

# Inequity in Risk Prediction: Examining and Mitigating Racial Bias in the Veterans Affairs Care Assessment Needs (CAN) Risk Model

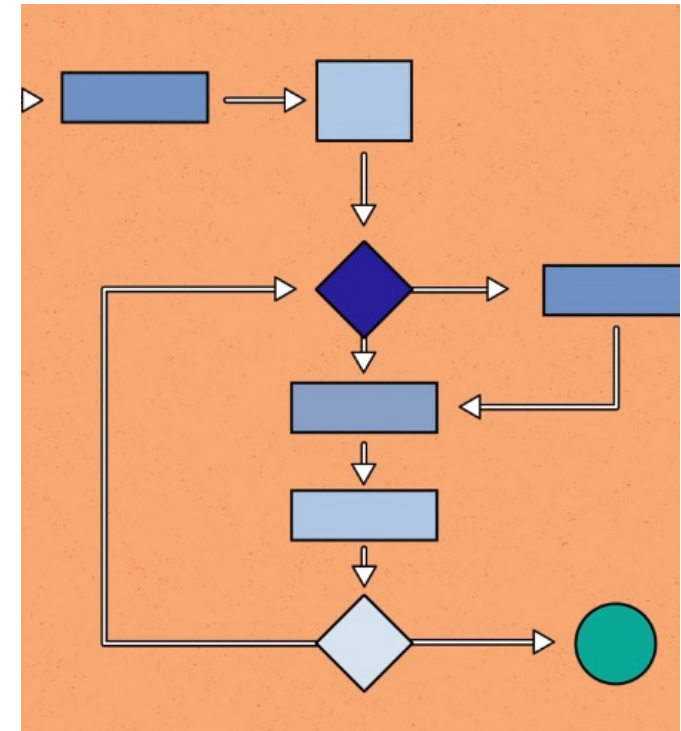
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# Algorithm—Broken promise or Breaking Barriers?

- I. Algorithms surfaced as tool that harnesses the power of machine learning to predict health and healthcare outcomes
- II. Current state of society we all are subject to algorithms
- III. Algorithm bias refers to attributes of its composition that make it create subjective or unfair outcomes
- IV. Bias could be ascribed to:
  - I. Makeup of algorithm and what it thinks is important data
  - II. Selection of data – omitting or selecting specific data
  - III. Humans → algorithms are made by humans so inherent bias can be projected
- V. Are our current methods embracing algorithmic unfairness?



<https://edu.gcfglobal.org/en/computer-science/algorithms/1/>

# The VA Invested in Understanding the Source of Racial Unfairness in Algorithms

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- I. Research has shown us that there are massive disparities between Black and White Veterans how can we address this issue?
- II. The VA implemented predictive algorithms to predict the risk of negative outcomes and to improve forecasting health services usage among the most vulnerable needed
- III. The VA CAN score is the algorithm that they mainly use
- IV. Unfortunately, the algorithm underestimates hospitalizations and death due to the lack of consideration for racial bias

