

# Cancer Disparity from Different Angles: How to Tackle It?



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City of Hope®

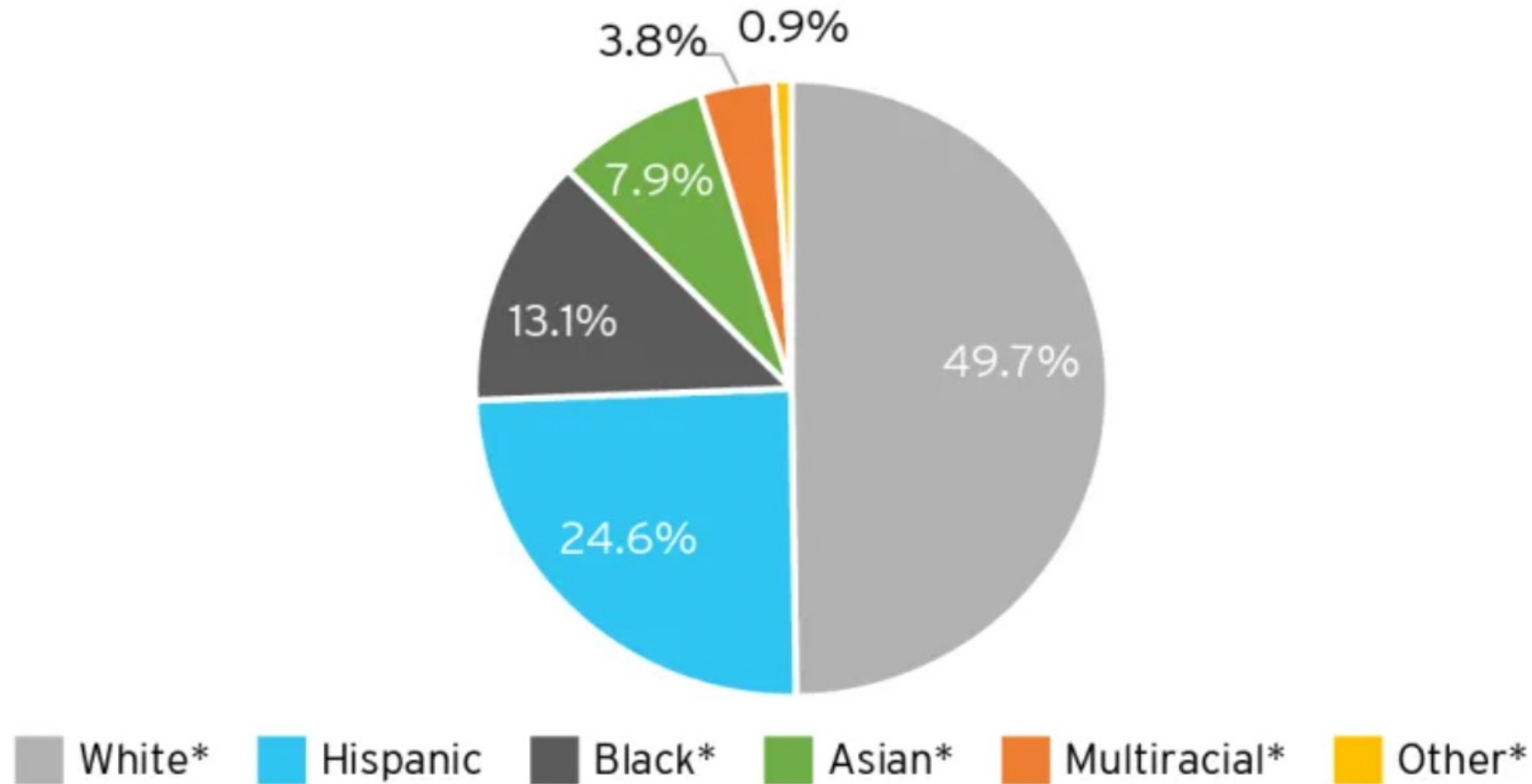
# Cancer Disparities and Cancer Health Equity

This presentation will focus mostly on cancer disparities among underrepresented racial/ethnic minorities and their related global diaspora, but we do not want to ignore the fact that there are other important diseases and also other medically underserved communities/populations.



# Cancer Disparities and Cancer Health Equity - Significance

Racial Profile of US Population, 2045



# Cancer Statistics and Cancer Disparities

**Table 5. Comparison of Cancer Incidence Rates between Non-Hispanic (NH) Blacks and Whites, US, 2008-2012**

Male					Female				
Cancer	NH Black Rate*	NH White Rate*	Absolute Difference†	Rate Ratio‡	Cancer	NH Black Rate*	NH White Rate*	Absolute Difference†	Rate Ratio‡
Kaposi sarcoma	1.7	0.5	1.2	3.57	Kaposi sarcoma	0.2	<0.1	0.1	3.96
Myeloma	14.8	7.0	7.8	2.11	Myeloma	11.1	4.3	6.8	2.58
Stomach	15.1	7.8	7.3	1.93	Stomach	8.0	3.5	4.5	2.30
Liver & intrahepatic bile duct	16.5	9.3	7.2	1.77	Liver & intrahepatic bile duct	4.8	3.2	1.6	1.52
Prostate	208.7	123.0	85.7	1.70	Uterine cervix	10.0	7.1	2.9	1.41
Larynx	9.3	6.3	3.0	1.48	Pancreas	14.4	10.6	3.8	1.36
Breast	2.0	1.4	0.6	1.45	Esophagus	2.5	1.8	0.7	1.34
Colon & rectum	60.3	47.4	12.9	1.27	Colon & rectum	44.1	36.2	7.9	1.22
Pancreas	17.2	14.0	3.2	1.23	Kidney & renal pelvis	13.0	11.3	1.7	1.15
Lung & bronchus	93.4	79.3	14.1	1.18	Breast	124.3	128.1	-3.8	0.97
Kidney & renal pelvis	24.2	21.8	2.4	1.11	Uterine corpus	23.0	25.5	-2.5	0.90
Hodgkin lymphoma	3.2	3.4	-0.2	0.95	Hodgkin lymphoma	2.4	2.7	-0.3	0.88
Esophagus	8.0	8.8	-0.8	0.90	Lung & bronchus	51.4	58.7	-7.3	0.87
Leukemia	13.2	17.7	-4.5	0.75	Leukemia	8.6	10.7	-2.1	0.80
Oral cavity & pharynx	15.3	18.1	-2.8	0.84	Oral cavity & pharynx	5.2	6.7	-1.5	0.78
Non-Hodgkin lymphoma	17.2	24.1	-6.9	0.71	Ovary	9.6	12.4	-2.8	0.77
Brain & other nervous system	4.9	8.8	-3.9	0.56	Non-Hodgkin lymphoma	12.0	16.6	-4.6	0.72
Urinary bladder	19.8	40.2	-20.4	0.49	Urinary bladder	6.7	9.9	-3.2	0.68
Thyroid	3.7	7.7	-4.0	0.48	Thyroid	12.9	21.9	-9.0	0.59
Testis	1.4	6.8	-5.4	0.21	Brain & other nervous system	3.6	6.3	-2.7	0.58
Melanoma of the skin	1.1	31.3	-30.2	0.04	Melanoma of the skin	1.0	20.6	-19.6	0.05
<b>All sites</b>	<b>592.3</b>	<b>528.9</b>	<b>63.4</b>	<b>1.12</b>	<b>All sites</b>	<b>408.1</b>	<b>436.2</b>	<b>-28.1</b>	<b>0.94</b>

Note: Sites listed in descending order by rate ratio. \*Rates are per 100,000 and age adjusted to the 2000 US standard population. †Absolute difference is the rate in blacks minus the rate in whites. ‡Rate ratio is the unrounded rate in blacks divided by the unrounded rate in whites.

Source: North American Association of Central Cancer Registries.<sup>183</sup>

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Stomach	9.4	3.6	5.8	2.58	Stomach	4.5	1.8	2.7	2.48
Prostate	47.2	19.9	27.3	2.38	Myeloma	5.4	2.4	3.0	2.22
Larynx	3.7	1.8	1.9	2.02	Uterine cervix	4.1	2.0	2.1	2.00
Myeloma	7.8	4.0	3.8	1.95	Uterine corpus	7.8	4.1	3.7	1.92
Liver & intrahepatic bile duct	12.8	7.6	5.2	1.69	Liver & intrahepatic bile duct	4.4	3.1	1.3	1.43
Colon & rectum	27.6	18.2	9.4	1.52	Breast	31.0	21.9	9.1	1.42
Oral cavity & pharynx	5.2	3.8	1.4	1.36	Colon & rectum	18.2	12.9	5.3	1.41
Lung & bronchus	74.9	62.2	12.7	1.20	Pancreas	12.6	9.5	3.1	1.32
Pancreas	15.4	12.7	2.7	1.21	Esophagus	2.0	1.6	0.4	1.28
Kidney & renal pelvis	5.7	5.9	-0.2	0.97	Urinary bladder	2.6	2.3	0.3	1.12
Hodgkin lymphoma	0.4	0.5	-0.1	0.94	Kidney & renal pelvis	2.6	2.6	0.0	1.02
Esophagus	7.1	8.0	-0.9	0.89	Lung & bronchus	36.7	41.1	-4.4	0.89
Leukemia	8.1	9.9	-1.8	0.82	Leukemia	4.8	5.4	-0.6	0.89
Non-Hodgkin lymphoma	5.9	8.3	-2.4	0.71	Hodgkin lymphoma	0.3	0.3	0.0	0.89
Urinary bladder	5.4	8.4	-3.0	0.65	Ovary	6.8	8.2	-1.4	0.83
Brain & other nervous system	3.2	6.0	-2.8	0.53	Non-Hodgkin lymphoma	3.6	5.0	-1.4	0.71
Melanoma of the skin	0.5	5.0	-4.5	0.09	Brain & other nervous system	2.2	3.9	-1.7	0.55
					Melanoma of the skin	0.4	2.1	-1.7	0.18
<b>All sites</b>	<b>267.7</b>	<b>210.6</b>	<b>57.1</b>	<b>1.27</b>	<b>All sites</b>	<b>170.4</b>	<b>149.2</b>	<b>21.2</b>	<b>1.14</b>

Note: Sites listed in descending order by rate ratio. \*Rates are per 100,000 and age adjusted to the 2000 US standard population. †Absolute difference is the rate in blacks minus the rate in whites. ‡Rate ratio is the unrounded rate in blacks divided by the unrounded rate in whites.

