# Measuring racial inequalities in health care outcomes: Prostate cancer in the US

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BIOSTATISTICS DEI RESEARCH SEMINAR

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# Prostate cancer

2ND MOST COMMON CANCER IN US MEN

5 YEAR SURVIVAL RATE IS 98%

RACIAL DISPARITIES IN INCIDENCE AND MORTALITY

# Prostate cancer survival

Good prognosis, especially in early stages

Long term survival means long term follow up

Many competing risks like death from other causes

# Prostate cancer racial disparities

Black men more likely to

- Be diagnosed with prostate cancer
- Present with distant metastases
- Die of their disease

than non-Hispanic white men.

# RESEARCH QUESTION:

Is the disparity in prostate cancer specific mortality due to a biological mechanism or socioeconomic status?

Measured and unmeasured confounders

Competing risks

# Main concerns

Measured and unmeasured confounders

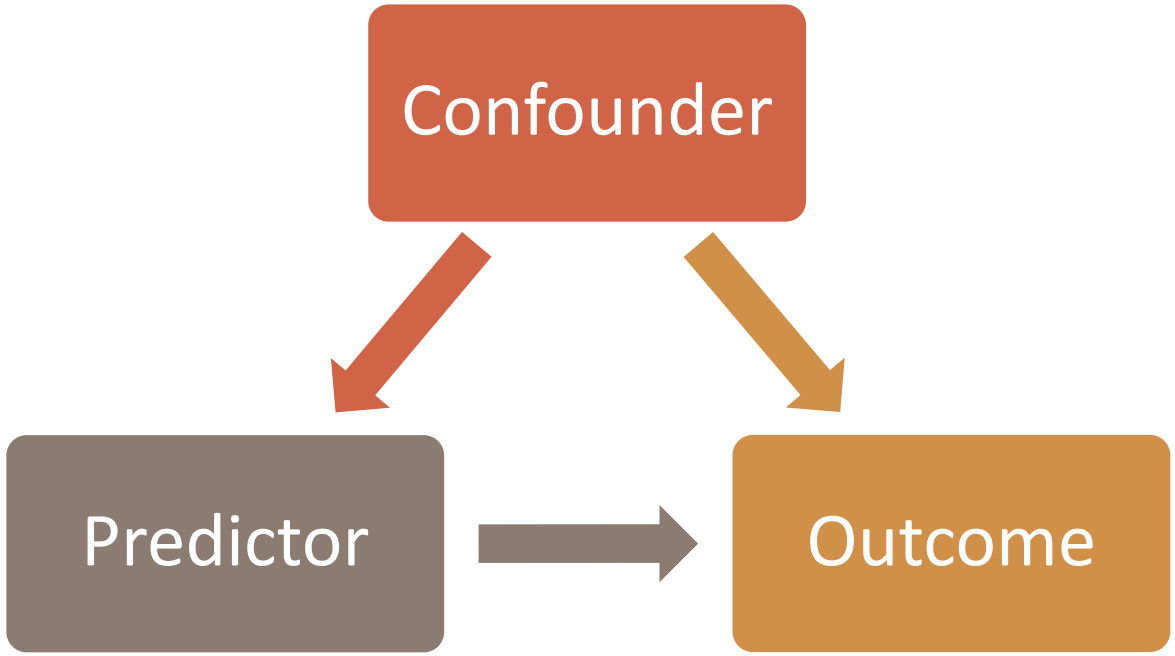
Competing risks

# Main concerns

# Observational data

Only data available to study racial differences

Problems come from confounders



# Propensity scores

Statistical method to adjust for confounding in ”treatment” assignment

Propensity score is the probability of receiving the treatment received conditional on covariates

Can obtain unbiased estimate of the treatment effect when conditioning on the propensity score

Developed by Rosenbaum and Ruben 1983

# SEER

Surveillance, Epidemiology, and End Results

National cancer registry database

# Black men = 52,840

# White men = 243,433

# SEER variables

**Cancer related**

Treatments

T-stage

N-stage

Prostate specific antigen (added in 2017)

**Insurance status**

Uninsured

Insured

Medicaid

**No comorbidities**

**Yost variable (added in 2017)**

Measure of socioeconomic status

# Yost socioeconomic status

Validated continuous measure of socioeconomic status

Estimated based on county level variables

- Median household income
- Median home values
- Percent below 150% poverty level
- And others

# SEER demographics

Black men were younger, had worse cancer, lower SES, less likely to receive surgery.

