

# Should statistical models of hospital quality include patient's race as a covariate?

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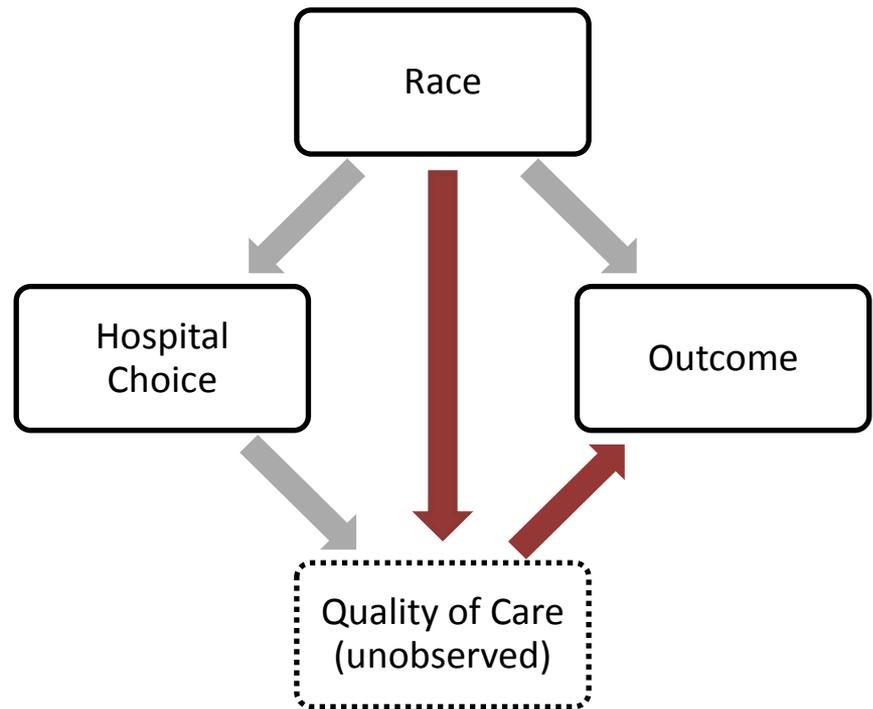
# Motivation

- Inadequate access to high quality hospital care may be a cause of racial disparities in health outcomes
- Increasingly, hospitals are ranked on quality of care based on statistical models
  - CMS, VA OQP
  - Readmission or death= $f(\text{patient risk factors})$
- Q: Should those statistical models include patient race as covariates?
- A: It depends on how race affects the outcome

