

## Overview

In this assignment, you will replicate and stress-test the findings of “*Dissecting racial bias in an algorithm used to manage the health of populations*” (Obermeyer et al., 2019) which claim to uncover a case where the choice of proxy variable (medical costs) induces significant systemic bias in race. You will use the publicly available [synthetic dataset](#) released by the authors to do this analysis.

## Tasks

### 1) Replication

Recreate multi-panel figures 1 and 3 on the synthetic dataset. This involves producing calibration curves against the number of chronic conditions and mean health expenditures.

In a writeup, document any implementation preprocessing "judgment calls" you made and discuss whether alternative reasonable choices could have been made. Also comment on how your results compare to the results in the main paper. It's possible that your replication may not exactly reproduce the main findings (note that the available dataset is synthetic). Are the qualitative conclusions the same from your analysis and the original paper?

### 2) Prediction

Next you will explore whether these conclusions hold for different metrics on a different health outcome. In the paper, the authors define **uncontrolled blood pressure** as systolic blood pressure exceeding 139 mmHg. We will now evaluate the risk score against this binary target. Produce ROC curves and report on the AUC for the entire population and stratified by race. Create a binary variable **High Cost** that indicates whether cost expenditure exceeded the median costs, and reproduce the ROC/AUC analysis using **High Cost** as the target. Provide compelling visualizations (e.g., overlaid ROC curves or AUC tables) and relevant metrics comparing results across label choice and demographic stratification. Discuss your results, and whether they materially change the consequences of the bias in the algorithmic bias.

### 3) Stability

Perturb the analysis or visualization from Task 1 or 2 to deepen the audit of the bias. Choose the perturbation you believe best strengthens understanding of the effect of the bias. Some options:

- label stability: how does the magnitude of the bias change if you redefine “health”?

- population subsampling: does the bias vary across different insurance types or age demographics in the synthetic data? A bootstrap of individual patients, though good to check, will not be compelling enough.

- metric/visualisation stability: does the bias persist with a different metric for algorithmic bias? (see data and analytic strategy section)

Discuss the results and conclusions of your stability check.

### *What to submit*

You should hand in a short report in response to this assignment, no longer than 4 pages. A short introduction should discuss the flow of the report. The structure should roughly follow the 3 categories named above with a concluding section summarizing results and findings.

Please also submit any script necessary for reproduction by sharing the code script/notebook.