Potential for Earlier Cancer Diagnosis to Reduce Cancer Deaths: Differences By Sex and Race/Ethnicity

Clarke CA[1], Kurian A[2], Hubbell E[1], Gomez S[3]

1. GRAIL, Inc., Menlo Park, CA, USA, 2. Stanford University, Stanford, CA, USA, 3. University of California, San Francisco, San Francisco, CA, USA

INTRODUCTION

- According to the most recent ACS statistics, 1,898,160 new cancer cases and 608,570 cancer deaths are projected to occur in 2021 in the United States, making it the second leading cause of

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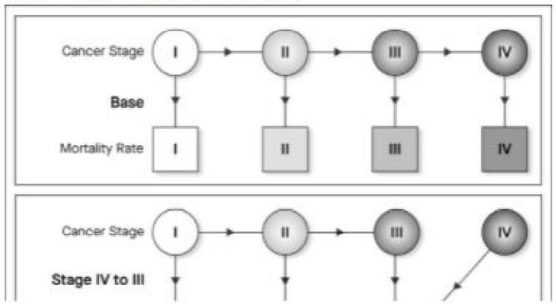
METHODS

Figure 1. Early Diagnosis Scenarios



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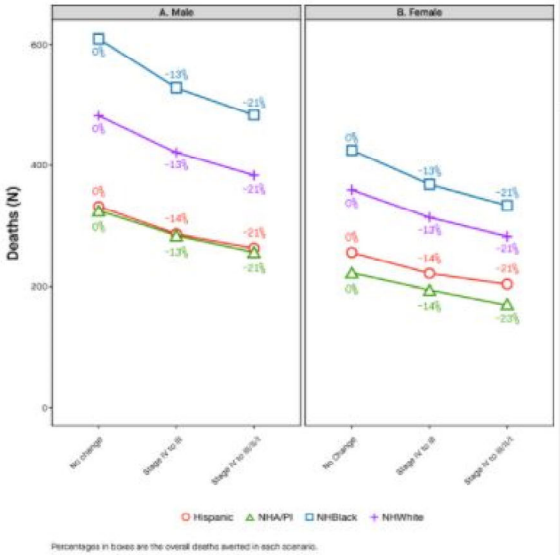
KEY RESULTS: Cancer Deaths Averted by Earlier Diagnosis

Total Deaths Averted

Figure 2. Overall Deaths Averted in Stage-Shift Scenarios by Race and Sex



- This model predicts that similar percentage reductions would

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CONCLUSIONS

- Overall proportion of deaths due to stage IV and all cancers are similar in both sexes for all racial/ethnic groups, but the absolute burden of disease, as measured by number of deaths, is much higher in Black patients.
- Death rates by cancer type show some race/ethnic-related differences; cancers with high mortality rates without

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RESULTS: SEER CANCER BURDEN DATA

Stage IV Cancer Burden by Cancer Type

Figure 4: Percentage[a] of Stage IV Cancer Deaths Due to Cancer Type by Race and Sex

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DISCLOSURES | ABSTRACT | REFERENCES | CONTACT AUTHOR

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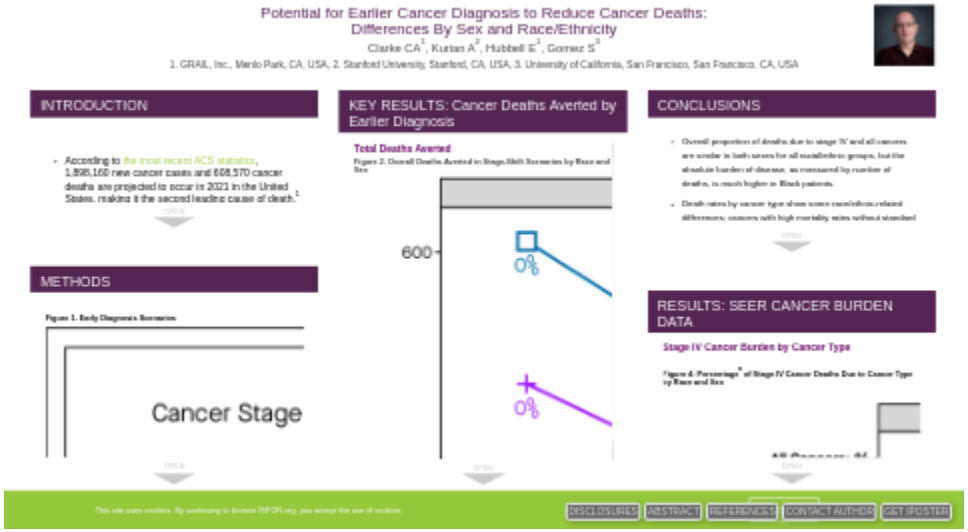

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INTRODUCTION

- According to the most recent ACS statistics (https://cancerstatisticscenter.cancer.org/?_ga=2.8163579.817312070.1617065785-2070647005.1615604508#!/), 1,898,160 new cancer cases and 608,570 cancer deaths are projected to occur in 2021 in the United States, making it the second leading cause of death.[1]

- Race, gender, and socioeconomic status (https://www.cancer.org/about-us/what-we-do/health-equity.html) have long been understood to greatly influence cancer mortality rates.[1-3]

- In particular, Black (non-Hispanic), male, and less socioeconomically advantaged populations have had disproportionately higher burdens of cancer compared to other groups. These groups historically have been underserved by current screening and diagnostic paradigms.