Source: National Center for Health Statistics, Centers for Disease Control and Prevention as provided by the SEER program in the SEER\*Stat database.<sup>186</sup>

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# Race and Ancestry Represent Different but Related Factors

Social/Societal

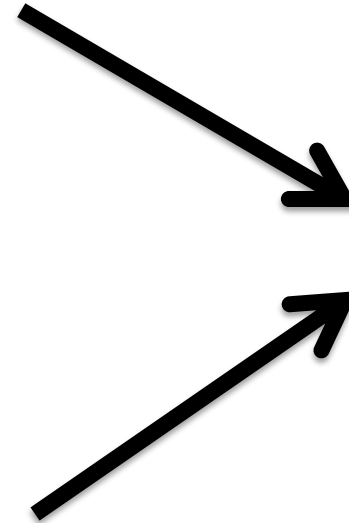
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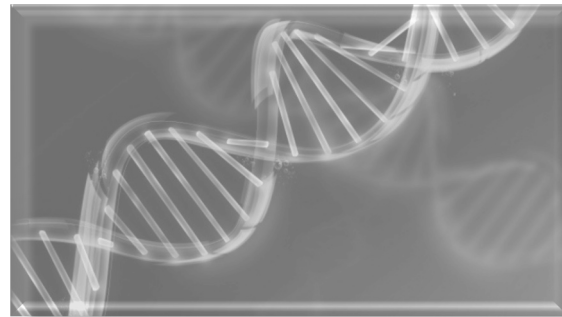
(SDOH)  
Race/Ethnicity  
(social)



Ancestry  
(genetic)



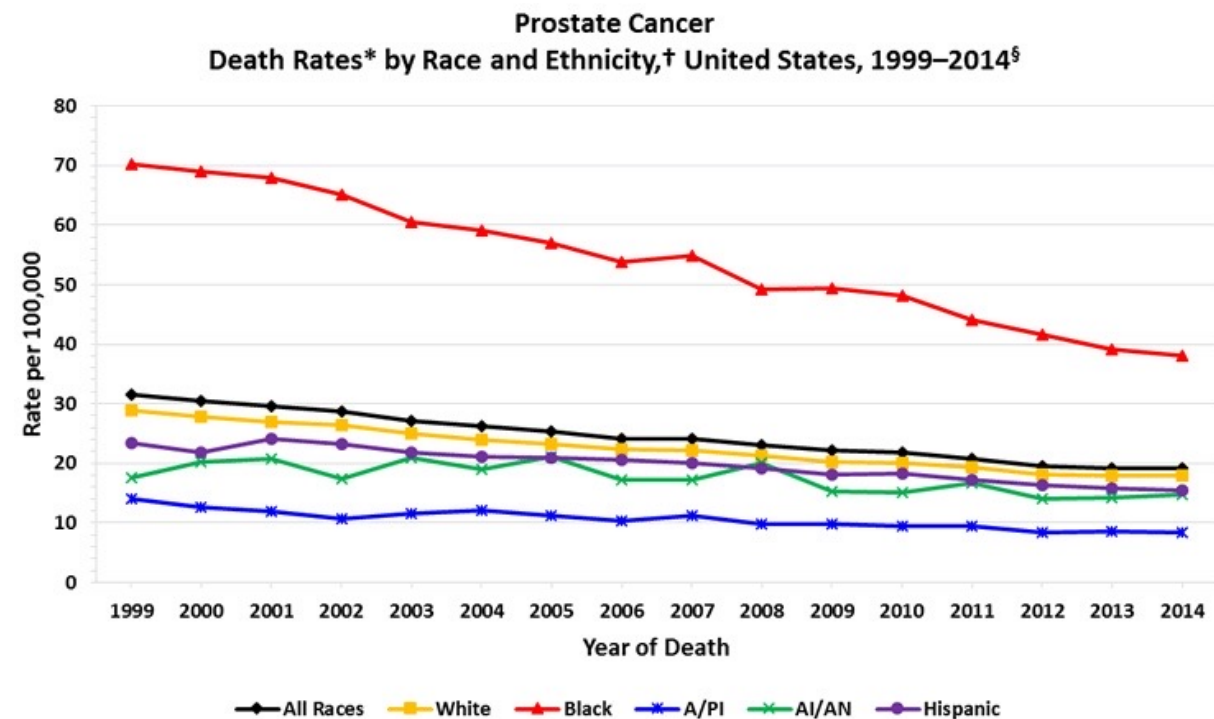
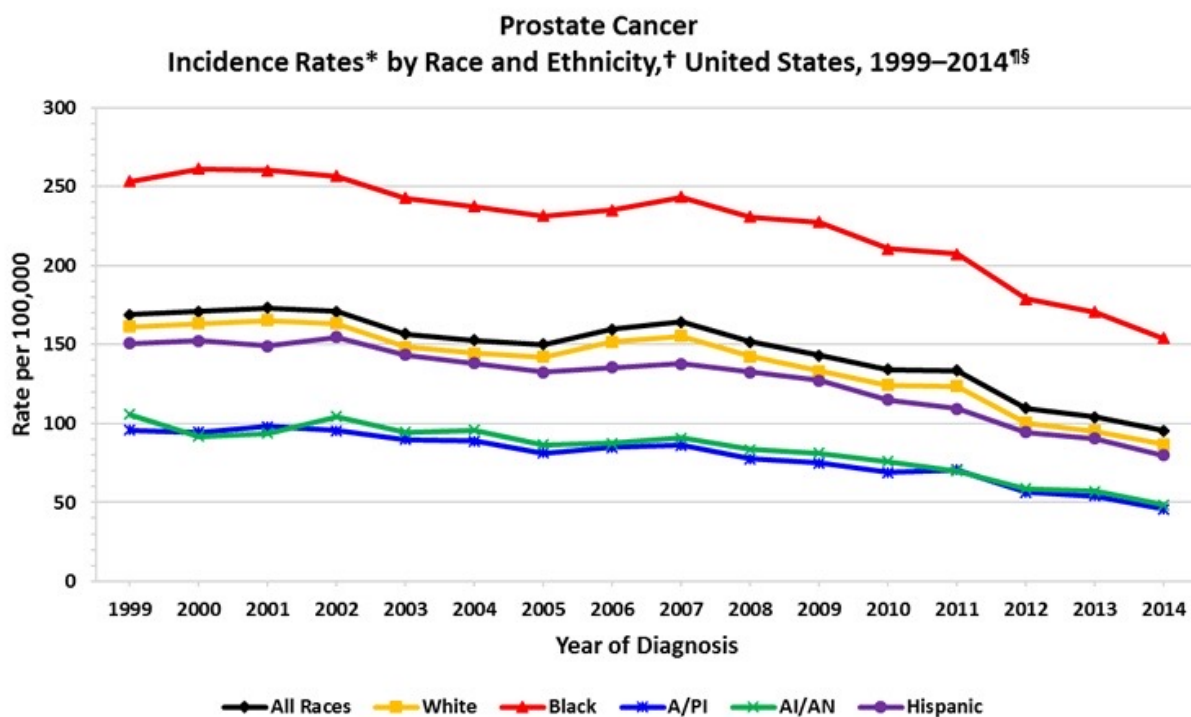
Host/Tumor  
Biology



