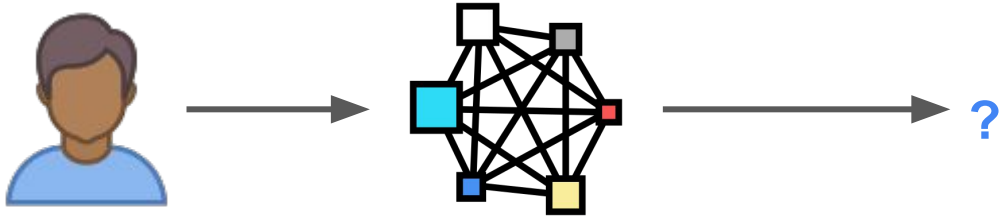
Surprising Performance Disparities in Atlanta!

Datathon Team 6 – Emory CXR Dataset

Problem Statement



We wish to train disease classifiers to **accelerate and support** clinical workflows

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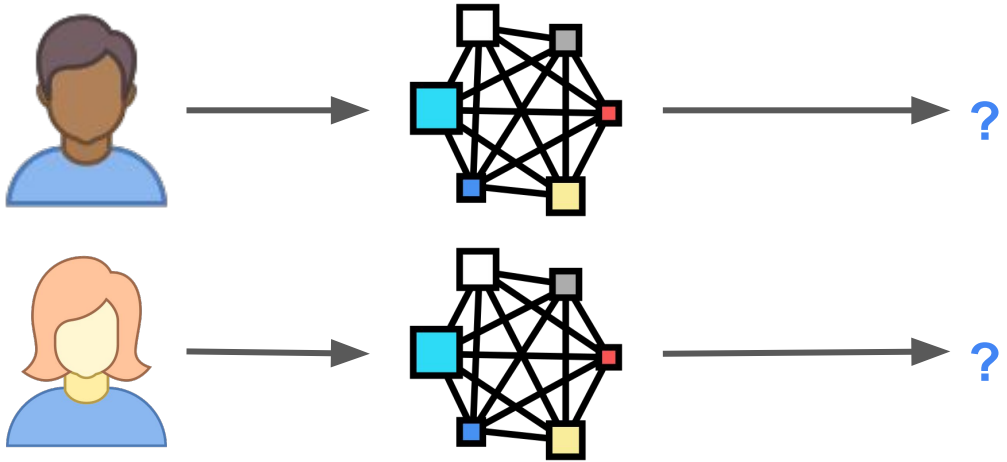
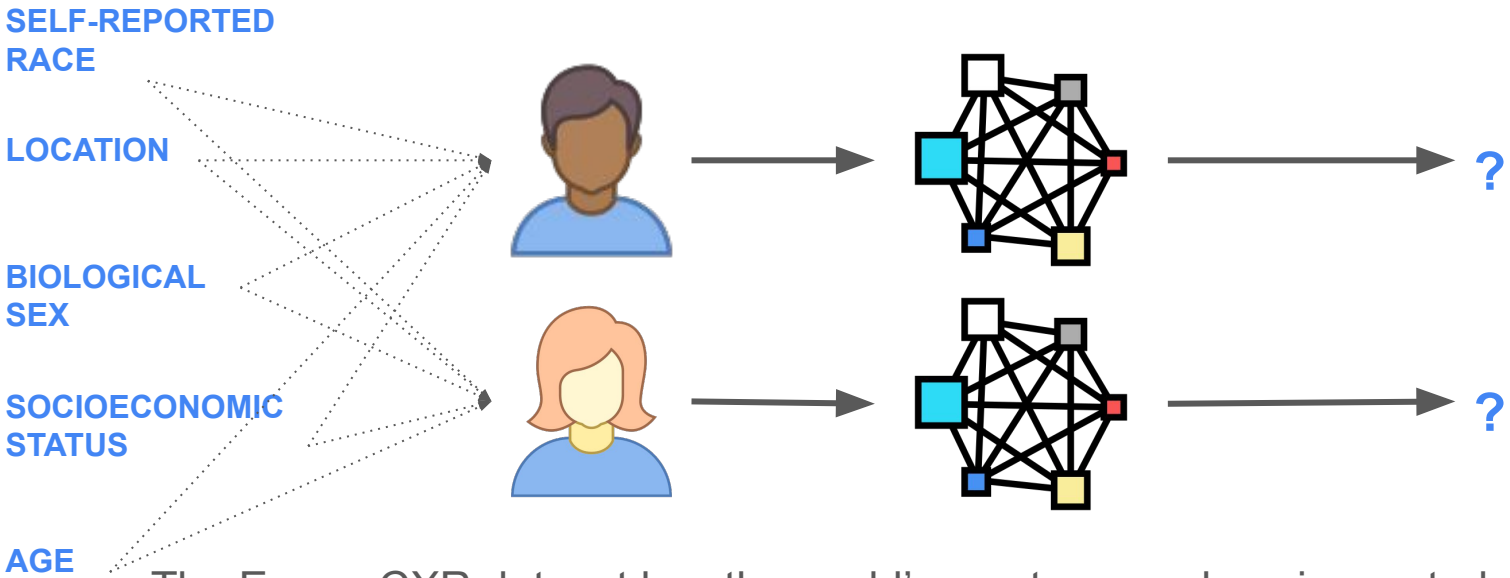


