Using a Solomon Four-Group Design

• Testing an Intervention for Homeless Adolescents

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Objectives

• 1. Describe a Solomon Four-Group Design.

• 2. Identify advantages and disadvantages to the design (validity).

• 3. Discuss lessons learned during ongoing intervention study.
Solomon Four-Group Design

- True experimental design:

  - $R \quad O_1 \quad X \quad O_2$
  - $R \quad O_3 \quad O_4$
  - $R \quad X \quad O_5$
  - $R \quad O_6$

  - $R =$ randomize
  - $X =$ intervention
  - $O =$ observation/measure
Primary advantage

• Determine intervention’s direct effect on outcome.

• Determine interaction between pre-test and intervention on outcome.
Advantages: Controls for all threats to internal validity (Campbell & Stanley)

- History
- Maturation
- Testing
- Instrumentation
- Regression
- Selection
- Mortality
- Interaction of Selection and Maturation
Allows for testing several hypotheses

- $O_2 > O_1$
- $O_4 > O_3$
- $O_2 > O_4$
- $O_2 > O_5$
- $O_2 > O_6$
- $O_5 > O_4$
- $O_4 > O_6$
- $O_5 > O_6$
Hypothesis: those randomly assigned to receive the intervention (X) will do better on the post-test (outcome) than the pre-test.

Conclusion: there is a significant difference between the pre-test and the post-test, therefore, the intervention made a difference.
• Hypothesis: for those randomly assigned to the control group, the post-test (outcome) score will be greater than the pre-test score.

• Conclusion: pre-test “primed” the subject to anticipate the outcome; there was no intervention to influence the outcome.
\[ O_2 > O_4 \]

- **Hypothesis:** those who are randomly assigned to receive the intervention will do better on the outcome/measure than those in the control group.
  - Test of the gold standard randomized controlled trial.
    - \[ R \ O_1 \times \ O_2 \]
    - \[ R \ O_3 \ O_4 \]

- **Conclusion:** the intervention made a significant difference in the outcome.
Hypothesis: those randomly assigned to receive the intervention and to take the pre-test, will do better on the post-test (outcome) than those who were randomly assigned to receive the intervention without the pre-test.

Conclusion: pre-testing influences the outcome.
Conclusion: pre-testing must be part of the intervention.
Hypothesis: those randomly assigned to the pre-test and the intervention, will do better on the post-test (outcome) than those who did not have the pre-test nor the intervention.

Conclusion: the intervention makes a significant difference in the outcome.
Hypothesis: those who were randomly assigned to the intervention but did not take the pre-test will do better on the outcome than those who took the pre-test but did not have intervention.

Conclusion: the intervention has a significant effect on the outcome.
Hypothesis: those randomly assigned to the control, but who took a pre-test, will do better on the outcome/measure than those who did not receive the intervention nor took the pre-test.

Conclusion: pre-testing has some influence on the outcome.
O_{5} > O_{6}

- Hypothesis: those randomly assigned to receive the intervention, even without doing a pre-test, will do better on the outcome than those who received neither the pre-test nor the intervention.

- Conclusion: the intervention has a significant effect on the outcome.
  - R \times O_{5}
  - R \quad O_{6}
Major Disadvantage

• Sample Size
  – Based on accessible population

• Power-analysis
  – Possible need for additional sites
Disadvantage

- Owing to size, more costly.
Longitudinal Intervention Study

- Two-sites: Austin, TX and Columbus, OH
- Solomon Four-group with repeated measures:
Random Assignment

• Group 1: Pre- Intervention- Post-3 mos – 6 mos.
• Group 2: Pre- Control- Post-3 mos – 6 mos.
• Group 3: Intervention- Post-3 mos – 6 mos.
• Group 4: Control- Post-3 mos – 6 mos.
Lessons Learned

• Longitudinal studies require large samples and many personnel.
  – Current study: expected $N = 600$

• Intervention fidelity is essential to be certain intervention delivered the same across locations—use digital recordings.

• Communication within and between sites is crucial.
Strict Adherence to Randomization

• Sequence of 300 numbers arranged 1 – 4 for both sites.
  – Based on order of enrollment in the study.

• Used website for calculation.

• Train personnel about strict adherence to the plan.
Conclusion

• The Solomon Four-Group Design is an elegant true experimental design with more advantages than disadvantages.

• \( R \ O_1 \ X \ O_2 \)
• \( R \ O_3 \ O_4 \)
• \( R \ X \ O_5 \)
• \( R \ O_6 \)
THANK YOU