

Can Multi-Cancer Early Detection Screening Prevent Late-Stage Cancer?

A Modeling Study

Jade Xiao¹, Andrew ElHabr¹, Christopher Tyson², Xiting Cao², Sana Raoof³, A. Mark Fendrick⁴, A. Burak Ozbay², Paul Limburg², Tomasz M. Beer², Ashish Deshmukh⁵, Andrew Briggs⁶, Jagpreet Chhatwal^{7,8}

¹Value Analytics Labs, Boston, MA, USA; ²Exact Sciences Corporation, Madison, WI, USA; ³Memorial Sloan Kettering Cancer Center, New York, NY, USA; ⁴School of Public Health, University of Michigan, Ann Arbor, MI, USA; ⁵Medical University of South Carolina, Charleston, SC, USA; ⁶London School of Hygiene & Tropical Medicine, London, UK; ⁷Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA; ⁸Center for Health Decision Science, Harvard University, Boston, MA, USA

Background

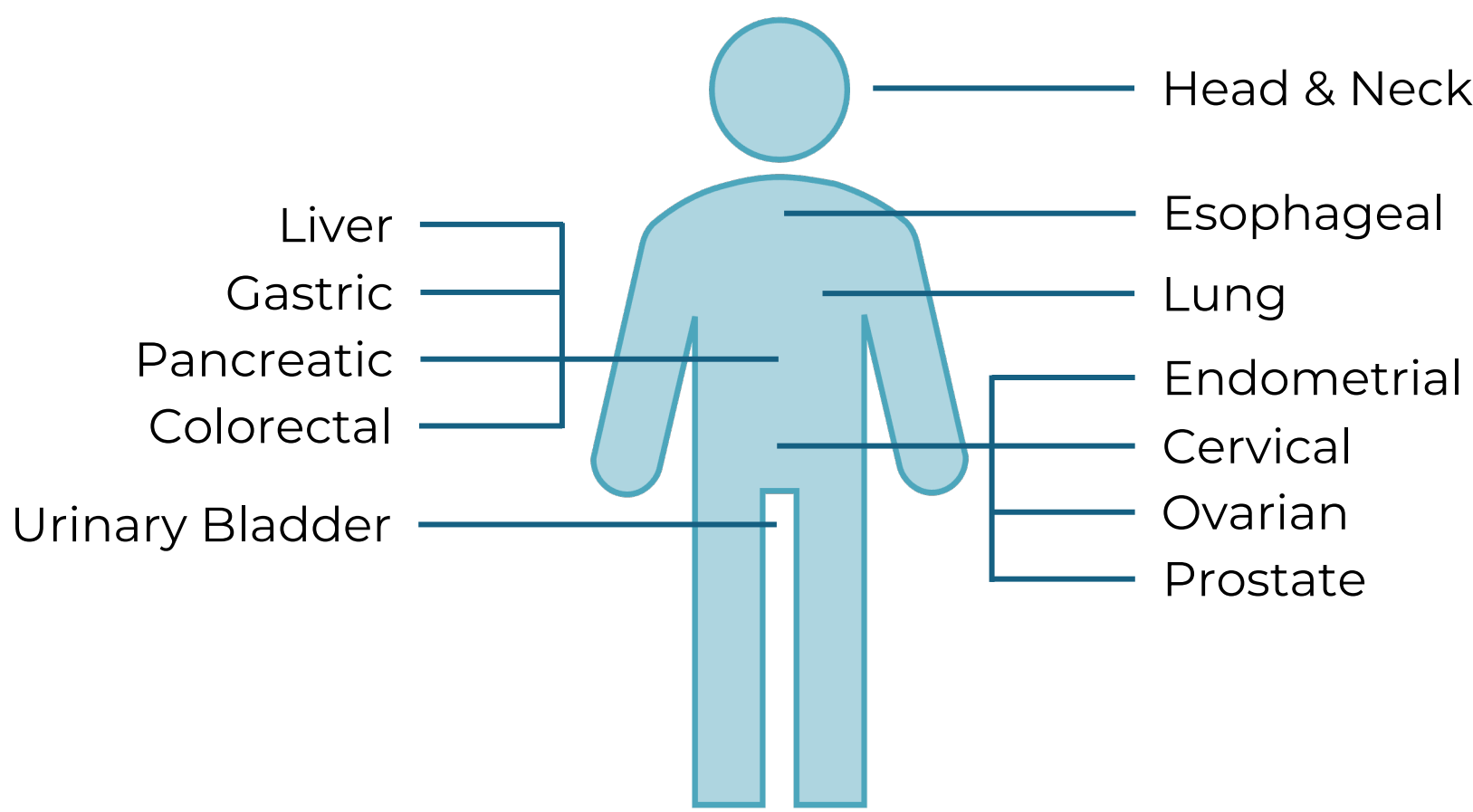
- Cancer is the second-leading cause of death in the United States, and the leading cause among people aged <85 years.¹
- Early detection is associated with a higher chance of survival, but currently around half of cancers are detected at an advanced stage.²
- Routine screening is USPSTF-recommended for only four cancer types: breast, cervical, colorectal, and lung.³
- Emerging blood-based multi-cancer early detection (MCED) tests have the potential to revolutionize early cancer detection.