After propensity weighting, no meaningful difference in any variable.

# SEER results

## Age

- 1.54 (1.49, 1.59)

## Age and severity

- 1.47 (1.43, 1.51)

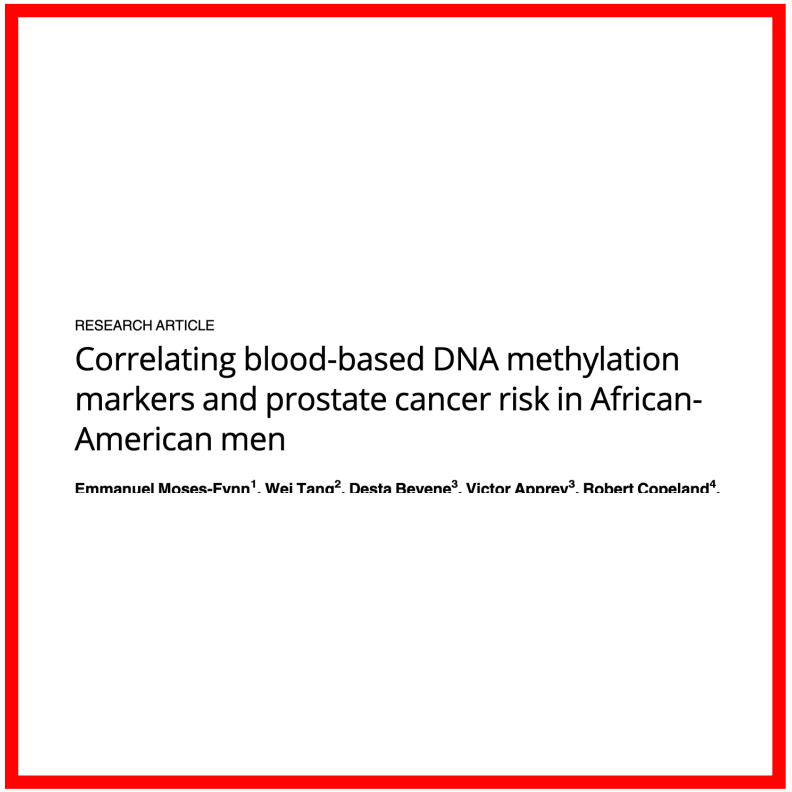
## Age, severity, and SES

- 1.30 (1.27, 1.34)

# SEER Conclusion

Adjusting for SES, cancer severity, and treatment black men are more likely to die of their prostate cancer. This could be due to a biological mechanism.

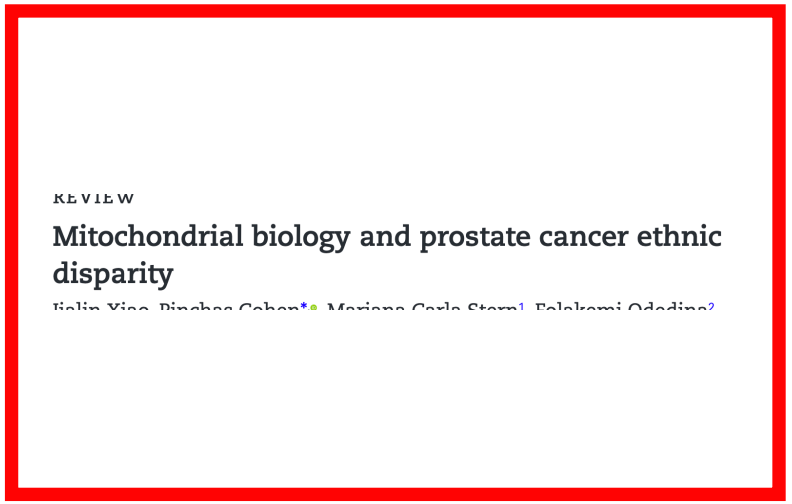
# Research on biology and prostate cancer


