NATIONAL ACADEMY OF SCIENCES, ENGINEERING, & MEDICINE

The Impact of Race & Ethnicity in Algorithms and Guidelines

Shazia Siddique MD MSHP

Assistant Professor of Medicine, Division of Gastroenterology, Univ of Pennsylvania Agency for Healthcare Research & Quality (AHRQ) Evidence-based Practice Center: ECRI-Penn Clinical Guidelines Committee, American Gastroenterological Association

December 14, 2023



Overview

- Background/Terminology
- The impact of algorithms on racial and ethnic disparities
- Mitigation strategies for algorithms
- Clinical practice guidelines
- Next steps

Terminology

Term	Definition	Example
Healthcare algorithm	A mathematical formula or model that combines different input variables or factors to inform a calculation or an estimate (e.g. disease risk, prognosis)	Estimated glomerular filtration rate (eGFR)
Clinical Practice Guidelines	IOM: "statements that include recommendations, intended to optimize patient care, that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options"	United States Preventive Services Taskforce and professional society guidelines
Clinical care pathways	Offers guidance on patient care - may or may not be based on an algorithm - may or may not be based on a guideline	Institutional care pathways or professional society-sponsored clinician support tools

Congress of the United States Mashington, DC 20510

September 22, 2020

Gopal Khanna, M.B.A. Director Agency for Healthcare Research and Quality 5600 Fishers Lane Rockville, MD 20857

Dear Mr. Khanna:

We write to request that the Agency for Healthcare Research and Quality (AHRQ) conduct a review of the use of race-based clinical algorithms in standard medical practice. The ongoing coronavirus disease 2019 (COVID-19) pandemic and its disproportionate consequences for communities of color have starkly revealed that racism itself is a public health crisis.¹ In order to

reduce health disparities a health organizations take ways in which current pra outcomes for people of color.

Race-based clinical algorithms, which include a patient's race among their inputs, inform how clinicians adjust medical test results based on their patient's race. These results then inform treatment regimens as well as overall assessments of health. These race-based algorithms risk embedding racism into medical practice. One such algorithm has recently come under fire after it was reportedly used by the National Football League (NFL) in a way that cut benefits for Black players. *The Wall Street Journal* reported that, because the NFL was using a clinical algorithm that assumed Black players had lower cognitive functioning compared to white players, Black players were entitled to lower settlements for concussion-related injuries.² But this overtly racist assumption and subsequent adjustment to players' test results is just one high-profile example of race-based clinical algorithms. There are many others.

Another example in which race-based assumptions are embedded in medicine is in the estimated glomerular filtration rate (eGFR), an algorithm that allows clinicians to indirectly measure a patient's kidney function.³ The eGFR adjusts test results for all patients identified as Black.⁴ This race-based adjustment to eGFR originated from a 1999 study which found differences in a measure of kidney health among Black study participants compared to white participants.⁵

Agency for Healthcare Research & Quality: RFP

Systematic Review to understand the current effect of healthcare algorithms and mitigation strategies on racial and ethnic outcomes

Final report published on AHRQ site

https://effectivehealthcare.ahrq.gov/sites/default/file s/related_files/cer-268-racial-disparities-healthhealthcare.pdf

Key insights from the algorithm literature

Algorithm potential effect on racial and ethnic disparities



The effect may vary based on the rationale for using race and other predictors, applied cohort, and outcome

Figure 5. Effect of algorithms on racial and ethnic disparities: Synthesis of KQ 1

