Part 1: Fairness and Health Equity in Machine Learning
Many ways to engage

- Virtually meet with us in gather.town
- Come chat with us in KCNI Summer School Slack :)
- You can always return to the session and re-watch the videos after the session ends
- Use the chat or the ask question!

Tell us how the session went (post session survey):
https://forms.gle/ji18qLMZEZ9L16Ln6

KCNISchool@camh.ca
Today’s Agenda

9:00 am - 10:30 am
An Introduction to AI and Ethics
Dr. Daniel Buchman

10:45 am - 12:15 pm
Fairness and Health Equity
Dr. Laura Sikstrom

1:00 pm - 2:30 pm
Workshop: Intersectionality
Dr. Laura Sikstrom and Dr. Marta Maslej

2:45 pm - 4:15 pm
Workshop: Race/Ethnicity and Health Equity
Dr. Laura Sikstrom and Dr. Marta Maslej

Day 2:
Applied ethics in machine learning and mental health
Dr. Laura Sikstrom
CIHR Health System Impact Fellow, KCNI
Medical Anthropologist
Twitter: @laurasikstrom
Email: laura.sikstrom@camh.ca
Objective 1:
Define fairness and health equity;

Objective 2:
Learn key analytical frameworks used to understand health inequities;

Objective 3:
Identify invisible power structures and biases that get baked into datasets.
Critical Perspective

• How can I think about myself, my work and the world in new ways?

Criticism/Critical Thinking

• Finding fault with arguments, analyses or interpretations;
• Assumes truth is generated when an analysis is rational, skeptical, unbiased and based on evidence considered factual.

See also twitter tutorial: @MedEdModels
ALGORITHMIC SYSTEM
A sociotechnical assemblage composed of algorithms and people.

ARTIFICIAL INTELLIGENCE/MACHINE LEARNING LIFE CYCLE
Research Design and Development
Data Collection and Analysis
Model Development and Validation
Deployment/Evaluation

Brad and his colleagues are not strangers to the human lifeworld. Their countless little choices hold algorithms together; they make algorithms responsive to the world… In the world of music recommendation, these people often argue that their human sensitivity is, in fact, key to their systems’ success: knowing things about music, caring about it… makes a programmer better at their job, because such things shape their choices and their choices matter. The algorithmic fabric has a human weft, p. 378
• Altering workflows and clinical encounters;
  • E.g. data collection, measurement based care etc.
• Incubating new delivery models;
  • E.g. Virtual Care
• Developing predictive tools;
  • E.g. Risk Assessments;
• Transforming what it means to be a doctor;

Mullainathan, S. 2017. The Algorithm Will See you Now: https://www.newyorker.com/magazine/2017/04/03/ai-versus-md
But...

- Algorithms inherit prejudices of previous decision makers;
- Featurization may reflect widespread societal biases;
- Disadvantaged groups are often erased;
  - E.g. “First nations or Inuit peoples”
- “Intrinsic opacity” makes it difficult to hold algorithmic systems accountable.

“We shape our tools and thereafter our tools shape us” – Culkin on McLuhan

**Mathematical Fairness**

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Figure 1. “Fair” values of cultural discrimination ($r_{cx}$) for tests of different validities ($r_{xy}$) according to four definitions of cultural fairness, assuming $r_{cv} = .2$.

[Link to YouTube video 1: Definitions of fairness](https://www.youtube.com/results?search_query=21+definitions+of+fairness)

[Link to YouTube video 2: Fairness in ML](https://www.youtube.com/watch?v=p5yY2MyTJXA&t=2411s)

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**EVERY AI HAS A WEAKNESS. OUR MISSION IS TO FIND IT.**
WHAT IS FAIRNESS?

SOMETIMES RIGHT ISN'T EQUAL
AND EQUAL ISN'T ALWAYS FAIR

Corb Lund, The S Lazy H
Fairness is a "strategically deployable shifter."

Silberg and Manyika 2019
Fairness cannot be reduced to a single mathematical equation;

Humans must make decisions about the relative importance of different criteria and equity goals. For example, individual vs group fairness.

“Sometimes I worry that we prioritize getting patients through long wait lists quickly, rather than really trying to make sure each patient has the right clinician for their needs.”

- Psychiatrist, CAMH

Fairness is the social, political and technical process required to achieve equitable health outcomes.
What is Health Equity?

Everyone has a *fair* and just opportunity to be healthier.