RESEARCH ARTICLE

Correlating blood-based DNA methylation markers and prostate cancer risk in African-American men

Emmanuel Moses-Fynn[1], Wei Tang[2], Desta Bevene[3], Victor Apprey[3], Robert Copeland[4],


**Elevation of Stromal-Derived Mediators of Inflammation Promote Prostate Cancer Progression in African-American Men**


REVIEW

Mitochondrial biology and prostate cancer ethnic disparity


SCIENTIFIC REPORTS

OPEN

Dysregulated gene expression predicts tumor aggressiveness in African-American prostate cancer patients

ived: 8 April 2018
pted: 22 October 2018

If you were reading this paper, what questions would you have for the authors?

# Assumptions of propensity scores

No unmeasured confounders

Unbiasedness proven in linear cases, but can still result in bias for odds ratios or hazard ratios

# Confounders

## Measured confounders

- Stage of disease
- Age
- Treatment

## Unmeasured confounders

- Distrust of medical professionals
- Access to care
- Institutional racism

# Institutional racism

**Definition:** Differential access to the goods, services, and opportunities of society

**Example:** Public school budgets are dictated by taxes. Wealthy areas with higher school budgets tend to be white. The quality of the education able to be provided is likely higher due to the larger budget.

# Institutional racism is seen in:

## Housing

Home Owner's Loan Corporation denying loans for areas with high risk of defaulting

## Health

EHR data is commonly from wealthy and white hospitals and algorithms from this data prioritize white diseases

## Crime/law

Police monitor minority neighborhoods more and have more contact with people in those areas leading to more arrests

## Education

Students who have to work to pay for school may do worse and be less likely to attend grad school

To look at the racial disparity in prostate cancer mortality, we examined 2 additional data sources with lower chances for unmeasured confounders