Biological/Genetic



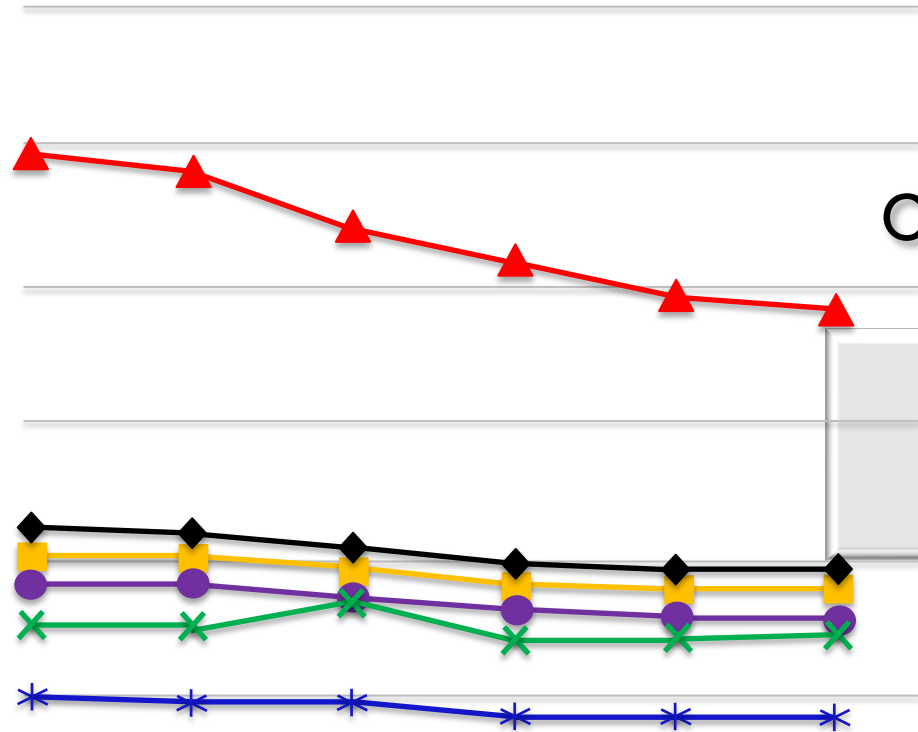
# Disparities as Gaps



<https://www.cdc.gov/>



# Disparities as Gaps – Reducing the Gaps



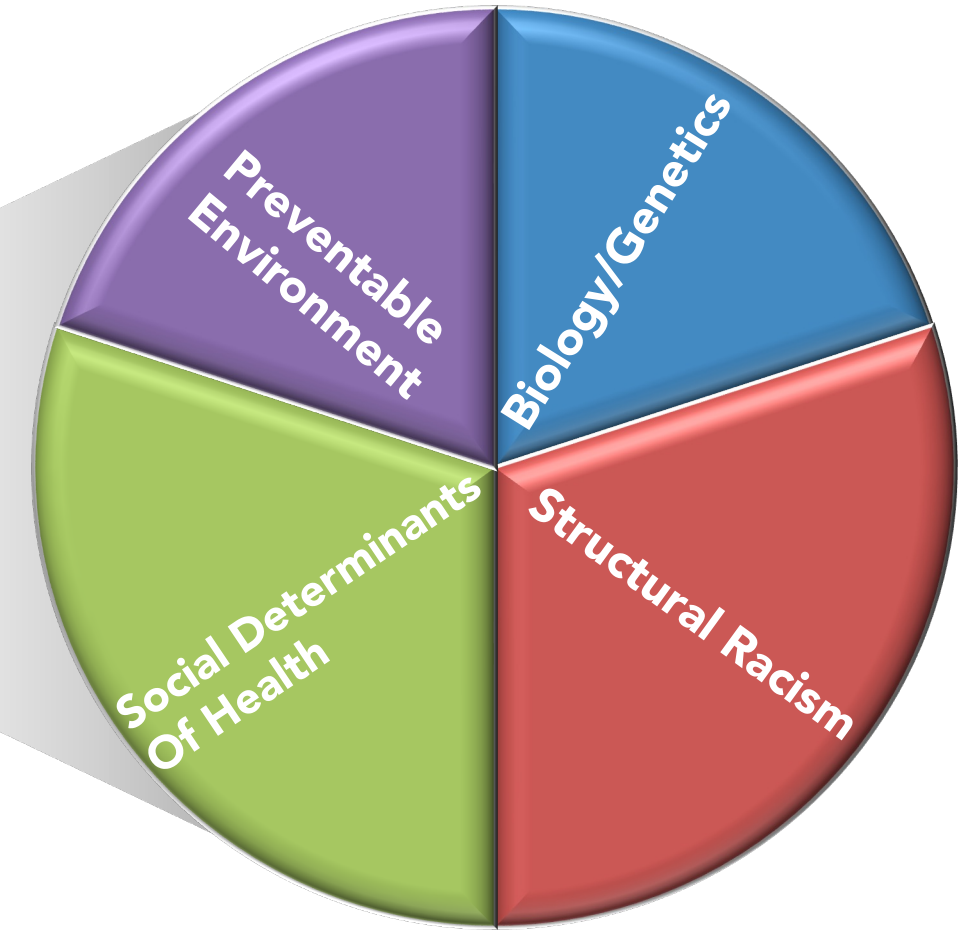
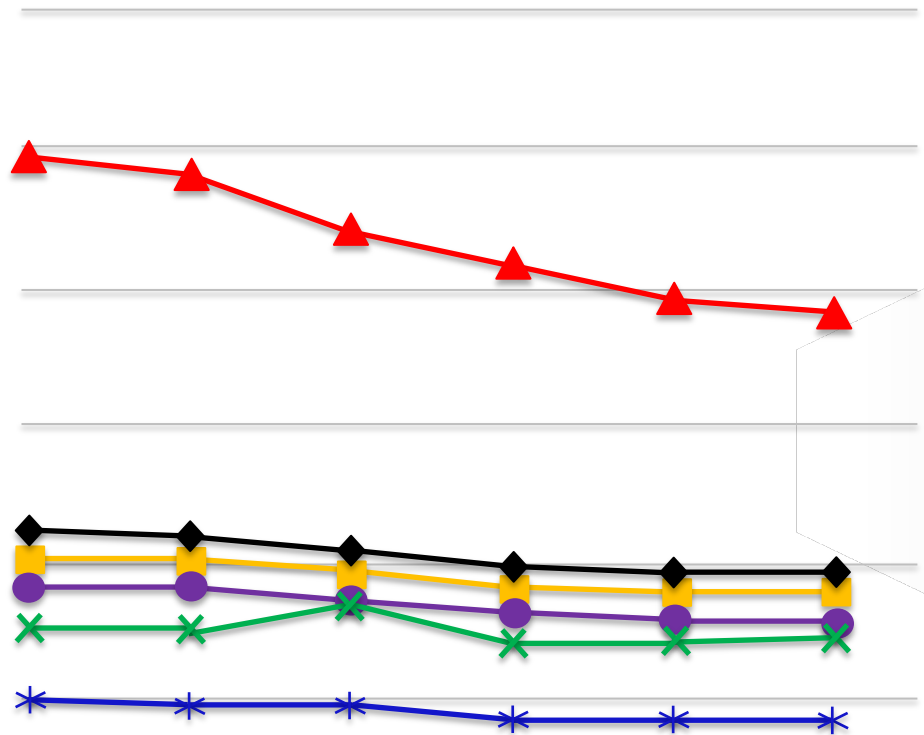
## Cancer Disparities Research as Gap Analysis.

- What are the factors influencing this gap?
- **To what proportion does each factor influence the gap?**
- Tailor strategies and approaches to address each factor?



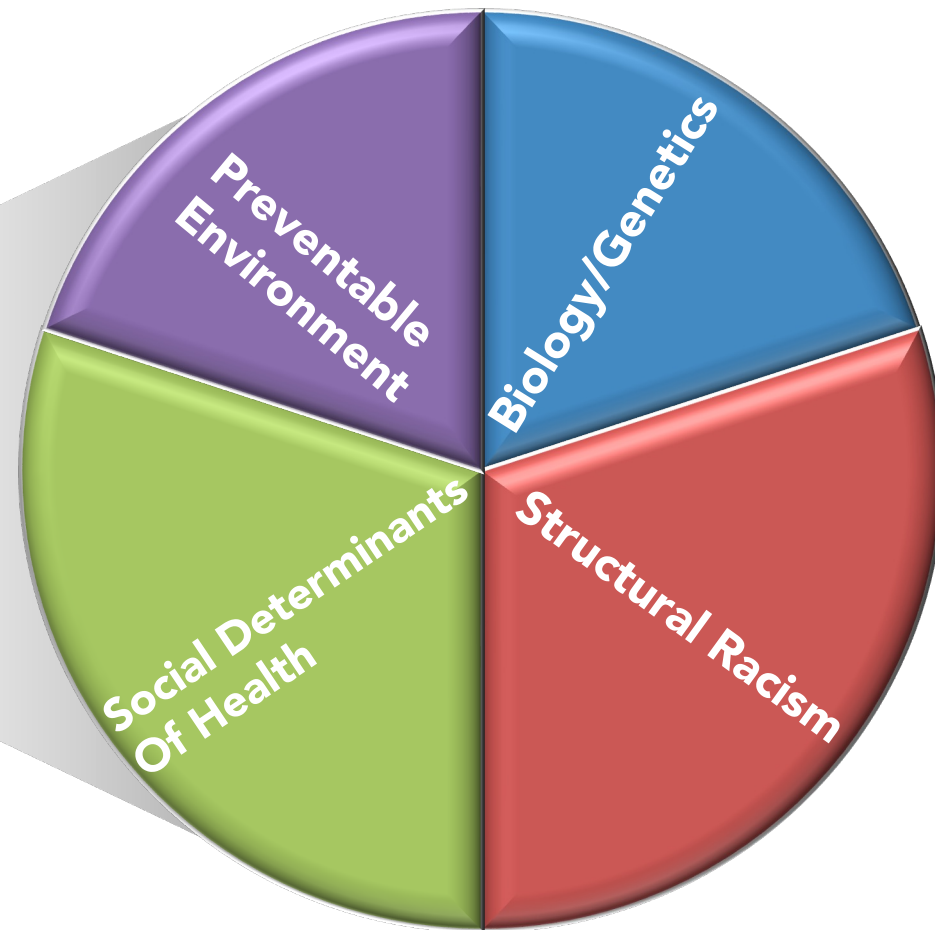
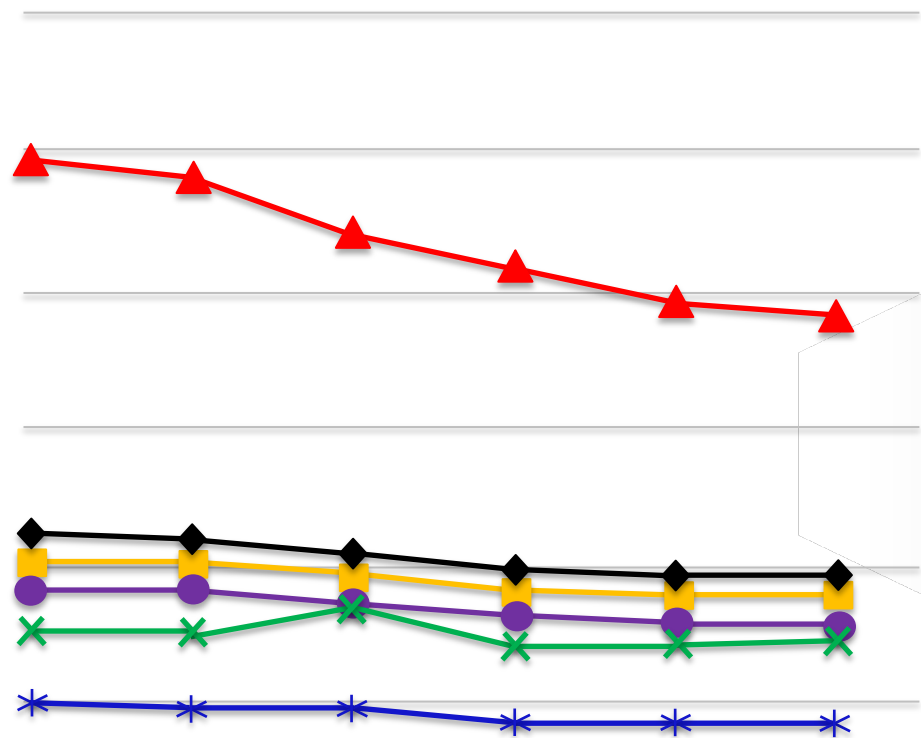


# Disparities as Gaps – Reducing the Gaps



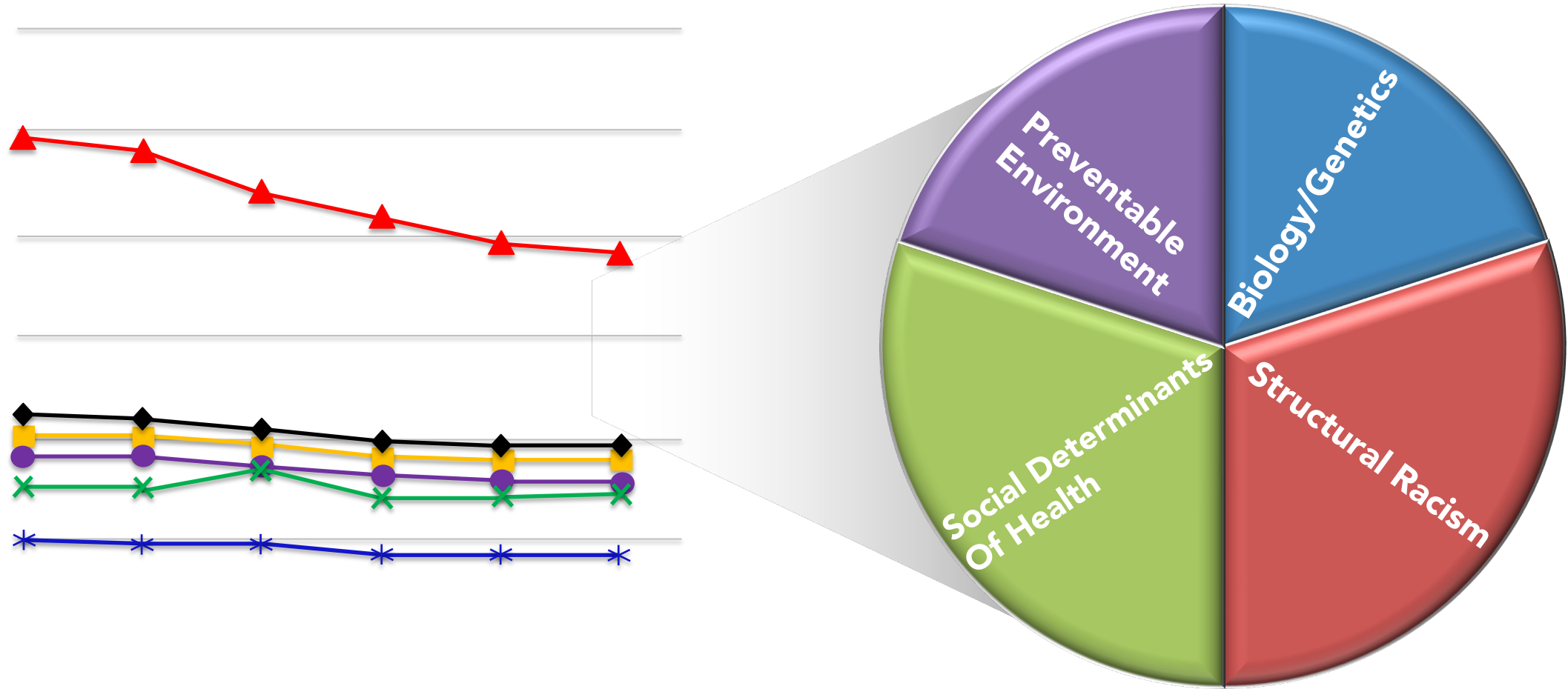
# Disparities as Gaps – Reducing the Gaps