Objective

To evaluate the potential impact of screening with an MCED test on stage IV cancer incidence in the general US population.

Methods

- We developed **Simulation Model for MCED** (SiMCED), a continuous-time, discrete-event microsimulation model of 14 solid tumor cancer types that account for nearly 80% of all cancer incidence and mortality:⁴



Natural History

- Figure 1** is a high-level model schematic.
- An individual can develop only one cancer type in their lifetime, with exponentially-distributed time to cancer incidence.
- The cancer type with the earliest incidence time before the time of all-cause death was chosen.
- In the absence of a diagnosis, cancer progresses according to exponentially-distributed dwell times.
- Unobserved cancer prevalence and incidence were estimated using a backwards induction approach.^{5,6}

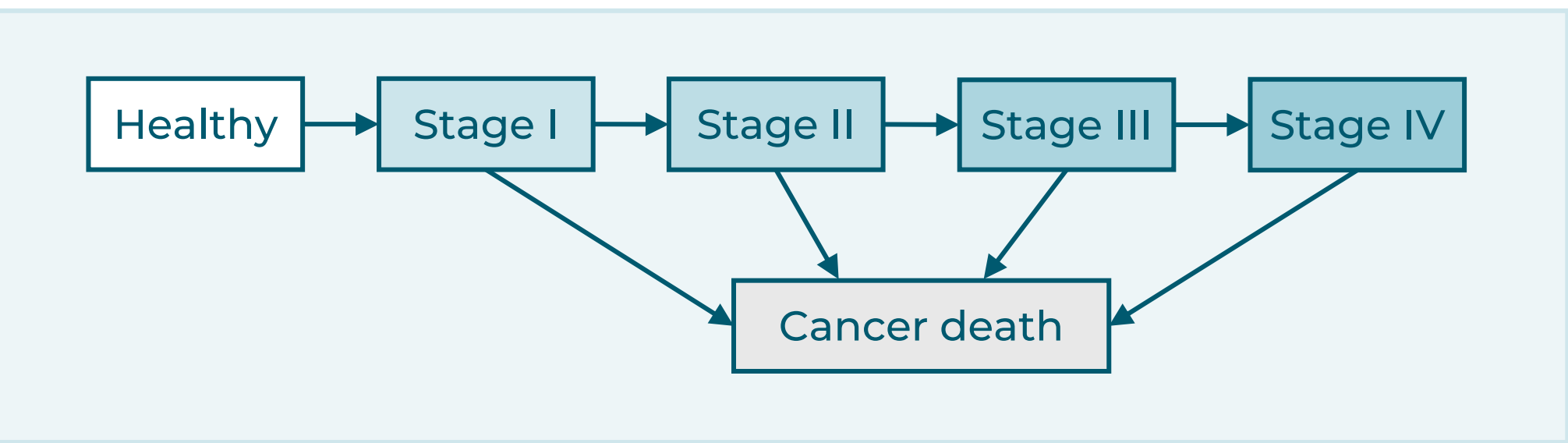


Figure 1: High-level model schematic of SiMCED

Supplemental screening with an MCED test could reduce stage IV cancer incidence by **39%** over 50 years.

