# Three-phase generalized raking and multiple imputation estimators to address error-prone routinely collected data

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# Research question

- Data from the East Africa International Epidemiology Databases to Evaluate AIDS consortium
    - 85,324 HIV-positive women
    - between 15 and 45 years of age
    - January 1, 2011 to December 31, 2015.

**Assess whether efavirenz-containing ART decreased effectiveness of the contraceptive implant.**

# Variables collected

| ART REGIMEN | CONTRACEPTIVE TYPE | PREGNANCY |
|---|---|---|
| Nevirapine-containing ART | Implant | Yes |
| Efavirenz-containing ART | Depomedroxyprogesterone acetate (DMPA) | No |
| Protease inhibitor (PI)-containing ART | Combined oral contraceptives or oral contraceptive pills (OCPs) | |
| No ART | Other more effective family planning (MEFP) | |
| Nucleoside reverse transcriptase inhibitors (NNRTIs) | Less effective family planning (LEFP) | |
| Combination of ART regimens containing two or more of efavirenz, nevirapine, or PIs | No contraceptive method | |

+ MARITAL STATUS, EDUCATION STATUS, ANY NUMBER OF LIVING CHILDREN, CD4 CELL COUNT, BMI, WHO STATUS, US OF ANY TB MEDICATIONS

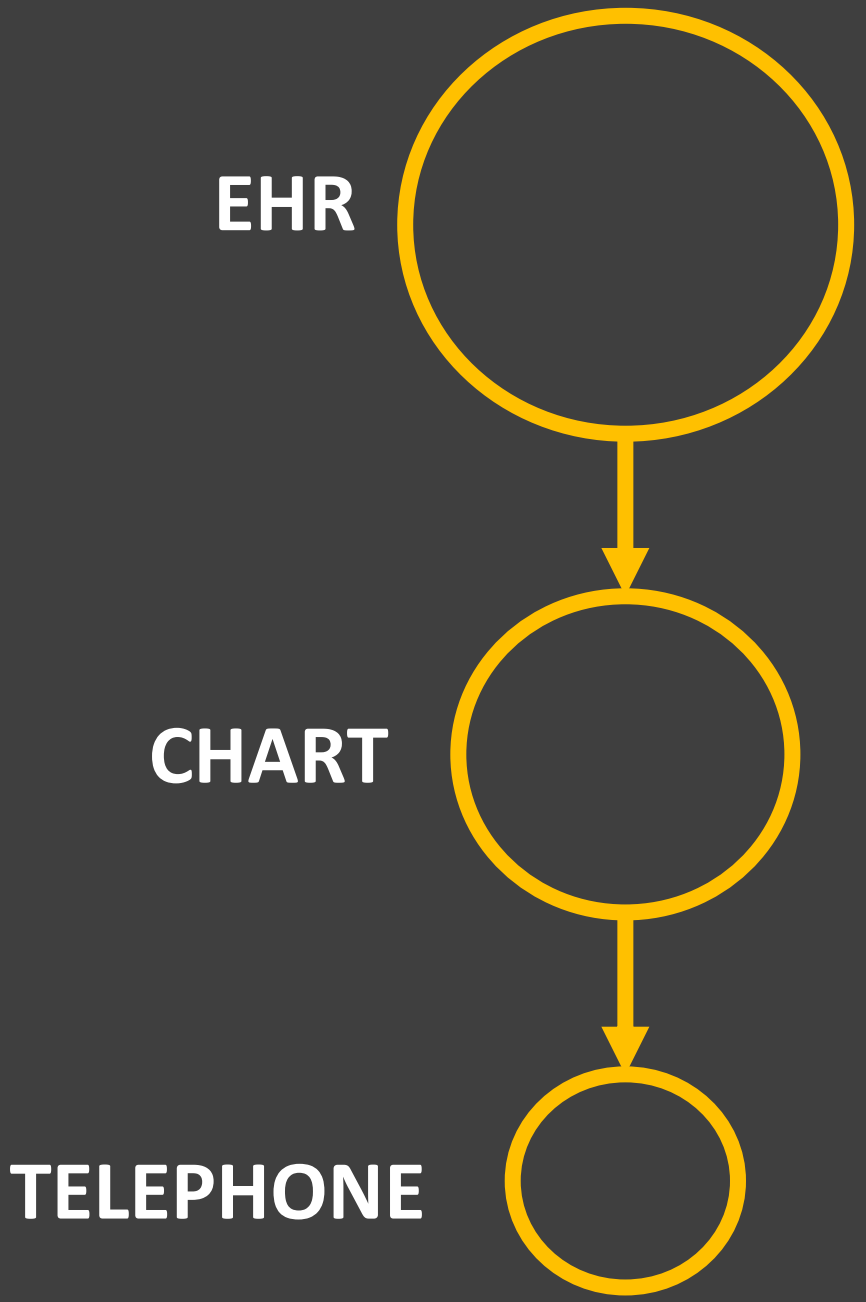
# Data collection

# Validation design

- Concerns about data collection

- 2-stage validation study
  - Chart review (5080)
  - Telephone interview (1285)

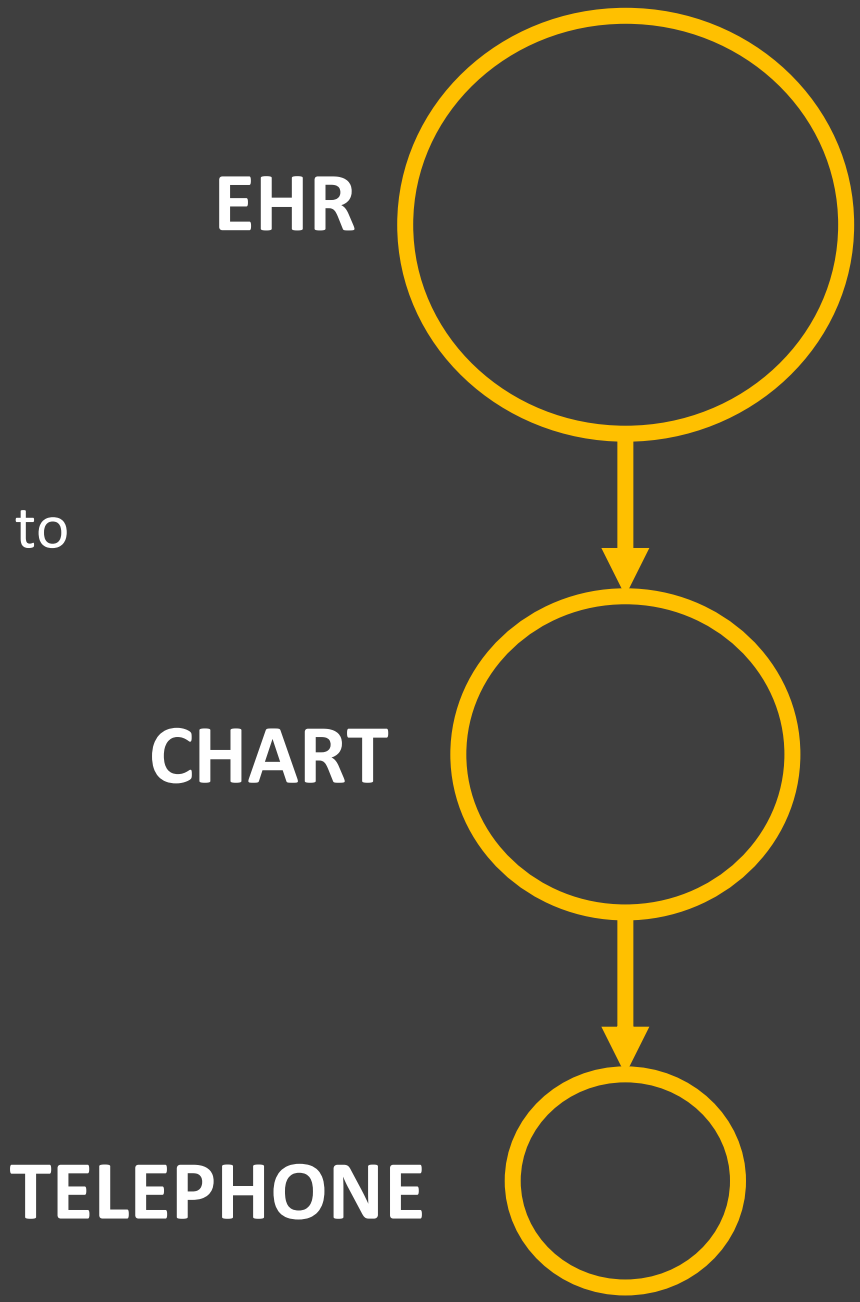
**3-phase study**



# Estimation

- Design-based estimators will reduce the problem to a 2-phase study
  - Ignore the chart review data
  - Inefficient

