Learning objectives

Define multilevel study.

Recognize a multilevel study.

Describe the advantages of a multilevel study.

Learning objectives

Recognize that some authors use the terms group- or cluster-randomized trial or observational cluster or hierarchal study, rather than using the level terminology.

Describe how multilevel studies induce correlation.
A multilevel study involves one or more hierarchical groups of observations
Authors use different but equivalent terminology.

Examples:
“Two-level study”
“Two-level group design”
“Two-level cluster design”
“Two-level hierarchical design”

Members of a level, also referred to as a group or cluster, share experiences which induce correlation
Multilevel studies involve two or more layers of correlation.

For example, reading scores from students in the same school are correlated
Shared teacher → induces a correlation
Shared school → induces a correlation

Two level design

<table>
<thead>
<tr>
<th></th>
<th>ISU</th>
<th>Level 1</th>
<th>Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classrooms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Murray, D. M., 1998
A randomized controlled trial is a study in which participants are randomized into either a study group which receives an intervention or a control group which does not. May have more than two groups. It is sometimes better, and sometimes necessary, to randomize two or more participants at a time, i.e., randomize clusters of participants.

We examine an example of a multilevel, randomized controlled trial

The study assessed the effectiveness of a literacy intervention

Researchers conducted a cluster randomized control trial to evaluate the effectiveness of a web-based literacy intervention called ABRACADABRA (ABRA).

The study assessed the effectiveness of a literacy intervention

Vignette, continued

The study included 24 classrooms within 12 elementary schools within a single school district. Researchers assumed that schools within the district were under local control and were therefore independent.
The study assessed the effectiveness of a literacy intervention

Vignette, continued
Schools were randomized into the intervention group or the control group. Change in literacy was evaluated using pre- and post-tests to determine whether ABRA technology significantly improved literacy in elementary school children.

Randomization of study conditions took place at the school level

The goal of the study was to assess the effectiveness of a literacy intervention

Null hypothesis:
There is no significant difference in literacy between elementary students in the intervention group and those in the control group.
Researchers adjusted for correlation to isolate the impact of the intervention

Several sampling features of the design created correlations.
Classrooms within schools are correlated.
Students within each classroom are correlated.
Failure to adjust for correlation would inflate Type I error rate.

Change in literacy scores was chosen as the measure of intervention effectiveness

Independent sampling unit:
School

Unit of observation:
Difference between pre- and post-test performance

The goal of the study was to assess the effectiveness of a literacy intervention

Between-independent sampling unit factor:
Randomization group (scientific focus)

Within-independent sampling unit factor:
Cluster member

No scientific interest in within factor here. Within factor is interesting in other settings.
ABRACADABRA was associated with greater improvements in early literacy
By accounting for existing organizational groups, the multilevel design enabled researchers to isolate the ABRACADABRA program as the primary cause of literacy improvement.

Adapted from Piquette, et al., 2014

REVIEW OF LEARNING OBJECTIVES

Can you describe a multilevel study?
A research design with multiple layers of correlated units.
What are multilevel features in studying tobacco counseling by health providers?

Clinics operate in health systems.

Providers operate in clinics.

Many patients see the same provider.

What should be the Independent Sampling Unit (ISU)?

Questions?