But such models may **learn to rely on sensitive information.**
This often causes **performance disparities** in deployment**.**

Problem Statement



The Emory CXR dataset has the world's most comprehensive metadata.

Can we leverage this metadata to gain insight into algorithmic bias?

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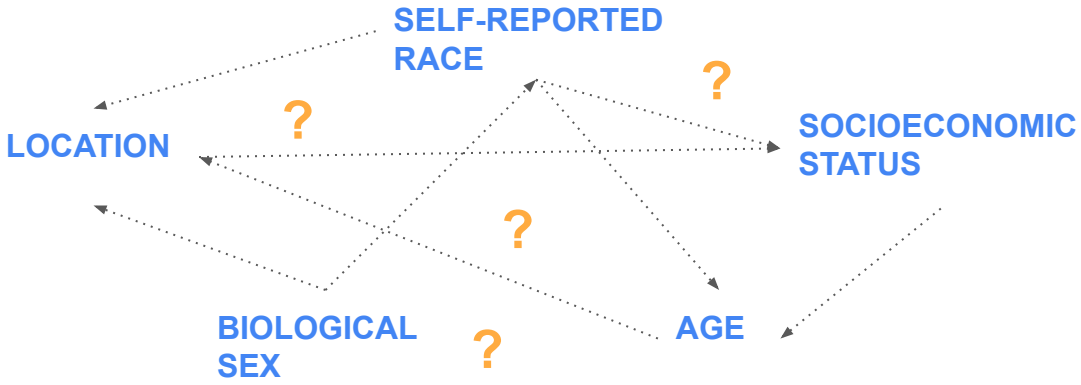
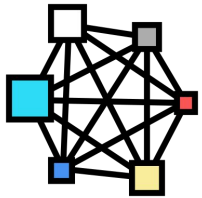
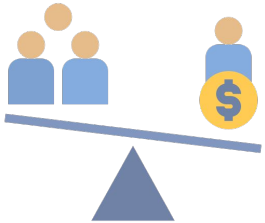


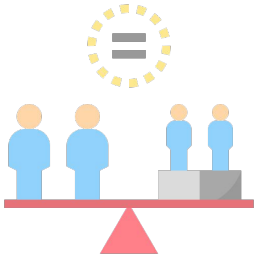
Previous work has demonstrated performance disparities related to Sex, Age, Race. **But these variables may be confounded by other factors.**

With the Emory CXR dataset, we have the world's most comprehensive metadata. **Which attributes are the most important for studying algorithmic bias?**

Our Analysis







STEP 1:

Analyse correlations between findings and protected attributes

STEP 2:

Train a disease classifier to predict presence of Pneumothorax, Pleural Effusion and Cardiomegaly

STEP 3:

Analyse subgroup-wise performance disparities to detect potential algorithmic bias.