Model Calibration

- Using an open population version of the model, we calibrated the initial prevalence, the rate of developing cancer, and the rate of usual care diagnosis for each cancer type/stage, such that model outputs matched the annual incidence rates of diagnosis in the Surveillance, Epidemiology, and End Results (SEER) database (**Figure 2**).⁴

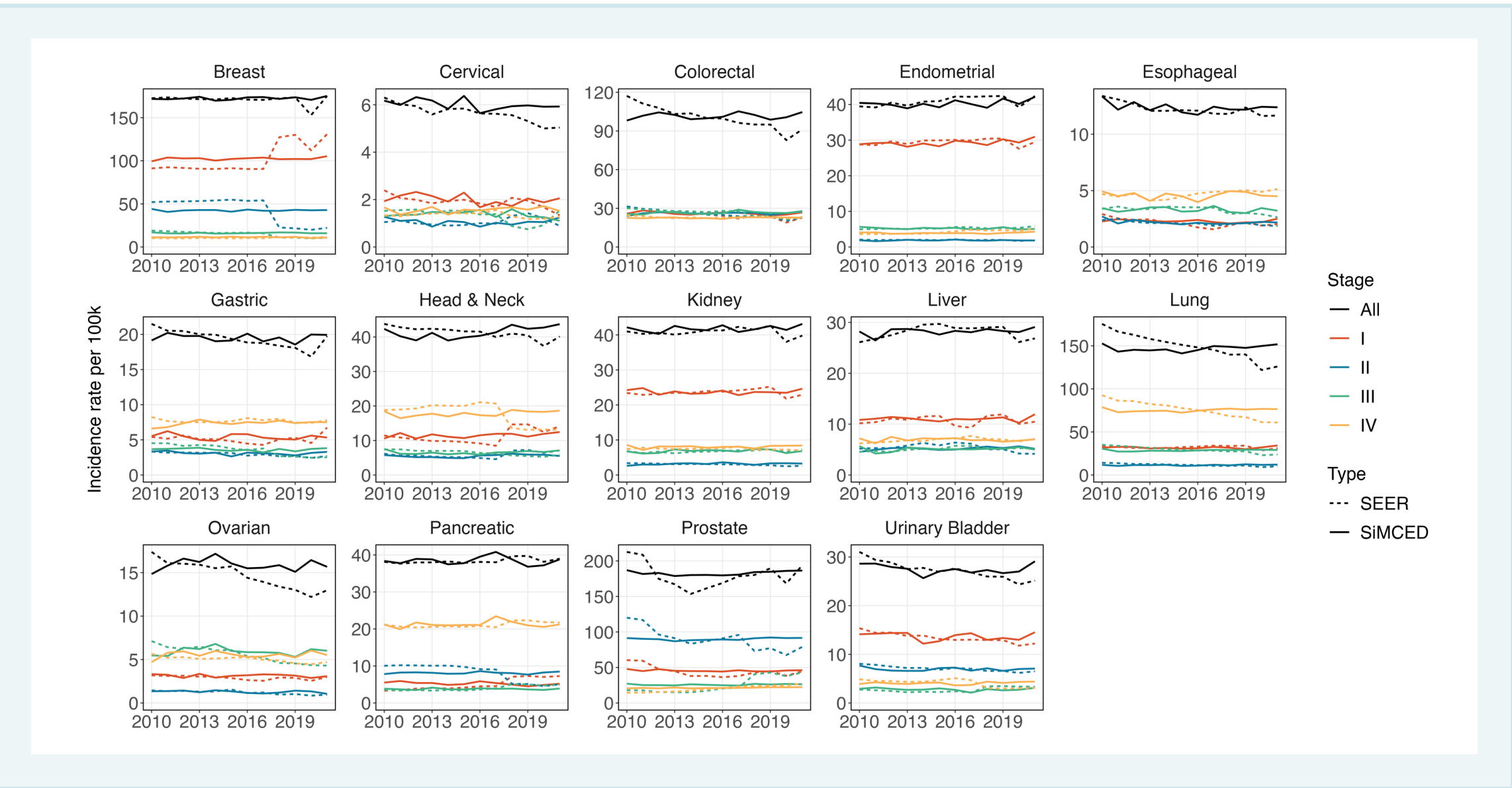


Figure 2: Calibration results

Screening and Diagnosis

- Diagnosis via usual care encompasses existing screening procedures, incidental detection, and symptomatic presentation.
- The MCED test was modeled as a supplemental screening approach with test sensitivities derived from a large, multi-center, prospective, case-control study (ASCEND-2).⁷

Model Outcomes

- Using a 50-year horizon, we simulated the life course of 5 million adults aged 50-84 years, representative of the US population.
- The model was run twice, once without MCED testing (**Usual care**) and once with annual MCED testing (**Usual care + MCED**).