Addressing each component requires some specific but also overlapping mitigators



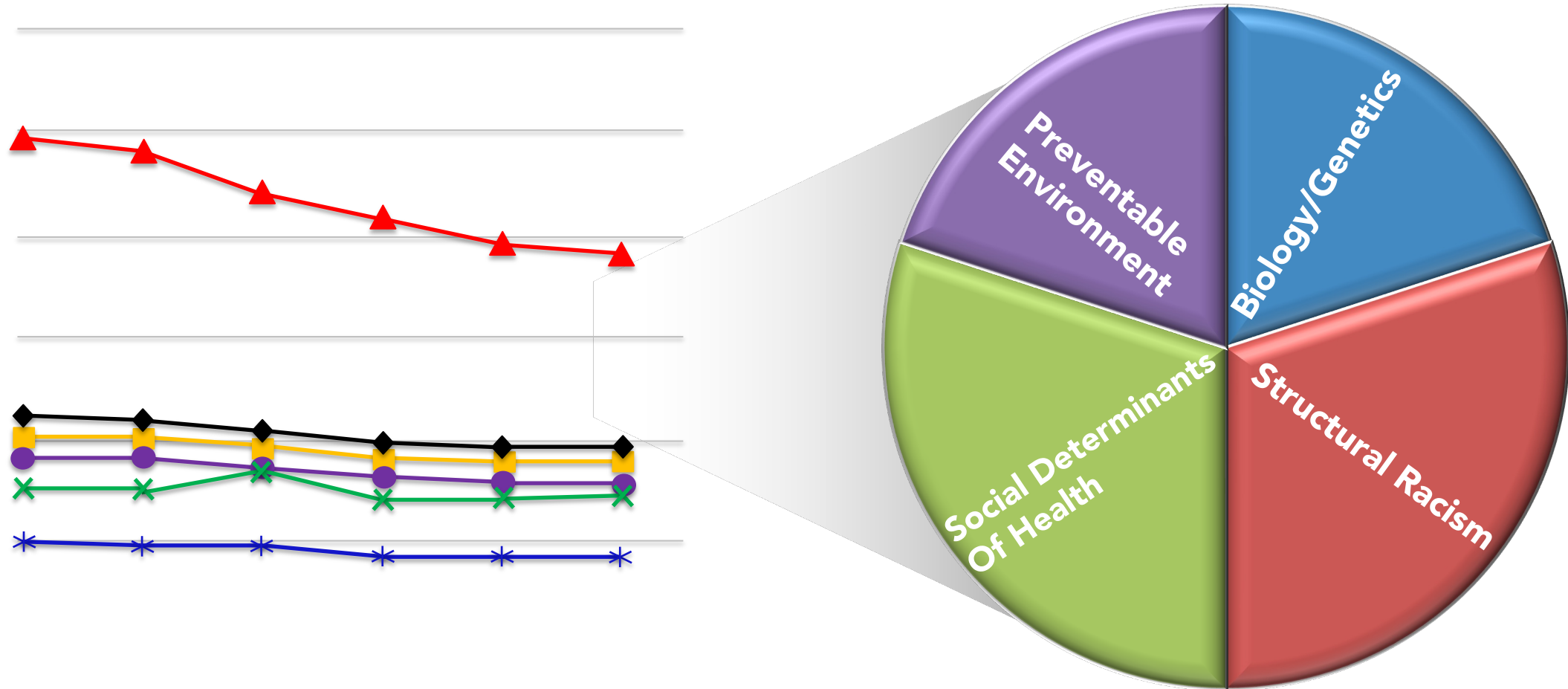
# Disparities as Gaps – Reducing the Gaps – Context Dependent

Context Dependent – Differ by Indication (PrCa vs Cervical; or BrCa vs CRC; LuCa vs Endometrial)



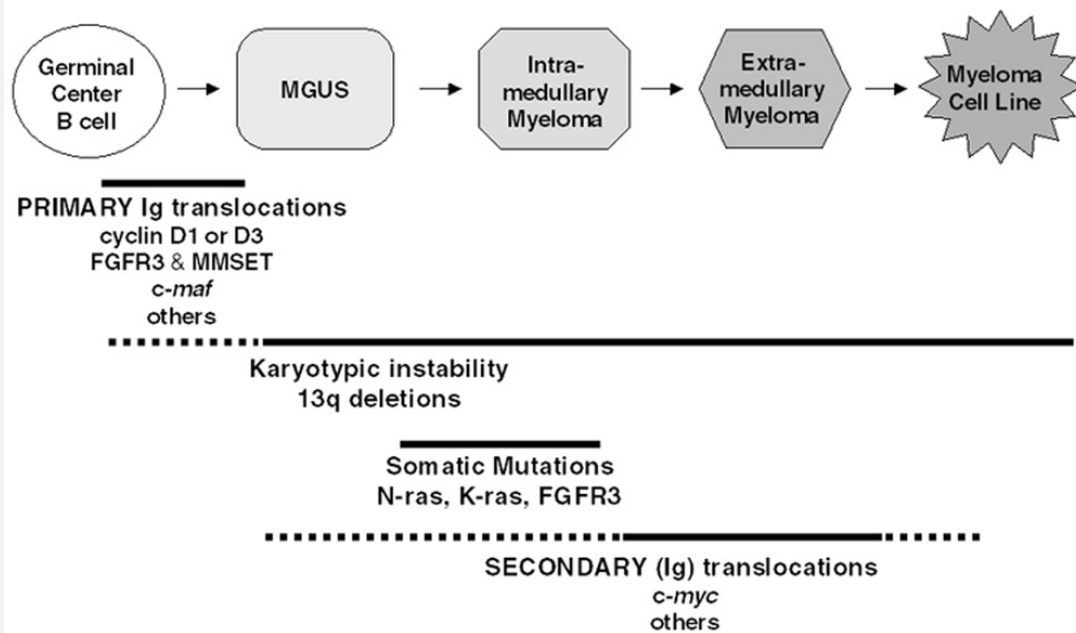
# Disparities as Gaps – Reducing the Gaps – Context Dependent

Context Dependent – Differ by Clinical Issue (Incidence versus Outcomes)



# Multiple Myeloma Pathogenesis

Cancer of the plasma cells in the bone marrow leading to bone destruction and bone marrow failure.



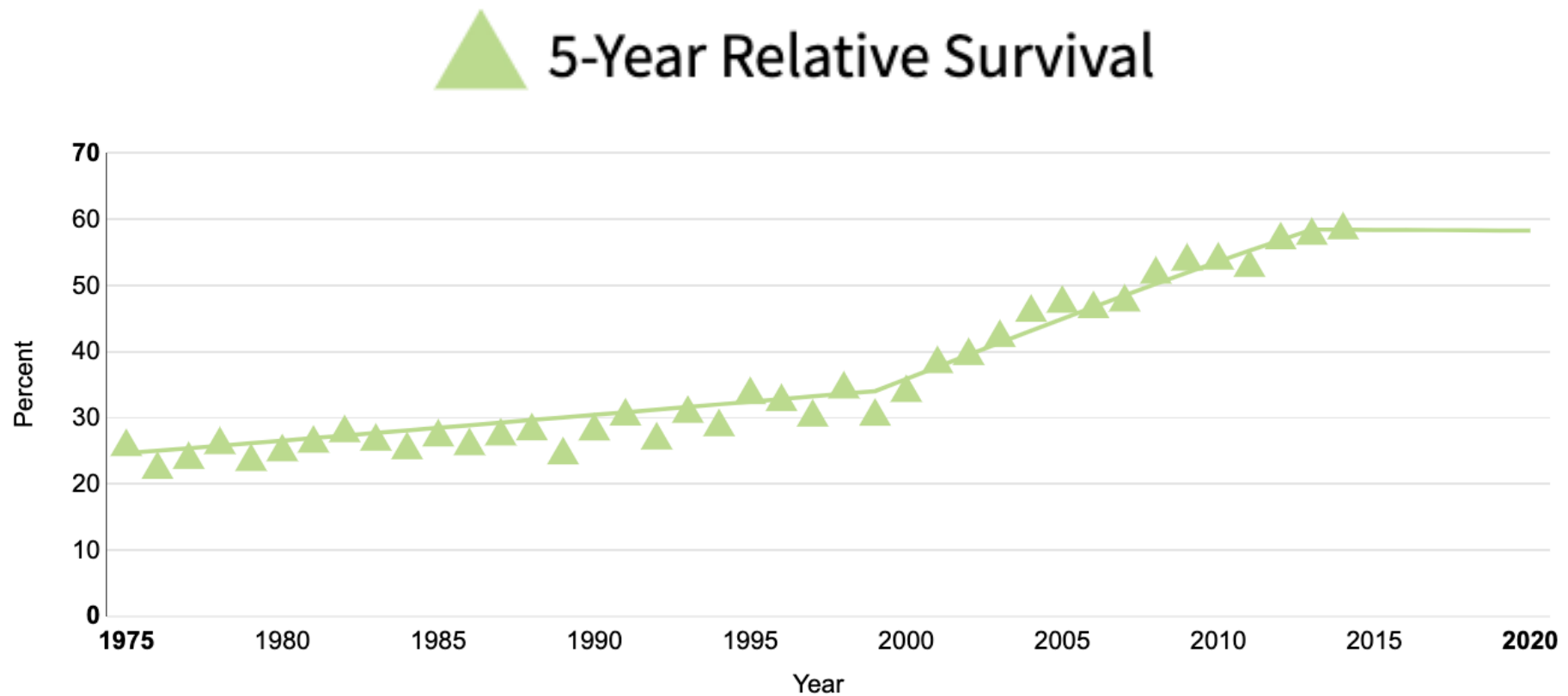
Dalton W et al, Amer Soc Hematology 2001

- ~31,000 new Myeloma cases and an estimated ~13,000 deaths attributed.
- Historically treated with Dexamethasone and bone marrow transplant.
- *More recent development of myeloma "blockbuster" drugs.*
  - *iMids – Lenalidomide*
  - *Proteasome inhibitors – Bortezomib, Carfilzomab*
- 5 year survival rate has increased from ~30% to >50% in last 10-15yrs!!