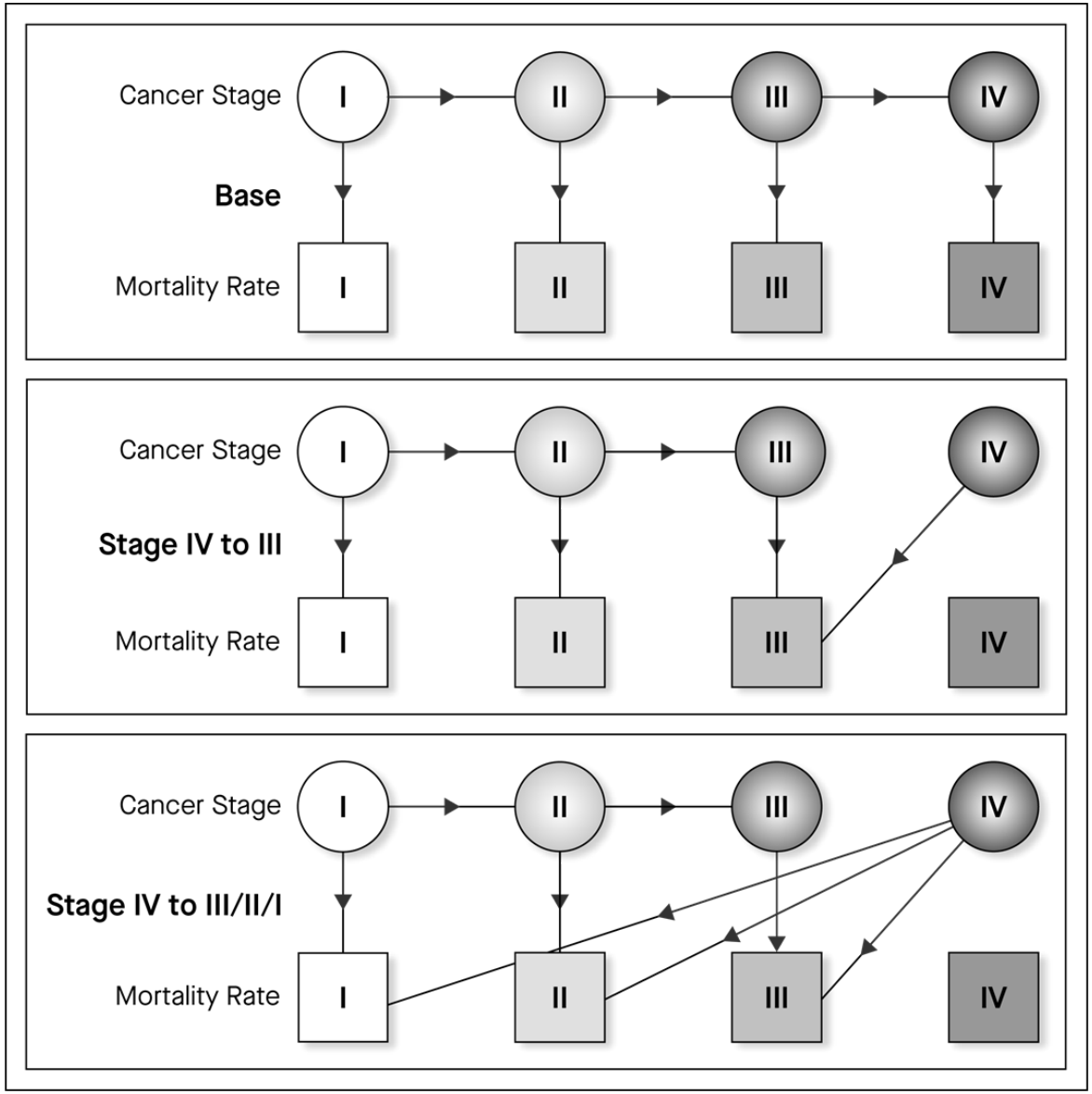
- A new type of test, known as multi-cancer early detection (MCED) tests, can screen for multiple forms of cancer simultaneously[4-6] and may address the critical unmet need for better early detection in the populations with high burdens of cancer through broader access.