# Three scenarios by which race can affect hospital outcomes

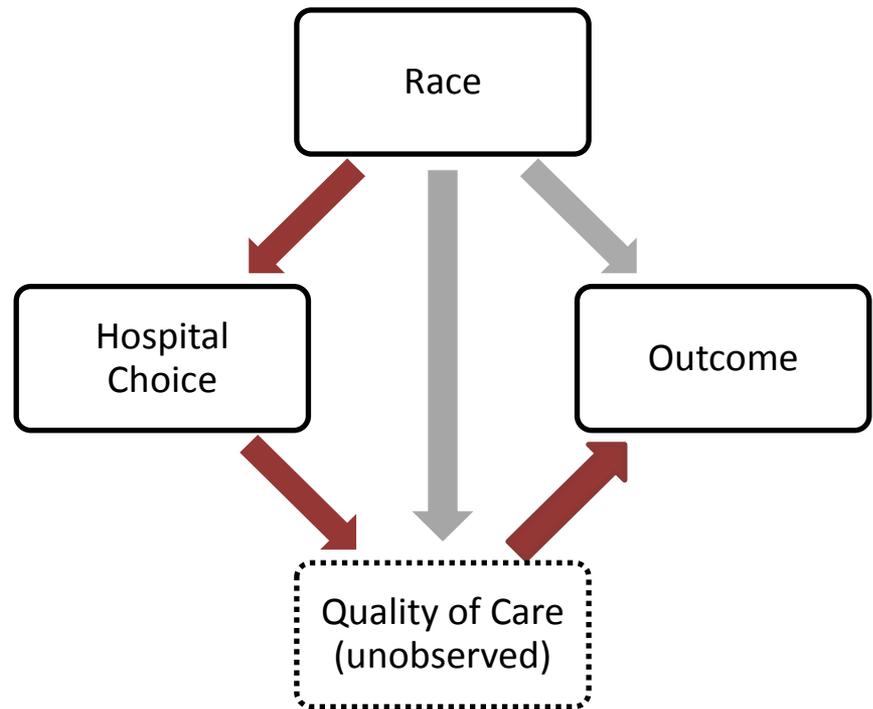
## 1. Treatment disparity

- White patients get better quality of care at all hospitals
- Communication problems, cultural competency, “statistical discrimination”
- Stereotyping, bias



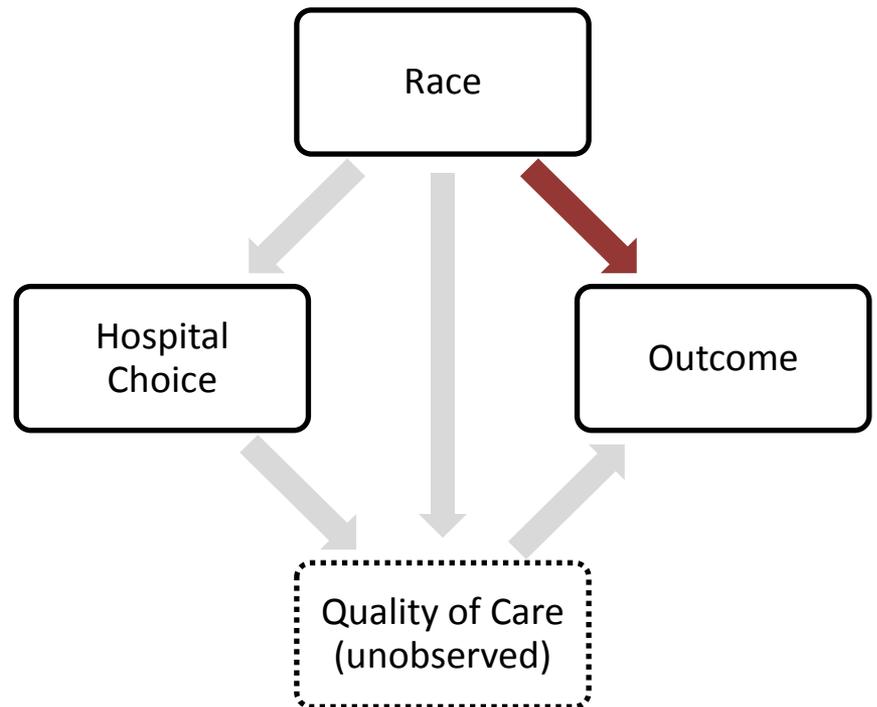
# Three scenarios by which race can affect hospital outcomes

1. Treatment disparity
2. Allocation disparity
  - White patients systematically go to hospitals where all patients receive high quality care



# Three scenarios by which race can affect hospital outcomes

1. Treatment disparity
2. Allocation disparity
3. Survival disparity
  - White patients are more likely to survive irrespective of in hospital treatment
  - Higher quality outpatient care for whites
  - Social determinants of health favor whites



# Conceptually, how does this affect the modeling of hospital quality?

Role of race in outcome of hospital care	Effect on modeling hospital outcomes
1. Treatment disparity	<b>DO NOT</b> include race as a covariate. Including race would be like controlling for racism
2. Allocation disparity	<b>DO NOT</b> include race as a covariate. Race is a marker for a bad hospital. Including race is would be like controlling for the provision of poor quality care.
3. Survival disparity	<b>DO</b> include race as a covariate. Race is a risk factor for bad outcomes. Controlling for race is like controlling for age or gender.

