Making Precision Medicine

Socially Precise

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SAMPLING BIAS

Most genome-wide association studies have been of people of European descent.

96% European descent

4% Non-European descent

Nature 2011
NIH-Funded Pulmonary Publications

95% European Origin

Publications including minority participants (%)

Year of publication

All minorities
Black, African American
Latino, Hispanic
Asians, Asian American
Other minorities
Native American, American Indian
Native Hawaiian, Pacific Islander

AJRCCM 2015
Lung research survey highlights lack of minority subjects in many biomedical studies
GALA & SAGE STUDIES
Local, national, international

1998 - present
Deep Phenotyping

> 8,500 Latino & African American children & adolescents (8-21yrs)

**Domain**

- Asthma
- Medical history & Blood work
- Exposures

**Information Gathered**

- Spirometry
- Drug response
- Genotyping
- Cotinine
- Methylation
- RNA-seq
- Environmental
- Nutritional
- FeNO
- IgE
- Social

UCSF
Lung Function Testing

Forced Expiratory Volume$_1$ (FEV$_1$)

Exhalation

Flow (L/s)

Volume (L)

Inspiration
Volume (L)

Exhalation

Flow (l/s)

Inspiration

Bronchodilator Response

Δ FEV₁
Children - Moderate-to-Severe Asthma

Drug Response

Puerto Ricans  African Americans  Mexicans

J. of Asthma, 2007
Racially Mixed Populations

Rich resource for study of complex diseases
Locus Specific Ancestry

[Diagram showing chromosome bands with various colors, representing different loci and ancestry patterns.]
Locus Specific Ancestry

- European
- Native American
- African

LAMP – Pasaniuc et al., Bioinformatics, 2009
Can We Leverage Ancestry to Scientific Advantage?
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Clinical Relevance?
Lung Function Testing

Forced Expiratory Volume₁ (FEV₁)

Exhalation

Flow (l/s)

Volume (L)

Inspiration
Self-identified Race & Lung Function

Figure 1. Mean FEV₁ versus age (2-yr increments) for male subjects.
Adapted from NHANES data - Hankinson JL et al. AJRCCM 1999

Figure 2. Mean FEV₁ versus age (2-yr increments) for female subjects.
Self-identified Race & Lung Function

**Figure 1.** Mean FEV$_1$ versus age (2-yr increments) for male subjects.

**Figure 2.** Mean FEV$_1$ versus age (2-yr increments) for female subjects.

Adapted from NHANES data - Hankinson JL et al. AJRCCM 1999
Self-identified Race vs. *Genetic Ancestry*?
Ancestry & Lung Function (FEV$_1$)

FEV1 (Liters)

% African Ancestry

NEJM 2010

UCSF
Kumar et al. *NEJM* 2010
Ancestry & FEV$_1$

Science 2014
Ancestry & Lung Function

Ancestry

Environmental exposures
- Number of siblings
- Daycare attendance
- Pets
- In utero smoking
- Second-hand smoke
- Air pollutants

Socioeconomic factors
- Income
- Education
- Insurance
- Discrimination
- Acculturation

Lung function
Ancestry & Lung Function in Latinos

\[ \beta = -80 \text{ ml}, \ p = 6 \times 10^{-5} \]

FEV\(_1\) (liters)

African ancestry (%)