- As risk of cancer-related death is lowered substantially when cancers are diagnosed before they metastasize, new strategies for detecting cancers early are central to reducing its burden.[1]

- At present, widespread population screening is recommended by the U.S. Preventive Services Task Force (USPSTF) for only three cancer types: breast,[7] cervical,[8] and colorectal,[9] although lung cancer screening is also recommended for patients with heavy smoking history.[10] Altogether, these recommended screening programs have reduced deaths due to the cancer types targeted, but can only maximally address about 20-25% of total cancer deaths, leaving 75-80% of cancer deaths unaddressed.

- The analyses in this poster quantify the potential impact on overall cancer mortality of reducing cancer diagnoses at metastatic stage across racial and ethnic groups for men and women.

Figure 1. Early Diagnosis Scenarios



- Cancer incidence and survival statistics for population subgroups defined by race/ethnicity and sex as available in the Surveillance, Epidemiology, and End Results Program (SEER) were assessed to quantify the potential impact of reducing detection at metastatic stage, using previously published methods.[11]

- We focused on patients aged 50-79 years at diagnosis; the upper limit to minimize non-cancer-related deaths and the lower limit to overlap with existing cancer screening recommendations.

- The eight population subgroups assessed included males and females of non-Hispanic White, non-Hispanic Black, non-Hispanic Asian/Pacific Islander, and Hispanic (all races) origin.

- For each population, a hypothetical cohort of 100,000 persons based on SEER incidence and survival rates were created to estimate the potential reductions in mortality that could occur from detection of cancers before metastasis (ie, stage IV cancer).

- Cancer types included in this assessment reflect the ACS 2021[1] cancers with high burden, specifically: prostate, breast, lung/bronchus, colorectal, urinary bladder, uterine corpus, melanoma of the skin, renal pelvis/kidney, non-Hodgkin lymphoma, pancreas, esophagus, liver/intrahepatic bile duct, oral cavity/pharynx (head and neck), thyroid, ovary, leukemia, and brain/other nervous system, in addition to myeloma, stomach, and cervical cancer, which are among the leading cancer types for African-Americans (https://www.cancer.org/research/cancer-facts-statistics/cancer-facts-figures-for-african-americans.html) and Hispanics/Latinos (https://www.cancer.org/research/cancer-facts-statistics/hispanics-latinos-facts-figures.html).[12,13]

- Crude incidence rates were used to estimate numbers of type- and stage-specific cancers that would arise within 1 year; type- and stage-specific rates were multiplied by the corresponding type- and stage-specific 5-year cumulative probabilities of cancer-related death (ie, one minus the cancer-specific survival rate). All such calculations included five categories of stage (I, II, III, IV, and unknown/unstaged).

- Estimates of “all cancers” number of deaths were case-mix adjusted; ie, based on summing the stage-specific deaths for each cancer-type category shown, including the “other” category, which consists of a heterogeneous mix of cancer types.

- Other includes: Small Intestine, Anus, Anal Canal and Anorectum, Intrahepatic Bile Duct, Gallbladder, Other Biliary, Retroperitoneum, Peritoneum, Omentum and Mesentery, Other Digestive Organs, Nose, Nasal Cavity and Middle Ear, Larynx, Pleura, Trachea, Mediastinum and Other Respiratory Organs, Bones and Joints, Soft Tissue including Heart, Other Non-Epithelial Skin, Vagina, Vulva, Other Female Genital Organs, Testis, Penis, Other Male Genital Organs, Ureter, Other Urinary Organs, Eye and Orbit, Brain, Cranial Nerves Other Nervous System, Other Endocrine including Thymus, Hodgkin - Nodal, Hodgkin - Extranodal, Acute Lymphocytic Leukemia, Chronic Lymphocytic Leukemia, Other Lymphocytic Leukemia, Acute Myeloid Leukemia, Acute Monocytic Leukemia, Chronic Myeloid Leukemia, Other Myeloid/Monocytic Leukemia, Other Acute Leukemia, Aleukemic, Subleukemic and NOS, Mesothelioma, Kaposi Sarcoma, Miscellaneous.

- Two scenarios were modeled in which cancers that would be diagnosed after metastasis (stage IV) instead had mortality outcomes improved to that reported for an earlier stage. To compute the overall number of deaths expected under each scenario, stage-specific deaths were estimated for each cancer type (including “other”) and summed. In the base case, no additional cancers are detected prior to metastases (Figure 1, Panel A).