_

Clinical Assessment	Algorithm	Study	Study Design ^a	Disparities in Health Outcome ^b	Disparities in Access ^b	Disparities in Quality ^b
Emergency	Rapid triage fast-track	Boley et al. 202263	Retrospective		Ť	
assessment	ESI	Metzger et al. 2022 ⁶⁴	Retrospective		Ť	
	HEART Pathway	Snavely et al. 202158	Pre-post	÷		↑°
High-risk care management	Novel algorithm for high-risk care management	Obermeyer et al. 2019 ^{5d}	Modeling®		Ť	
Kidney transplant allocation	Revised KAS ^r	Zhang et al. 2018 ⁶¹	Pre-post		Ļ	
Lung cancer	USPSTF-2013	Han et al. 202059	Modeling ⁹			Ť
risk	USPSTF-2013	Pasquinelli et al. 2021 ¹⁰⁹	Modeling ^e		1	
	USPSTF-2013, USPSTF-2021, PLCOm2012(Race3L)	Williams et al. 202267	Modelinge		Ť	
Lung transplant allocation	LAS	Wille et al. 2013 ⁶²	Pre-post		Ļ	
Opioid misuse risk	Natural language processing algorithm	Thompson et al. 2021 ^{108d}	Modelinge			Ť
Prostate cancer risk	PCPT	Carbunaru et al. 2019 ⁶⁰	Modelinge			Ļ
	KPCC RC ^r	Presti et al. 2021 ³⁶	Modelinge			Ļ
Severity of illness	SOFA, LAPS2	Ashana et al. 2021 ^{107d}	Modelinge	1	1 (
measurement for crisis	SOFA tiering systems	Miller et al. 2021 ⁵⁴	Modelinge		Ť	
standards of Care	CSC algorithm based on SOFA and either comorbidities or physician assessment	Riviello et al. 2022 ⁶⁵	Modeling ^e	t		
	APACHE IVa, OASIS, SOFA	Sarkar et al. 2021 ⁵⁷	Modelinge	1		
Stroke risk	ACC/AHA atrial fibrillation guideline based on CHA2DS2- VASc (2020)	Yoo et al. 202366	Modelinge	Ļ		

What is the effect of interventions, models of interventions, or other approaches to mitigate racial and ethnic bias in the development, validation, dissemination, and implementation of healthcare algorithms?



Mitigation strategies

- **1.** Removed race
- **2.** Replaced variable (often race)
- 3. Added race
- 4. Added non-race variables
- 5. Algorithmic recalibration
- 6. Population stratification
- 7. Statistical adjustment

One example: one strategy and one algorithm (eGFR)

Mitigation Strategy	Study	Initial Algorithm	Revised Algorithm	Algorithm Includes Race or Ethnicity	Effect of Mitigation Strategy
Removed race	19 studies ^{21,69,70,72,73,75} -77,79,80,82,83,99-105	eGFR for kidney function	eGFR without race coefficient	Initial algorithm	 Increased diagnosis of CKD or severe CKD: 8 studies^{21,69,70,77,79,80,82,83,105} Improved accuracy: 5 studies⁹⁹⁻¹⁰³ Increased access to care: 4 studies^{72,77,80,105} Reduced access: 2 studies^{69,104} Improved antibiotic dosing: 1 study⁷⁶ Underestimated GFR: 1 study⁷³ Mixed effects on organ transplant: 1 study⁷⁷ No effect on prediction of acute kidnev iniury: 1 study⁷⁵

Removing race from eGFR may increase the likelihood of diagnosis of chronic and severe kidney disease in Black patients. This could result in broader and earlier eligibility for kidney transplant. Conversely, it may reduce access to other types of treatment, affect medication dosing for a broad range of conditions, and reduce enrollment of Black patients in clinical trials

Mitigation strategies: Summary

- Modeling may not fully reflect potential biases in algorithm translation, dissemination, and implementation
- Mitigation strategies improve algorithmic accuracy, but inference and simulation used to estimate effect on disparities
- A mitigation strategy's effectiveness may depend critically on a unique combination of algorithm, clinical condition, population, setting, and outcomes.