# Practically, what difference does it make if you do or do not include race?

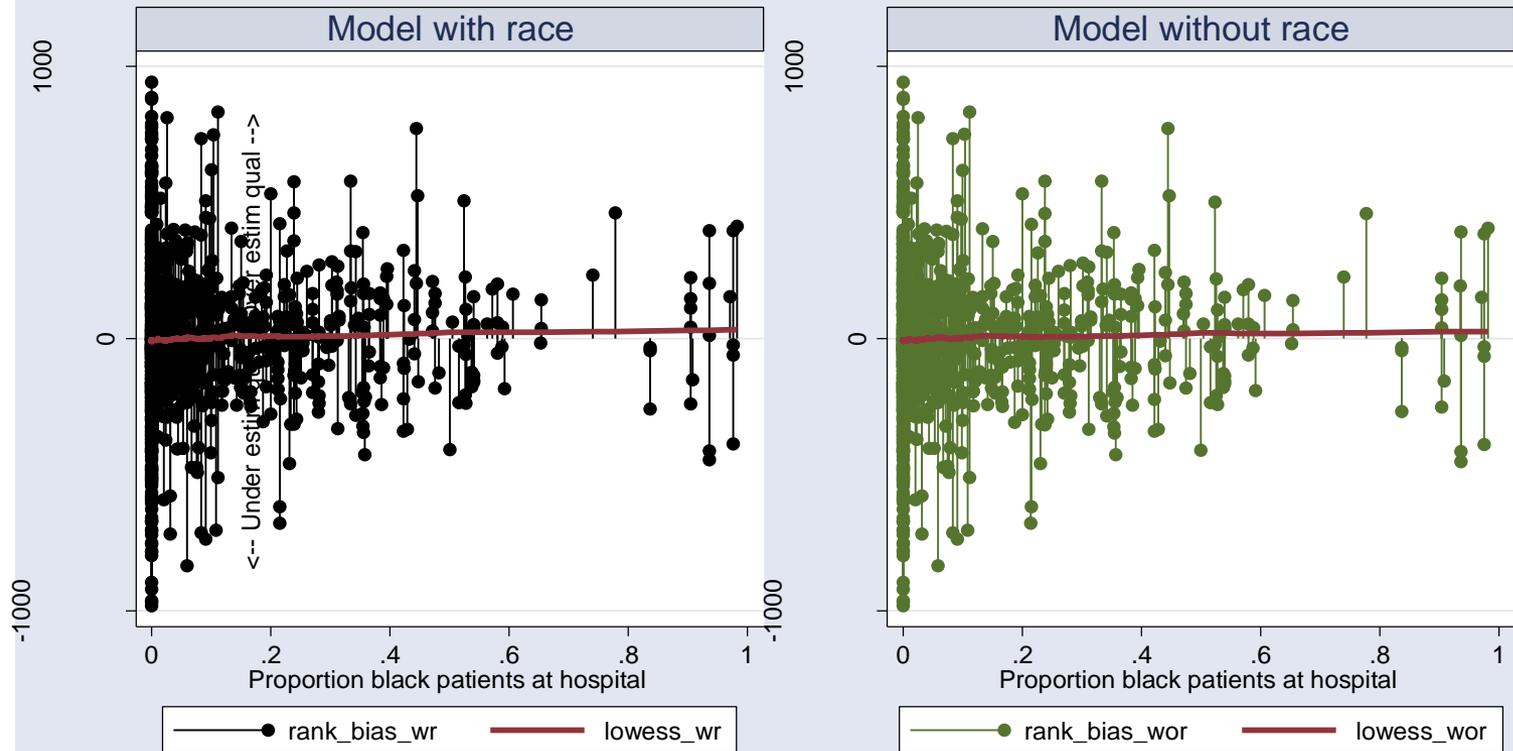
- Simulation: use hospital readmission for heart failure as example
- Fixed assumptions for simulations
  - 100,000 discharges from 1000 hospitals
  - Binary outcome: e.g., readmission/death
  - True hospital quality: Only 1 treatment is appropriate and each patient either gets it or doesn't. (In practice, this information is unobserved by the researcher.)
    - True hospital quality=% ptns who get appropriate treatment.
    - Assign quality to hospitals assuming it is  $\sim N(0.67,10)$
  - Two races: Black (15%) and White (85%)
    - Distribution of race across hospitals based on HCUP data 2008
  - Other assumptions:
    - probability of survival (no readmission) given poor quality (72%), probability of survival given good quality (90%)