# Multiple Myeloma Outcomes



SEER 8 5-Year Relative Survival Percent from 1975–2014, All Races, Both Sexes.

Modeled trend lines were calculated from the underlying rates using the [Joinpoint Survival Model Software](#).



# Multiple Myeloma Disparities

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Kaposi sarcoma	1.7	0.5	1.2	3.57	Kaposi sarcoma	0.2	<0.1	0.1	3.96
Myeloma ✖	14.8	7.0	7.8	2.11	Myeloma ✖	11.1	4.3	6.8	2.58
Stomach	15.1	7.8	7.3	1.93	Stomach	8.0	3.5	4.5	2.30
Liver & intrahepatic bile duct	16.5	9.3	7.2	1.77	Liver & intrahepatic bile duct	4.8	3.2	1.6	1.52
Prostate	208.7	123.0	85.7	1.70	Uterine cervix	10.0	7.1	2.9	1.41
Larynx	9.3	6.3	3.0	1.48	Pancreas	14.4	10.6	3.8	1.36
Breast	2.0	1.4	0.6	1.45	Esophagus	2.5	1.8	0.7	1.34
Colon & rectum	60.3	47.4	12.9	1.27	Colon & rectum	44.1	36.2	7.9	1.22
Pancreas	17.2	14.0	3.2	1.23	Kidney & renal pelvis	13.0	11.3	1.7	1.15
Lung & bronchus	93.4	79.3	14.1	1.18	Breast	124.3	128.1	-3.8	0.97
Kidney & renal pelvis	24.2	21.8	2.4	1.11	Uterine corpus	23.0	25.5	-2.5	0.90
Hodgkin lymphoma	3.2	3.4	-0.2	0.95	Hodgkin lymphoma	2.4	2.7	-0.3	0.88
Esophagus	8.0	8.8	-0.8	0.90	Lung & bronchus	51.4	58.7	-7.3	0.87
Leukemia	13.2	17.7	-4.5	0.75	Leukemia	8.6	10.7	-2.1	0.80
Oral cavity & pharynx	15.3	18.1	-2.8	0.84	Oral cavity & pharynx	5.2	6.7	-1.5	0.78
Non-Hodgkin lymphoma	17.2	24.1	-6.9	0.71	Ovary	9.6	12.4	-2.8	0.77
Brain & other nervous system	4.9	8.8	-3.9	0.56	Non-Hodgkin lymphoma	12.0	16.6	-4.6	0.72
Urinary bladder	19.8	40.2	-20.4	0.49	Urinary bladder	6.7	9.9	-3.2	0.68
Thyroid	3.7	7.7	-4.0	0.48	Thyroid	12.9	21.9	-9.0	0.59
Testis	1.4	6.8	-5.4	0.21	Brain & other nervous system	3.6	6.3	-2.7	0.58
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Larynx	3.7	1.8	1.9	2.02	Uterine cervix	4.1	2.0	2.1	2.00
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Colon & rectum	27.6	18.2	9.4	1.52	Breast	31.0	21.9	9.1	1.42
Oral cavity & pharynx	5.2	3.8	1.4	1.36	Colon & rectum	18.2	12.9	5.3	1.41
Lung & bronchus	74.9	62.2	12.7	1.20	Pancreas	12.6	9.5	3.1	1.32
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Urinary bladder	5.4	8.4	-3.0	0.65	Ovary	6.8	8.2	-1.4	0.83
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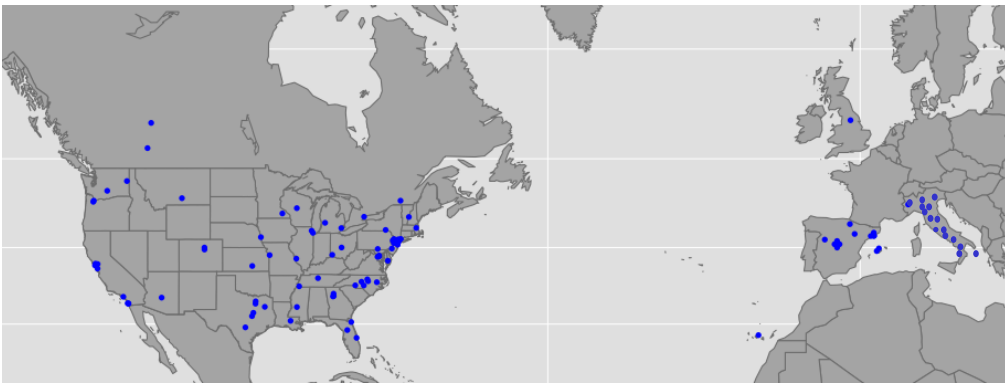
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# Genomic Studies In Cancer Disparities – Multiple Myeloma

## CoMMpass Enrollment

1,000+ patients enrolled from >90 sites worldwide, with over 850 samples molecularly profiled at baseline and >100 sequentially.



3



Angela Baker



Zarko Manojlovic



Jonathan Keats



John Carpten



## RESEARCH ARTICLE

# Comprehensive molecular profiling of 718 Multiple Myelomas reveals significant differences in mutation frequencies between African and European descent cases

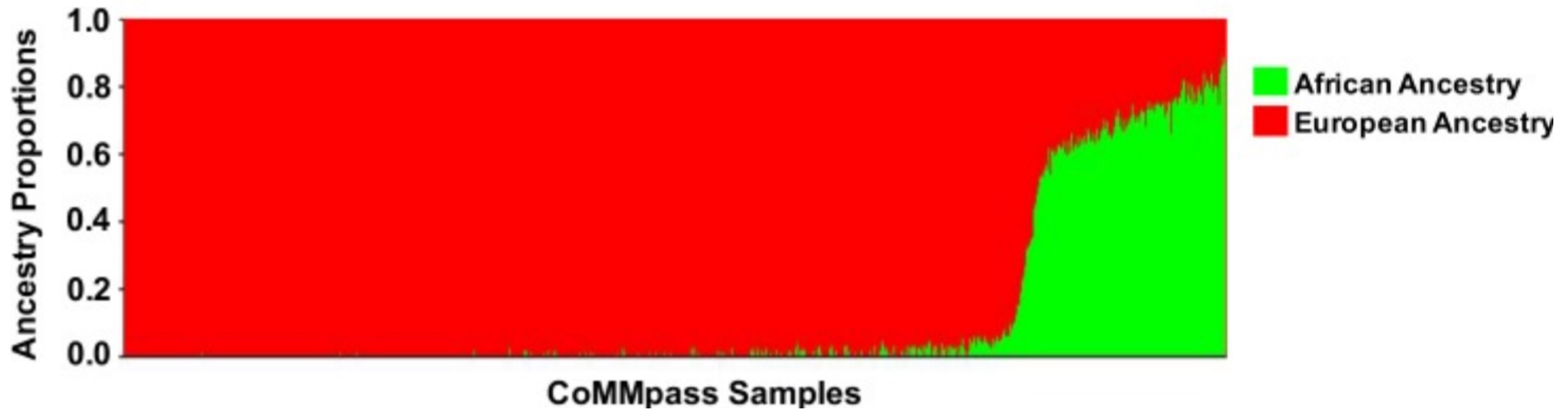
Zarko Manojlovic<sup>1,2\*</sup>, Austin Christofferson<sup>2</sup>, Winnie S. Liang<sup>2</sup>, Jessica Aldrich<sup>2</sup>, Megan Washington<sup>2</sup>, Shukmei Wong<sup>2</sup>, Daniel Rohrer<sup>3</sup>, Scott Jewell<sup>3</sup>, Rick A. Kittles<sup>4</sup>, Mary Derome<sup>5</sup>, Daniel Auclair<sup>5</sup>, David Wesley Craig<sup>1</sup>, Jonathan Keats<sup>2</sup>, John D. Carpten<sup>1,2</sup>

**1** Department of Translational Genomics, Keck School of Medicine, University of Southern California, Los Angeles, CA, United States of America, **2** Translational Genomics Research Institute, Phoenix, AZ, United States of America, **3** Van Andel Research Institute, Grand Rapids, MI, United States of America, **4** Department of Surgery, Division of Population Genetics, University of Arizona, Tuscon, AZ, United States of America, **5** Multiple Myeloma Research Foundation, Norwalk, CT, United States of America



# Genomic Studies of Myeloma Cancer Disparities

## All Newly Diagnosed Treatment Naive Patients



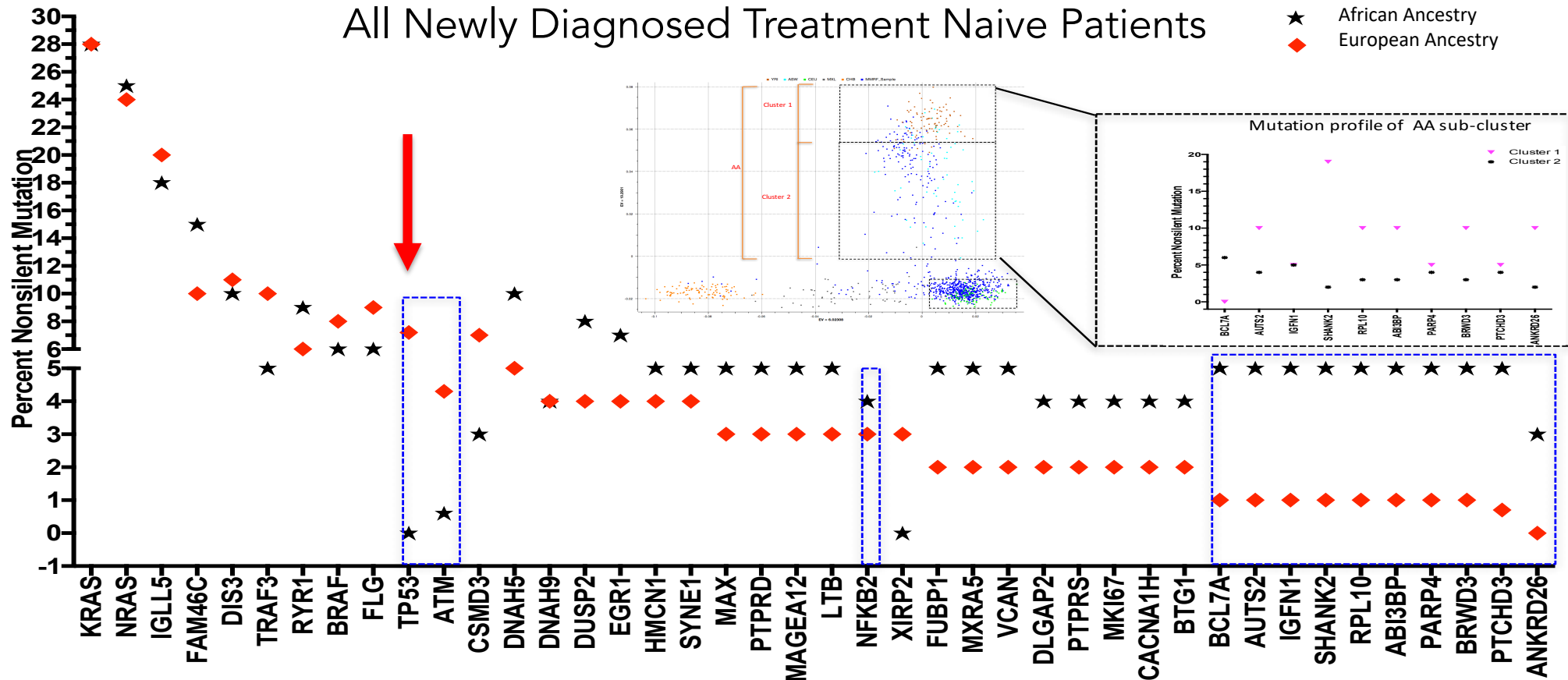
African Ancestry AA (n=127)  
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Manojlovic et al., PLoS Genet. 2017; 13(11):e1007087.