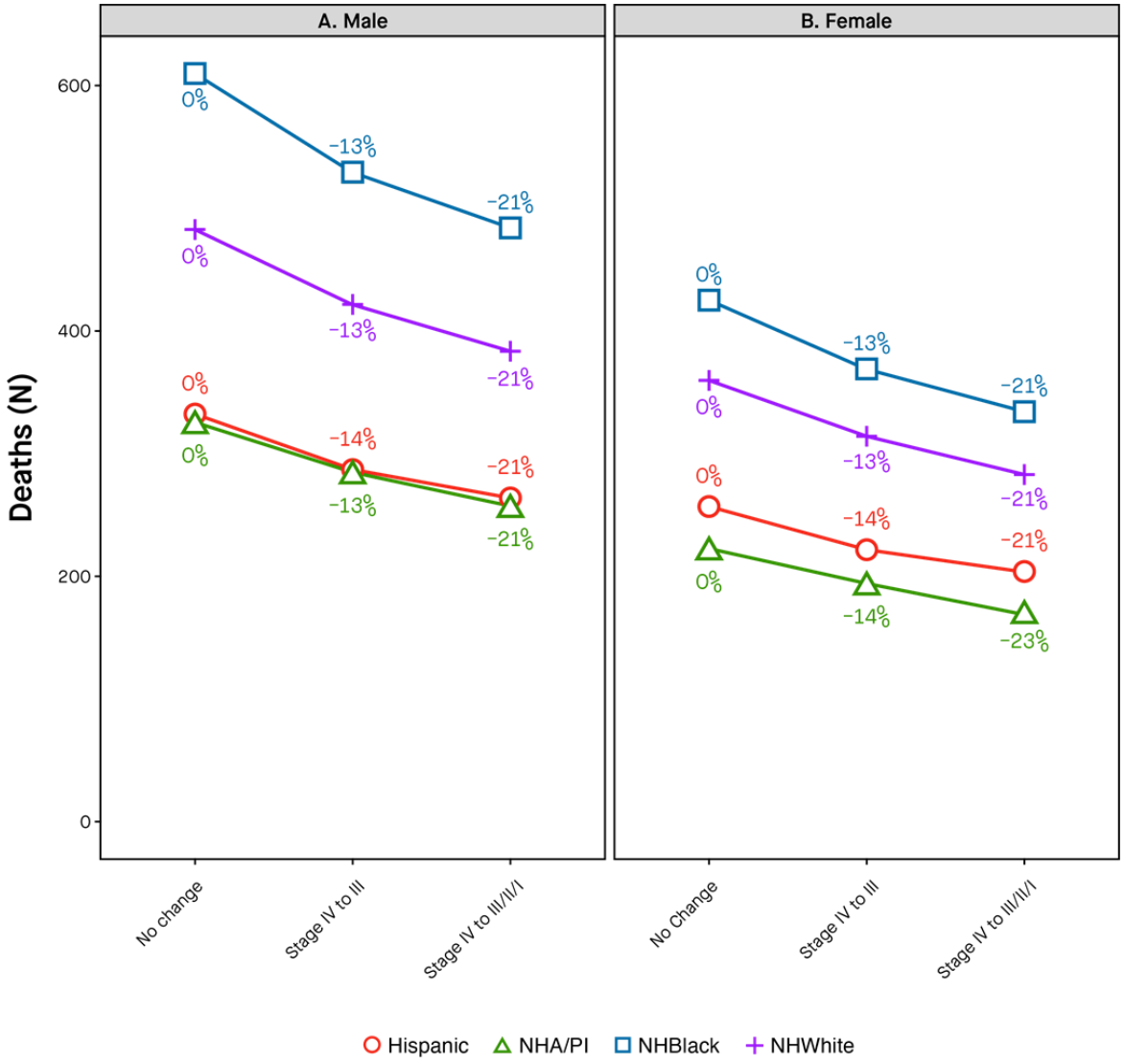
- The stage IV to III scenario mimics the effect of detecting stage IV cancer at stage III; ie, all persons diagnosed with cancer at stage IV were assigned outcomes for stage III cancer (Figure 1, Panel B).

- The stage IV to III/II/I scenario mimics the effect of intercepting a portion of stage IV cancers at each earlier stage; ie, one third of people diagnosed with cancer at stage IV were assigned outcomes for stage III, one third for stage II, and one third for stage I cancer (Figure 1, Panel C).

KEY RESULTS: CANCER DEATHS AVERTED BY EARLIER DIAGNOSIS

Total Deaths Averted

Figure 2. Overall Deaths Averted in Stage-Shift Scenarios by Race and Sex



Percentages in boxes are the overall deaths averted in each scenario.

- This model predicts that similar percentage reductions would be seen across all races and both sexes by replacing metastatic outcomes with those of earlier stages, ~13% with Stage IV to III and ~21% with Stage IV to III/II/I (Figure 2).