# Simulation continued

- Vary assumptions about disparities
  - Treatment disparity: Black ptns are 80% as likely to receive appropriate tx as whites (test: 90%, 80%, 50%)
  - Allocation disparity: Probability that any ptn receives high quality care decreases by 0.5% with the every 1% increase in Black discharges at a hospital (test: -0.25%, -0.5%, -1.0%)
  - Survival disparity: Irrespective of treatment, Black ptns have 90% probability of survival of White ptns (test: 95%, 90%, 80%)
- Estimate hospital quality using statistical models that do/do not include race as covariate
- Report hospital **rank bias**: difference between true hospital quality rank and hospital quality rank estimated by statistical models
  - **Does rank bias change with more of black patients at a hospital?**
  - **What is the rank bias for a typical teaching hospital?**
    - Teaching=23% Black heart failure discharges; Non-teaching=9%

# Results: No disparities

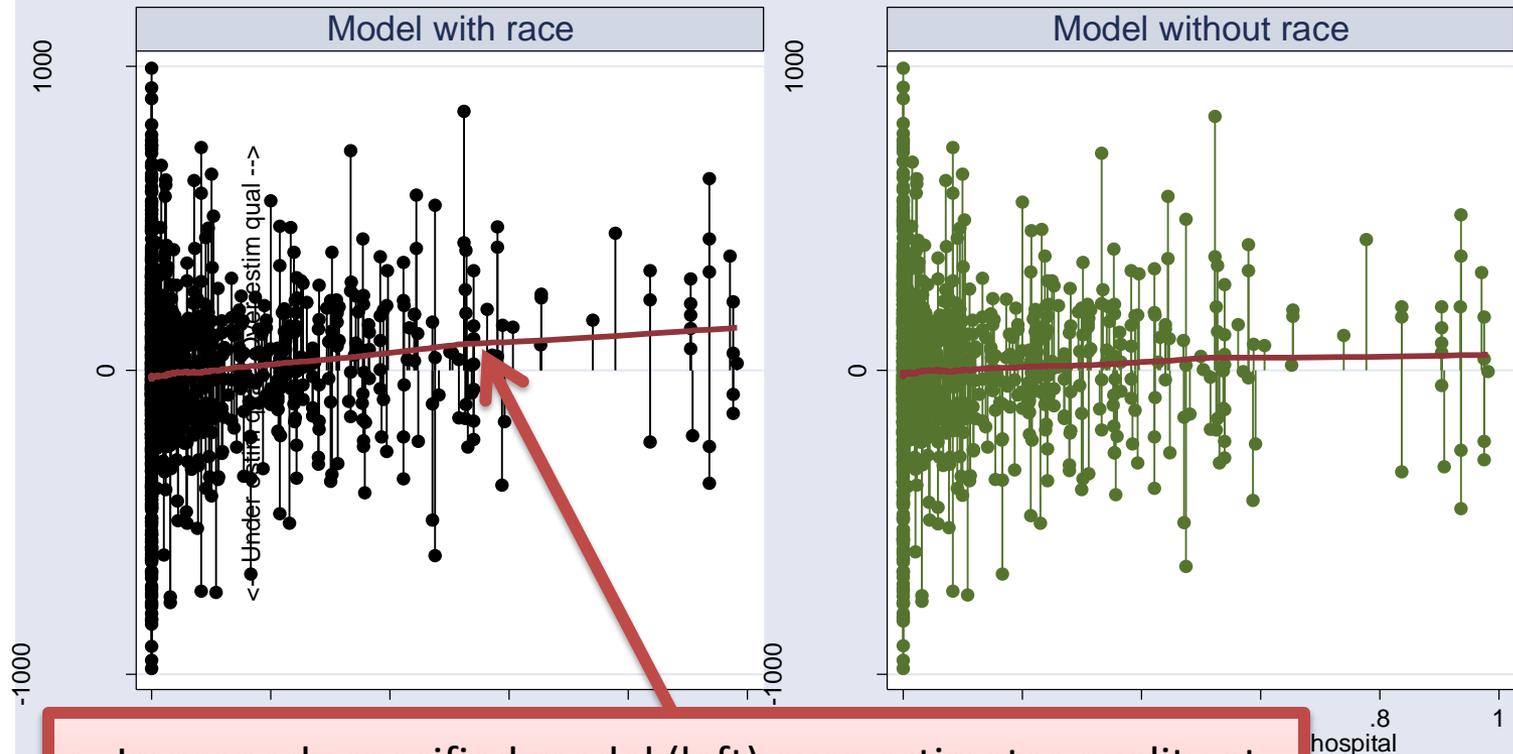
Rank bias as a function of percent Black patients  
Tx disparity=none Allocative disparity=none Survival disparity=none



