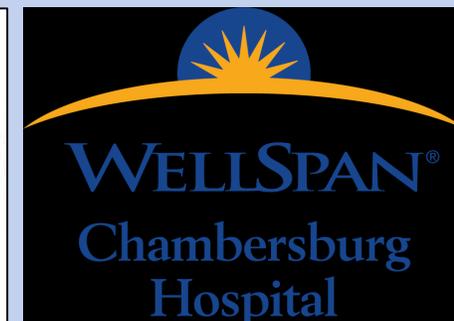
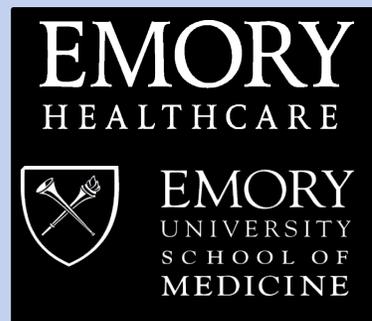


Geographic, Hospital-Level, and Racial Disparities in the Use of Advanced Imaging in the Emergency Department

Tarek N. Hanna, Ryan S. Dolan, Eric Friedberg, Ivan M. Dequesada,
Laura Chaves, Robert Pyatt, Richard Duszak Jr.



DISCLOSURES

- Work for this exhibit was performed with the support of the American College of Radiology Network Committee of the General, Small, Emergency and/or Rural Practice Commission.
- Dr. Richard Duszak receives research support from the Harvey L. Neiman Health Policy Institute.
- Dr. Tarek Hanna is a co-investigator on an American Society of Emergency Radiology grant unrelated to this work.
- Thanks to Danny R Hughes, PhD and the Harvey L. Neiman Health Policy Institute for their support with this study.
- No disclosures on behalf of the remaining authors.

BACKGROUND

Emergency department (ED) visits are rapidly increasing as a growing percentage of the U.S. population relies on EDs for healthcare [1,2]



22 million

Annual visits by Medicare beneficiaries [3]

Increasing number of Critical Access Hospitals (CAHs):
➔ Serve rural areas (>35 miles from nearest hospital)
➔ Predominantly emergency and short-stay visits (≤25 inpatient beds, ≤96-hour length of stay)



20% of U.S.

population (~60 million individuals) rely on CAHs for healthcare [4]

Use of advanced imaging, namely CT and MRI, has increased per ED encounter [2], playing a critical role in the diagnostic algorithm for many emergent conditions



Unequal access to or utilization of advanced imaging could influence patient outcomes



BACKGROUND

ED Health Disparities Exist

Patient Level

Race/Ethnicity:

- ➔ Difference in ED wait times, including for stroke imaging [5,6]
- ➔ Difference in ED resource utilization, including imaging [7,8]

Gender:

- ➔ Difference in ED wait times [6]

Hospital & Population Level

Critical Access Hospitals:

- ➔ Fewer clinical capabilities and resources, including imaging [9]
- ➔ Higher mortality rates for common conditions (myocardial infarction, heart failure, pneumonia) [10]

HYPOTHESIS: Risk-adjusted advanced imaging utilization in the ED differs based on patient-level characteristics (race/ethnicity, gender) and hospital or population-level characteristics (critical access hospital, rural vs. urban).

METHODS

Database: 5% Research Identifiable Files from Medicare

Year: 2015

Select: All Emergency Department visits

What is this? These research files contain a random, representative 5% national sample of Medicare fee-for-service beneficiaries.

Risk Adjustment: Using 2014 claims, Charlson Comorbidity Index (CCI) was calculated for each beneficiary.