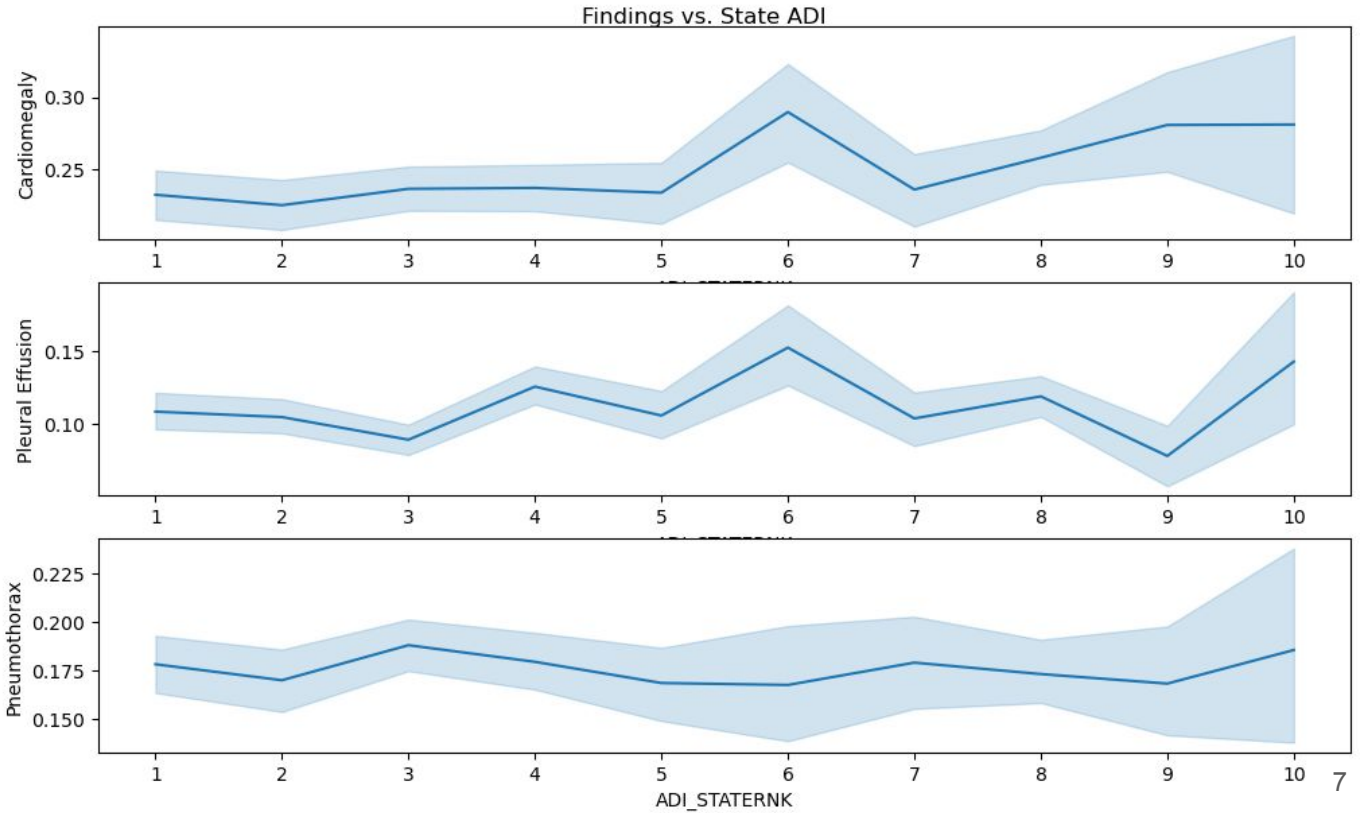
...