# Genomic Studies of Myeloma Cancer Disparities



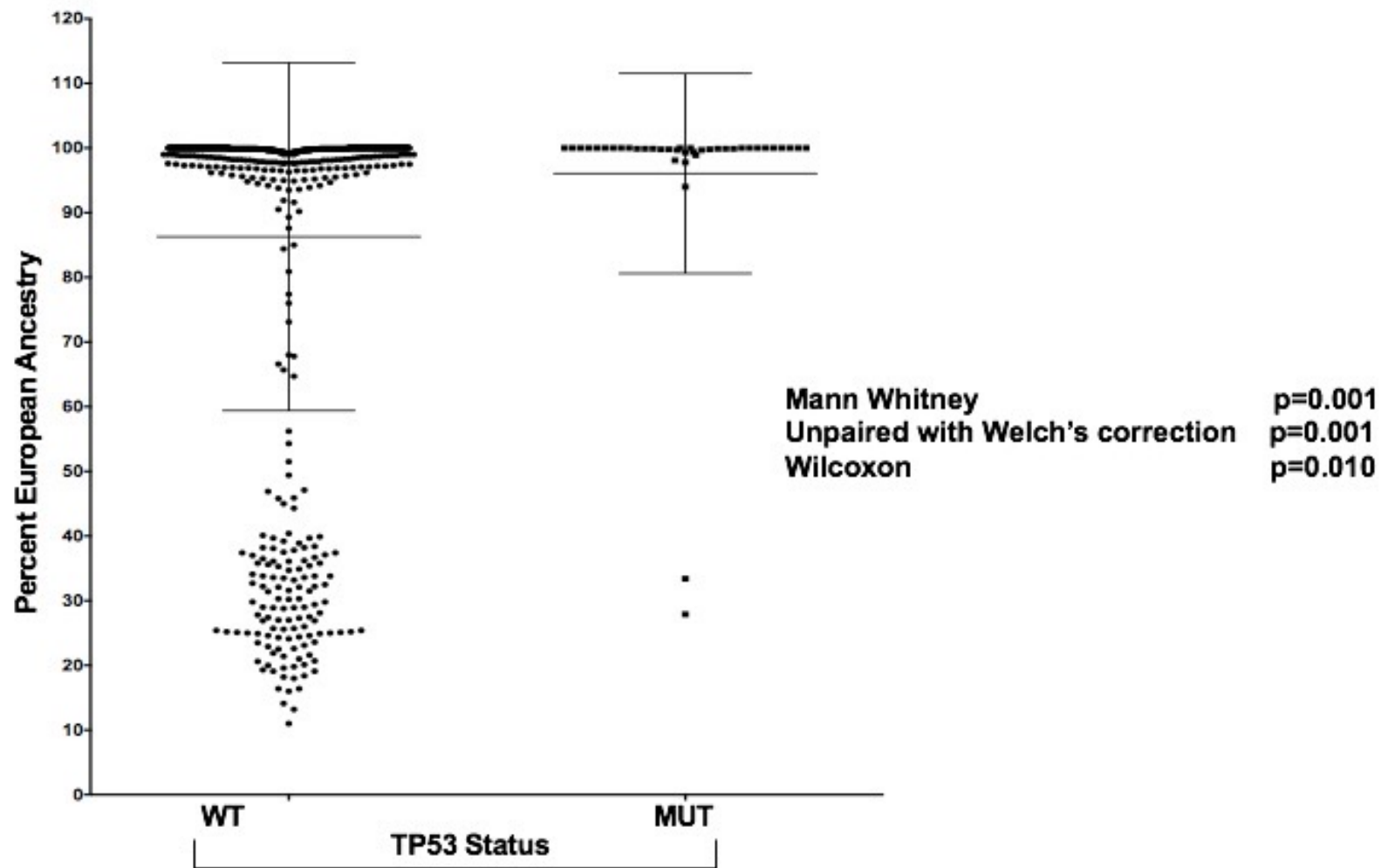
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# Genomic Studies In Cancer Disparities – Multiple Myeloma



# Genomic Studies In Cancer Disparities – Multiple Myeloma

- These data provide clear evidence of differences in tumor profiles among AA and EA MM patients in a sufficiently powered tumor cohort.
- TP53 loss is associated with poor outcome, yet is enriched in tumors from EA cases.
- *These data suggest that AA MM patients may have tumors with molecular features associated with more favorable outcomes.*
- *Perhaps in MM, equal treatment could lead to similar or better outcomes in AA patients.*



# Genomic Studies In Cancer Disparities – Multiple Myeloma

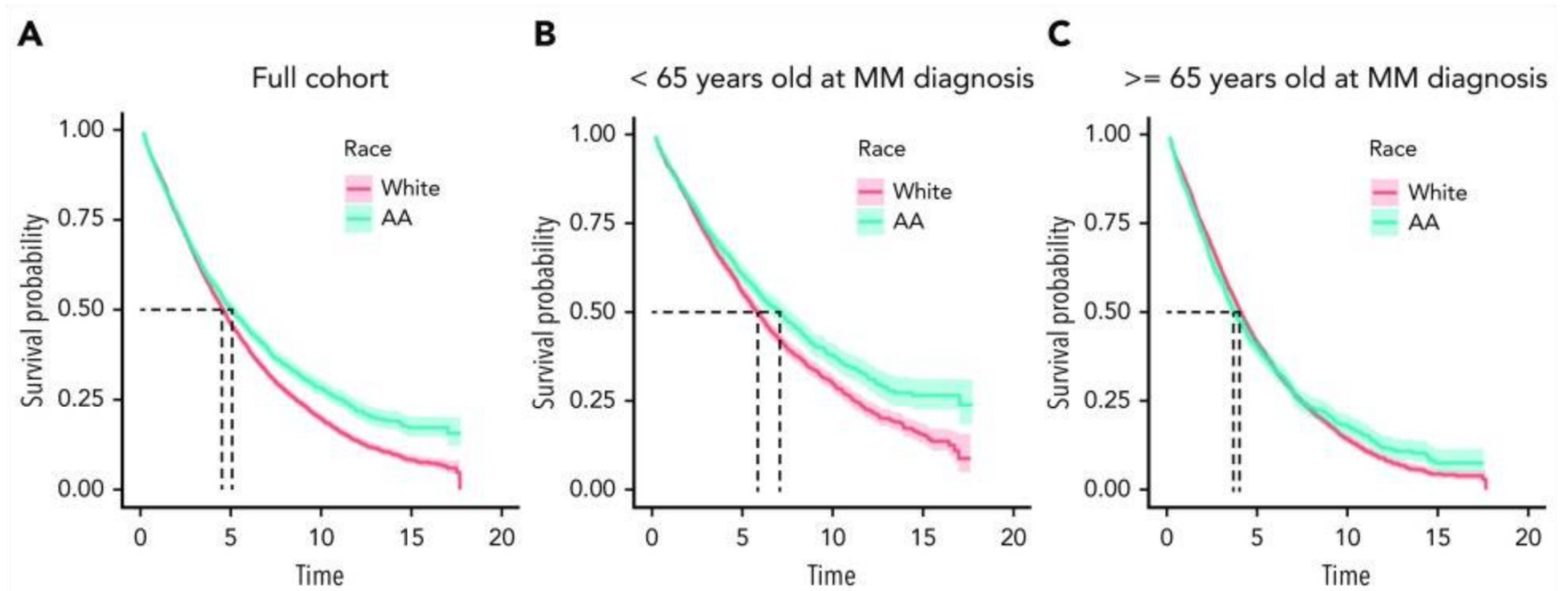


- Results show a low participation of minorities in MM clinical trials of newer agents.
- Despite this limitation, mortality was slightly lower in participants of other racial and ethnic groups.
- Observed that Imid- and PI-class drugs may be working better in minorities.
- Examination of survival in the current SEER data shows that overall 5-year survival from 2007 to 2013 increased to 52.3% for African Americans and 50.6% for whites, suggesting that the earlier observed disparities were likely related to a temporary phenomenon (ie, differences in treatment utilization, access).

Pulte et al., *Blood Advances*. 2018 Jan 23;2(2):116-119.



# Genomic Studies In Cancer Disparities – Multiple Myeloma

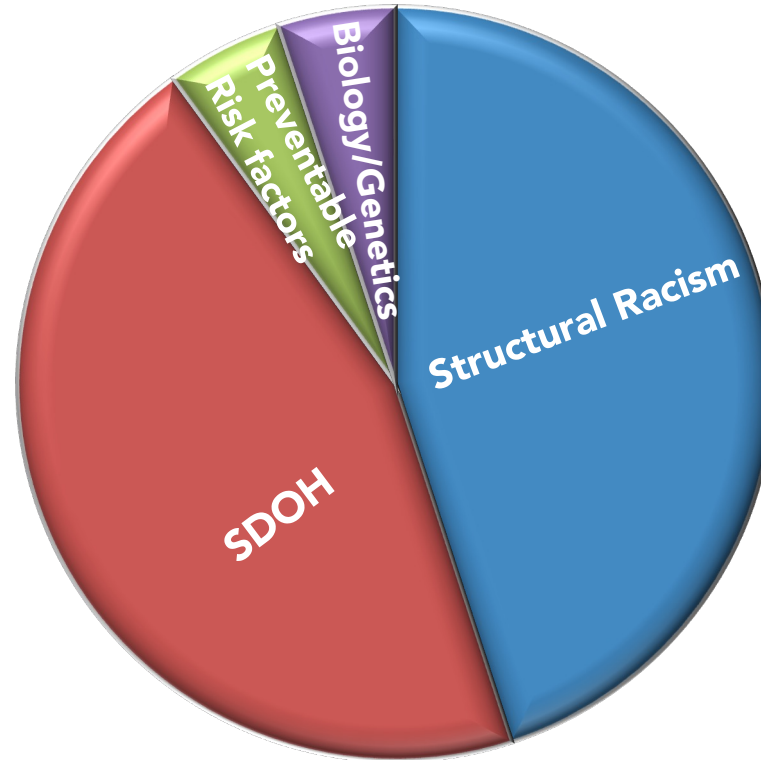


Fillmore et al., *Blood*. 2019 Jun 13;133(24):2615-2618.