Inclusion Criteria - The Patient:

- 1) Maintained continuous Medicare Part A and B enrollment for both 2014 and 2015
- 2) Age 65 or older in 2015
- 3) Lived in the 50 U.S. states or District of Columbia
- 4) Alive at the end of 2015

EXCLUDED

1

ED encounters occurring in hospitals without advanced imaging capabilities

2

Patients with any medical claims within 30 days prior to index ED event were excluded (to minimize confounding conditions)

METHODS

Included ED Patient Encounters

- Patient characteristics were identified using Medicare files
- Hospital characteristics were identified using the American Hospital Association (AHA) Annual Survey of Hospitals



- **Outcome variable:** ED patient received an advanced imaging procedure (dichotomous – yes or no)
- Multivariate logistic regression to assess influence of patient characteristics (gender, age group, race, ambulance transportation, CCI) and hospital characteristics (hospital region of country, hospital part of a network, academic institution, CAH status, urban vs rural)

AHA Survey was linked to ED visits of individual Medicare beneficiaries based on hospital they presented to providing more hospital characteristics to examine.

Our use of the 5% Medicare RIFs was approved by IRB for the American College of Radiology

RESULTS

Total ED visits: 901,917

Met Inclusion Criteria: 515,149

Exclude 428,173 individuals who had medical care <30 days prior to ED visit

Final Cohort: 86,976 ED visits

Factors associated with decreased use of advanced imaging in the ED:

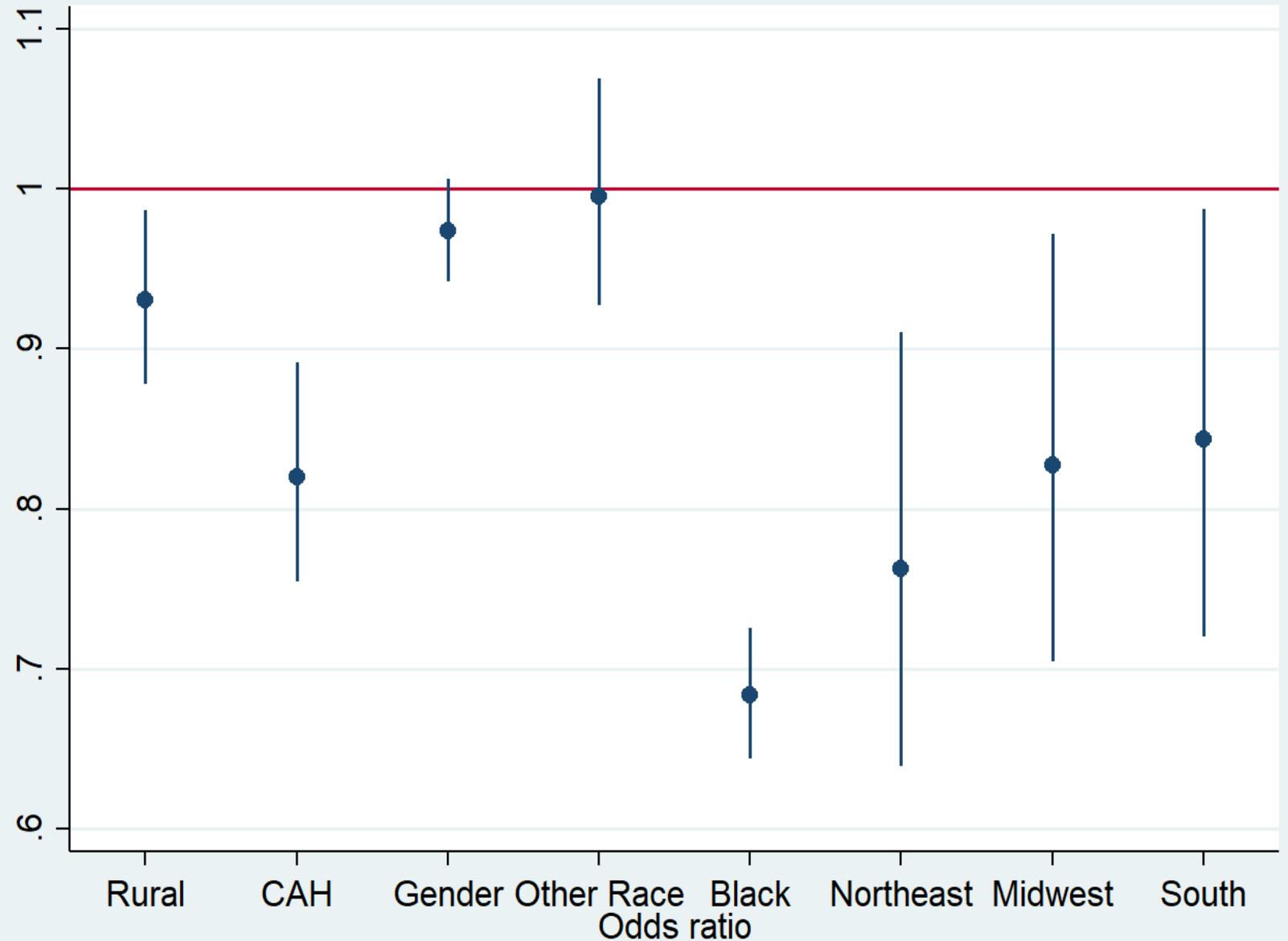
- 1) Rural hospital
- 2) Critical access hospital
- 3) Male gender
- 4) Black race
- 5) Younger age
- 6) Lower comorbidity index (CCI)