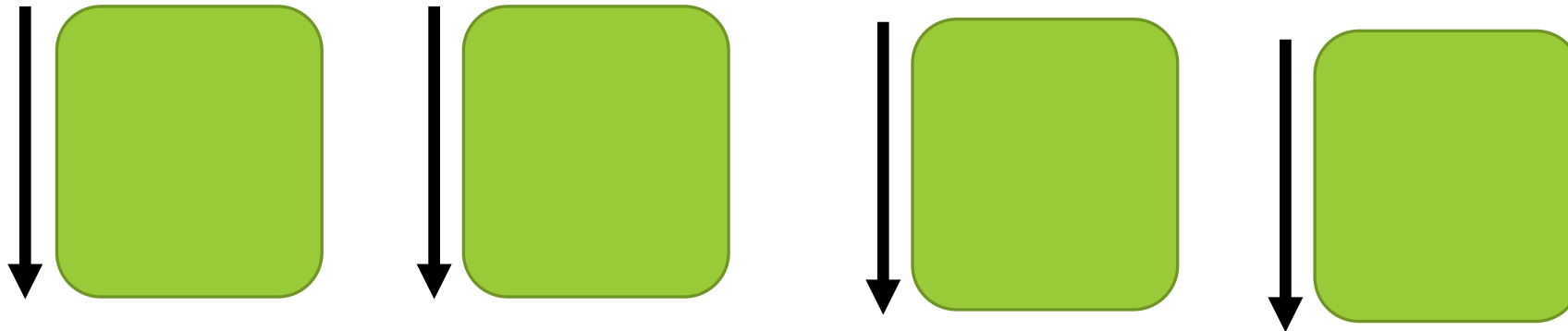
# Introduction to the Study

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- I. Racial differences between CAN Score inputs
- II. Are there any differences in specific inputs that could resurface as disparities?
  - I. For example, does BMI as a variables have racial bias in the input which could affect algorithm
- III. Highlights the importance of making sure that the input variables biomarkers and SDOH variables are not racially biased

# Structural discrimination often linked to health disparities but not liable

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- I. Saha, Somnath et al. 2008
  - I. For some Cancers, African Americans less likely to undergo potentially curative surgeries than White people
  - II. African Americans are more likely to delay seeking treatment for heart failure
  - III. African Americans are less likely to receive Influenza vaccination
- II. Alexander, Booth et al. 2021
  - I. Black patients undergoing surgeries for IBD are more likely to experience morbidity readmission compared to White patients

# Project Overview

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- I. **The VA computes the Care Assessment Needs (CAN) score weekly for over 5 million Veterans to predict risk of one-year mortality or hospitalization, and to improve resource allocation to high-risk Veterans.**
- II. Various checks to corroborate CAN prediction scores with data from Morality rate
- III. Importance of comorbidities and adjusting for age
  - I. Mitigates the disparities

Table 3. CAN 2.0 Covariates		
Demographics	Utilization	Laboratory
Age group	Hospital days	Albumin
Air Force Flag	# Medical providers	Blood Urea Nitrogen
Eligibility	# specialty visit types (e.g. emergency, cardiology, etc.)	Lymphocytes/White Blood Cells
Rank flag	# phone visits	Red blood cells
Marital status	# office visits	Sodium
Priority		White Blood Cells
Sex	<b>Comorbidities</b>	Umber of troponin checked
SES Index	Charlson index	
<b>Vital signs</b>	Select HCCs (e.g. Afib, dementia)	<b>Pharmacy</b>
BMI	EtOH intake	Antipsychotic
Weight variability	COPD exacerbation	Beta-blocker
Heart rate		Benzo
Respiratory rate	<b>Text notes</b>	Beta agonist nebulizer
Blood pressure	# consent and telephone notes	Furosemide, statin, metformin, NSAID, etc.

# CAN Score

- I. Purpose to enhance quality of care and eliminate unplanned care
- II. Reflects estimated probability of admission or death on a specific time period (90 days or 1 year)
- III. Expressed as a percentile ranging from 0, the lowest risk, to 99 – the highest risk
- IV. Indicates how a Veteran compares to others in terms of likelihood of hospitalization or death
- V. Clinical Biomarkers vs SDOH Variables

# Algorithm Team Preliminary Findings

- I. Team is trying to find out how we can improve accuracy of risk prediction and the importance of SDOH variables into the algorithm

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- II. Black Veterans compared to White Veterans:
  - I. Younger
  - II. Lower CAN Score
- III. When attempting to match Black and White Veterans with CAN Scores, we found that 53% were left unmatched
  - I. From ages 21-65 Black Veterans make most of the younger high CAN score Veterans
  - II. This highlights individual unfairness linked to an age-driven class imbalance that displays the presence of the weathering effect
- IV. Central hypothesis assumes that statistically modeling the Weathering Effect in algorithms will improved accuracy in risk predication by estimating physiologic deterioration