Results

- Figure 3** shows total reduction in stage IV incidence, expressed as a rate per 100k people in the initial closed cohort.
- Over the 50-year horizon, stage IV incidence was 5,806 under **Usual care** and 3,533 under **Usual care + MCED** – a reduction of 2,273 (39%).
- Among the four screening cancers, the reduction was 1,331 (42%).
- Among the ten non-screening cancers, the reduction was 942 (35%).

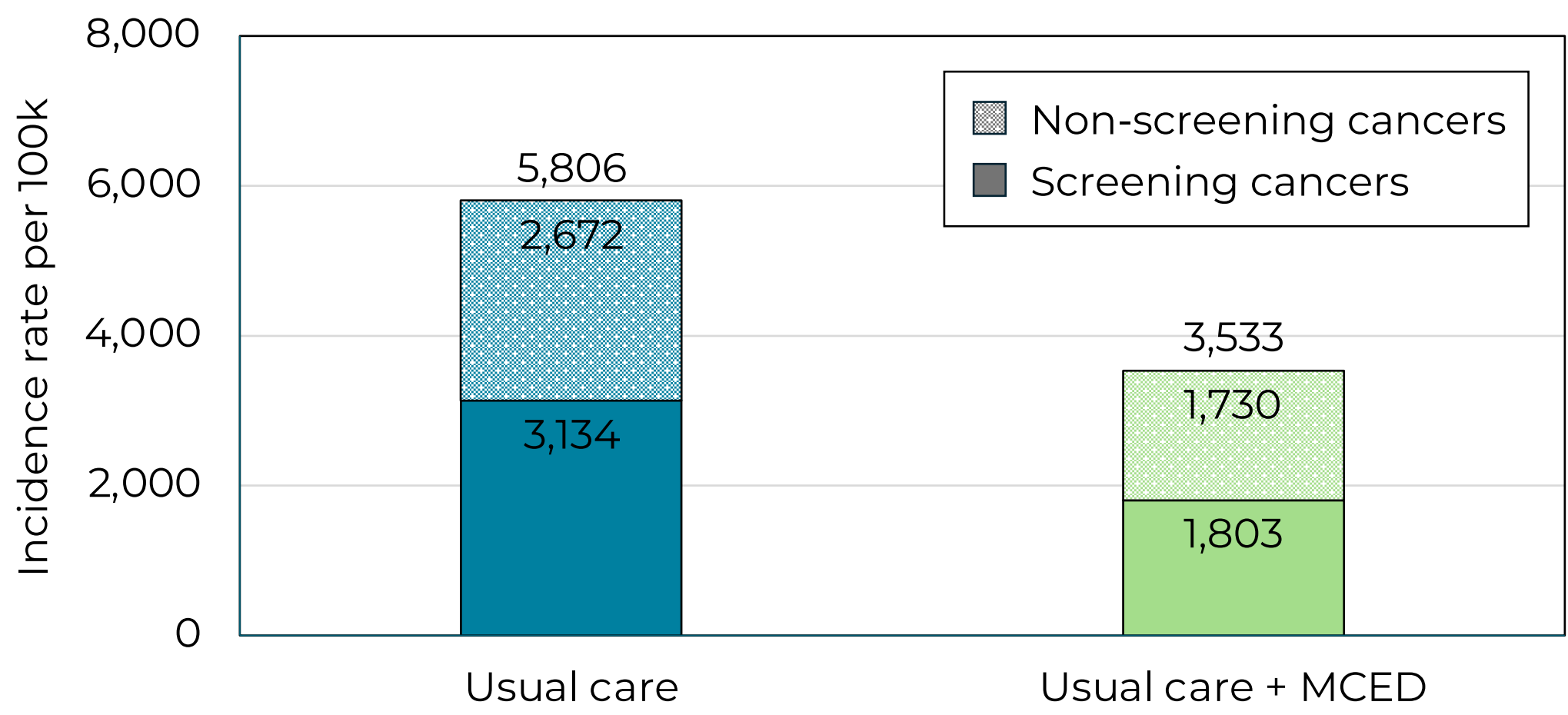


Figure 3: Total reduction in stage IV incidence

- Figure 4** shows cancer-specific reductions in stage IV incidence, listed in order of absolute reduction.
- Stage IV reduction was most pronounced for lung, pancreatic, and colorectal cancer.