Variable	All episodes	Had Advanced Imaging	No Advanced Imaging	p-value
Qualifying ED Visits	Number (%)	Number (%)	Number (%)	
Rural Hospital Indicator				<.0001
Rural	25,245 (29.03%)	6,072 (25.14%)	19,173 (30.52%)	
Urban	61,731 (70.97%)	18,080 (74.86%)	43,651 (69.48%)	
Critical Access Hospital				<.0001
Yes	13,750 (15.81%)	2,850 (11.8%)	10,900 (17.35%)	
No	73,226 (84.19%)	21,302 (88.2%)	51,924 (82.65%)	
Gender				<.0001
Male	34,143 (39.26%)	9,001 (37.27%)	25,142 (40.02%)	
Female	52,833 (60.74%)	15,151 (62.73%)	37,682 (59.98%)	
Race				<.0001
White	72,304 (83.13%)	20,658 (85.53%)	51,646 (82.21%)	
Black	9,608 (11.05%)	2,147 (8.89%)	7,461 (11.88%)	
Other	5,064 (5.82%)	1,347 (5.58%)	3,717 (5.92%)	
Age Group				<.0001
65-69	4,731 (5.44%)	1,039 (4.3%)	3,692 (5.88%)	
70-74	23,143 (26.61%)	5,513 (22.83%)	17,630 (28.06%)	
75-79	17,109 (19.67%)	4,432 (18.35%)	12,677 (20.18%)	
80-84	14,188 (16.31%)	3,975 (16.46%)	10,213 (16.26%)	
85>	27,805 (31.97%)	9,193 (38.06%)	18,612 (29.63%)	
Charlson Comorbidity Index				<.0001
0	36,568 (42.04%)	9,643 (39.93%)	26,925 (42.86%)	
1	19,157 (22.03%)	5,381 (22.28%)	13,776 (21.93%)	
2	11,884 (13.66%)	3,508 (14.52%)	8,376 (13.33%)	
3 or more	19,367 (22.27%)	5,620 (23.27%)	13,747 (21.88%)	

RESULTS

ED patients at rural hospitals were 6.9% less likely to undergo advanced imaging compared to patients in urban hospitals (OR=0.931, $p=0.015$)

Black patients were 31.6% less likely to receive advanced imaging than non-black patients (OR=0.684, $p<0.001$)



The graph above includes odds-ratios from our multivariate regression for the likelihood that a Medicare ED patient received a CT or MRI during their ED encounter.

