



GILLINGS SCHOOL OF  
GLOBAL PUBLIC HEALTH

# Imperfect imputation: Adjusting for the error incurred when we impute.

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# What is Huntington's Disease?

... a neurodegenerative disease that leads to **motor**, **cognitive**, and **psychiatric** impairments



Figure: George Huntington, MD. 1872

# How do we model Huntington's Disease?

Model of interest:

$$E[Y_{ij}|\cdot] = \beta X_{ij} + \alpha T_i + b_i$$

- $Y_{ij}$ : Cognitive impairment
- $X_{ij}$ : Striatum volume
- $T_i$ : Age at disease onset, possibly censored by  $C_i$
- $b_i$ : Random intercept

The challenge:

**Estimate this model despite covariate censoring.**

# How do we overcome censored covariates?

Using **conditional mean imputation**<sup>1</sup>, we can replace censored  $T_i$  with  $T_i^*$ :

$$T_i^* = E(T_i | T_i > C_i, X_i).$$

However, this method can produce **biased parameter estimates**.

We reduce this bias using a **measurement error** approach:

$$T = T^* + U.$$

We allow  $U$  to follow **any distribution**  $f_U(\cdot)$ .

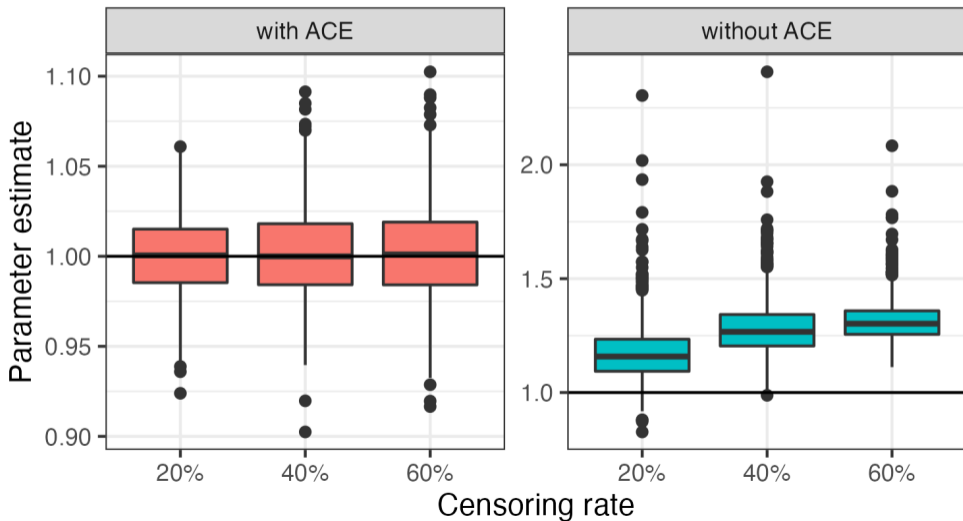
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<sup>1</sup>Atem, F. D., Sampene, E., & Greene, T. J. (2019). Improved conditional imputation for linear regression with a randomly censored predictor. *Statistical methods in medical research*, 28(2), 432-444.

We dub this method:

Actively correcting for error in imputation, or, **ACE Imputation.**

# How does ACE perform in simulation?



# What do we do next?

- See how well ACE Imputation performs when the linear predictor is mis-specified in the imputation model
- Apply this method to data from an **observational study of Huntington's Disease**.
- Extend our work to **nonlinear models**.



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Thank you! Any questions?

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