INTERPRETING RESULTS (despite imperfect implementation)

Diane Early
Outline

• Intent to Treat vs. Treatment on the Treated
• External and Internal Validity
• Threats to Validity
  • Attrition
  • Spillover
  • Compliance/non-compliance
  • Hawthorne and John Henry Effects
  • Observer bias
Example: New cancer treatment

What do you want to know?

1) If prescribed to people with cancer, will their cancer go away? (ITT)
2) Can it cure cancer? (ToT)

When everything goes as planned ITT = ToT
External validity extent to which the results apply to people or groups that were not in the study (also called generalizability).
Internal validity is extent to which the results can be attributed to the intervention, rather than a design flaw or implementation flaw.
Threats to Validity

• Attrition
• Non-compliance
• Spillover
• John Henry effect
• Hawthorne effect
• Observer bias
Attrition is when people agree to participate, but then are not available for the post-test.

Why is there attrition?
  – People move
  – People change their minds
  – Children are absent
Why is attrition a problem?

- Can decreases sample size, thereby decreasing power to detect effects (threatening internal validity).
- Can makes the previously equivalent groups non-equivalent (threatening internal validity).
- Sample may no longer be representative (threatening external validity).
Attrition Example

- **Question:** Does a new early language intervention increase children’s vocabulary?
- **Evaluation:** Randomly assign half the children to the new program, and the other half to an old program.
- **Hypothesis:** Children in the new program will know more words at the end of the school year.
## Results Without Attrition

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tx</td>
<td>Control</td>
</tr>
<tr>
<td>85</td>
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<tr>
<td>90</td>
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<td>115</td>
<td>120</td>
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<td></td>
<td>100</td>
<td>108</td>
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</tbody>
</table>

Average Difference

<table>
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<tr>
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<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Difference</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Trends: Child
What if children the intervention is fun, so children in treatment are more likely to come to school?

More children in the treatment condition will have be present to be tested at posttest.
## Differential Attrition

<table>
<thead>
<tr>
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<td>115</td>
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<tr>
<td>Average</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Difference</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Tx</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95</td>
<td>Missing</td>
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<tr>
<td></td>
<td>100</td>
<td>Missing</td>
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<td>110</td>
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<td></td>
<td>120</td>
<td>110</td>
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<tr>
<td></td>
<td>108</td>
<td>107</td>
</tr>
<tr>
<td>Difference</td>
<td>1.3</td>
<td></td>
</tr>
</tbody>
</table>
Limiting Attrition: Partial Solutions

- Strong relationships with participants; make sure they understand the study’s importance.
- Make participation enjoyable; consider offering (small) incentives.
- Make the experience equivalent in the two groups, so they attrition will be equally likely in both groups.
- Get contact information for families, friends, and relatives; contact participants often.
- Allow time/resources to return to follow up with hard to reach participants (e.g. absent children).
- Other?
Threats to Validity

- Attrition
- Non-compliance
- Spillover
- John Henry effect
- Hawthorne effect
- Observer Bias
Non-Compliance

- Those assigned to treatment, do not get the full treatment:
  - Change their minds
  - Do not attend all trainings
  - Do not follow instructions

- Those who are assigned to control, do not get the treatment:
  - A slot in treatment opens up (waitlist-control)
  - Implementers permit control-group members to join treatment
Minimizing Non-Compliance

• Happens in every study, but should work to minimize

• Why people might not comply:
  • Transportation (arrange bus service)
  • Forgetting (send a reminder text)
  • Lack of child care (provide a sitter)
  • Missing lunch/dinner (provide a meal)
  • Don’t agree with program (provide rationale)
  • Other?
Children are randomly assigned to a new preschool program, but compliance is not perfect.

<table>
<thead>
<tr>
<th></th>
<th>Treatment Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Always-takers</strong></td>
<td>![Green icon]</td>
<td>![Green icon]</td>
</tr>
<tr>
<td><strong>Compliers</strong></td>
<td>![Green icon]</td>
<td>![Red icons]</td>
</tr>
<tr>
<td><strong>Never-takers</strong></td>
<td>![Red icons]</td>
<td>![Red icons]</td>
</tr>
</tbody>
</table>
Three Options for Handling Non-Compliance

• Intent-to-Treat (ITT)
• Treatment on the Treated (ToT)
  • Local area treatment effect (LATE)
• When everyone complies ITT = ToT
Intent to Treat

Compare those assigned to TX to those assigned to Control (regardless of up-take).

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<td>![Green Circle]</td>
</tr>
<tr>
<td>Compliers</td>
<td>![Green Circle]</td>
<td>![Red Circle]</td>
</tr>
<tr>
<td>Never-takers</td>
<td>![Green Circle]</td>
<td>![Red Circle]</td>
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</table>
Treatment on the Treated

Compare those who were assigned to treatment and participated to those assigned to control who did not participate.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Always-takers</strong></td>
<td>![Circle of women and men]</td>
<td>![One woman]</td>
</tr>
<tr>
<td><strong>Compliers</strong></td>
<td>![Circle of green women and men]</td>
<td>![Circle of red men]</td>
</tr>
<tr>
<td><strong>Never-takers</strong></td>
<td>![Circle of red women and men]</td>
<td>![Two women]</td>
</tr>
</tbody>
</table>

Includes some always takers and some never takes, because we don’t know who they are so we can’t exclude them.
Local Average Treatment Effect

Adjusts ToT account for the always-takers in the treatment group and the never-takers in the control group.

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<td>![Compliers]</td>
<td></td>
</tr>
<tr>
<td><strong>Never-takers</strong></td>
<td>![Never-takers]</td>
<td></td>
</tr>
</tbody>
</table>

\[
\frac{(Y(T)-Y(C))}{\text{Prob(Treated|T)-Prob(Treated|C)}}
\]

\[
\frac{(108-98)}{(.80-.10)}
\]

\[
10/.70=14.3
\]
Handling Partial Compliance

• Intent-to-treat (ITT): Compare those who were assigned to treatment to those who were assigned to control (regardless of compliance).

• Treatment on the treated (ToT): Compare those who were assigned received the treatment to those who did not.
Downside of ToT

• Can not be certain effects are causal (due to treatment).
• People who took up the intervention are not the same as those who did not.
Threats to Validity

- Attrition
- Compliance/non-compliance
- Spillover
- John Henry effect
- Hawthorne effect
- Observer bias
**Spillover** is when the treatment effects those who are not in the treatment group, often through social interactions.
Avoiding/Addressing Spillover

• Randomize at the level of the social unit (school, classroom, family).

• Measure spillover
  • May later exclude some cases (treatment on the treated)
  • Can control for spillover statistically
  • Can inform future implementation/policy
Threats to Validity

• Attrition
• Compliance/non-compliance
• Spillover
• John Henry effect
• Hawthorne effect
• Observer bias
Hawthorne and John Henry Effects

- **Hawthorne (or observer):** Tendency for study participants to change their behavior because they are being studied or observed.

- **John Henry:** Tendency for those in the control group to try harder than they would have if they weren’t in a study, to compensate for not getting treatment.
Avoiding Hawthorne and John Henry

• Spend as much time as possible with participants, so your presence becomes less novel.
Observer Bias

- Data is affected by the data collector’s
  - Preconceived ideas
  - External knowledge of the teacher/program
  - Knowledge of the study’s hypothesis


Avoiding Observer Bias

- Consider:
  - Avoiding sharing hypotheses and participant conditions with the data collectors
  - Using data collectors who do not know the participants personally
Thank you!

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