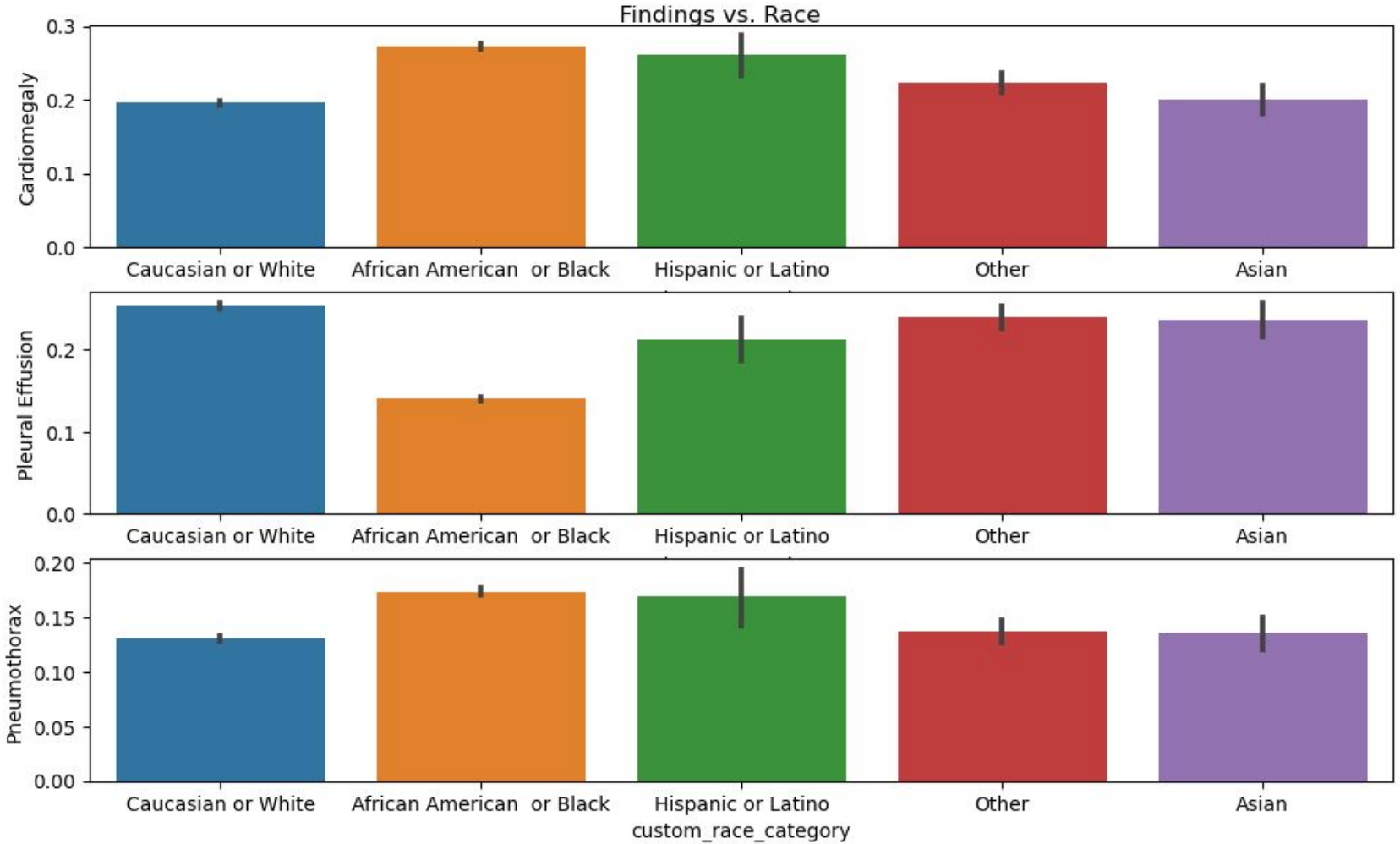
STEP 4 (future):

Implement bias mitigation strategies to improve performance on worst subgroups.