- We propose:
  - A 3-phase Generalized Raking estimator that uses all information available



# Simulation results

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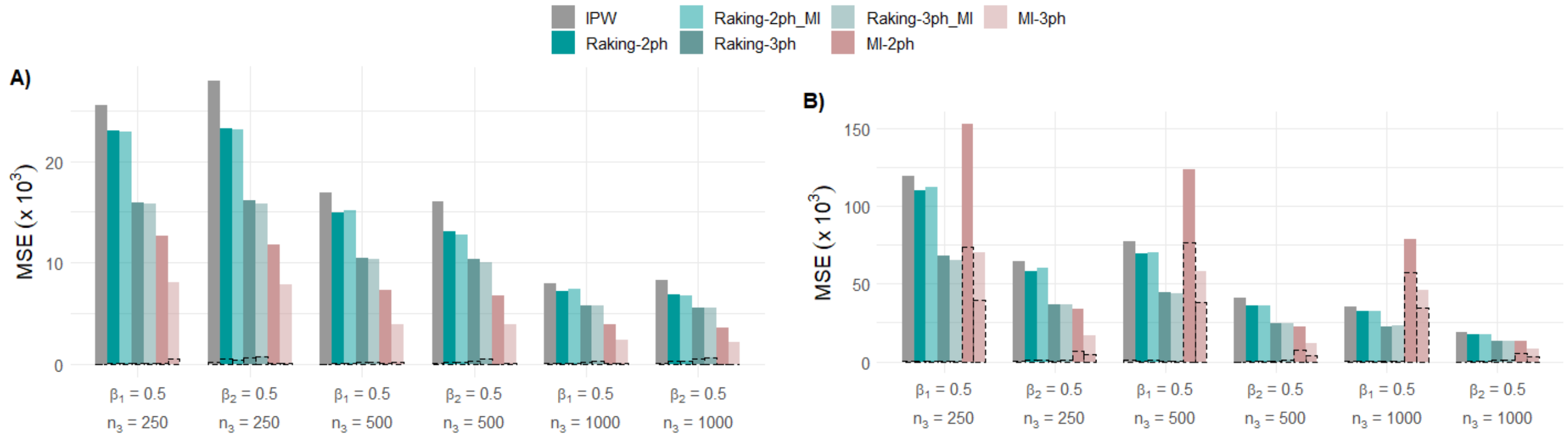

# Revisiting the pregnancy study

| CONTRACEPTIVE TYPE | ART REGIMEN | IPW (2-phase) | 2-Phase Generalized Raking | 3-Phase Generalized Raking | 2-phase MI | 3-phase MI |
|---|---|---|---|---|---|---|
| Implant | Nevirapine | Ref | Ref | Ref | Ref | Ref |
| | Efavirenz | **3.2 (1.6,6.7)** | **3.3 (1.6,6.8)** | **3.2 (1.8,5.7)** | **3.5 (1.8,6.7)** | **1.4 (1.1,1.7)** |
| | PI | 0.9 (0.2,4.4) | 1.7 (0.7,4.2) | 0.9 (0.3,2.7) | 1.1 (0.3,5.0) | 1.0 (0.7,1.3) |
| | No ART | 1.6 (0.6,3.9) | 0.9 (0.2,4.5) | 1.9 (0.9,3.7) | 1.3 (0.5,3.0) | 1.4 (1.2,1.7) |
| DMPA | Nevirapine | Ref | Ref | Ref | Ref | Ref |
| | Efavirenz | 1.1 (0.4,2.9) | 1.1 (0.4,2.9) | 1.0 (0.3,2.9) | 0.6 (0.3,2.0) | 0.8 (0.4,1.5) |
| | PI | 0.8 (0.2,3.3) | 0.9 (0.4,2.1) | 0.8 (0.2,2.9) | 1.0 (0.2,3.8) | 0.9 (0.2,2.0) |
| | No ART | 1.0 (0.4,2.2) | 0.8 (0.2,3.1) | 0.9 (0.3,2.4) | 0.9 (0.2,2.1) | 1.0 (0.3,1.8) |

More about 3-phase Generalized Raking, simulations, and the dataset can be found in the recorded talk

# Thank you!