

Assessment of Value-based Price (VBP) for a Multi-cancer Early Detection (MCED) Test in a Medicare Population

ISPOR 2022
May 15-18, 2022
Washington, DC, USA

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INTRODUCTION

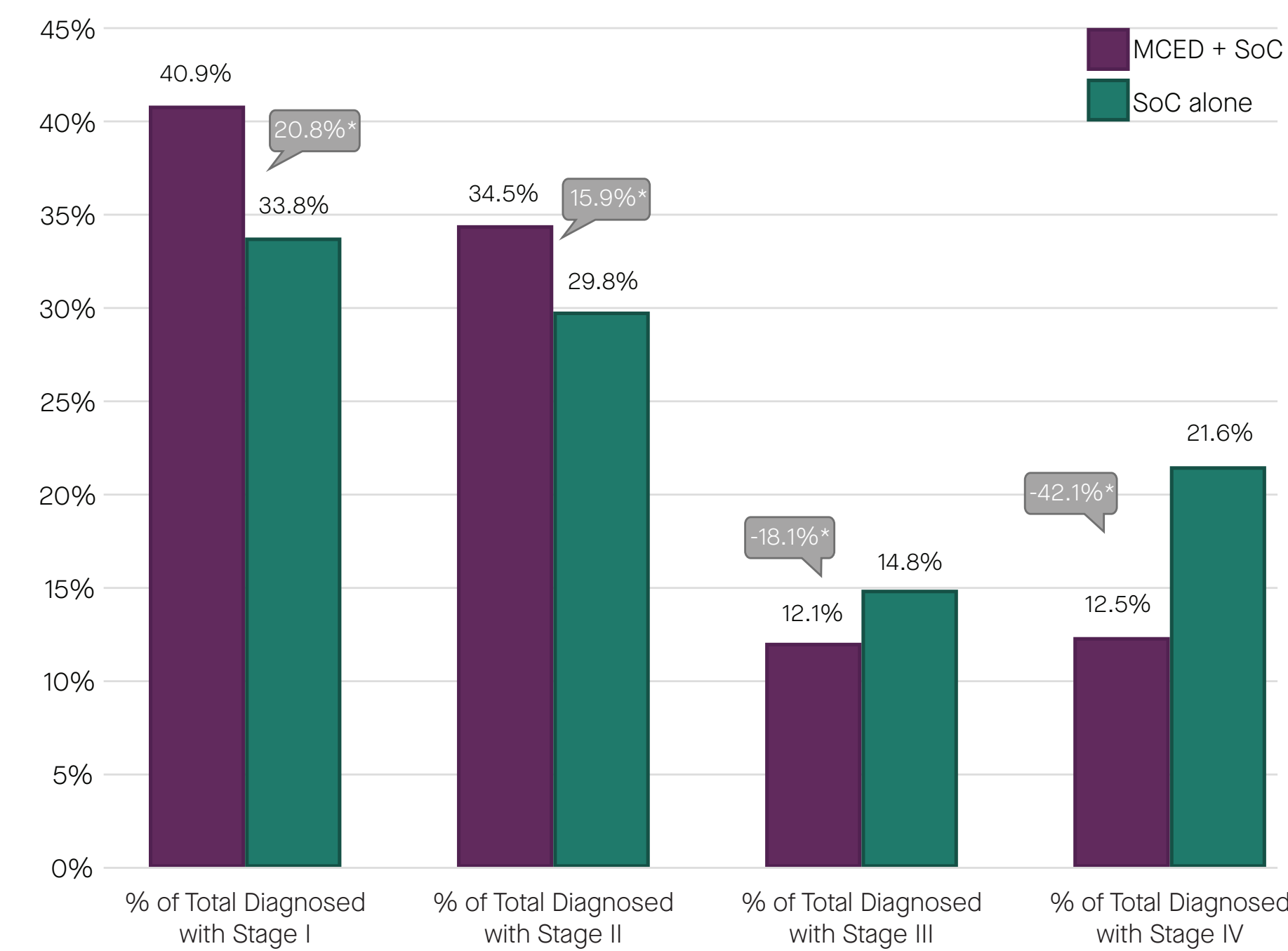
- The risk of getting cancer increases—and cancer-specific survival decreases—with age. Approximately 80% of people diagnosed in the United States (US) are older than 55 years, while 57% are older than 65.¹
- As the US population ages, cancer-related costs are expected to increase by 34% between 2015 and 2030, based on population growth and aging alone.¹
- The use of cancer screening programs, which can target older populations, can provide timely detection of cancer, reduce mortality, and improve treatment outcomes.²⁻⁴ New blood-based, multi-cancer early detection (MCED) tests that can simultaneously screen for multiple types of cancer have recently been developed.⁵⁻⁸

OBJECTIVE

- This modeling study explored key drivers of the potential range of the value-based price (VBP) for MCED testing in a US Medicare population (aged 65+).