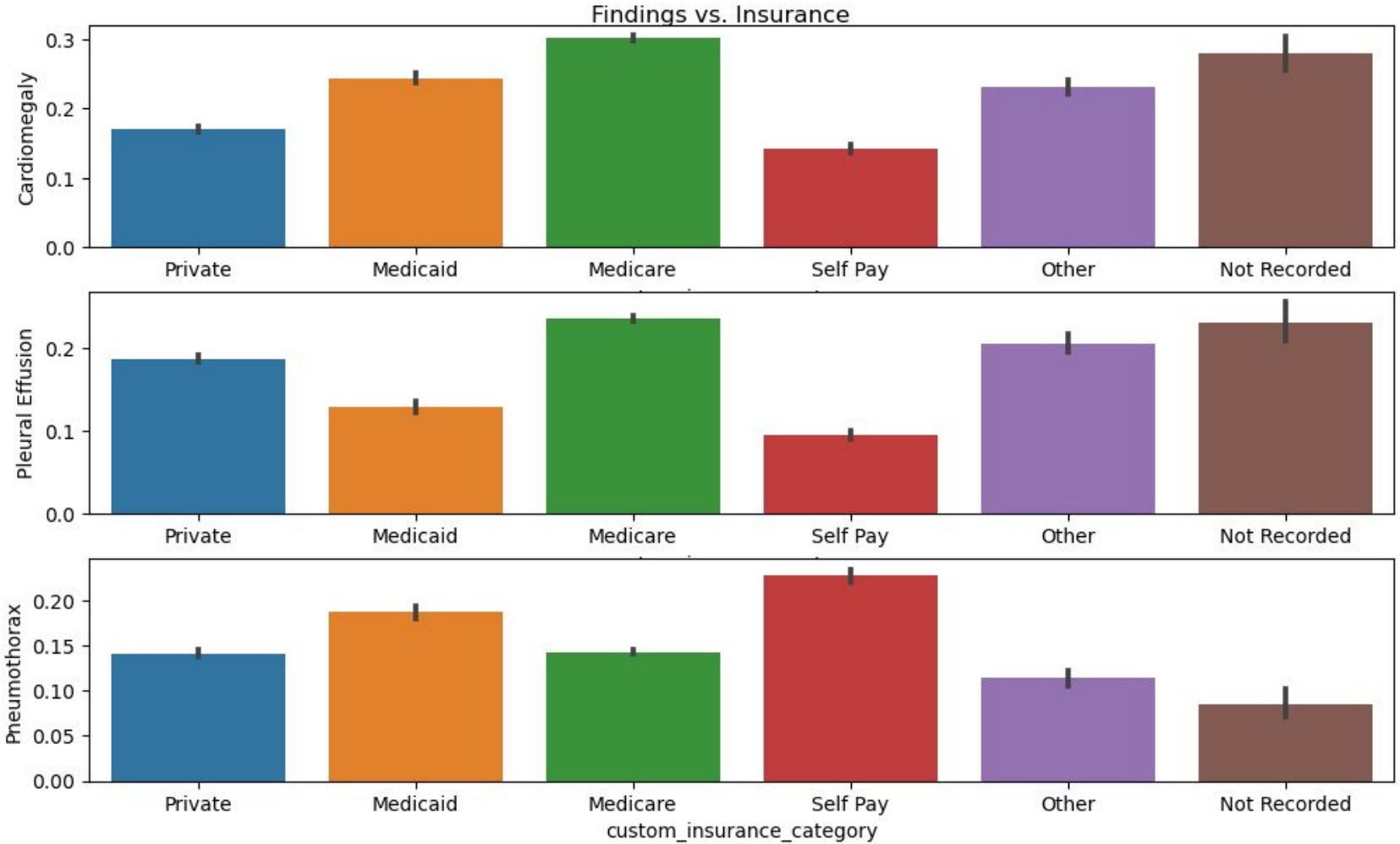
Findings distribution by Area Deprivation Index

State ADI: Block groups ranked from **1 = least disadvantaged** to **10 = most disadvantaged** in each state based on an index of 17 socioeconomic factors.



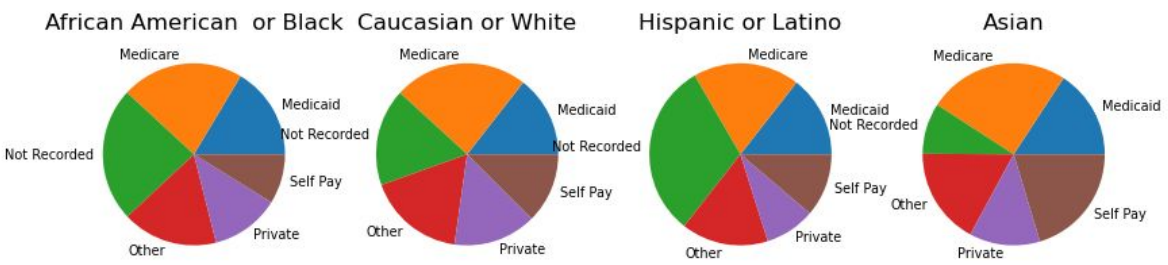


- **Most Prevalent Groups - Cardiomegaly: Blacks, Pleural Effusion: Whites, Pneumothorax: Blacks**

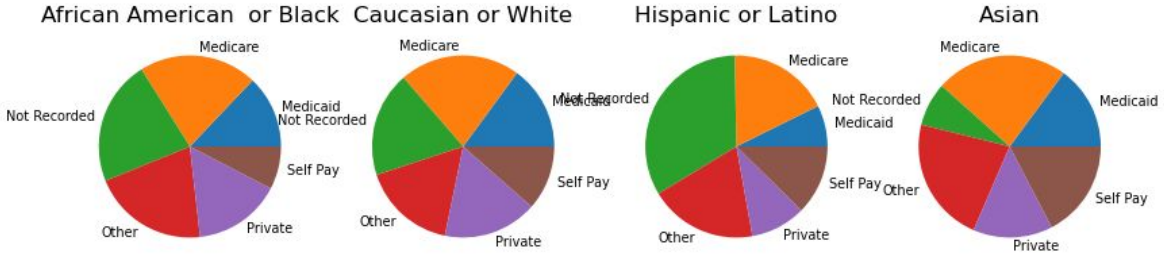


- **Most Prevalent Groups - Cardiomegaly: Medicare, Pleural Effusion: Medicare, Pneoumothorax: Self Pay**