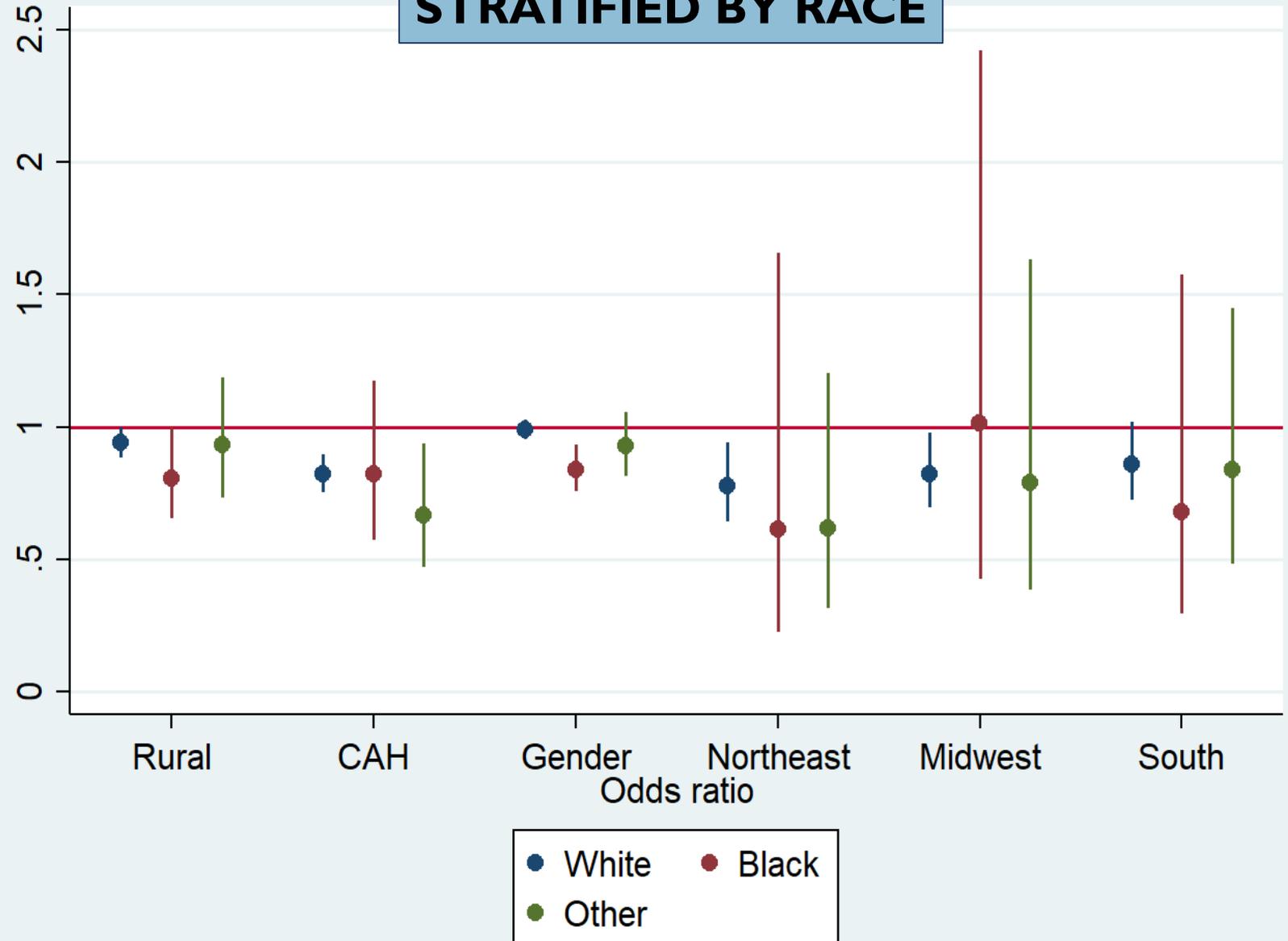
RESULTS

Rural black and white ED patients were less likely to receive advanced imaging relative to urban black and white patients (OR=0.808, $p=0.047$; OR=0.941, $p=0.05$)

White and non-white or black patients in CAHs were less likely to receive advanced imaging (OR=0.824, $p<0.001$; OR 0.667, $p=0.021$)

Black male ED patients were less likely to receive advanced imaging than black female patients (OR=0.841, $p=0.001$)