KEY RESULTS

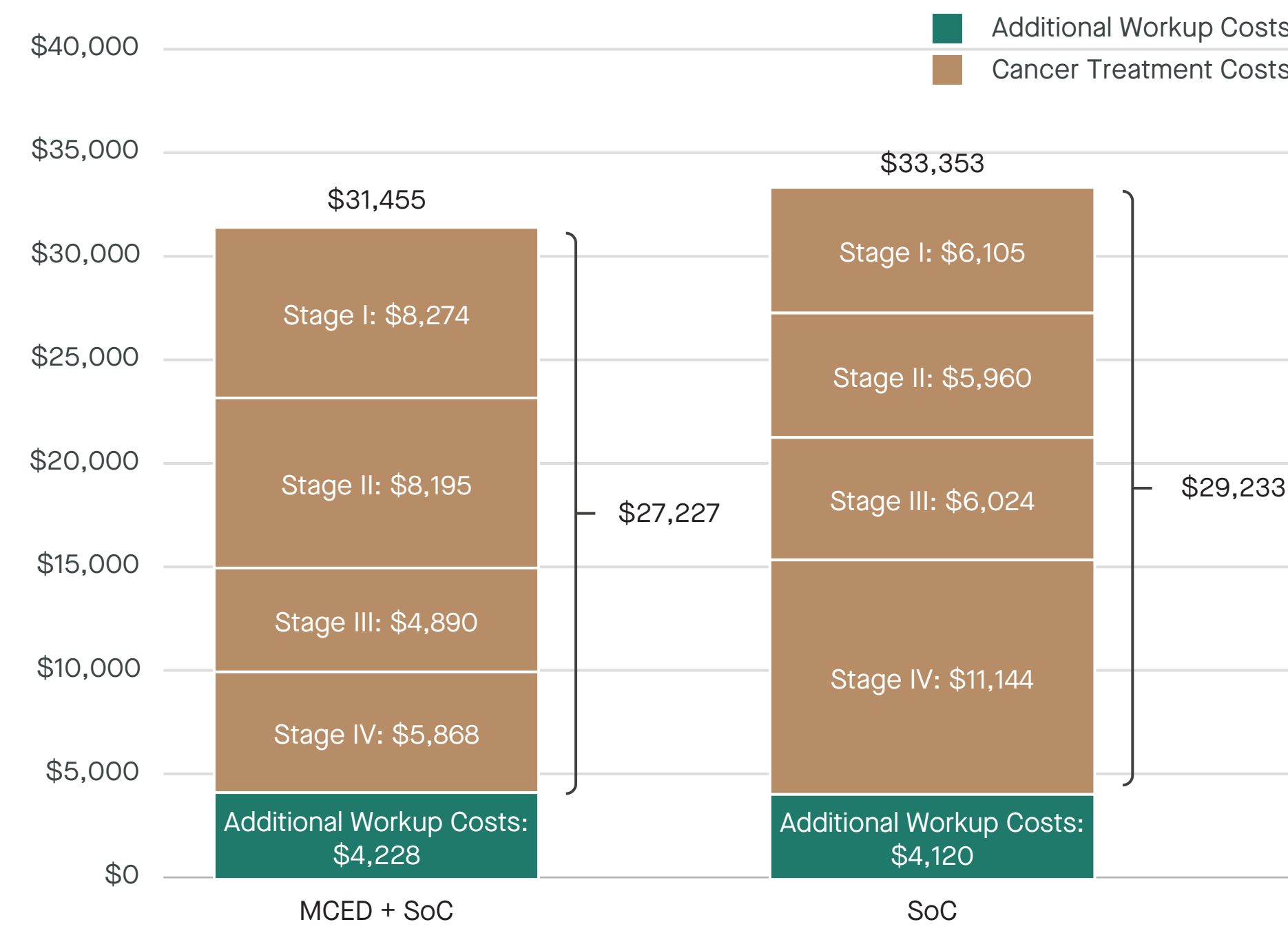
Figure 1. Percent of Total Cancers Diagnosed by Stage



*The relative change in total diagnosed by stage between MCED + SoC and SoC alone. Total number of cancers was 29,318 in the SoC arm and 29,575 in the MCED + SoC arm (including 258 additional diagnoses due to overdiagnosis).
Abbreviations: MCED = multi-cancer early detection; SoC = standard of care

- The proportion of cancers detected at stage IV decreased from 21.6% to 12.5% (Figure 1).
- Patients diagnosed with an MCED test in addition to standard of care (SoC) screening had on average \$2,006 less cancer-related treatment and diagnosis costs than SoC alone, excluding the cost of the MCED screening test or additional workup costs (Figure 2).