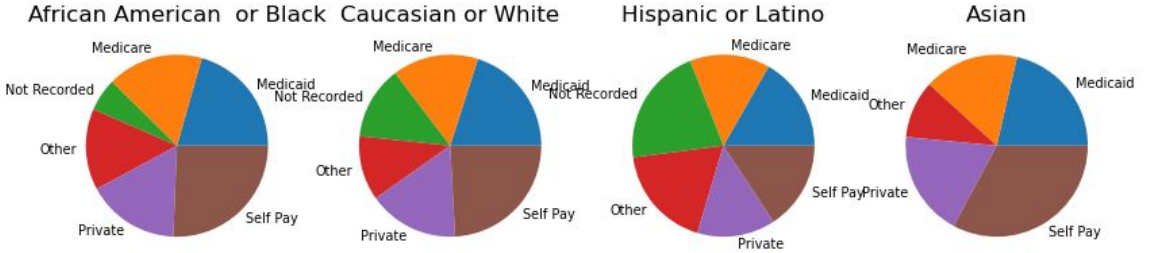
'Cardiomegaly'



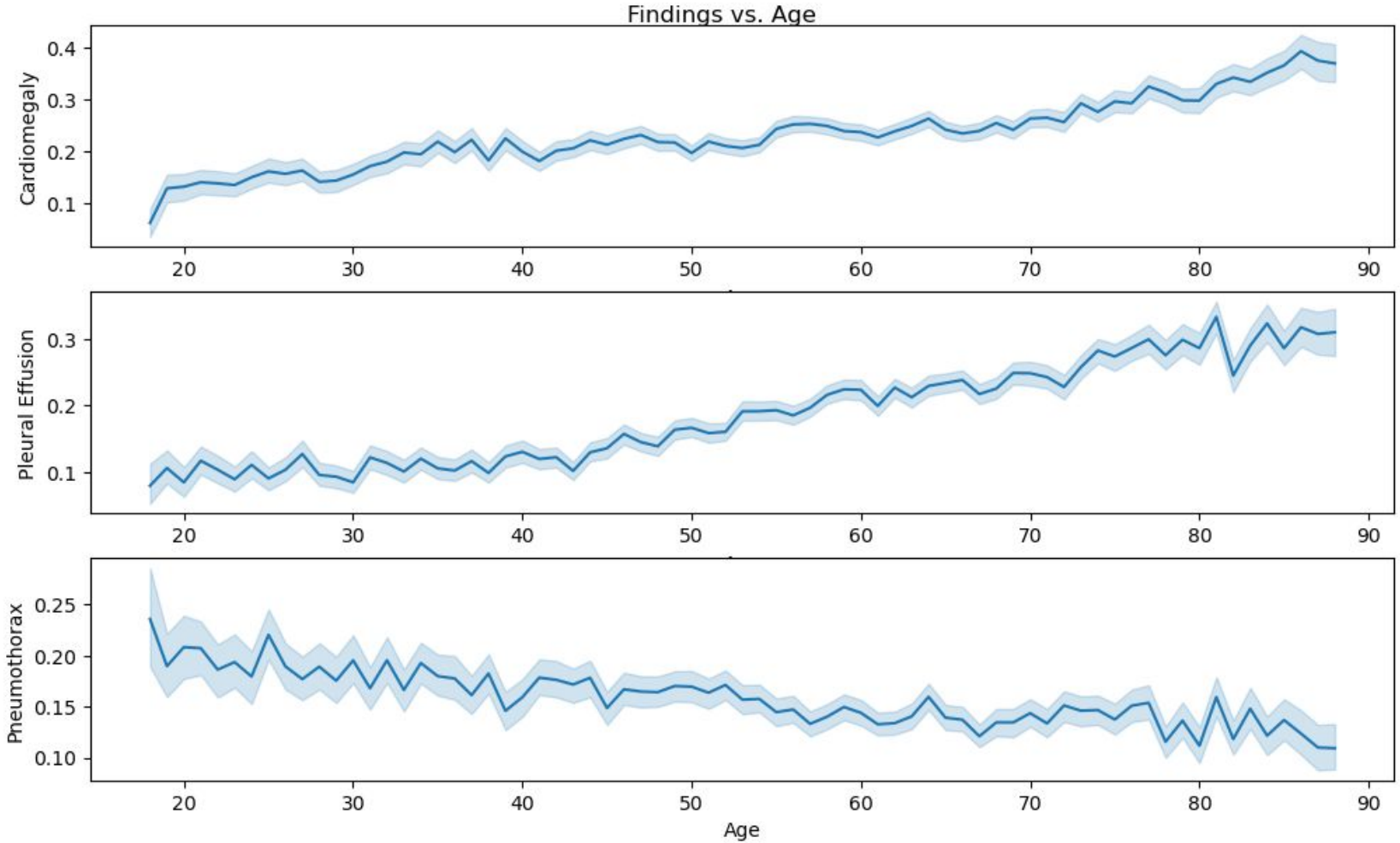
'Pleural Effusion'