# Multiple Myeloma Disparities

Disparities in MM Outcomes Likely Due to Access to Quality Care





# Multiple Myeloma Disparities

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Liver & intrahepatic bile duct	16.5	9.3	7.2	1.77	Liver & intrahepatic bile duct	4.8	3.2	1.6	1.52
Prostate	208.7	123.0	85.7	1.70	Uterine cervix	10.0	7.1	2.9	1.41
Larynx	9.3	6.3	3.0	1.48	Pancreas	14.4	10.6	3.8	1.36
Breast	2.0	1.4	0.6	1.45	Esophagus	2.5	1.8	0.7	1.34
Colon & rectum	60.3	47.4	12.9	1.27	Colon & rectum	44.1	36.2	7.9	1.22
Pancreas	17.2	14.0	3.2	1.23	Kidney & renal pelvis	13.0	11.3	1.7	1.15
Lung & bronchus	93.4	79.3	14.1	1.18	Breast	124.3	128.1	-3.8	0.97
Kidney & renal pelvis	24.2	21.8	2.4	1.11	Uterine corpus	23.0	25.5	-2.5	0.90
Hodgkin lymphoma	3.2	3.4	-0.2	0.95	Hodgkin lymphoma	2.4	2.7	-0.3	0.88
Esophagus	8.0	8.8	-0.8	0.90	Lung & bronchus	51.4	58.7	-7.3	0.87
Leukemia	13.2	17.7	-4.5	0.75	Leukemia	8.6	10.7	-2.1	0.80
Oral cavity & pharynx	15.3	18.1	-2.8	0.84	Oral cavity & pharynx	5.2	6.7	-1.5	0.78
Non-Hodgkin lymphoma	17.2	24.1	-6.9	0.71	Ovary	9.6	12.4	-2.8	0.77
Brain & other nervous system	4.9	8.8	-3.9	0.56	Non-Hodgkin lymphoma	12.0	16.6	-4.6	0.72
Urinary bladder	19.8	40.2	-20.4	0.49	Urinary bladder	6.7	9.9	-3.2	0.68
Thyroid	3.7	7.7	-4.0	0.48	Thyroid	12.9	21.9	-9.0	0.59
Testis	1.4	6.8	-5.4	0.21	Brain & other nervous system	3.6	6.3	-2.7	0.58
Melanoma of the skin	1.1	31.3	-30.2	0.04	Melanoma of the skin	1.0	20.6	-19.6	0.05
<b>All sites</b>	<b>592.3</b>	<b>528.9</b>	<b>63.4</b>	<b>1.12</b>	<b>All sites</b>	<b>408.1</b>	<b>436.2</b>	<b>-28.1</b>	<b>0.94</b>

Note: Sites listed in descending order by rate ratio. \*Rates are per 100,000 and age adjusted to the 2000 US standard population. †Absolute difference is the rate in blacks minus the rate in whites. ‡Rate ratio is the unrounded rate in blacks divided by the unrounded rate in whites.

Source: North American Association of Central Cancer Registries.<sup>183</sup>

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## Disparities in MM Incidence Rates Remain

- Rate of MGUS and conversion rate to MM??
- Immunological Factors??
- Germline Genetic Risk??
- Environmental Exposure??
- Some combination of the above??



# Multiple Myeloma Disparities

## Disparities in MM Incidence Rates

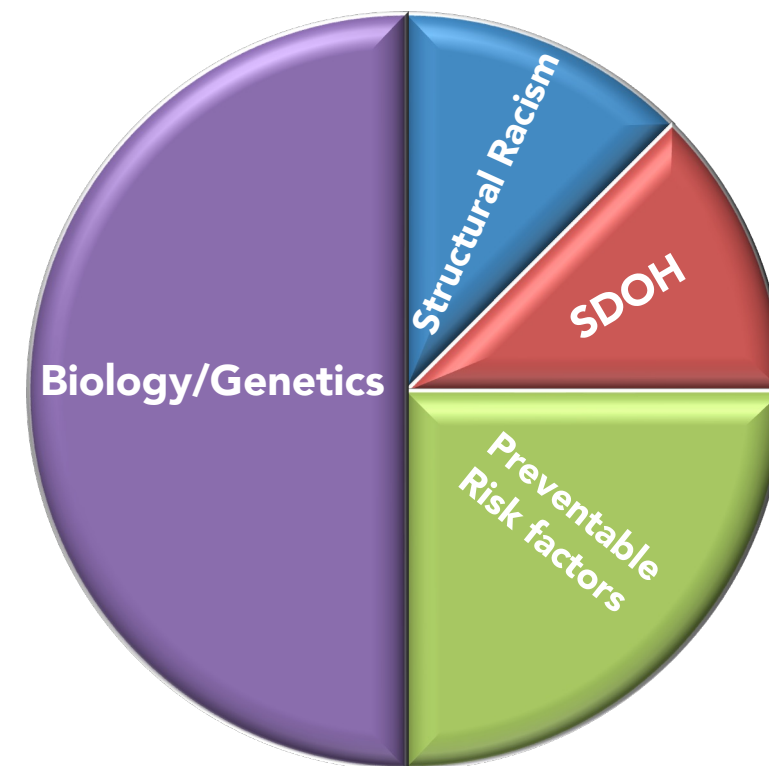
Table 5. Comparison of Cancer Incidence Rates between Non-Hispanic (NH) Blacks and Whites, US, 2008-2012

Male					Female				
Cancer	NH Black Rate*	NH White Rate*	Absolute Difference†	Rate Ratio‡	Cancer	NH Black Rate*	NH White Rate*	Absolute Difference†	Rate Ratio‡
Kaposi sarcoma	1.7	0.5	1.2	3.57	Kaposi sarcoma	0.2	<0.1	0.1	3.96
Myeloma ✖	14.8	7.0	7.8	2.11	Myeloma ✖	11.1	4.3	6.8	2.58
Stomach	15.1	7.8	7.3	1.93	Stomach	8.0	3.5	4.5	2.30
Liver & intrahepatic bile duct	16.5	9.3	7.2	1.77	Liver & intrahepatic bile duct	4.8	3.2	1.6	1.52
Prostate	208.7	123.0	85.7	1.70	Uterine cervix	10.0	7.1	2.9	1.41
Larynx	9.3	6.3	3.0	1.48	Pancreas	14.4	10.6	3.8	1.36
Breast	2.0	1.4	0.6	1.45	Esophagus	2.5	1.8	0.7	1.34
Colon & rectum	60.3	47.4	12.9	1.27	Colon & rectum	44.1	36.2	7.9	1.22
Pancreas	17.2	14.0	3.2	1.23	Kidney & renal pelvis	13.0	11.3	1.7	1.15
Lung & bronchus	93.4	79.3	14.1	1.18	Breast	124.3	128.1	-3.8	0.97
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Hodgkin lymphoma	3.2	3.4	-0.2	0.95	Hodgkin lymphoma	2.4	2.7	-0.3	0.88
Esophagus	8.0	8.8	-0.8	0.90	Lung & bronchus	51.4	58.7	-7.3	0.87
Leukemia	13.2	17.7	-4.5	0.75	Leukemia	8.6	10.7	-2.1	0.80
Oral cavity & pharynx	15.3	18.1	-2.8	0.84	Oral cavity & pharynx	5.2	6.7	-1.5	0.78
Non-Hodgkin lymphoma	17.2	24.1	-6.9	0.71	Ovary	9.6	12.4	-2.8	0.77
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<b>All sites</b>	<b>592.3</b>	<b>528.9</b>	<b>63.4</b>	<b>1.12</b>	<b>All sites</b>	<b>408.1</b>	<b>436.2</b>	<b>-28.1</b>	<b>0.94</b>

Note: Sites listed in descending order by rate ratio. \*Rates are per 100,000 and age adjusted to the 2000 US standard population. †Absolute difference is the rate in blacks minus the rate in whites. ‡Rate ratio is the unrounded rate in blacks divided by the unrounded rate in whites.

