Effect of multi-cancer early detection screening on late-stage cancers: A modeling study

Jagpreet Chhatwal,[1,2,3] Jade Xiao,[3] Selin Merdan,[3] Andrew ElHabr,[3] Christopher Tyson,[4] Xiting Cao,[4] Sana Raoof,[5] A. Mark Fendrick,[6] A. Burak Ozbay,[4] Paul Limburg,[4] Tomasz M. Beer,[4] Ashish Deshmukh,[7] Andrew Briggs[8]

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

Background

- Early cancer detection is associated with a higher chance of survival, but currently around half of incident cancers are detected at an advanced stage.[1]
- Routine screening is recommended for only four cancers (breast, cervical, colorectal, lung),[2] and two-thirds of incident cancers lack screening guidelines.[3]
- Emerging blood-based multi-cancer early detection (MCED) tests can revolutionize early cancer detection.

Objective

We evaluated the potential impact of MCED screening on Stage IV cancer incidence for 12 cancers that represent 70% of all cancer incidence in the US.[4]

Methods

- We developed *Simulation Model for MCED* (SiMCED), a microsimulation model of 12 solid tumor cancers.
- Cancer type- and stage-specific dwell times informed the transitions between cancer stages I-IV.
- Cancer type- and stage-specific MCED test sensitivities were derived from the PRE-ASCEND case-control study on average-risk American adults.[5]
- Unobserved cancer incidence rates were estimated for each combination of sex, age group, cancer type and stage using a backwards induction approach.[6,7]
- The model was calibrated to reproduce annual incidence rates of cancer diagnosis via usual care as captured in the Surveillance, Epidemiology, and End Results (SEER) database.
- We simulated the life course of 100,000 US adults aged 50–84 years. Cancer diagnosis could arise from usual care or MCED screening. The MCED test was administered at the beginning of each year to individuals aged <85 years.

MCED screening could be effective for reducing Stage IV cancer incidence.

Results

- Over the 50-year simulation horizon, the Stage IV incidence rate per 100,000 was 5,225 in the **Usual care only** arm and 3,954 in the **Usual care + MCED** arm (**Figure 1**).
- Overall, the supplemental use of MCED screening reduced Stage IV incidence by 1,271 (24%) per 100,000.