- The number of deaths is highest in Blacks in both males and females with current diagnostic protocols, and therefore Blacks would also have the greatest number of deaths averted by shifting detection from stage IV to an earlier stage (Figure 2, Table 1).

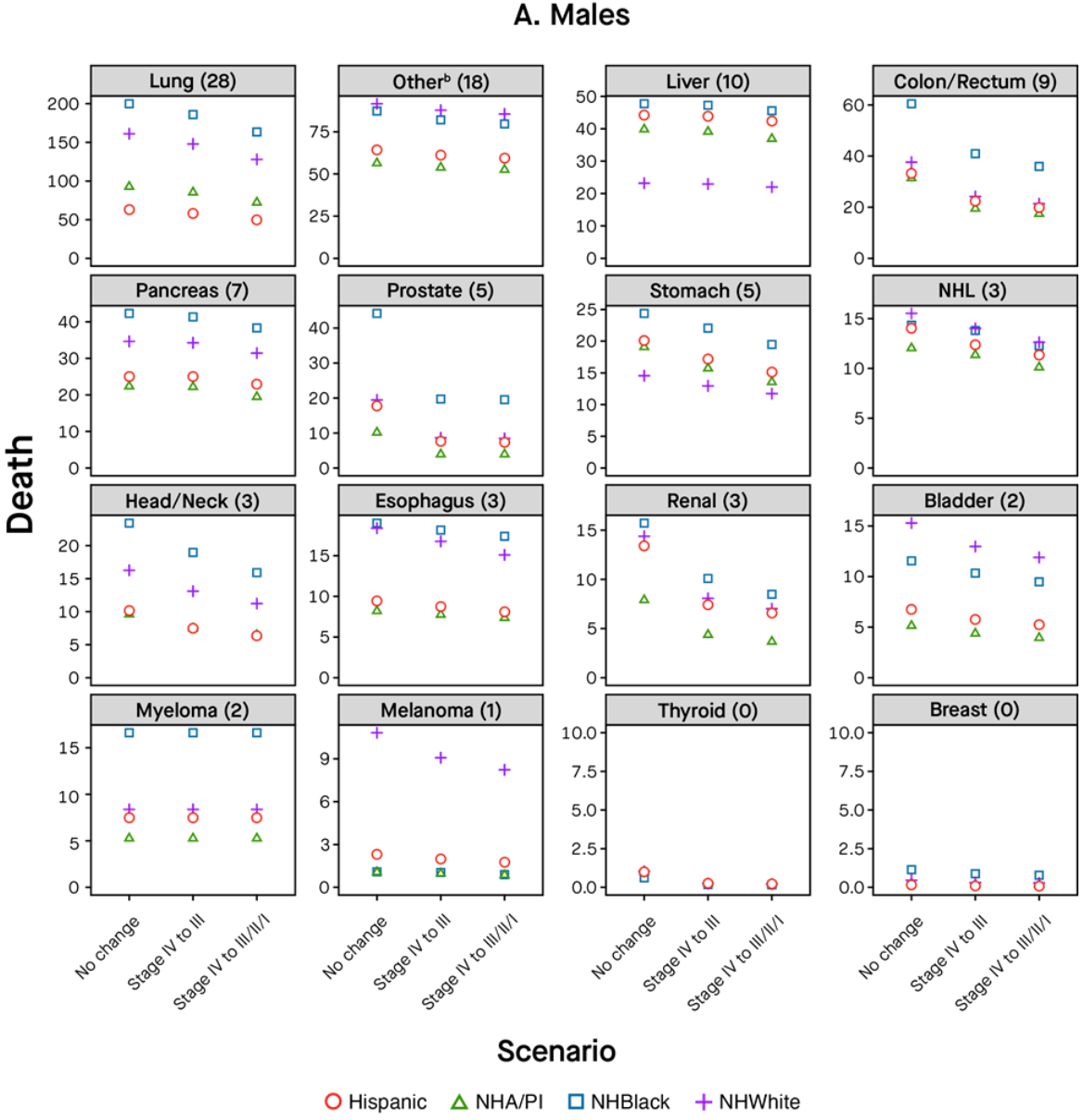
Table 1. Absolute Number of Deaths Averted by Earlier Diagnosis Scenarios (N)

	Deaths Averted Per Scenario[a]	
	Stage IV to III	Stage IV to III/II/I
Males		
Black, non-Hispanic	80	126
White, non-Hispanic	61	99
Hispanic, all races	45	68
Asian/Pacific Islander, non-Hispanic	41	68
Females		
Black, non-Hispanic	56	91
White, non-Hispanic	46	77
Hispanic, all races	35	53
Asian/Pacific Islander, non-Hispanic	32	52