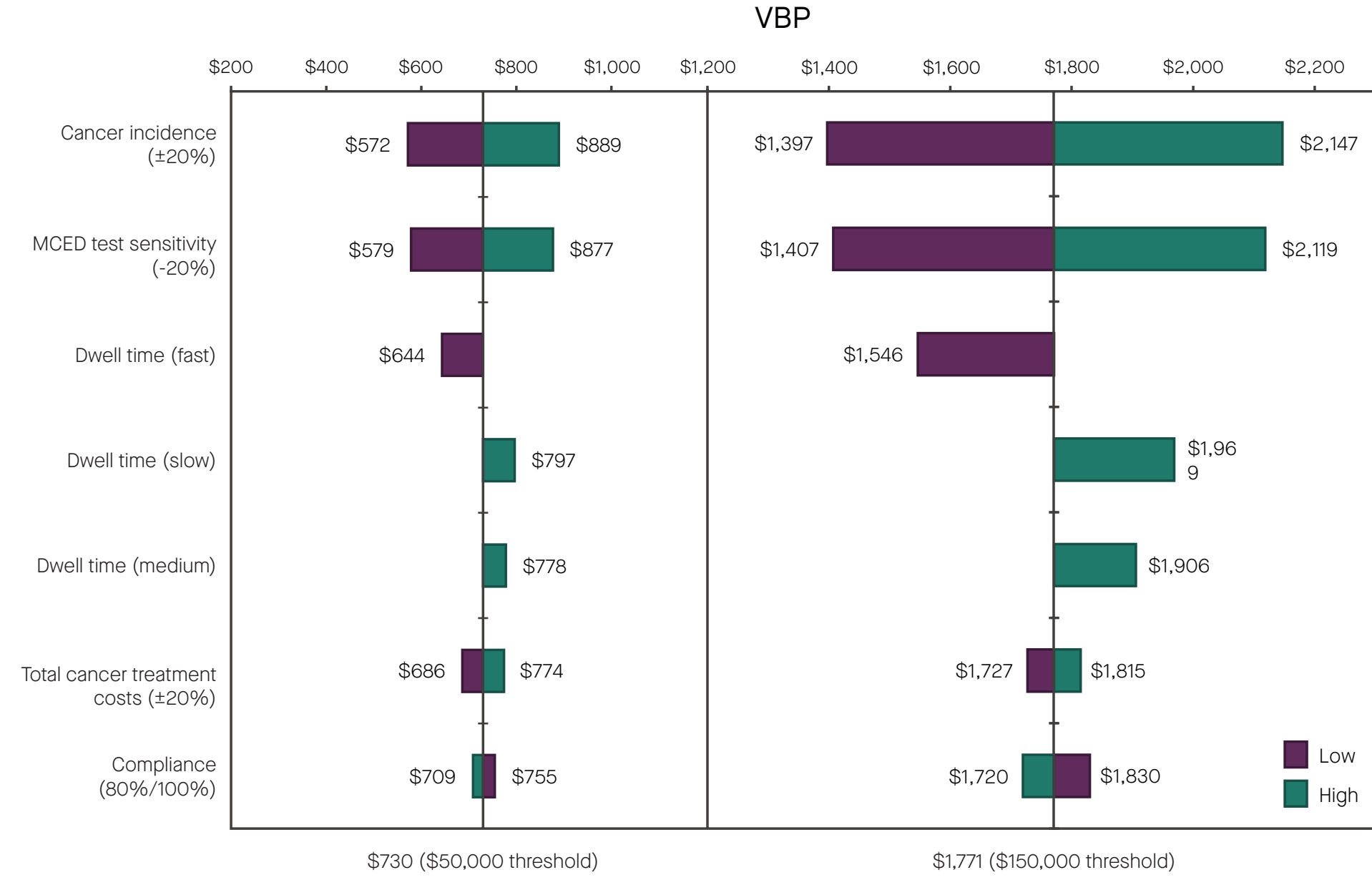
Figure 2. Treatment and Workup Costs per Patient