SEER

National cancer registry database

Commonly used observational data

VA

Equal access to care

RCT

4 RTOG trials

Homogeneous population

# VA data

5 equal access medical centers

All patients were treated with surgery

# Black Men: 1513

# White Men: 2495

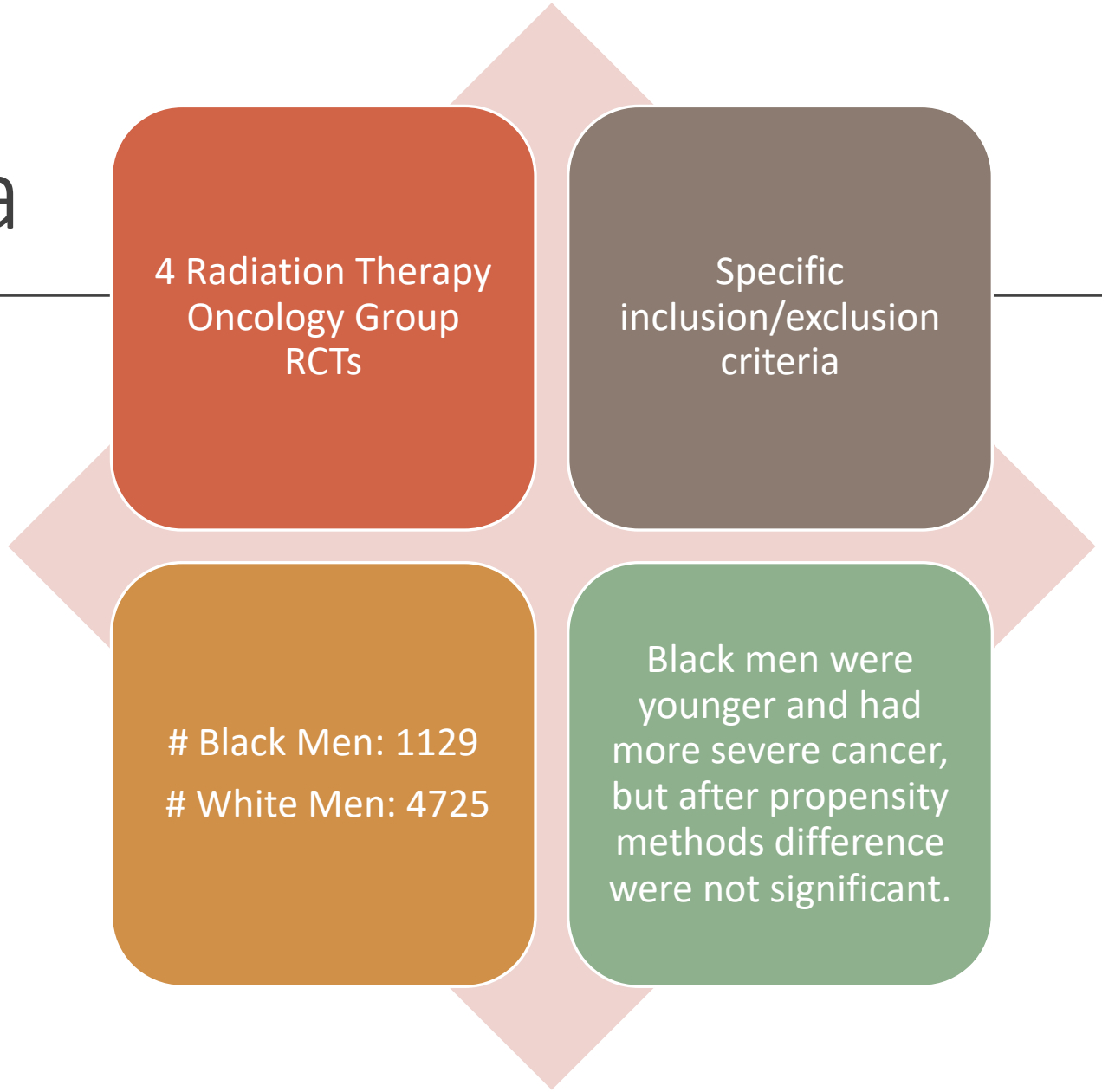
Black men were younger and had more severe prostate cancer, but these differences were not present after propensity weighting.

# VA results

Age adjusted: 0.88 (0.57, 1.34)

Age and severity adjusted: 0.85 (0.56, 1.30)

# RCT data


4 Radiation Therapy Oncology Group RCTs
Specific inclusion/exclusion criteria
# Black Men: 1129
# White Men: 4725
Black men were younger and had more severe cancer, but after propensity methods difference were not significant.

# RCT results

Age adjusted: 0.90 (0.74, 1.09)