**When there is no racial disparity, whether or not you include race in the model makes little practical difference.**

# Results: Treatment disparity= 0.8

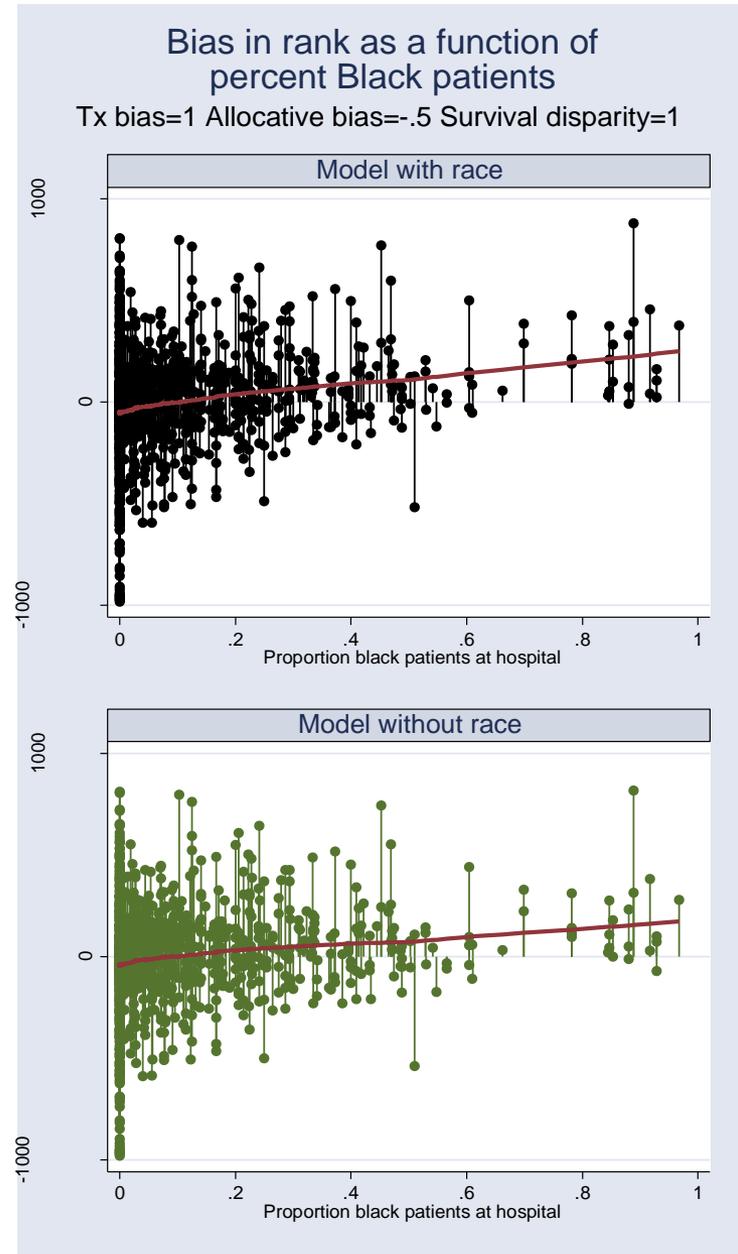
Rank bias for 1000 hospitals as a function of % Black discharges  
Tx disparity=0.8 Allocative disparity=none Survival disparity=none



- Improperly specified model (left) over-estimates quality at high % black hospitals more than correct specification, but
- Agreement in hospital rank between correct and incorrect models is high (kappa=0.92)