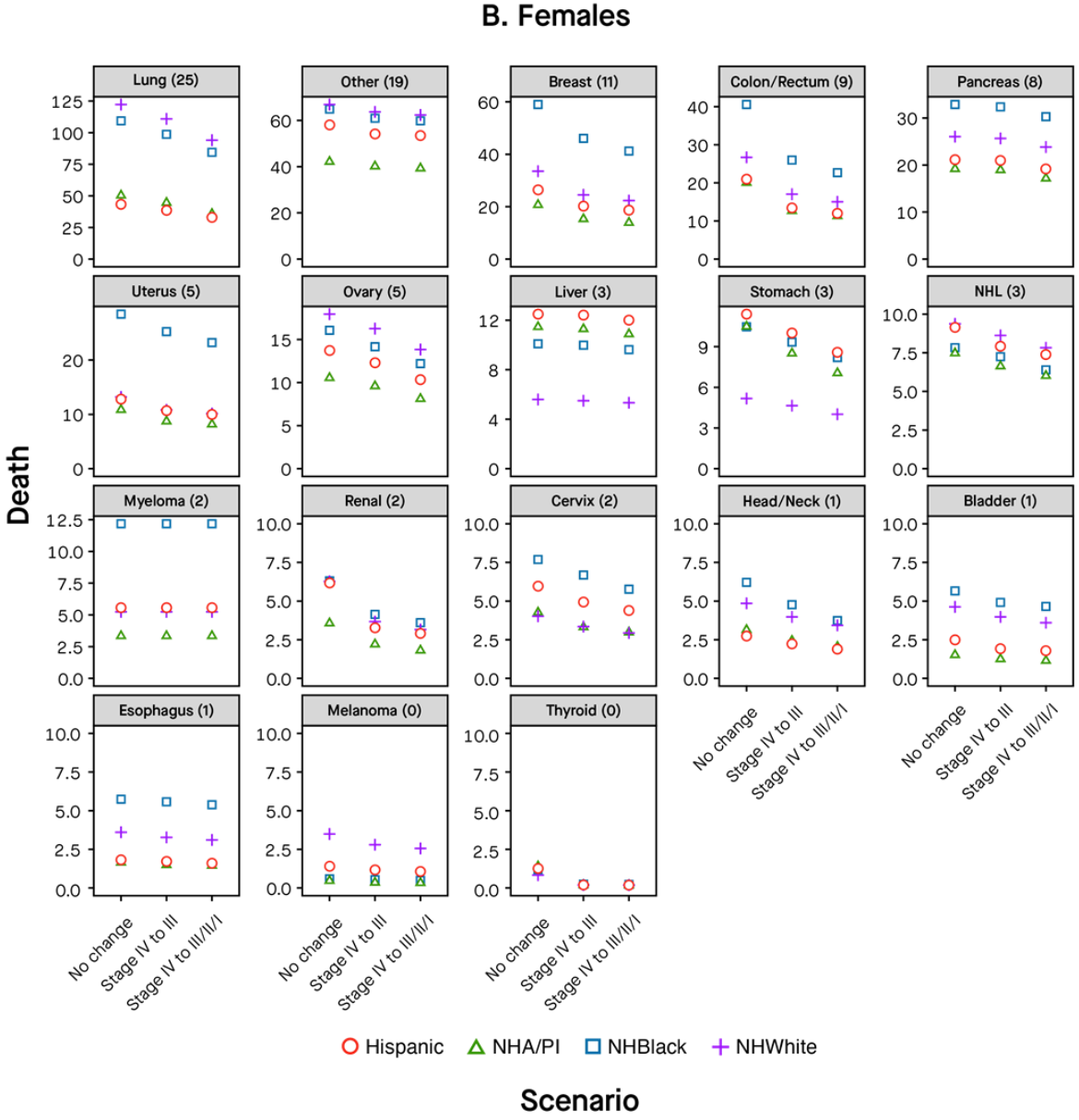
[a]*Number of deaths averted per 100,000 people per group.*

Deaths Averted by Cancer Type

Figure 3. Deaths Averted in Different Scenarios by Cancer Type, Race, and Sex



[a]Unweighted averages for all races; listed in descending order of occurrence.
[b]"Other" includes cancers detailed in Methods.



- As shown in **Figure 3**, lung, colorectal, pancreas, prostate, stomach, head and neck, myeloma are markedly higher in Black men versus other races.

- Earlier diagnosis has a larger impact on lives saved among patients with colorectal, prostate, head and neck, and renal cancer.

- Breast, colorectal, pancreas, uterus, myeloma, bladder and esophagus were higher in Black women (**Figure 3**).

CONCLUSIONS

- Overall proportion of deaths due to stage IV and all cancers are similar in both sexes for all racial/ethnic groups, but the absolute burden of disease, as measured by number of deaths, is much higher in Black patients.

