



Missing Data

A Look at the Ethical Implications

What would you
do for your
family?



Imagine If Your Tap Water Was Not Safe

- 2003 Washington DC Water Crisis
 - Residential water with high levels of lead
 - Chloramine, old lead pipes
- 2004 CDC Report: lead in water - no harm to public

But they were WRONG.

- **4000** lab results for children were missing from analysis
- Would have shown the levels were toxic

Why is Data Missing?

- From record attributes:
 - Data entry
 - Collection not available
 - Not known at time
- Attrition - missing outcome variables
 - Participant drops out
 - Unable to measure last result
 - Death

Missing Data Mechanisms

Missing Completely at Random (MCAR)

- No correlation
- Does not introduce bias

Missing at Random (MAR)

- Missing at random related to another known attribute
- Bias for missing groups of records

Missing Not at Random (MNAR)

- Missing due to unobserved attribute
- Hardest to identify

Imputation

- Logically substitute missing data
 - Unethical?
- Imputed Data does not add Information
 - Increases statistical power
 - Understates variance and standard errors
- Caution
 - Useful only for generalizations
 - Missing data may not be an error

Imputation Methods

- Conventional
 - Mean of known values
- Single Imputation
 - Similar records
- Multiple Imputation
 - Audition of models
- MNAR Imputation
 - Pattern models

Investigate the missing data and determine the original values

Extreme Attrition

- Is the research still valid?
- Should the research be discarded?
- I suggest **NO**:
 - Burden on Participants
 - Sunk Costs
 - Future Research

Cost-Utility Model

A model for determining the ethical ramification of abandoning a study before it even begins.

The failure to conduct a study that could be conducted is as much an act to be evaluated on ethical grounds as is the conduction of a study”

- Rosenthal & Rosnow

Reporting Missing Data

- Journal Article Reporting Standard (JARS)
 - Deleted data
 - Percentages of missing data
 - Evidence of mechanism (MCAR, MAR, MNAR)

American Psychological Association

Concluding Remarks

- Washington DC Water Crisis:
 - Impact beyond Washington DC
 - **One** sentence or footnote
 - **One** phone call
- Responsibility:
 - Researchers
 - Authors of papers
 - Academic, business, and research communities

From my family to yours,
have a **SAFE** and **HEALTHY** holiday
and a happy new year.