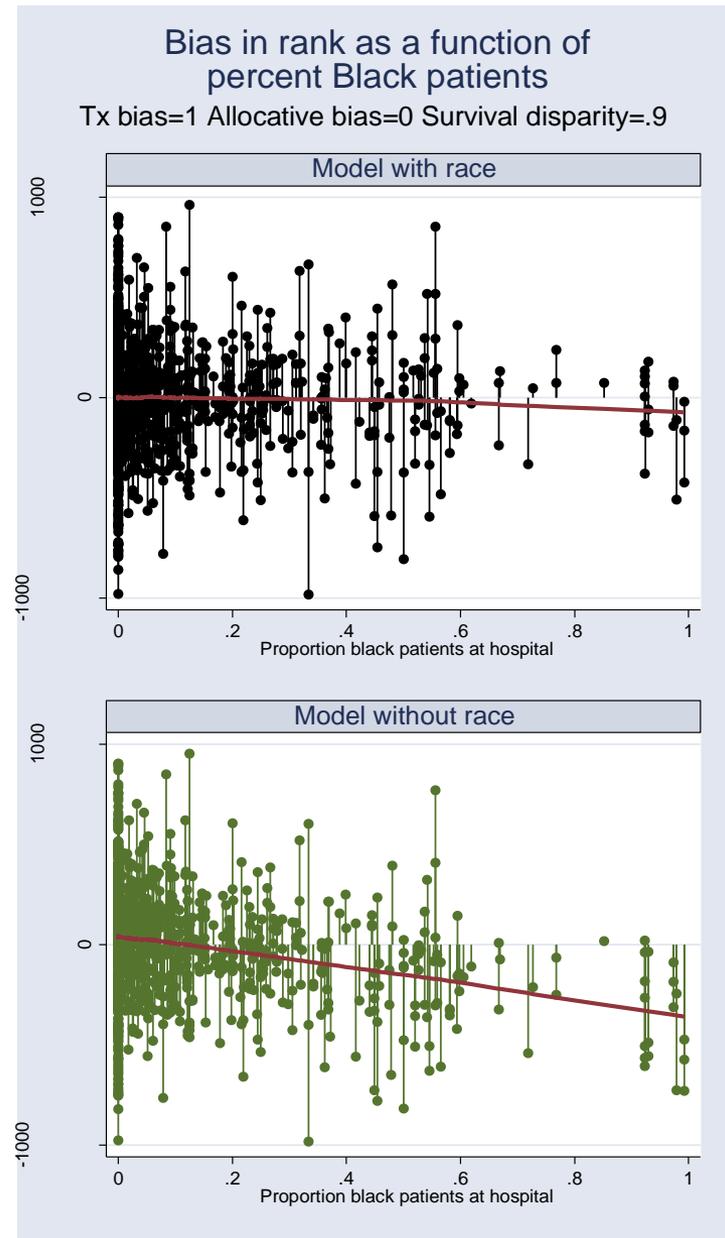
# Allocation Disparity

- Simulation: 1 % increase in Black discharges at hosp means 0.5% decrease in probability that any patient gets treated appropriately
- Results:
  - Overestimation of quality if model improperly include race (top), but
  - Agreement in hospital rank between models is still high (kappa=0.93)



# Survival Disparity

- Simulation: Black patients have 0.9 lower likelihood of survival regardless of treatment
- Results:
  - Sizable underestimation of quality at Black hospitals if model excludes race (bottom)
  - Agreement between models drops ( $\kappa=0.72$ )



# Consequence for the rank of a typical teaching hospital of model mis-specification

Penalty in loss/gain in rank for assigning rank by a mis-specified statistical model	
Treatment disparity	
0.9	+5.7
0.8	+10.3
0.5	+28.7
Allocation disparity	
-0.25	+5
-0.5	+9.4
-1.0	+13.4
Survival disparity	
0.95	-20.8
0.90	-41.0
0.80	-54.2

# Conclusion

- Relatively small penalties in terms of hospital rank for improperly including race as an explanatory variable if disparity in outcomes is caused by treatment or allocation disparities.
- Larger penalties for improperly excluding race if disparity in hospital outcomes is caused by survival disparities beyond the control of the hospital.
- My opinion: OQP and CMS should add race to models of hospital quality.
- Future research: how can you tell which type of disparity is causing the poor outcomes?