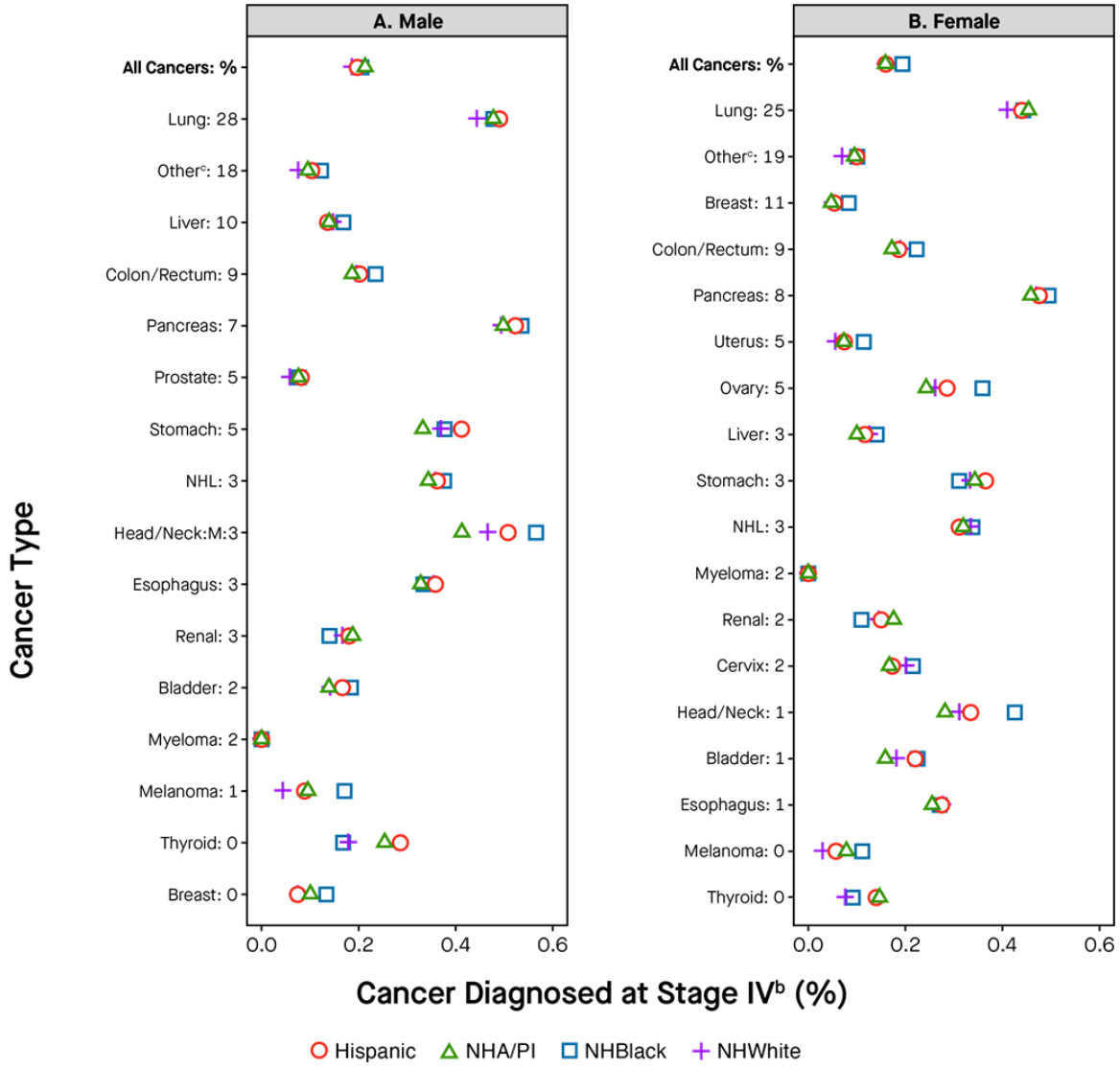
- Death rates by cancer type show some race/ethnic-related differences; cancers with high mortality rates without standard screening measures are higher in minority populations and some cancers with screening options have lower mortality rates in non-minority populations.

- Therefore the number of lives that could be saved by earlier cancer detection is highest among Black patients, a traditionally underserved population, particularly with a test that can detect multiple cancers for which there are no current screening options available.

RESULTS: SEER CANCER BURDEN DATA

Stage IV Cancer Burden by Cancer Type

Figure 4: Percentage[a] of Stage IV Cancer Deaths Due to Cancer Type by Race and Sex



[a]Unweighted averages for all races; listed in descending order of occurrence.
[b]Broader spread on x-axis indicates greater difference between races in percentage of cancer diagnosed at stage IV.
[c]"Other" includes cancers detailed in Methods.