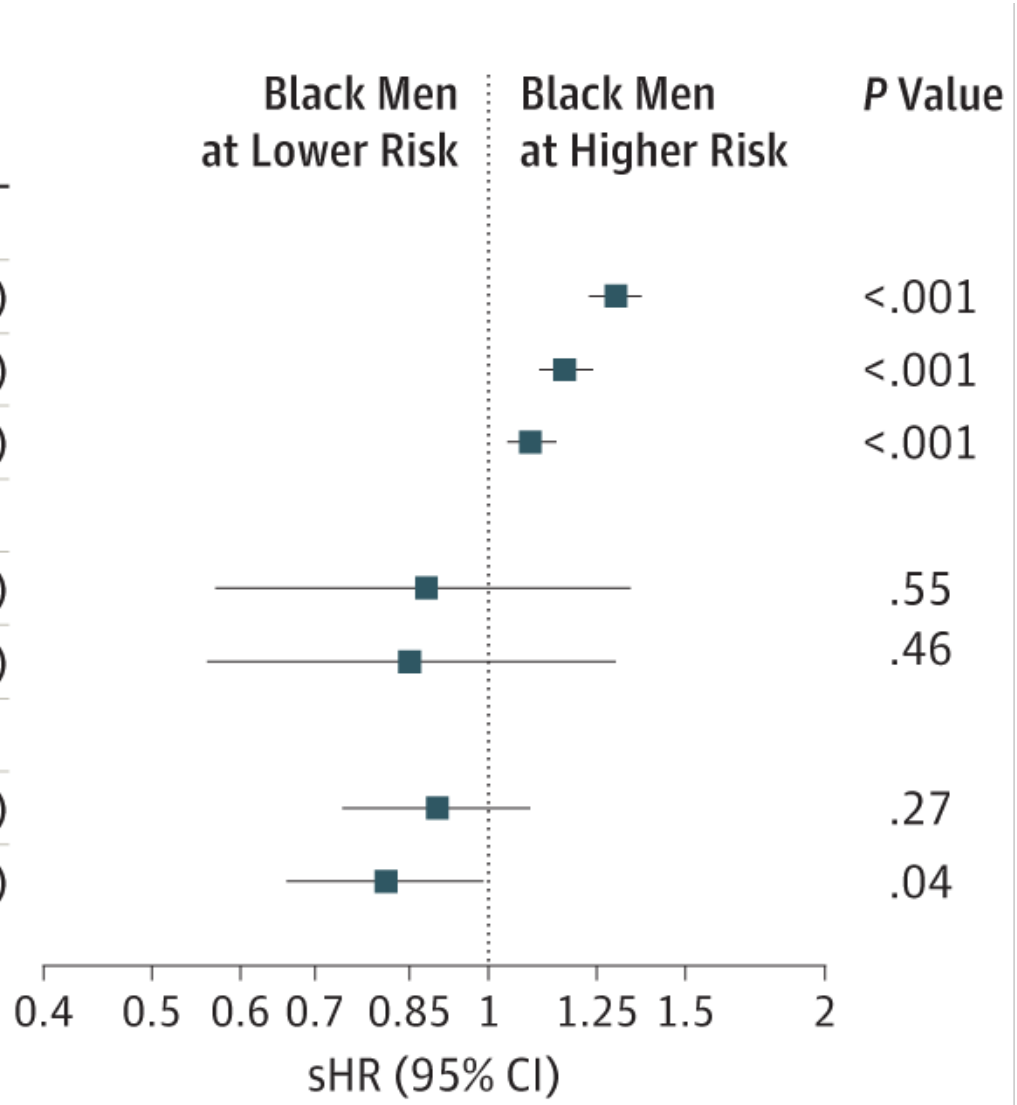
Age and severity adjusted: 0.81 (0.66, 0.99)

# RCT results

Age adjusted: 0.90 (0.74, 1.09)

Age and severity adjusted: 0.81 (0.66, 0.99)

| Cohort (No. Black/White) | sHR (95% CI) |
|---|---|
| SEER (52 840/243 433) | |
| Age weighted | 1.30 (1.23-1.37) |
| Age and stage weighted | 1.17 (1.11-1.24) |
| Fully weighted | 1.09 (1.04-1.15) |
| VA (1513/2459) | |
| Age weighted | 0.88 (0.57-1.34) |
| Fully weighted | 0.85 (0.56-1.30) |
| RCT (1129/4725) | |
| Age weighted | 0.90 (0.74-1.09) |
| Fully weighted | 0.81 (0.66-0.99) |



# Conclusions

The difference seen at the population level in prostate cancer specific mortality between black and white men is likely not due to biological differences.

If black men and white men receive equal care and have equal access, then they will have similar survival.

# What we don’t know from this work

01

Why do black men have higher incidence rates of prostate cancer?

02

Why do black men present with more advanced prostate cancer?

03

Why are black men more likely to die of other causes?

04

HOW do we fix these disparities?