Note: Total cancer treatment costs were \$2,006 lower in the MCED + SoC arm vs. SoC alone. Screening costs (not shown) were \$9,310, \$18,833, and \$2,651 for the MCED + SoC arm at a \$50,000 threshold, the MCED + SoC arm at the \$150,000 threshold, and the SoC arm, respectively.
Abbreviations: MCED = multi-cancer early detection; SoC = standard of care

- Testing with MCED increased life years and quality-adjusted life years (QALY) by 0.10 and 0.10, respectively, for older individuals.
- Due to the consideration of overdiagnosis, 258 additional cancers were detected with MCED plus SoC vs. SoC alone, of which 87.0% were diagnosed in stages I and II.

Figure 3. Tornado Diagram Exploring Effects of Variations in Parameters on VBP



Note: Results of variations of the following parameters are not shown in the diagram due to minimal impact on VBP: disability for false-positive workups, disability due to cancer, and false-positive workup costs. Dwell time is cancer- and stage-specific and is defined as the time to progression between two subsequent stages of cancer.
Abbreviation: MCED = multi-cancer early detection; VBP = value-based price

- The VBP for an MCED test ranged from \$730/test to \$1,771/test, at willingness-to-pay (WTP) thresholds of \$50,000/QALY to \$150,000/QALY, respectively.
- Sensitivity analyses indicated that VBP in this population was sensitive to the number of clinically significant cancers detected, as indicated by the large impact of cancer incidence and test sensitivity at both thresholds (Figure 3).
- Changes in treatment cost and burden associated with false-positives had small impacts on VBP.

LIMITATIONS

- The model did not consider cancer recurrence or patients with multiple cancers; it did not account for the additional post-diagnosis risk of developing cancer later in life.

CONCLUSIONS

- As an aging population is expected to increase the overall cancer burden in the US, the addition of MCED testing to SoC in a Medicare population can improve survival and lower treatment costs as compared with SoC alone, potentially offsetting some of this burden.

References

- American Cancer Society. 2022. <https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/annual-cancer-facts-and-figures/2022/2022-cancer-facts-and-figures.pdf>.
- Duma N, et al. Mayo Clin Proc. 2019;94(8):1623-1640.
- Tsikouras P, et al. J Buon. 2016;21(2):320-325.
- Myerson RM, et al. J Policy Anal Manage. 2020;39(3):577-604.
- Chen M, Zhao H. Hum Genomics. 2019;13(1):34.
- Liu MC, et al. Ann Oncol. 2020;31(6):745-759.
- Lennon AM, et al. Science. 2020;369(6499).
- Klein EA, et al. Ann Oncol. 2021;32(9):1167-1177.
- Hubbell E, et al. Cancer Epidemiol Biomarkers Prev. 2021;30(3):460-468.
- SEER. 2019. <https://seer.cancer.gov/data-software/documentation/seerstat/nov2019/>.
- SEER. 2021. <https://seer.cancer.gov/seerstat/>.
- Arias E, et al. 2017;66.
- Medicare Payment Advisory Commission. 2020. http://medpac.gov/docs/default-source/reports/mar20_entirereport_sec.pdf.
- Reddy SR, et al. Current Medical Research and Opinion. 2022;1-25.

Disclosures

Study funded by GRAIL, LLC, a subsidiary of Illumina, Inc.

Acknowledgements

The authors would like to acknowledge Evidera's production staff for figure generation and editorial services.