Figure 1. Total reduction in Stage IV incidence.
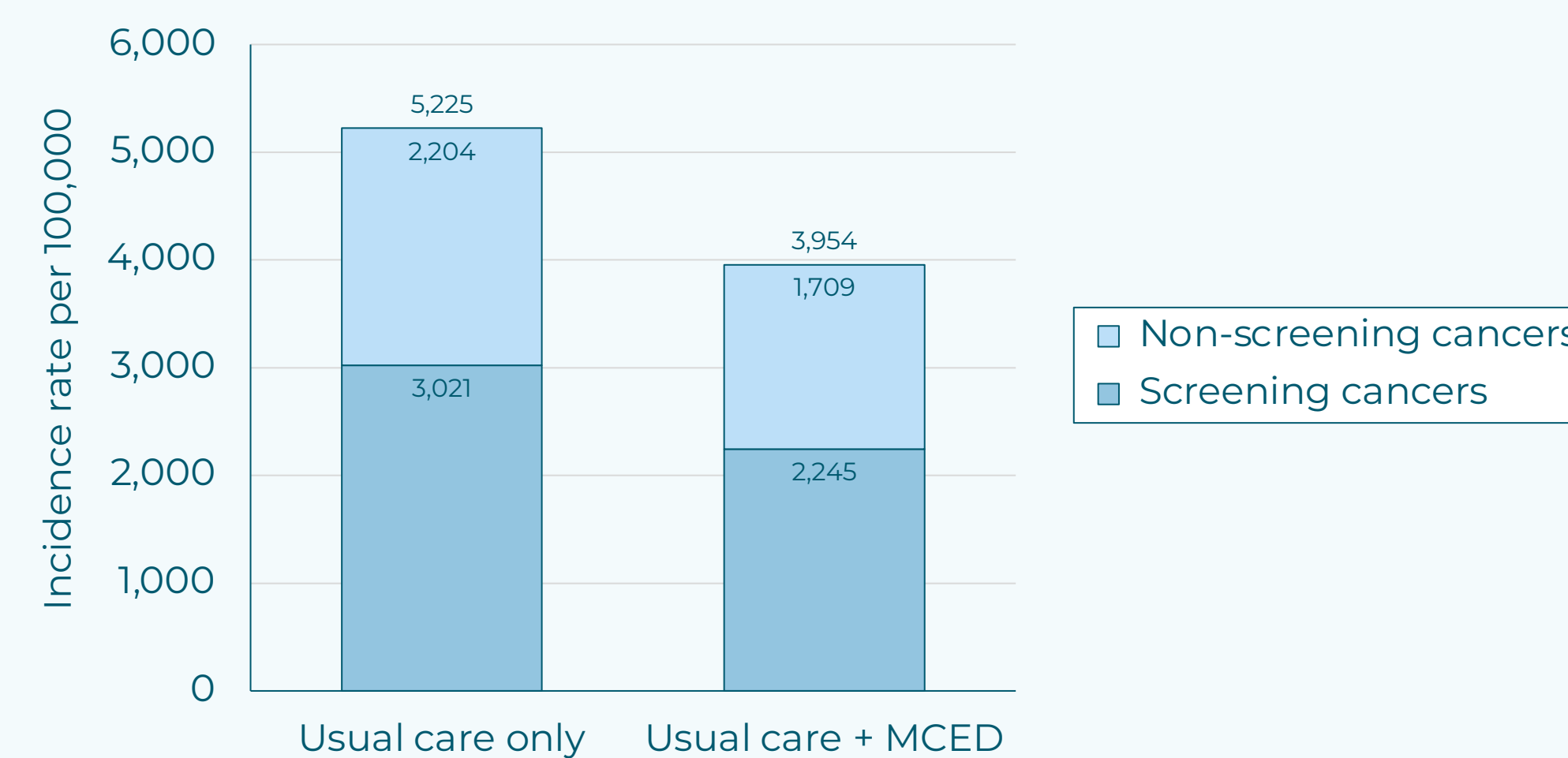
- **Figure 2** shows cancer-specific reductions in Stage IV incidence for 11 cancers listed in order of absolute reduction.
- Among the nine non-screening cancers, the reduction was 22%.
- Among the three screening cancers, the reduction was 26%.