Shifting from algorithms to guidelines

(a) Algorithm Development Phase



External Context & Drivers: Policy / Payers / Vendors



Figure informed by Sittig DF, Singh H. Cog Informatics for Biomed Health Informatics . 2015; and Rajkomar A et al. Ann Intern Med. 2018

Understanding the role of clinical practice guidelines

Potential effect on racial and ethnic disparities



Reduce

No effect

Perpetuate or exacerbate

Guideline recommendations can impact disparities regardless of whether they:

- Include an algorithm
- Include race-specific decision-making

Closer scrutiny of guidelines

US Preventive Services Task Force

November 8, 2021

Actions to Transform US Preventive Services Task Force Methods to Mitigate Systemic Racism in Clinical Preventive Services

US Preventive Services Task Force

Article Information

JAMA. 2021;326(23):2405-2411. doi:10.1001/jama.2021.17594

FREE

- Culture of inclusivity and diversity
- Re-examination of USPSTF guideline processes
- Review of equity implications of existing recommendations



Race-based recommendations in Gl

Gastroenterology 🕨 aga

DIVERSITY, EQUITY, AND INCLUSION IN GI I VOLUME 162, ISSUE 2, P408-414.E2, FEBRUARY 01, 2022

Race-Based Clinical Recommendations in Gastroenterology

Shazia Mehmood Siddique • Folasade P. May

Published: December 06, 2021 • DOI: https://doi.org/10.1053/j.gastro.2021.12.234 • 🦲 Check for updates

- Systematic review of GI guidelines over past 10 years in 4 societies (AGA, ACG, ASGE, AASLD)
- 8 recommendations in 4 topic areas:
- Screening for hepatocellular carcinoma (HCC) in those with chronic hepatitis B virus (HBV)
- Surveillance for Gastric Intestinal Metaplasia
- Screening for H. pylori infection
- Surveillance for Barrett's Esophagus

Clinical example of a race-based guideline

- <u>Hepatitis B</u>: Screen Asian men>40 and women>50 with HBV for HCC. Also all Black individuals (any age)
- Screening tests: blood draw and ultrasound every 6 months

Rationale: In many Asian and select African countries, HBV is highly prevalent and vaccination is not common at birth. Therefore many individuals have chronically high levels of virus, which predisposes them to liver cancer

Would you treat the following two patients the same?



- Immigrated from a HBV-endemic country
- Suspected HBV since birth/childhood



US born with Asian or African ancestry Known needle-stick exposure to HBV

• 2023: AASLD replaced race with country of origin, and a new algorithm (PAGE-B score)

Biased algorithms and guidelines appear to be pervasive in healthcare

Deep engagement of all involved stakeholders

- Algorithm developers, users, data collectors, clinicians, health system leaders, payers, investigators, funders, systematic reviewers, guideline developers, etc
- Representative Datasets
- Transparency
- Accountability
- Diverse, multidisciplinary teams
- AI and non-AI algorithms
- Methodologic studies to reassess guideline development process to reduce bias



Acknowledgements

EPC Report Authors:

- Kelley Tipton, M.P.H., and Brian F. Leas, M.S., M.A. (Co-Leads)





- Emilia Flores, Ph.D., R.N.
- Christopher Jepson, Ph.D.
- Jaya Aysola, M.D., M.P.H.
- Jordana Cohen, M.D., M.S.C.E.
- Michael Harhay, Ph.D.
- Harald Schmidt, Ph.D.
- Gary Weissman, M.D., M.S.H.P.
- Jonathan Treadwell, Ph.D.
- Nikhil K. Mull, M.D.

AHRQ Leadership:

- Robert Otto Valdez, Ph.D., M.H.S.A. Director
- Craig A. Umscheid, M.D., M.S. Director Evidence-based Practice Center Program Center for Evidence and Practice Improvement
- Arlene Bierman, M.D., M.S. Director, Center for Evidence and Practice Improvement
- Anjali Jain, M.D. Task Order Officer Center for Evidence and Practice Improvement
- Christine S. Chang, M.D., M.P.H. Task Order Officer Center for Evidence and Practice Improvement