Ethical and Equity Considerations for Healthcare AI Applications

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Background - Health Equity
The Impact of Social Determinants of Health

Transforming the conditions in which people are BORN, GROW, LIVE, WORK and AGE for optimal health, mental health & well-being.

Healthy People

Prevention
Mental Health Services
Culturally/Linguistically Appropriate and Competent Services
Income Security
Housing
Neighborhood Safety/Collective Efficacy
Environmental Quality

Healthy Community

Health Care
Child Development, Education, and Literacy Rates
Food Security/Nutrition
Built Environments
Discrimination/Minority Stressors

Healthy Environment

Health Outcomes

Length of Life (50%)
Quality of Life (50%)

Health Factors

Clinical Care (20%)

Health Behaviors (30%)
Alcohol & Drug Use
Sexual Activity
Access to Care
Quality of Care

Social & Economic Factors (40%)
Education
Employment
Income
Family & Social Support
Community Safety

Physical Environment (10%)
Air & Water Quality
Housing & Transit

Policies & Programs

Let's Get Healthy California

National Academy of Sciences
Inequality
Unequal access to opportunities

Equity
Custom tools that identify and address inequality

Equality?
Evenly distributed tools and assistance

Justice
Fixing the system to offer equal access to both tools and opportunities

Conceptually Mapping SDoH

Social Determinants of Health (SDoH)

Socioecological Model of Health (SEM)

Health Care Access & Quality
Social and Community Context
Economic Stability
Neighborhood & Built Environment
Education Access & Quality

Society & Policies
Communities
Organizations
Interpersonal
Individuals

Adapted from Healthy People 2030, U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion.
“However, if not developed and implemented equitably, technology advancements could actually widen disparities in care as the “haves” get more and the “have-nots” are increasingly left behind.”

_The Persistent Health Care Access Gap for Children in Poverty_

The Children’s Health Fund, 2015
Why this Matters

Dissecting racial bias in an algorithm used to manage the health of populations

Ziad Obermeyer\textsuperscript{1,2,*}, Brian Powers\textsuperscript{3}, Christine Vogeli\textsuperscript{4}, Sendhil Mullainathan\textsuperscript{5,4,†}
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Black patients assigned the same level of risk by the algorithm are sicker than White patients. The authors estimated that this racial bias reduces the number of Black patients identified for extra care by more than half.
Why this Matters

IN THE NEWS

Pulse Oximetry May Be Inaccurate in Patients with Darker Skin

JANUARY 28, 2021

Senators Warren, Booker and Wyden Urge FDA to Address Concerns about Dangerous Pulse Oximeter Inaccuracies for Patients of Color

Clinical Science | April 2005

Effects of Skin Pigmentation on Pulse Oximeter Accuracy at Low Saturation

Philip E. Bickler, M.D., Ph.D.; John R. Feiner, M.D.; John W. Severinghaus, M.D.


https://doi.org/10.1097/00000542-200504000-00004

CORRESPONDENCE

Racial Bias in Pulse Oximetry Measurement

December 17, 2020


DOI: 10.1056/NEJMc2029240

Metrics

Comparative Study


Dark skin decreases the accuracy of pulse oximeters at low oxygen saturation: the effects of oximeter probe type and gender

John R Feiner, John W Severinghaus, Philip E Bickler
Special Considerations for AI in Healthcare
General Considerations

- AI is highly dependent on data
- Healthcare data is… messy
  - Missingness
  - Bias
  - Class imbalance
  - Human-generated variation
- Result of complex interconnected systems that are not necessarily well understood by its users
Identifying at risk individuals
AI-enabled remote monitoring
AI-driven behavior modification

Early detection
Risk stratification
Comorbidity screening
Patient support and education

Clinical decision support
Treatment optimization
Comorbidity management
Population health management

Data Sources
- Medical devices
- Medical records
- Imaging
- Labs
- Genomics
- Health care utilization
- Mobile apps and sensors
- Social determinants of health
- Geospatial data
- Environmental exposures
- Dietary intake
- Physical activity

Potential Applications
- Screening & Prevention
- Diagnosis & Prognosis
- Treatment & Management
- Patients
- Mobile apps and sensors
- Social determinants of health
Key Principles

- Safety and Efficacy
- Equity and Inclusivity
- Informed Consent and Transparency
- Data Privacy and Protection

AI Development

- Training Data
- Algorithm Design
- Validation Data
- Real World Application

Healthcare Applications

- Public Health
- Documentation
- Patient-Provider Communication
- Workflow Optimization

Research & Discovery
- Care Delivery
- Patient Education
- Clinician Training
- Healthcare Finance
Regulation of AI in Healthcare

- Many countries regulate AI applications in healthcare
- Software as a Medical Device (SaMD)
  - Often treated as a medical device (FDA, EMA, Health Canada, etc)
- IMDRF guidance on SaMD

Most regulated AI is **static**: AI was used to develop the algorithm, but once it is reviewed and approved, it is no longer learning in the real world (otherwise, not the same algorithm that was reviewed and approved)
AI Legislation

**US - Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence**

- **AI Safety & Security Enhancements**
  - The executive order establishes new benchmarks for the safety and security of AI technologies. It mandates commercial developers to disclose their safety testing results to the U.S. Government, aiming to shield Americans from potential risks associated with AI systems.

- **Backcaching the Workforce**
  - The order outlines principles aimed at minimizing harms and maximizing the benefits of AI for the workforce. It also calls for a comprehensive report to analyze the potential impacts of AI on the labor market.

- **Promoting Equality and Fighting Algorithm Bias**
  - The directive is committed to ensuring equitable treatment and addressing issues of algorithmic discrimination to foster fairness.

- **Bolstering American Leadership on Global Stage**
  - The U.S. aims to extend its influence and collaboration in AI through bilateral, multilateral, and multi-stakeholder engagements, expediting the development and implementation of crucial AI standards worldwide.

- **Upholding Privacy of All Americans**
  - The order champions bipartisan data privacy legislation, striving to safeguard the privacy of all citizens, with a particular focus on children. It emphasizes the development of technologies that preserve privacy and scrutinizes the data collection and utilization practices of government agencies.

- **Fostering Innovation and Competitive Practices in AI**
  - By driving AI research nationwide and advocating for an open, fair, and competitive AI ecosystem, the order seeks to stimulate innovation and maintain healthy market competition.

- **Advocating for Consumers, Healthcare Patients and Students**
  - The directive encourages the responsible deployment of AI in critical sectors like healthcare and education, prioritizing the well-being of consumers, patients, and students.

- **Ensuring Responsible and Proficient Government Adoption of AI**
  - The order provides guidelines for government agencies on AI usage and prioritizes the swift recruitment of AI professionals to enhance expertise within the public sector.

**EU - The AI Act**

[Diagram showing risk levels: Unacceptable Risk, High Risk, Limited Risk, Minimal Risk]
AI Roadmaps

AI Governance
How will your organization govern AI models, their evaluation, and implementation?

Models, Data & Architecture
How will your organization develop AI models and the required infrastructure?

Operating Model
How will your organization implement AI models and continuously improve and innovate?
3 General Pathways for AI:

1. Purchased technology, regulated, contracted
   - AI governed by contract
     - Available to provide guidance to purchasing decision makers

2. Clinical applications, operational applications
   - AI governed by AI Oversight Committee
     - Available to provide guidance to IRB

3. Research applications, not directly affecting routine patient care
   - AI governed by IRB
Thank You.

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Please, give me feedback on today’s talk:

https://tinyurl.com/JuanEval
https://airtable.com/shrgBH0ltwKdyyjDW