Single Subject Research Design (SSRD)

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Objectives

- Define Single Subject Research Design (SSRD)
- Rationale for using SSRD
- Describe several forms of SSRD
- Discuss the methods of analyses using SSRD
- Discuss strengths & weaknesses of SSRD
Continuum of Research

Case report → Case Study

Quasi-Experimental
  (Groups - no random selection)

Experimental
  (RCT)

Pre Scientific | Scientific

SSRD Workshop
Other Names for SSRD

• Single case experimental design
• Time series design
• Small-N design
• Single system designs
• Within-subject comparison
• Idiographic research
• N of one trial
SSRD Defined

SSRD involves studying a single individual or system by taking repeated measurements of 1 or more dependent variables and systematically applying & sometimes, withdrawing or varying the independent variable.

(OTtenbacher, 1986; Bloom & Fischer, 1982)
Why Chose SSRD?

• Demonstrates individual differences
• Difficulty obtaining adequate power (N)
• Difficulty obtaining homogeneous group
• SSRD is relatively easy to do
• Helps validate practice
• Demonstrate treatment (tx) effectiveness
• Great pilot
About SSRD

• Collection of methods (eg; AB, ABAC)
• Answers research question or tests hypothesis
• Involves at least one;
  • Subject (individual or clinical unit/department)
  • Baseline or “A” Phase - series of repeated observations or measurements with no intervention
  • Intervention or “B” Phase - introduction of experimental variable with evaluation to see if change occurs
  • Dependent variable (quantifiable)
  • Independent variable (treatment / intervention)
SSRD Phases

Baseline
• Period of no tx - reflects natural state
• Provide standard for evaluating tx effect
• Measurements usually repeated until stability demonstrated
• 5 or more data points
Sample Baseline Phases

A)  
B)  
C)  
D)
SSRD Phases

Intervention Phase

• Introduce tx or intervention
  • = independent variable
• Multiple treatments are alright
• Repeated measurement of dependent variable
• Phase length should be approximately same as baseline
Dependent Variable

• Variable of interest needs to be quantifiable
• Does not require a standardized test
  • Usually frequency, duration, magnitude
  • i.e. episodes of self-abuse / walk time / pain intensity
• Should assess reliability of variable
  » total % agreement
  » Point by point % agreement
  » kappa
Simple Design

**A-B**
- 1 baseline + 1 tx phase

**Problems**
- Limited control over threats to internal validity

**Solution → Replication**
- Add phases
- Add other tx/interventions
- Add subjects
Withdrawal Designs

A-B-A

– Shows intervention leads to target behaviour (TB)
– TB disappears when intervention stopped

• Problems
  – Unethical to withdraw tx
  – Reversible target behaviour
Withdrawal Designs

**A-B-A-B**
- adds an extra tx phase
- ↑ confidence in tx effect

Problems
- Reversible target behaviour
- Unethical to withdraw tx
Multiple Treatment Designs

Alternating

- Rapid alternation of $\geq 2$ txs (or tx & placebo)
- Txs alternated within same session, session to session
- Advantage = quick results, baseline unnecessary
- Sequence effect randomizing counterbalance
- Target must be clear & happen rapidly
Multiple Treatment Designs

Interactive (A-B-BC-B-BC)

- Assess separate & joint effects of 2 or more txs
- Best to replicate tx
- Interactions can be tested
Multiple Baseline Designs

Across Subjects/Conditions/Behaviors

- Useful when:
  - Behaviours non-replicable
  - Unethical to withdraw tx

- Uses basic A-B phase design
  - Measure baseline in all
  - Establish stability
  - Intro tx to 1st subject/condition…
  - Intro next tx when previous tx stabilizes
SSRD Analysis

• Visual analysis most common
• Assess trends & levels between adjacent phases
  – Level – refers to change in value or magnitude of dependent variable after intervention
  – Trend – refers to change in direction
    – Described as accelerating, decelerating, stable or variable
• Another technique Split middle Difference
  – Uses celeration line to which statistical significance can be explored
  – Also 2 standard deviation method
Visual Analysis

A) Change in level

B) Change in trend
Sample Visual Analyses

How would you describe the following changes?
Split-Middle Technique
SSRD, Case Study & Group Designs: Contrast and Comparison

<table>
<thead>
<tr>
<th></th>
<th>SSRD</th>
<th>Case Study</th>
<th>Between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
<td>Own control</td>
<td>No control</td>
<td>Group control</td>
</tr>
<tr>
<td><strong>Hypothesis</strong></td>
<td>Test</td>
<td>Generate</td>
<td>Test</td>
</tr>
<tr>
<td><strong>Extraneous variable</strong></td>
<td>Controls</td>
<td>Describes</td>
<td>May control</td>
</tr>
<tr>
<td><strong>Design flexibility</strong></td>
<td>Permits change</td>
<td>Permits change</td>
<td>No change</td>
</tr>
<tr>
<td><strong>Differences</strong></td>
<td>Individual</td>
<td>Individual</td>
<td>Group</td>
</tr>
<tr>
<td><strong>Generalizability</strong></td>
<td>Limited</td>
<td>None</td>
<td>Similar to groups</td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td>Repeated freq</td>
<td>Through-out</td>
<td>Few</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>Low</td>
<td>Low</td>
<td>Can be high</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>Limited</td>
<td>None</td>
<td>Significance bt grps</td>
</tr>
</tbody>
</table>

SSRD Workshop
Useful References