'Pneumothorax'

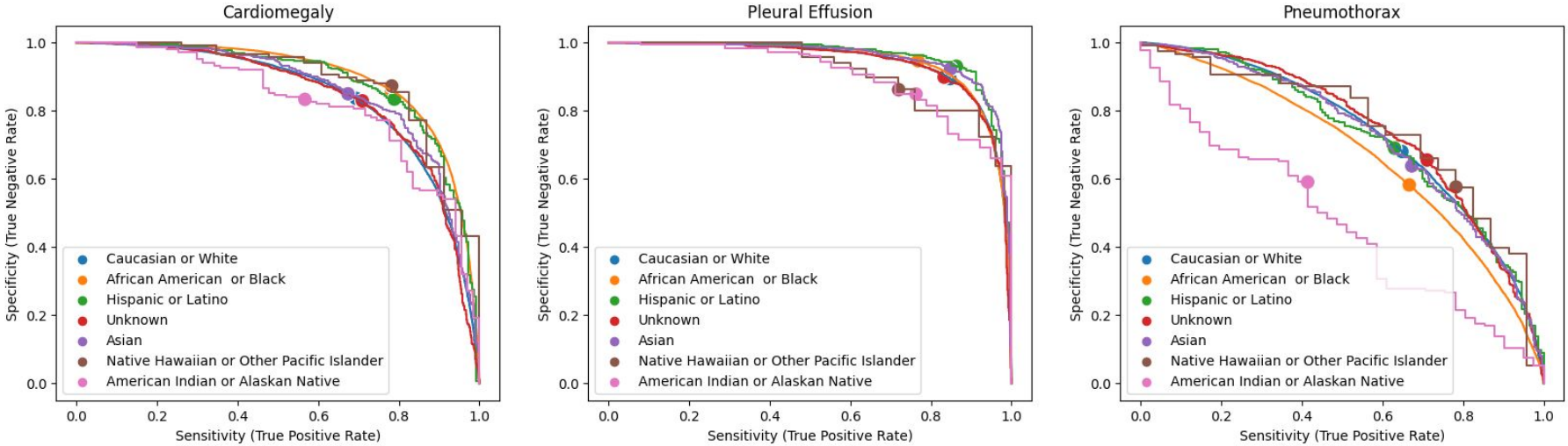


- **Similar Insurance pattern across Blacks and Whites**
- **More ‘Not Recorded’ in Latinos and more ‘Self Pay’ in Asians**



