven strategies evaluated **compared to no screening.**
- **Strategy II** (PSA-risk-stratification followed by systemic [SBx] biopsies at 50) emerged as the most **optimal** among the eight strategies.
- **Strategy IV** (PSA-risk-stratification followed by combined SBx and targeted [TBx] biopsies at age 50) **reduced screen-initiated biopsies by 67%** and **overdiagnosis rate by 29%** compared to **Strategy II**. However, the high costs of MRI and TBx offset the expected cost savings.

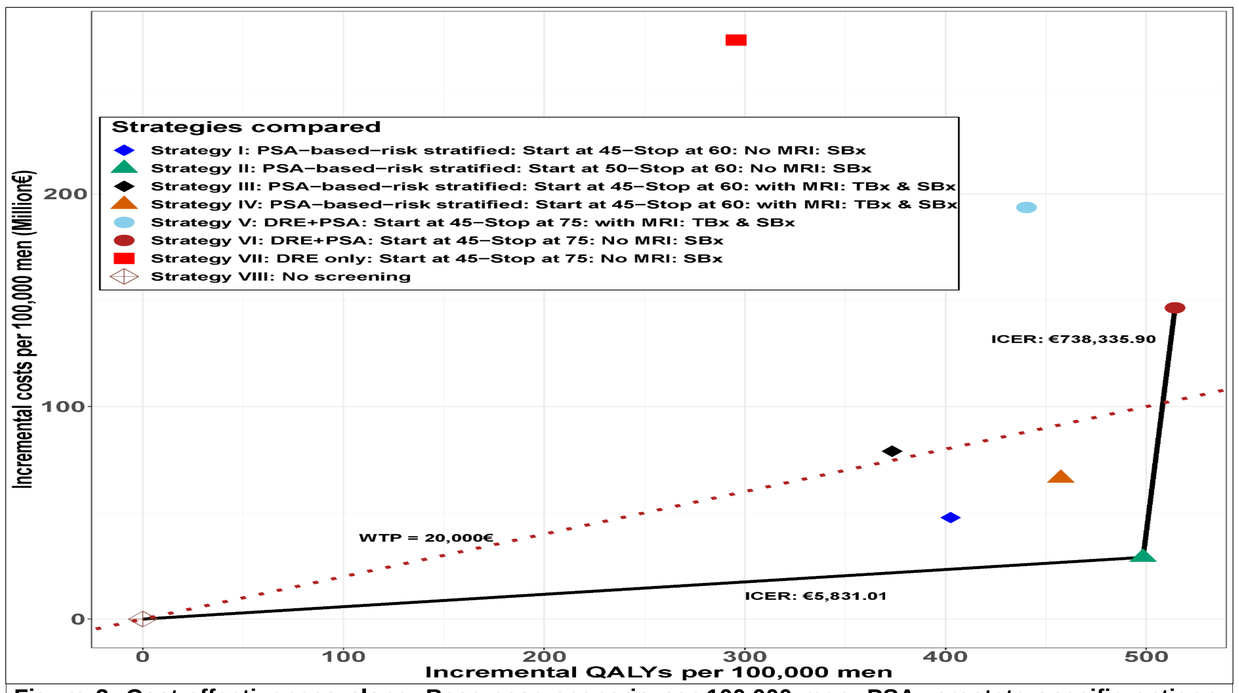

Figure 2: Cost-effectiveness plane: Base case scenario per 100,000 men: PSA: prostate specific antigen, WTP: nominal willingness to pay threshold per QALY gained; DRE: digital rectal examination; MRI: Magnetic Resonance Imaging; SBx: systemic biopsy; TBx: targeted biopsy

Sensitivity analysis

- In the DSA, **extending the screening period from 60 to 70, or discounting cost and health at 5% instead of 3%,** increased the ICER **fourfold** for Strategies II compared with no screening.
- **Figure 3** depicts the outcomes of the **probabilistic sensitivity analysis.** Strategies II has a **100% chance of being cost-effective** when the WTP threshold is under 10,000 per QALY gained.

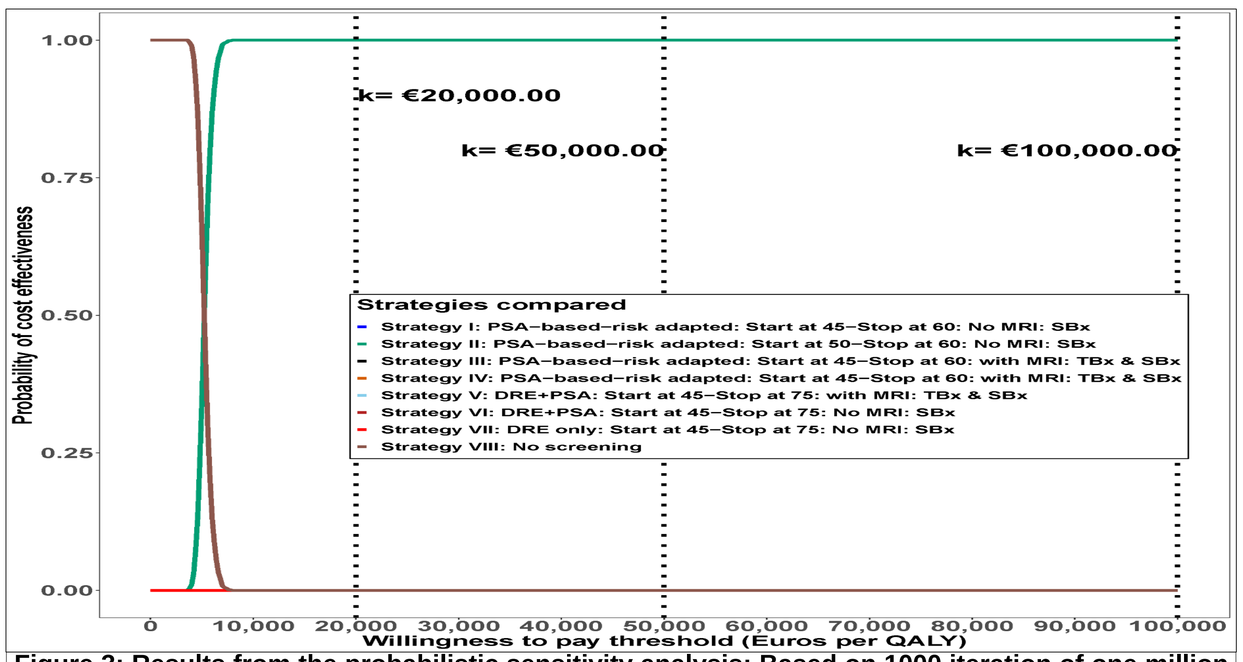

Figure 3: Results from the probabilistic sensitivity analysis: Based on 1000 iteration of one million men simulated. MRI: Magnetic Resonance Imaging; PSA : prostate specific antigen; DRE: digital rectal examination; SBx: systemic biopsy; TBx: targeted biopsy; k: nominal willingness to pay threshold per QALY gained

CONCLUSION

- Based on the model results, **it is evident that Germany should reconsider its guidelines on DRE examination for PCa screening**.
- **A shift towards PSA risk-adapted screening,** starting at age 50 and ending at age 60, could be more economically sustainable and beneficial.

KEY REFERENCE

1. Karlsson et al. A natural history model for planning prostate cancer testing: Calibration and validation using Swedish registry data. PLoS One. 2019 Feb 14;14(2):e0211918.

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