Responsible AI in Healthcare – Ensuring Quality Care for All

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“Of all the forms of inequality, injustice in healthcare is the most shocking and inhumane.”

-Dr. Martin Luther King, Jr.
AI can be sexist and racist — it’s time to make it fair

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

**Pre:** Black Patients were 50% less likely to be referred to case management despite being equally sick

**Post:** Black Patients were just as likely to be referred to specialist when equally sick

Fair AI ML Tools Eliminates the AI Racial Bias By Repairing the Model

**Fairness Metric:** Statistical Parity

**Bias Mitigation Method:** Better Proxy Label

*by Ziad Obermeyer, Brian Powers, Christine Vogeli, and Sendhil Mullainathan*
Lost Opportunity Cost of a Biased Algorithm

80M

# of Patients Exposed to Biased Case Management Algorithm

$1B

Direct Healthcare Cost Savings Opportunity from CCM

$146M

CMS Chronic Care Management Fee-For-Service Charge Capture

$830M


14 studies evaluated an algorithm effect on health or outcomes stratified by race/ethnicity.

### Impact of Healthcare Algorithms on Racial and Ethnic Disparities in Health and Healthcare

#### Effective Health Care (EHC) Program (ahrq.gov)

**Kidney function measurement**

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<th>Clinical Category</th>
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#### Kidney transplant allocation

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#### Severity of illness scores for Crisis Standards of Care

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#### Prostate Cancer Risk

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#### Clinical Category

- Liver transplantation
- Cardiovascular risk
- Lung Cancer Screening
- Lung Transplant Allocation
- Lung Function
- Anticoagulation
- Emergency Department Triage
- Other

### Direction of Effect (arrow direction)

- ↑ Increase
- ↓ Decrease
- ↔ No effect

*Not reported
Problem Formulation: Only 26% of computer scientists are women, 8% are Black, 8% are Hispanic.

Data creation: Real world data may not be representative of the target population.

Data acquisition: Low quality or missing data.

Model Development: Bias can be amplified or introduced by modeling decisions, such as labeling error.

Model Evaluation: Evaluation often excludes subpopulation analysis or fairness.

Model Deployment: The decisions made during, and post-deployment may introduce biased decision making.

Bias Occurs Throughout The AI Lifecycle
Bias Mitigation Methods Applied Throughout The AI Lifecycle

Social Mitigation Methods

- Diverse Teams
- AI Governance
  - Local Policy and Procedures
  - Stakeholder Engagement
  - Including Patients, Clinicians, Leadership, Ethicists
- Regulatory Environment
  - Europe
  - US
  - FDA QS & CBMP
  - HHS/ONC Proposed Rule

Technical Mitigation Methods

- Responsible/Ethical AI Frameworks and Toolkits
  - DHHS Trustworthy AI Playbook
  - Promoting the Use of Trustworthy AI in the Federal Government
  - NIST AI Risk Management Framework
- Bias Mitigation for data and ML Methods
  - EqualityML Toolkit
  - AI Fairness 360
  - Fairlearn
- Monitoring for Outcome

Data creation
Origination of data used to train and evaluate an AI model

Model deployment
Real-world implementation and use of the AI model

Data acquisition
Gathering or purchasing of data to train and evaluate the AI model

Model evaluation
Testing of the AI model to evaluate performance and efficacy

Model development
Iterative algorithmic formation process to build the AI model

AI life cycle

References:

The AI Promise: Unlocking Unprecedented Value in Healthcare

Value is defined as the ratio of quality over cost multiplied by the patient experience.

Value = \frac{Q}{C} \times E

Value in healthcare: Value is defined as the ratio of quality over cost multiplied by the patient experience.

Quality in healthcare: Quality refers to the effectiveness of treatment and patient outcomes.

Cost in healthcare: Cost includes the total healthcare expenses for diagnosis, treatment, and care.

Patient experience: Patient experience includes factors like waiting times, communication with doctors, amenities, and overall satisfaction.