# Effects of misusing statistical methods

Funds being used for incorrect solution (focusing on biology vs institutional racism)

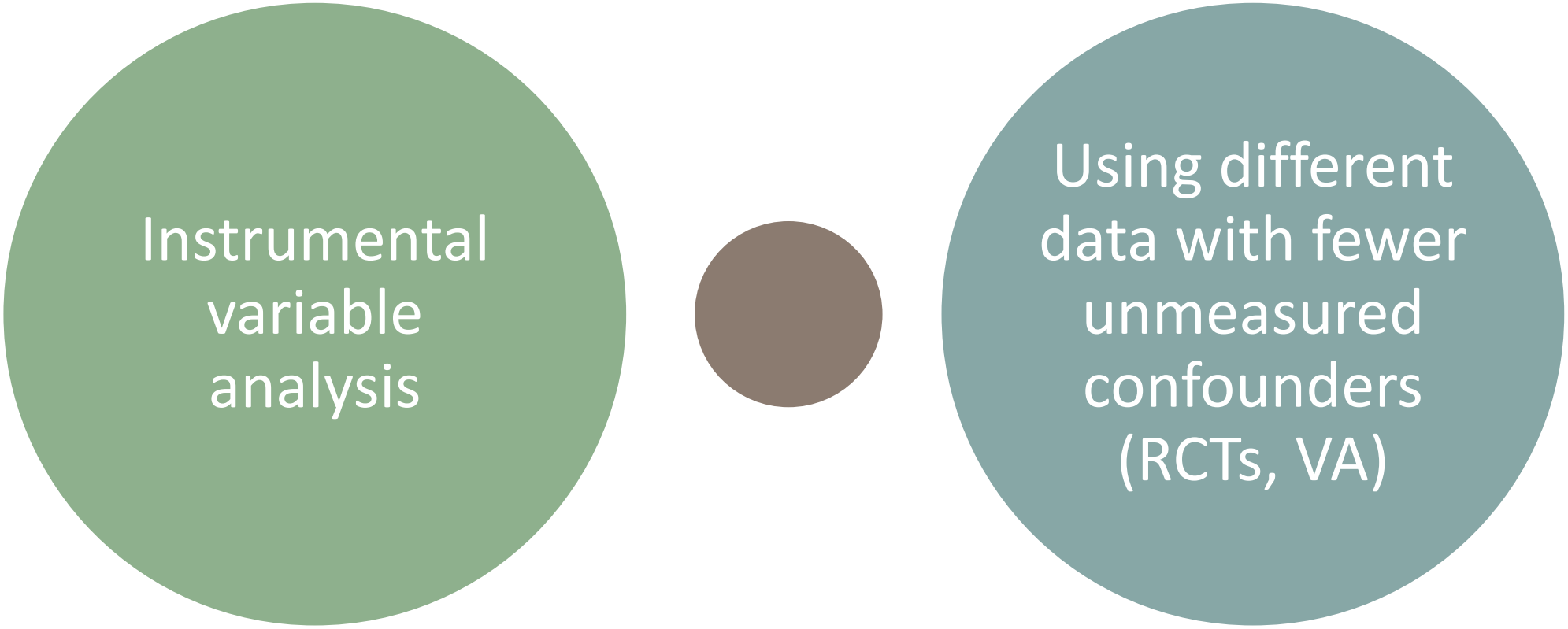
Differential treatment based on race because of belief of more aggressive cancer

Similar databases used to compare efficacy of treatments and we have also shown that these results do not match with RCTs leading to improper treatment guidelines

# Other areas with racial disparities

- Diabetes
- Cardiovascular disease
- Asthma
- Chronic kidney disease
- Hypertension
- Infectious Diseases

# Other statistical methods



# What can statisticians do?

| Discuss | Acknowledge | Clarify | Explore |
| --- | --- | --- | --- |
| Discuss the diversity within a study | Acknowledge institutional racism in our research and our own systems | Clarify the limitations of the methods and data used | Explore possible alternative explanations for results |

# Take away messages

Observational data has unmeasured confounders and we must use methods that account for this

Using improper methods will use up resources and time

# References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