Source: North American Association of Central Cancer Registries.<sup>183</sup>

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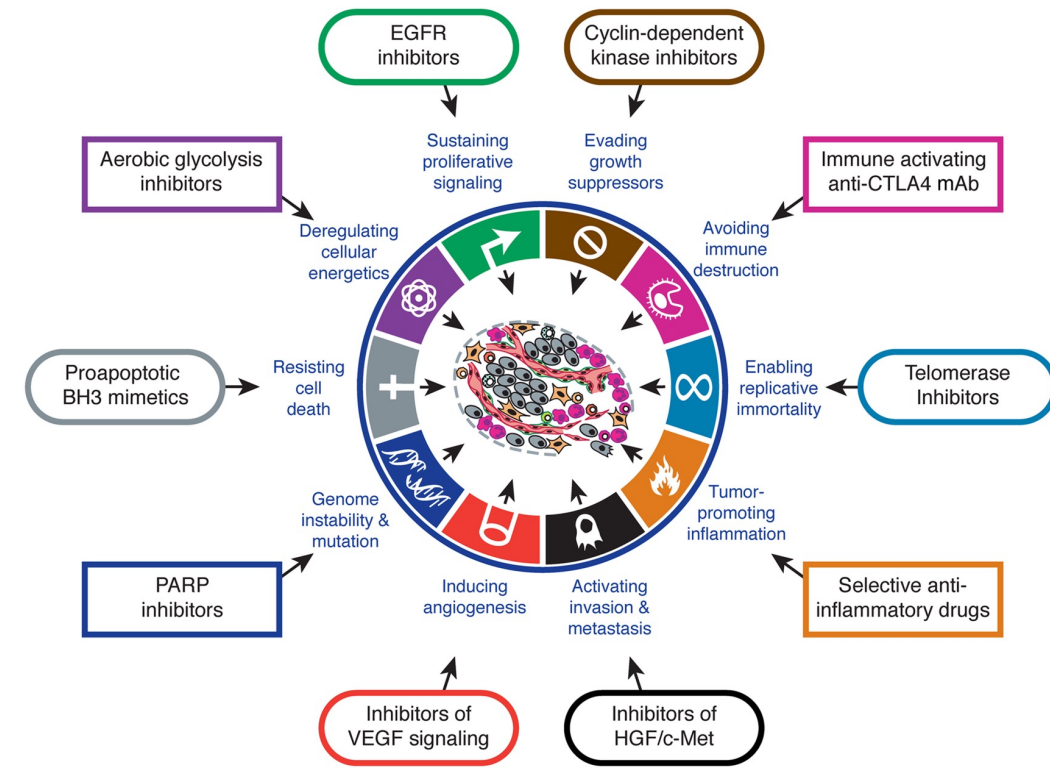
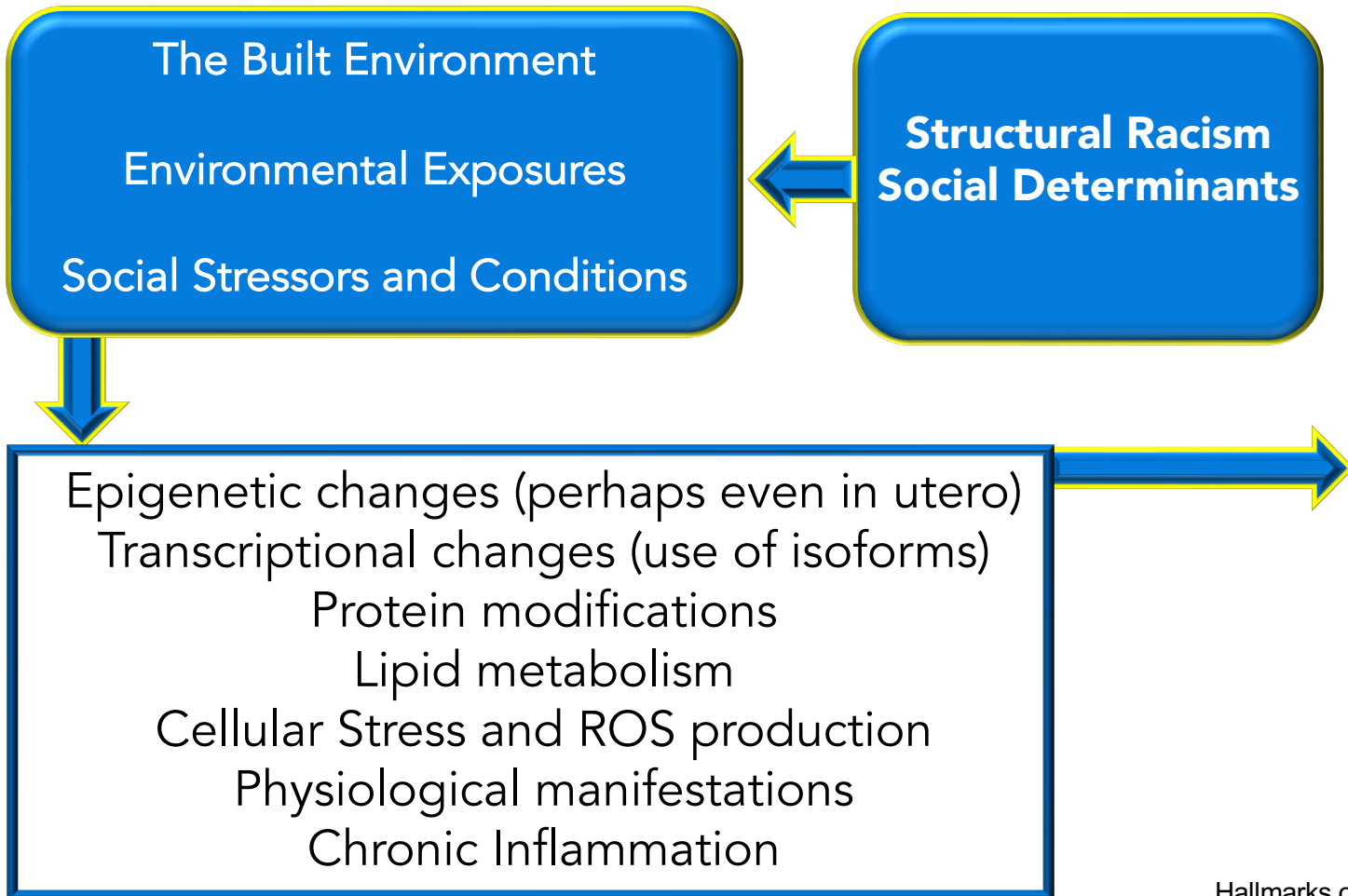


Perhaps a different proportion of factors influencing risk?



# Integration of Environment/Social/Biological Sciences

Cancer exacts a heavy burden on underrepresented communities and the medically underserved.





# Integration of Environment/Social/Biological Sciences



## RESPOND

A National Study of Prostate Cancer  
in African American Men

CLICK HERE TO PARTICIPATE  
OR LEARN MORE!

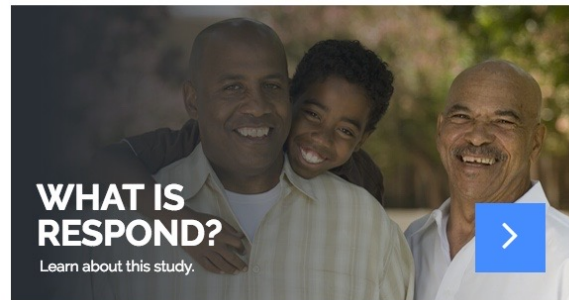
HOME WHAT IS RESPOND? WHO ARE WE? FAQs HOW TO PARTICIPATE



African American men are more likely to develop prostate cancer than men of any other race and the disease is often more aggressive when diagnosed.

If you are African American, and have been diagnosed with prostate cancer, join the nation-wide RESPOND study!

Working together, we can understand how to prevent this disease and improve survival for African American men.



### WHAT IS RESPOND?

Learn about this study.



### WHO ARE WE?

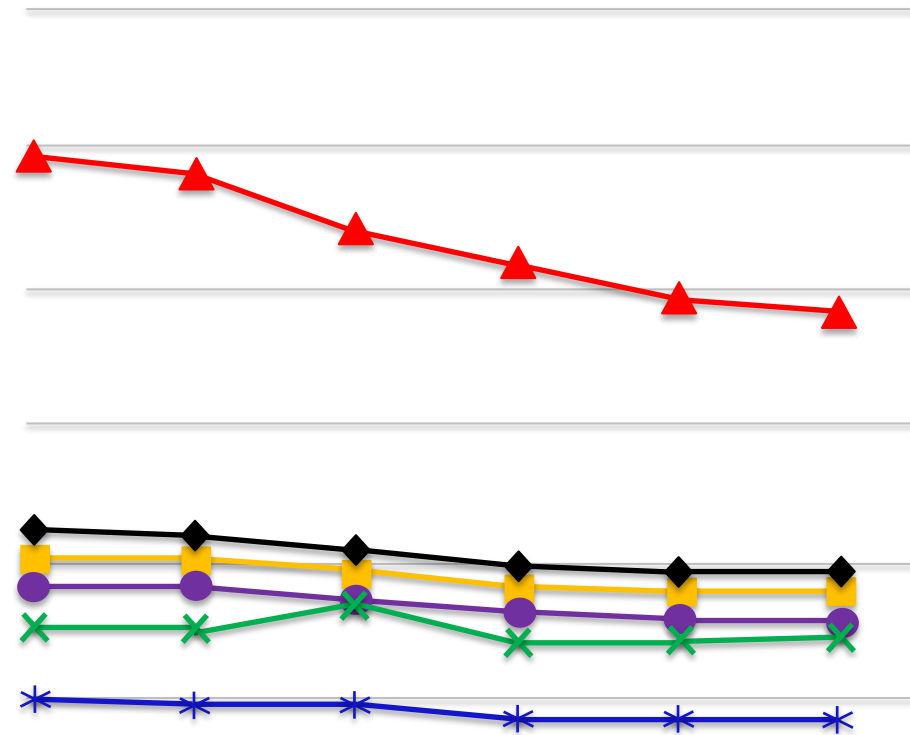
Meet the Research Team.



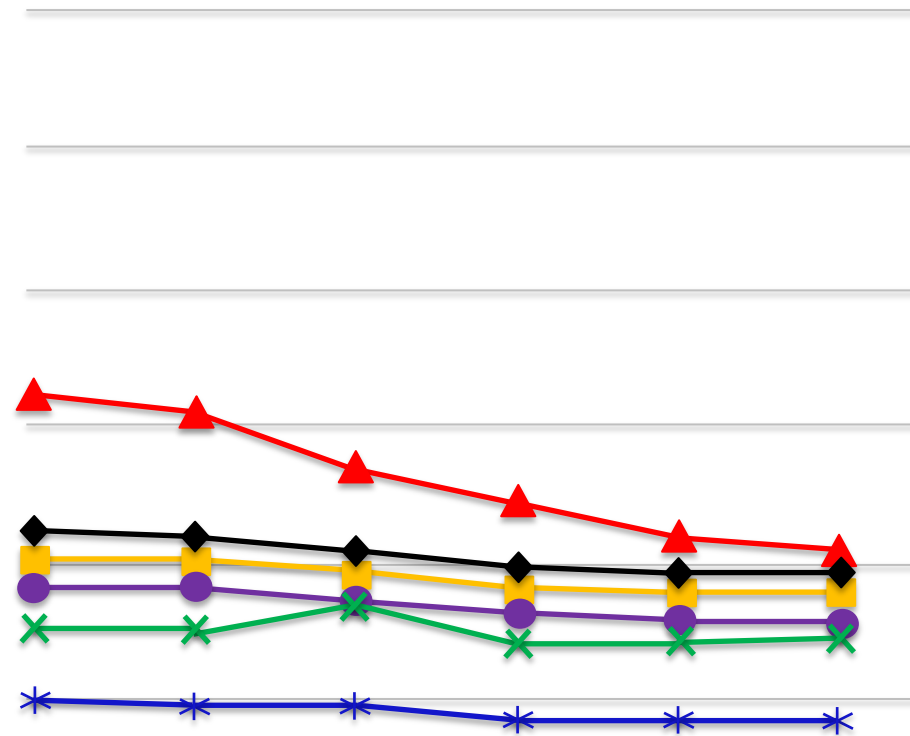
A large, national, population-based cohort study, RESPOND, (Research on Prostate Cancer in Men of African Ancestry: **Defining the Roles of Genetics, Immunity and Access to Care**) of **10,000 AA men with incident PCa** identified through nine SEER and NPCR U.S. cancer registries from states that include 38% of all AA PCa cases in the U.S.



## *Must Continue Analyzing the Gaps*



## *To Close the Gaps to Achieve Health Equity*







# City of Hope

HELFORD CLINICAL RESEARCH HOSPITAL