Defining AI value in healthcare by assessing improved quality, decreased cost, and improved patient and provider experience.
The Total Cost of Deployment of AI Without an AI Safety and Management System

1. Bias in AI Systems:
   - **Risk of Inequitable Care**: Amplify disparities in diagnosis/treatment for underrepresented groups.
   - **Regulatory and Compliance Risks**: Expose healthcare providers to legal challenges, regulatory penalties, and reputational damage from biased AI.

2. Misalignment with AI Transformation and Health Equity Goals:
   - **Missed Opportunity Cost for Health Equity**: AI investments not aligned with health equity goals limit transformative potential.

3. Underperformance of AI Investments:
   - **AI Benefits not Fully Realized**: Lack of strategic alignment and governance restricts AI's potential in improving outcomes and reducing costs.
   - **Lack of Transparency in AI Models**: Poor AI system management erodes trust, hindering adoption and utilization.
Equality AI Products: For Each Stage of Responsible AI Transformation

Stage 1: Equality AI Foundations is the starting point for most healthcare organizations, offering a structured approach to ensure effective and ethical AI integration with enterprise strategy and AI governance capability. AI model audits are performed by Equality AI using Equality AI technology.

Stage 2: Equality AI Builder provides all the benefits of Foundations plus access to the Equality AI Studio, enhancing the team’s capabilities in developing responsible AI ML models, and empowering the data science team with Responsible AI tools and training. It also includes an enhanced AI model audit, measuring both AI model technical performance and adherence to AI governance process using the NIST AI Risk Management Framework or ISO/IEC 42001 AI Management System.

Stage 3: Equality AI Enterprise combines the features of the Foundations and Builder stages with advanced functionalities of the Equality AI Studio Enterprise version, offering comprehensive management of AI models, outcomes dashboard, configuration and implementation support, AI analytics and dashboarding tools, and custom API integration with the organization’s data ecosystem.
Equality AI Foundations

A Structured process that establishes the foundation to a responsible AI transformation aligned with enterprise strategy and health equity. AI model audits are performed by Equality AI using Equality AI technology.

**Kickoff**
- Executive Sponsor
- AI Strategy Core Team

**Discovery Phase**
- Stakeholder Interviews
- Data & Technology Audit
- Current Process Review

**AI Strategy & AI Governance**
- AI Strategy Formulation
- AI Governance Framework
- Roadmap Creation

**AI Transformation Roadmap Recommendations**
- Technical Gaps
- Operationalization Gaps
- Training and Capacity Building

**AI Model Audit (2) by Equality AI Technology**
Sub-population analysis for bias, performance, and compliance with AI governance process

Next Step: Equality AI Builders

Responsible AI Foundations Complete
AI Strategy Alignment:
Focus on High-Value Domains & Health Equity

Value = \frac{Q}{C} \times E

AI Strategy Alignment

Prioritizes Health Equity

Serve all patient populations fairly
Advances inclusive healthcare
AI Governance Committees

Algorithmic Bias Playbook

Ziad Obermeyer
Rebecca Nissan
Michael Stern
Stephanie Easelt
Emily Joy Benbeneck
Sendhil Mullainathan

June, 2021
RESPONSIBLE AI AUDIT PROCESS

RESPONSIBLE AI FRAMEWORK

- ROBUST & RELIABLE
- RESPECTFUL OF PRIVACY
- SAFE & SECURE
- FAIR & IMPARTIAL
- TRANSPARENT & EXPLAINABLE
- RESPONSIBLE & ACCOUNTABLE

Technical Audit of AI Models

- Equality AI uses our technology to measure biases and model performance
- Provide actionable insights for AI governance team and data scientists to improve the model

Process Audit: Adherence to Institution AI Governance Processes

- Ensure effective and responsibly managed AI initiatives
- Critical tool for AI governance team to oversee and manage AI lifecycle
**EQUALITY AI TECHNOLOGY:**

1. **AI/ML Collaboration for ALL**
   - A studio for data scientists and stakeholders to collaborate.
   - Transparency and validation through diverse teams