Case Study: Diabetes/Depression

• Indigenous peoples living in Canada have higher rates of chronic diseases than non-Indigenous peoples;
• Highest risk populations for diabetes and related complications;
  • E.g. 17% vs. 5%
• Highest risk populations for cardiovascular disease;
  • E.g. 76% higher for First Nations women compared to non-Indigenous populations).

SYNDEMIC: A syndemics-based focus goes beyond common medical concepts of comorbidity and multimorbidity because it concerns the health consequences of identifiable disease interactions and the social, environmental, or economic factors that promote such interactions and worsen disease (Singer et al. 2017).

What about Brian?

Case Study: The Gift of Diabetes
Structural Violence

Social, political, economic and historical context [Settler Colonialism]

Social Policies and Government Regulations [Bill-C31]

Social Determinants of Health [ACES, Racism]

Individual Behaviors and Characteristics [Anger, depression]
David (Agency) vs Goliath (Structures)
Structures vs. Agency

Suffering is ‘structured’ by historically given (and often economically driven) processes and forces that conspire – whether through routine, ritual or... the hard surfaces of life – to constrain human agency [individual choices and opportunities].

- Paul Farmer, p. 40.
Like freedom, but more accurately: freedom for meaningful action and to make one’s own choices, within the pragmatic constraints (structures) of society;
- Marriage, geography, religion, workplace, gender ideologies etc.

A Conundrum

People Resist! (passive, active and negative agency)

Diffuses Responsibility (Why bother?)

Does not explain why unjust systems persist
What about all the Brads?

“In computer science, diffusion of responsibility often revolves around discussion of what is and isn’t ‘out of scope’”

- Hooker 2021: 3
“Is there a truly a disconnect between “studying the brain” and studying the “societal causes of mental illness”, so long as one isn’t confused for the other?”
Our material and social worlds result in uneven population patterns of health and disease.
- Krieger 2011; Nguyen and Pechard 2003
Social Suffering

- That socioeconomic and sociopolitical forces can at times cause disease;
- That social institutions, such as hospitals, can make suffering worse;
- That suffering extends outside the individual to include families and communities;
- Collapses the distinction between a health and a social problem.

Fairness and Health Equity require that we collapse the distinction between a health and a social problem.

- Intersectoral;
- Interdisciplinary;
- Theoretically engaged;

“Medical statistics will be our standard of measurement: we will weigh life for life and see where the dead lie thicker, among the workers or among the privileged.”
— Rudolf Virchow

Operationalizing Fairness

Three Pillars for Fairness.

- Inclusion
- Impartiality
- Transparency
1. Transparency

**Interpretability:** A range of procedures and statistical techniques used to test, validate and analyze findings (e.g. peer review, FAIR, fairness metrics, audits and so on)

**Explainability:** The social and technical process of translating the purpose, relevance and limitations of an algorithmic system to clinicians, patients, their families and the general public.

**Accountability:** A set of procedures and governance structures that hold algorithmic systems accountable in a timely manner.

Neff et al. 2017; Samek et al. 2017; Rajkomar et al. 2018
2. Impartiality

Provenance: Understanding the origins and limitations of any given dataset, very broadly defined.

Deployment: To what extent can a model be deployed into a clinical setting without reproducing and/or creating new health inequities?

Bowker and Star 1999; boyd and Crawford 2012; Neff 2019; Umoja Noble 2018; Engle 2016; Mullainathan 2019; Seaver 2015
3. Inclusion

Completeness: Collect necessary data on marginalized groups to perform audits of model function (e.g. on race, gender).

Patient Engagement: Engage patients, their families and caregivers in the process of determining acceptable fairness standards.

“Specifically, I want to know what assumptions he's [psychiatrist] making based on that data. Right? *So quantities aren’t of any value without qualitative scale.* And my qualitative scale is going to be different than his. So data is useful, as long as I'm looking at it through the same lens, and interpreting that data in the same way. And we can have communication regarding whether or not we agree on what this all means. Right, that closing the loop so to speak, bringing that back into view of both parties, I think is pretty crucial.”

- Adam, 34yr old living with MDD

Key Takeaways

- Health problems are social problems; social problems are health problems;
- Advances in ML hold tremendous potential for supporting efforts to achieve health equity;
- These advances could also cause tremendous harm;
- **Fairness** is more than a good mathematical equation;
- **Fairness** is a social and political process that necessitates sustained dialogue;
- Collaborative, interdisciplinary and transparent science will facilitate uptake and effective use;