Figure 2. Cancer-specific reductions in Stage IV incidence.
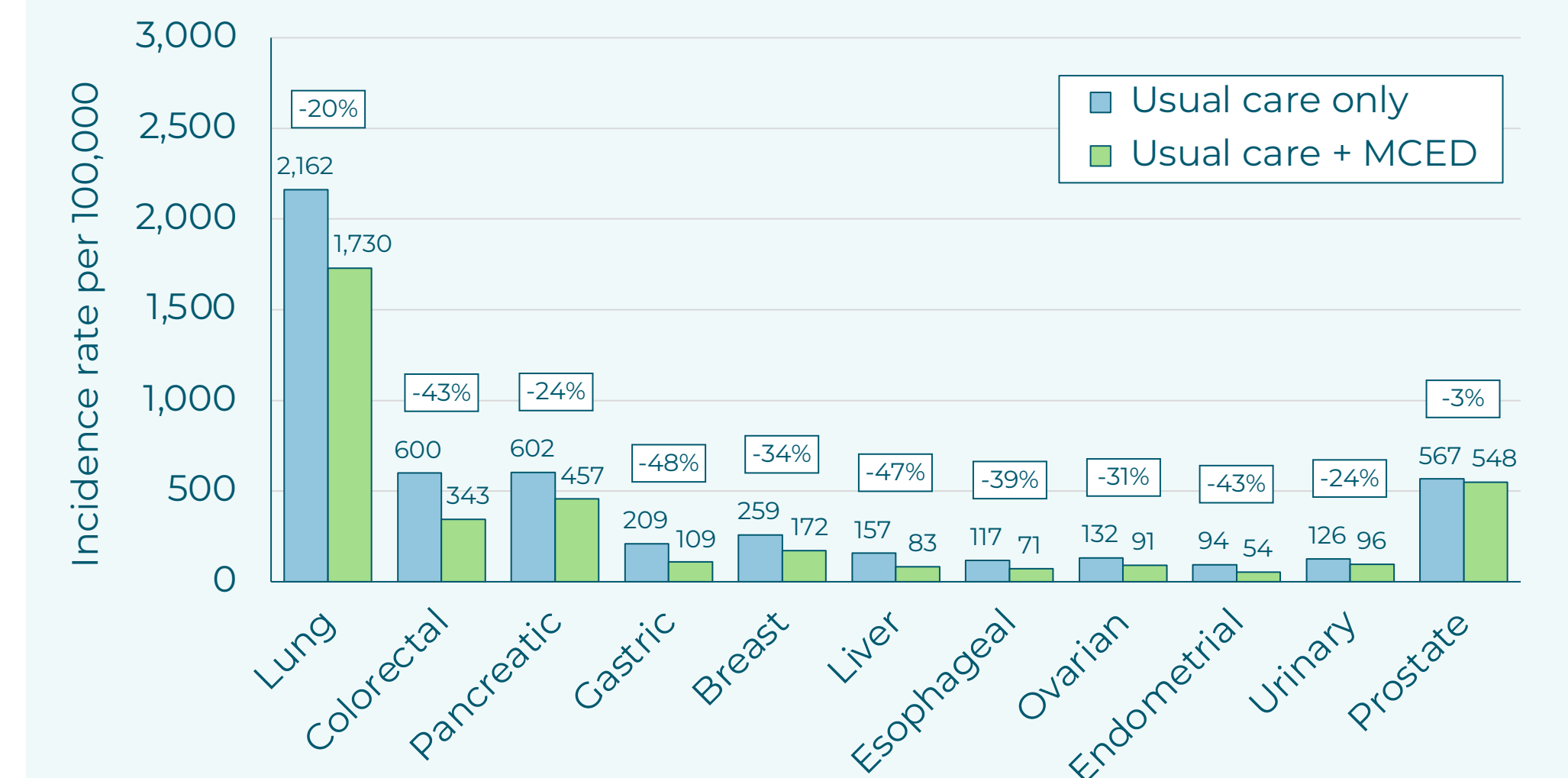
Footnote: The MCED test sensitivity for kidney cancer was zero, hence there was no reduction in Stage IV incidence.

Conclusions

- Our modeling study suggests that the supplemental use of MCED screening could reduce Stage IV incidence for 12 cancers by 24% over 50 years.
- Stage IV incidence reduction was most pronounced (in terms of absolute reduction) for lung, colorectal, and pancreatic cancers.
- The real-world impact and cost-effectiveness of MCED tests require further investigation.

References

1. Crosby D et al. (2022). Early detection of cancer. *Science*. 375(6586):eaay9040.
2. Centers for Disease Control and Prevention. Screening Tests. https://www.cdc.gov/cancer/dcpc/prevention/screening.htm
3. Siegel RL et al. (2023). Cancer statistics, 2023. *CA Cancer J Clin*. 73(1):17-48.
4. National Cancer Institute, DCCPS, Surveillance Research Program. Surveillance, Epidemiology, and End Results (SEER) Program. https://seer.cancer.gov/index.html
5. Douville C et al. (2022). 73P Multi-cancer early detection through evaluation of aneuploidy, methylation, and protein biomarkers in plasma. *Ann Oncol*. 33:S575.
6. ElHabr A et al. (2023). EPH232 The Large Hidden Prevalence Rate of Cancer Using Backward Induction Method Reveals Screening Opportunity in Earlier Stages. *Value Health*. 26:S205.
7. Chhatwal J et al. (2023). Correlation of unobserved incidence of cancer in earlier stages with the observed incidence. *J Clin Oncol*. 41(16_suppl):10634-10634.