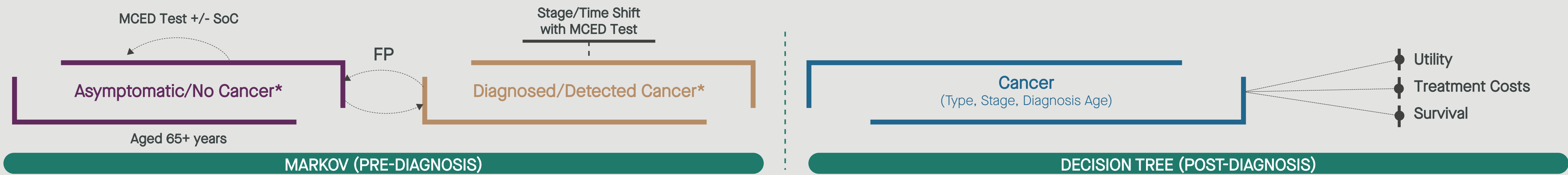


METHODS

Model Overview and Structure

- A Markov model was developed to compare annual screening with MCED plus SoC to screening with SoC alone in a cohort of asymptomatic adults ages 65 to 79, assuming 90% compliance.
- Patient survival, cost, and quality-of-life (QoL) measures were calculated pre- and post-diagnosis over a lifetime horizon, capped at 100 years. A 3% annual discount was applied to all costs and outcomes.
- The model explicitly tracked initial cancer diagnoses for 19 solid cancer groupings (Table 1), representing more than 40 cancer types according to the American Joint Committee on Cancer.

Figure 4. Model Diagram

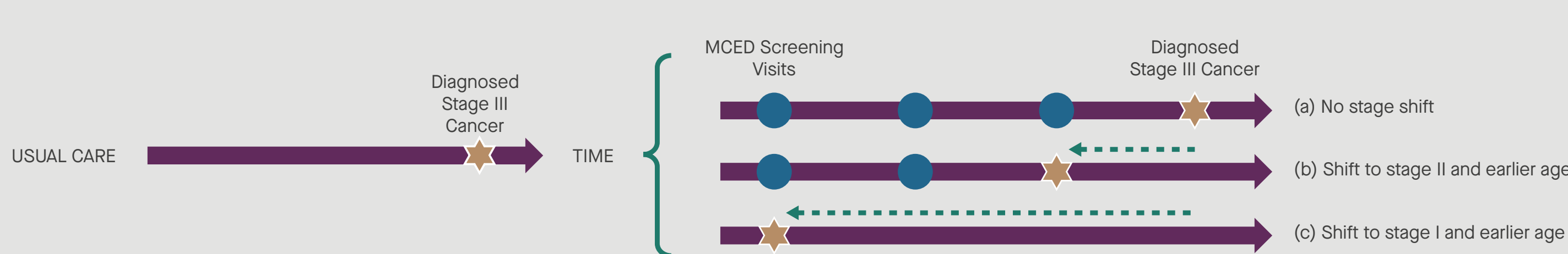


*False-positive patients (in asymptomatic/no cancer group) and those misdiagnosed due to wrong tumor of origin (in detected cancer group) accrued additional workup costs and disutilities before being accurately assigned to having cancer or not.
Abbreviations: FP = false-positive; MCED = multi-cancer early detection; SoC = standard of care

Model Inputs

- Incidence by age and stage at detection for the general population was informed by Surveillance Epidemiology and End Results (SEER) data.^{10,11}
- As reported in Klein et al. 2021, MCED test sensitivity (Table 1) differs by cancer and stage, while specificity is 99.5% across cancers.⁸
- Pre-diagnosis survival was based on baseline background mortality (derived from US life tables from the National Vital Statistics Report)¹² for the general population.
- Post-diagnosis mean survival was based on SEER and was assigned based on stage and age at clinical diagnosis and cancer type, considering stage shift if diagnosed with MCED.^{10,11}

Figure 5. Example of Stage and Time Shifting of Diagnosed Cancers due to MCED Test



Note: The distribution of stage shift is cancer-specific and not age-dependent. Patients are shifted to an earlier age, which is based on cancer dwell time by stage.⁹
Abbreviation: MCED = multi-cancer early detection

Table 1. MCED Test Sensitivity

Cancer	Stage I	Stage II	Stage III	Stage IV
Anus	25%	75%	100%	100%
Bladder	18%	18%	75%	100%
Breast: hormone receptor-negative	3%	48%	85%	91%
Breast: hormone receptor-positive	3%	48%	85%	91%
Cervix	58%	100%	100%	100%
Colon and rectum	43%	85%	88%	95%
Esophagus	13%	65%	94%	100%
Head and neck	63%	82%	84%	96%
Kidney and renal pelvis	5%	19%	19%	55%
Liver and intrahepatic bile duct	81%	81%	100%	100%
Lung and bronchus	22%	80%	91%	95%
Lymphoma	27%	58%	66%	66%
Other	0%	0%	0%	0%
Ovarian	50%	80%	87%	95%
Pancreas	61%	61%	86%	96%
Prostate	3%	5%	14%	83%
Stomach	17%	50%	80%	100%
Urothelial	0%	0%	0%	100%
Uterus	17%	30%	74%	100%

Source: Klein et al. 2021⁸