STRATIFIED BY RACE

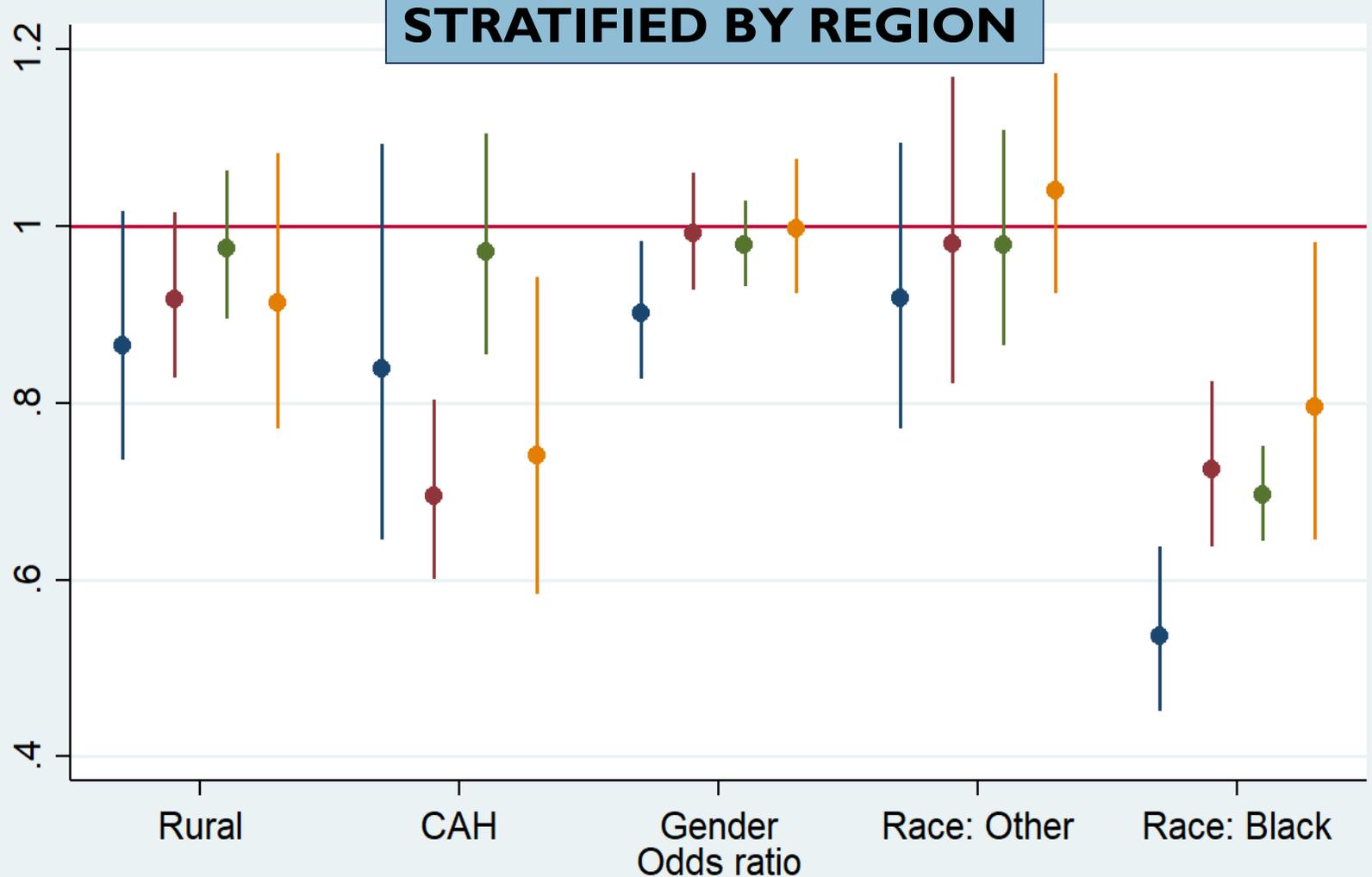


RESULTS

Black ED patients were less likely to receive advanced imaging in all regions (Northeast: OR=0.536, $p<0.001$; Midwest: OR=0.725, $p<0.001$; South: OR=0.696, $p<0.001$; West: OR=0.795, $p=0.032$)