# Justifying these Disparities

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- I. We know these disparities exist so what is causing them?
  - I. Comorbidities? → could increase likelihood of negative health outcomes
  - II. Stress? → release of stress hormones has been associated higher risk of death among Black Veterans compared to White Veterans
  - III. Racism is a psychosocial stressor that frequently correlates with uncontrolled blood pressure and negative cardiovascular events

# Aims

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1. Examine the CAN score for evidence of unfairness by race/ethnicity, urban/rural status, and socioeconomic status, and apply methods to mitigate algorithmic unfairness in the CAN score using the current set of predictors.
2. Incorporate several variables that reflect individual and area-level socioeconomic status and are predictive of adverse health outcomes in order to mitigate algorithmic unfairness in the CAN score.

# Lit Review Methods

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Looked at 2-3 Articles per variable in the CAN Score

- I. Search criteria
  - I. Included “Black Veteran,” “Biomarker,” “Health Disparity”
- II. Inclusion criteria for each paper
  - I. I was looking for literature that would help quantify and show the effects of disparities between Black and White Veterans

# Most CAN Score Inputs are associated with Black/White Veteran racial health disparities

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## Racial Disparities in CAN inputs:

- I. Based on Nguyen XT et al, they showed that black females had a higher BMI than their white counterparts.
- II. Furthermore, at the extremes, 5.1% of White males were obese as opposed to 6.0% of Black males.
- III. Among females, 7.8% of White females had BMI  $\geq 40$  and 9.0% of Black females had  $\geq 40$
- IV. Silva, Gabriella C et al showed that compared to White Veterans, Black Veterans have a lower mortality rate for Pneumonia → however they adjusted for racial differences by including more variables
- V. Future research should look at this study to conduct risk adjustment variables to mitigate racial discrepancies

# Significance

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- I. Algorithm bias has the possibility of hurting particular demographics, in particular people of color
- II. Mitigating algorithmic unfairness may require data on social determinants of health and should be a priority to improve healthcare equity.
  - I. The work on SDOH is necessary to investigate
- III. Bias in data learning
- IV. Bias caused by missing and proxy data
- V. Bias induced by learning algorithms
- VI. Lends evidence towards the Weathering Effect

# The Weathering Effect & Biological Aging

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- I. In a nutshell, the Weathering Effect helps show your “true” age
- II. Biological Aging – represents the “wear and tear” or cumulative degeneration of physiologic function due to environmental exposures
- III. Chronological Age – signifies the sequence of typical loss of biological function associated with one’s years of life
- IV. Researchers note that a positive Weathering Effect Value indicates that a person’s biological age is older than their chronological age

# Implications

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- I. Lot of people dismiss sociological side of algorithms and healthcare, but they are necessary
- II. Lit Review can help capture the missing sociological component in algorithms
- III. Expand type of data we collect
  - I. Infusion of qualitative data into this area of study
  - II. Try to collect data from interviews, experiences
- IV. Evidence that interdisciplinary teams are necessary
- V. Algorithms are meant to help people and use them to improve clinical treatment
  - I. If done correctly would be greatly beneficial but if not could do harm
- VI. Additionally, successful measurement of the physical toll of racism also improves health services projections and policymaking for most vulnerable patients

# Project Role + Next Steps

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- I. Attended weekly meetings with PIs and Data Analysts to go over analytic updates regarding the project
- II. I conducted a Literature Review to find health outcomes related to the variables going into the CAN Score
- III. We plan on incorporating variables into the new algorithm



# Lessons Learned

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- I. Research is collaborative + importance of working together
- II. The negative impacts of Big Data and Algorithms → We can strive for better outcomes
- III. Conduct literature reviews
- IV. How to present and interact in a larger group meeting

# Acknowledgements

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- II. Family
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THANK YOU!!