- Analysis of the SEER database show similar overall stage IV cancer rates by race/ethnicity and sex, but individual cancer types show some differentiation between groups (Figure 4).

- Lung cancer is the highest percentage of stage IV cancer in both males (29%; Figure 4A) and females (26%; Figure 4B).

- Additional cancers >5% of total stage IV diagnoses in both males and females are “other”, colorectal, and pancreas (Figure 4).

- Gender differences in common cancers include liver cancer, which is 10% of stage IV cancers in males versus 3% for females and higher rates of breast cancer in females (11%; Figure 4B) versus <1% for males (Figure 4A).

- Racial/ethnic differences are particularly evident in the higher rates of head and neck cancer and melanoma diagnosed at stage IV in Black males (Figure 4A) and head and neck and ovarian cancer in Black females (Figure 4B).

All Cancer Incidence and Mortality Rates

- ~80% of patients diagnosed with stage IV cancer will die within 5 years; this rate is similar across all race/sex groups.

- Stage IV cancer accounts for ~20% of all cancer, but ~40% of all deaths due to cancer; which is similar across all race/sex groups.

- In both sexes, Blacks have the highest and Asians the lowest cancer incidence.

- The absolute burden of death due to stage IV cancer is highest in Black males, followed by non-Hispanic White males, and Black females.

Table 2. SEER Data: Incidence and Mortality of Stage IV and All Stage Cancer By Race and Sex

	Annual Incidence[a]			Cancer Death Within 5 Years				
				Stage IV		All Stages		Proportion due to Stage IV[d]
	Stage IV (N)	All Stage[b] (N)	Proportion Stage IV	Deaths (N)	Probability[c]	Deaths (N)	Probability[c]	
Male								
Black, non-Hispanic	337	1636	21%	276	82%	610	37%	45%
White, non-Hispanic	269	1435	19%	206	77%	483	34%	43%
Hispanic, all races	179	908	20%	136	76%	332	37%	41%
Asian/Pacific Islander, non-Hispanic	177	827	21%	138	78%	322	39%	43%
Female								
Black, non-Hispanic	203	1049	19%	175	86%	425	41%	41%
White, non-Hispanic	181	1134	16%	146	81%	360	32%	41%
Hispanic, all races	124	777	16%	97	78%	257	33%	38%
Asian/Pacific Islander, non-Hispanic	117	734	16%	91	78%	223	30%	41%

[a]Crude average annual rates per 100,000 people in each race/sex group.
[b]Includes unknown/unstaged cancers.
[c]Number of deaths within 5 years/annual incidence per 100,000 people in each race/sex group.
[d]Estimated from multiplying stage-specific incidence and 5-year probabilities of death.

DISCLOSURES

Christina Clarke: employed by GRAIL, Inc with equity

Earl Hubbell: employed by GRAIL, Inc with stock and options

A Kurian: received consulting fees from GRAIL, Inc

S Gomez: received consulting fees from GRAIL, Inc; Spouse holds stock in Amgen, and is employed by Valentia Analytical

ABSTRACT

OBJECTIVE: To examine absolute disparities in stage IV cancer and quantify potential benefits of detection before metastasis for US subpopulations defined by sex and race/ethnicity.

METHODS: Annual cancer incidence and five-year probabilities of cancer deaths were obtained from the Surveillance, Epidemiology and End Results (SEER) Program for persons aged 50-79 diagnosed with invasive cancer between 2006-2015 for eight subpopulations defined by sex and race/ethnicity (Hispanic, non-Hispanic: African-American, Asian/Pacific Islander, White). Hypothetical five-year deaths and percentage deaths averted were calculated under two scenarios: (1) death rates of stage IV cancers with assigned mortality rates associated with stage III detection, and (2) death rates assigned for stage IV as a mix of stage I, II, and III.

RESULTS: The proportion of all cancer that was metastatic was generally similar in all subpopulations (16-21%). Case-mix adjusted probability of death within five years was ~79% with stage IV and ~35% with any stage diagnosis, though absolute numbers of deaths varied between groups. Among males, Asian/Pacific Islanders had the lowest (177) and African-Americans the highest (337) incidence of stage IV cancer per 100,000. Among females, Asian/Pacific Islanders had the lowest (117) and African-Americans the highest (203) incidence of stage IV cancer per 100,000. When hypothetical 5-year deaths were calculated using scenario 1, ~13% of all cancer deaths were averted across all groups; in African-Americans, this corresponded to 56 females and 80 males per 100,000. In scenario 2, ~21% of all deaths were averted, corresponding to 91 African-American females and 126 African-American males.

CONCLUSION: This model predicts that detection of cancer before metastasis could result in comparable relative reductions in mortality across the eight subpopulations, but that the absolute number of deaths averted would be highest among African-Americans, who have the highest incidence of stage IV cancer.

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