Bias in Health Data.
Aspects to Consider in our Models.

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Aspects to Consider in our Models

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Advancing technology + Expanding data availability

Window of possibilities

Decision-aid tools
Risk prediction
Natural language processing
etc

Photo by Mahdis Mousavi on Unsplash
Advancing technology + Expanding data availability

→ Window of possibilities

→ Greater impact

→ Greater responsibility

Trustworthy and responsible AI
Fairness of AI/ML system/model/algorithm

Absence of bias and discrimination.
Equal outcome or benefit; equal performance.
Risk of perpetuating / increasing systemic, historical, societal biases

- Representative sample - Diversity and inclusion
- Absence of biases
  - Statistical / computational biases
  - Societal / human biases

action needed
Health data

Demographics
Medication
Diagnosis
Clinical endpoints
Images (e.g., X-ray)
Patient-reported outcomes
Biomarkers
Genetics
SDoH
Lifestyle
Health data

wearables, apps...

EHR hospital

EHR primary care

registry
biobank and
images

primary collected
data

claims

Real-world data
Primary collected data
Other

Icons from Freepik and Flaticon
Systemic / societal / human biases

- Diversity and inclusion
- Determinants of health, potentially subject of discrimination

Photo by Jr Korpa on Unsplash
HISTORICAL LACK OF SEX AND GENDER DIMENSIONS IN HEATH RESEARCH AND PRACTICE

- Male body established as the norm
- Females underrepresented in preclinical research
- Women underrepresented in clinical trials
- Undervalue of female-specific conditions

- Data gap (and evidence gap) from the female body
  - Misdiagnosis
  - Worse treatment response / More safety events

- Mueller T, 2022 ELSEVIER.com
Gender

- Self-assessed health status
- Health behavior
- Clinical communication
- Diagnosis and treatment

Sex

- Immune system
- Body composition
- Disease clinical phenotype
- Treatment response (safety, half-life...)

Examples:

- Women’s pain is often dismissed, and pain medication given later than in men.

- LGBTQAI+ community faces discrimination in health

- Are we underdiagnosing depression in men?

References:

Rheumatoid arthritis (RA) in Switzerland

• **Males presented 21% higher odds** of achieving DAS28-remission within the year after starting their first b/tsDMARD.

• This may be explained by their **shorter RA-duration** and **lower DAS28** at the start of their 1st b/tsDMARD.

• **Relevance**: While other unmeasured factors could also affect the disparity, earlier step-up to b/tsDMARD treatment in female patients could benefit patients and reduce the observed disparity.

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Vallejo-Yagüe et al. PLOS ONE 17(10): e0275026
Historical exclusion from clinical trials.

- Biological aging
  - Decline in immune system – higher vulnerability for infections, cancer, etc.

- Social determinant of health
  - Risk behaviours
  - Income, resources
  - Access

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Health risk score – Bias attributable to label choice.

**Wrong label choice**, use of healthcare expenditures as proxy of endpoint health.

At same level of health (number of chronic illnesses), they observed that different race/ethnicity generated differ costs and types of costs. Here race/ethnicity was correlated to socioeconomic status, but other factors can also play a role, like trust in healthcare, racism from healthcare providers... (Note that race was excluded from the model for training, but included for fairness assessment)

Thus, although accurate prediction of cost, it led to wrong predictions of health, resulting in biases output, discriminating based on race/ethnicity.

The authors tested alternative labels. Similar prediction metrics but different race distribution among those categorized at high risk.

Authors and manufacturer looked for solutions. Better label: combination of health prediction with cost prediction.
Real-world data (RWD):
• Societal bias can lead to bias in label (e.g., differential exposure/outcome due to bias). Think in advance the role that this plays in the study objective and the model.

Primary collected data:
• Societal bias can (and should not) affect participation in studies. Efforts in recruitment are essential to ensure representative, diverse, and inclusive input data.

Wearables, digital apps...:
• Who uses them?
What can be done?
What can be done?

• Promote **diversity and inclusion** in your data.

• **Think in advanced** the role that these determinants of health can play in your data, your objective, and your model.

• Define and apply metrics to **evaluate** AI biases, and techniques for mitigating biases in datasets and models.

• **Multidisciplinary teams**, including end-user / patient-research partner.

• Education and training.

• **Opportunity:**
  • AI to help address disparities.
  • Contribute to bridge the sex/gender data gap and highlight health inequalities.
References


Note: Images from Unsplash have been cropped to fit.
THANK YOU

Merci / Danke / Gracias

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