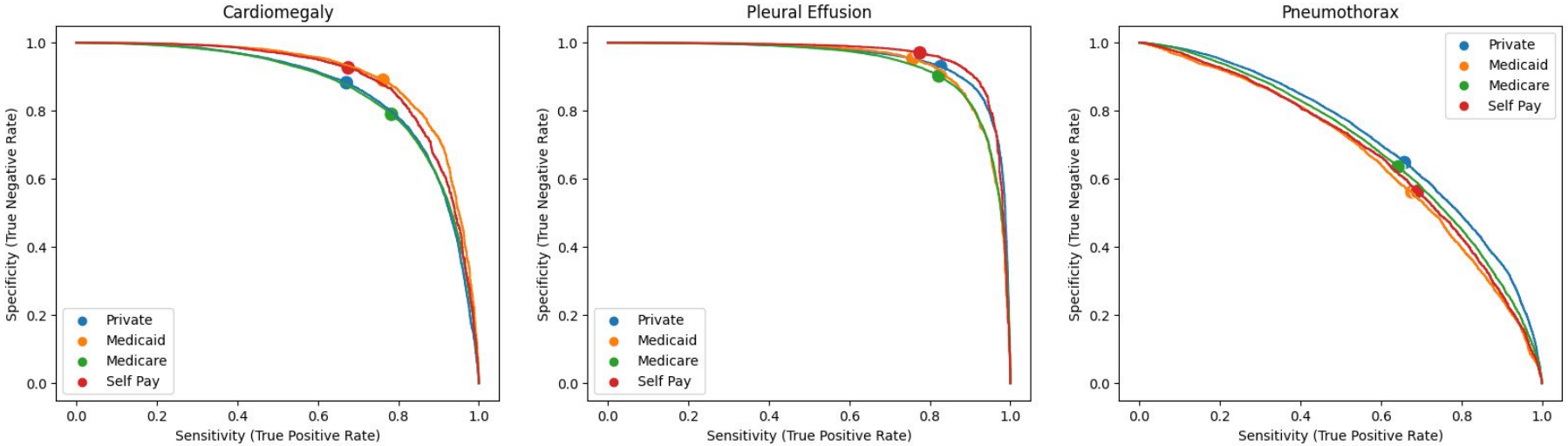
- **Most Prevalent Groups - Cardiomegaly: Older, Pleural Effusion: Older, Pneoumothorax: younger**

Performance disparities in function of self-reported race



Native americans have the worst performance across all disease.
Surprisingly and contrarily to previous work, on this dataset results are better on African American than on White subgroup.
→ **This shows that bias analysis should be repeated for every datasets / true underlying population.**

Performance disparities in function of insurance type

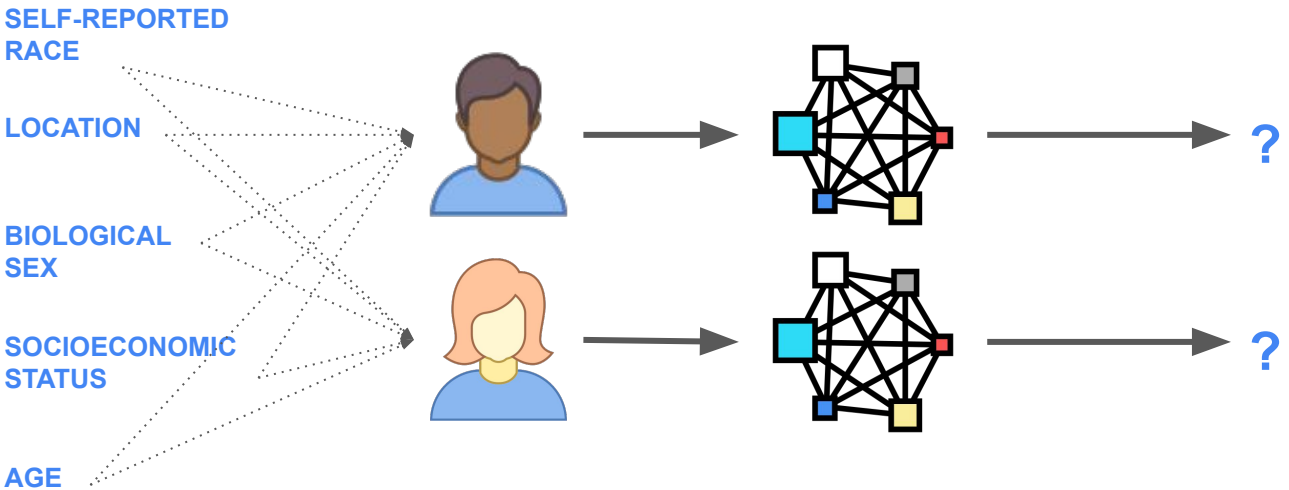


Surprisingly for Cardiomegaly our model performs better on Medicaid / Self Pay patients than on the others.

The opposite is true for Pneumothorax

→ **Not all models may show the same biases. Traditionally "under-served" population may not be necessarily the worst performing group. This may also be symptomatic of some underlying spurious correlation between labels and population characteristics.**

Summary: Surprising Performance Disparities in Atlanta!



- Preconceptions and intuitions about bias can be misleading!
- We studied performance disparities based on insurance and race.
- Compared to previous work, our results had disparities reversed!