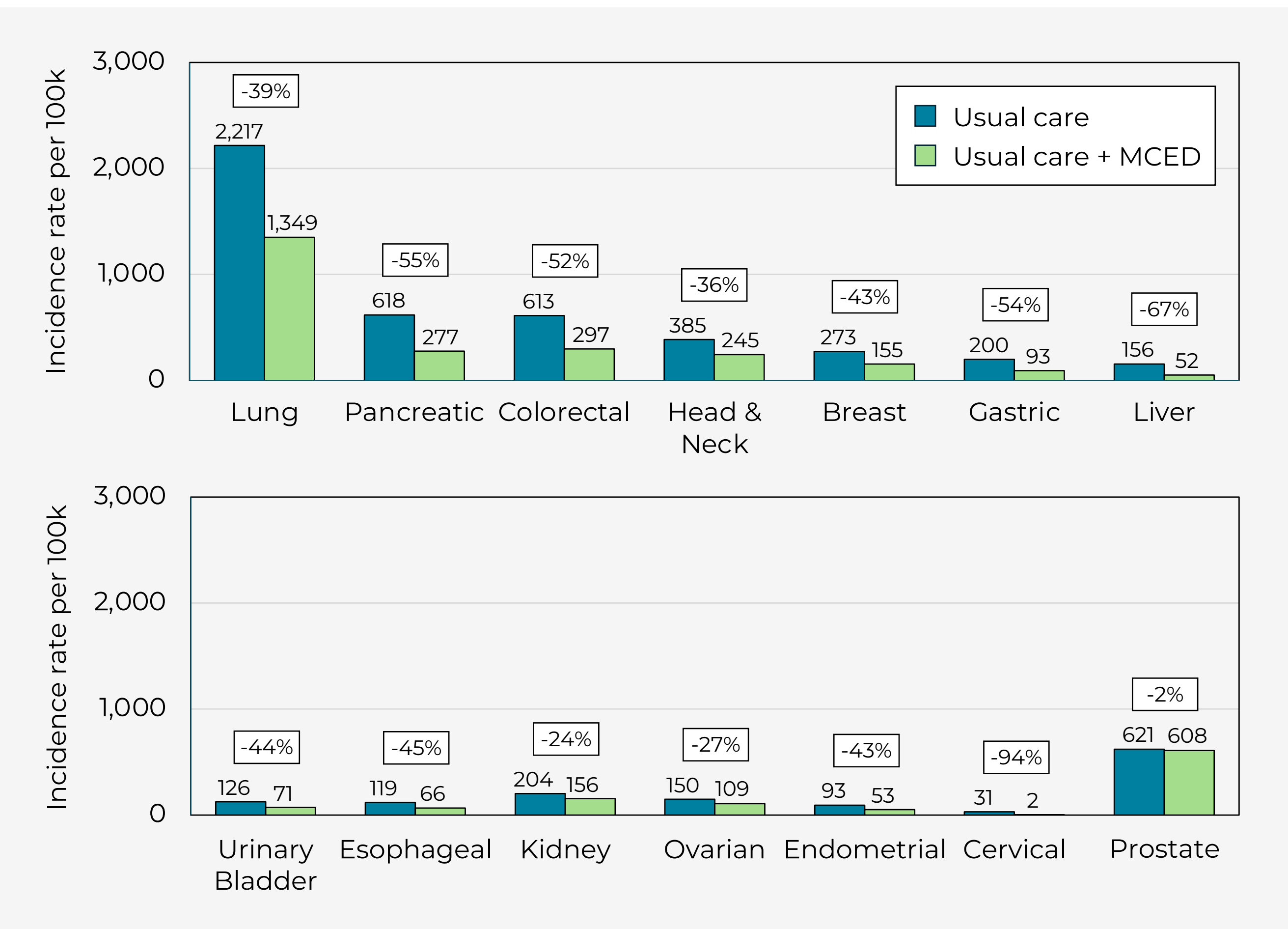


Figure 4: Cancer-specific reductions in stage IV incidence

Conclusions

- Our study suggests that supplemental screening with an MCED test could be effective for preventing stage IV cancer.
- The real-world impact and cost-effectiveness of MCED tests warrant further investigation.

References

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