2. **Fair ML Evaluation Tools**
   - Fairness Metrics
   - Bias Mitigation Methods
   - Python Notebook Template
   - Responsible AI Wiki

3. **Tutorials**
   - Tutorials embedded in workflow, always available when needed

4. **Chat Assistant**
   - Fairpaw, conversational fair ML assistant.
   - Chat-GPT Powered
   - Fair Code Co-pilot (TBD)

5. **Audit & Decision-Making Log**
   - Capture, store, and aggregate decisions
   - Share with stakeholders including regulatory agencies (FDA, etc.)

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**USER PAIN POINTS**

1. Healthcare real-world data is messy: biased and incomplete
2. Data Scientists are siloed from the Clinical SME
3. Don’t know how to evaluate for Fairness
4. The regulations are moving fast: FDA, NIST, ONC...

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Quickly start by Creating a [Free Trial](https://equalityai.com/)
Participate in our [Use Case](https://equalityai.com/) on GitHub or [Developer Design Lab](https://equalityai.com/)
https://equalityai.com/
We each have a ROLE to play in ensure the future of AI enabled healthcare is equitable and fair.
The community and patients have an important role to play in ensuring AI systems in healthcare are safe, effective and aligned with human values.
Role of Clinicians & Experts

Understand limitations of AI & Human in the Loop
Clinicians should be aware of the limitations of AI systems to provide the best possible care to patients.

Get Involved in AI Development
Clinicians should participate in the AI Lifecycle to increase the relevance and accuracy of the models.

Provide oversight
Clinicians should provide oversight of AI systems through AI Governance to ensure they are operating as intended and providing safe and effective recommendations.

Speak up about concerns
If clinicians have concerns about an AI system, they should voice those concerns to colleagues, administrators, regulators etc.

While AI promises many benefits, clinicians play a critical role in ensuring these systems are used responsibly and safely.
Design systems with Subpopulations in Mind
AI developers should develop expertise in Responsible AI methods: Fairness, bias mitigation

Test thoroughly
Extensive testing of AI systems using techniques like cross-validation helps identify bugs, edge cases, and training gaps to build more robust models.

Listen to stakeholders
Getting regular feedback from users, domain experts, and other stakeholders helps AI developers build systems that address real needs.

Transparency Through Documentation
Clear documentation of development workflows, system design, testing, and maintenance helps ensure transparency and enable collaboration.

Role of AI Developers & Researchers

Responsible AI requires AI developers to take great care through the full development lifecycle to build systems that are ethical, safe, and serve all stakeholders.
Role of Healthcare Leaders

**AI Strategy Alignment**
Align AI strategy for total value and commit to health equity

**AI Governance**
Oversee AI systems through policies and procedures

**AI Audit**
Evaluate AI systems for biases and harms with Sub-population analysis for bias, performance, and compliance with AI governance process

Healthcare leaders should champion responsible AI safety that improves health outcomes for all.
Data scientists are the newest members of the healthcare team. As such, the Hippocratic Oath applies...First do no harm. Therefore, we pledge to adhere to the following ethical code and swear to fulfill, to the best of our ability and judgement, this covenant:

- We respect that algorithms have power; over life and death; treatment and non-treatment; distribution of scarce resources. This awesome responsibility must be faced with great humbleness and awareness of our privilege.
- We respect healthcare data privacy and security. We won’t lose sight that each data point is a unique human experience digitally recorded.
- We respect the hard-won scientific gains of those in whose steps we walk and gladly share such knowledge.
- We will not be ashamed to say, "I don’t know...yet", and will call on our colleagues when the skills of others are needed.
- We value a culture that combines an agile mindset and processes with authenticity, personal wellness, and team fulfillment.

May we always act to preserve the finest traditions of the healthcare calling. We bring modern technology methods to solve healthcare’s most challenging problems: inequity, bias, and unfairness. We believe in AI for good, AI that is fair, and AI for equity.
Questions?

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