CAH patients in the Midwest and West were less likely to receive advanced imaging (OR=0.695, $p<0.001$; OR=0.742, $p=0.014$)

Male patients were less likely to receive advanced imaging in the Northeast (OR=0.901, $p=0.018$)



DISCUSSION

1

Black ED patients were **31.6%** less likely to undergo advanced imaging in the ED

- Risk adjusted by controlling for Charlson Comorbidity index in the preceding (2014) year.
- Why doesn't the use of evidence-based protocols in the ED minimize such disparities? Suggest: inconsistent use. Further study is needed.
- This finding is in keeping with prior studies [8]; possibly unconscious bias.
- Although we don't prove it, one would think that such a disparity in advanced imaging use of this magnitude would impact clinical diagnostic accuracy, time-to-diagnosis and patient outcomes in certain conditions.

2

Rural ED patients were **6.9%** less likely to undergo advanced imaging in the ED

- Keep in mind we eliminated hospitals without advanced imaging capabilities, so these are rural ED patients presenting to hospitals *with* CT/MRI
- We don't examine imaging appropriateness, so it could be that urban ED patients are being over-imaged or rural patients are being under-imaged. For rural America, this is concerning, and deserves further study.

DISCUSSION

3

ED patients at Critical Access Hospitals were **18%** less likely to undergo advanced imaging

- As before: Risk adjusted by controlling for Charlson Comorbidity index. And, these are only hospitals with advanced imaging capabilities.
- Critical access hospitals serve approximately 20% of the U.S. population, predominantly in rural areas, where patients are generally older, sicker, and of lower socioeconomic status than urban counterparts [10,11].
- Again, we don't look at imaging appropriateness here, but this is a big difference in imaging use between critical access hospitals and not.
- We know from prior literature that certain conditions have worse outcomes at Critical Access Hospitals. Here we show that there is significantly less imaging of these ED patients. Could the lack of imaging be a part of the cause of missed diagnosis/treatment and poor outcomes?

DISCUSSION

- Among Medicare fee-for-service beneficiaries receiving care in the ED, marked disparities exist in advanced imaging utilization across the United States based on patient characteristics (race, gender) and hospital or population characteristics (critical access hospitals, rural hospitals, region of country).
- Decreased use of diagnostic imaging may affect time-to-diagnosis and provider diagnostic accuracy and alter treatment algorithms, potentially leading to misdiagnosis, delayed diagnosis, or worse outcomes.
- Conversely, unnecessary over-imaging of patients may lead to repeated exposure to ionizing radiation (and its resultant health implications) and increase overall healthcare costs.
- This study does not examine appropriateness of such imaging but suggests inequity in ED medical imaging utilization among a risk adjusted population with uniform insurance coverage.

Inequity vs. inequality: these terms are *not* interchangeable. Inequity refers to unfair, avoidable differences while inequality simply refers to the uneven distribution of resources. In this study we attempt to adjust for unequal availability and distribution of imaging services, (e.g. multivariate regression + eliminate hospitals without CT/MRI) which is why our study suggests inequity.

TAKE HOME POINTS

- Certain groups of patients and those presenting to certain hospitals are less likely to get advanced imaging in the Emergency Department even when it's available:
 - Black ED: **31.6%** less likely
 - Critical Access Hospital ED patients: **18%** less likely
 - Rural ED patients: **6.9%** less likely
- We know from prior studies there is inequality in the distribution and availability of imaging equipment. This study demonstrates suspected inequity in utilization of ED medical imaging at the patient and hospital level.
- We suggest that this inequity in advanced imaging use may contribute to *known* disparities in healthcare outcomes (many of which have unknown etiologies).
- Focused efforts to address and mitigate these differences are needed.
- Potential future steps include standardizing ED imaging utilization or documenting guideline compliance objectively to eliminate disparities in both advanced imaging, and more importantly, in ED outcomes.

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THANK YOU FOR YOUR ATTENTION! PLEASE CONTACT TAREK.HANNA@EMORY.EDU FOR QUESTIONS.