Module 6: Random Effects & Linear Mixed Models

Introduction to Random Effects

Fixed Effects

Up to this point, we have been concerned exclusively with **fixed effects** models.

What were we always testing?

Fixed Effects

Fixed effects are appropriate when:

- Interest centers on the effects of the specific factor levels chosen.
- If the experiment were to be repeated, the same levels would be chosen.
- Interest is focused on means.

Random Effects

Random effects are appropriate when:

- The factor levels are a sample from a larger population of potential factor levels, and inferences are desired about the population of factor levels.

- If the experiment were to be repeated, a new set of levels would be chosen.

- Interest is focused on variances.

The Conceptual Contrast

Fixed	Random
Specific levels	Sample of levels
Same levels if repeated	New levels if repeated
Focus: means	Focus: variances
Compare (μ_i)	Estimate (σ^2_{factor})

Example 6.1: Retail Store.

Consider an experiment conducted by a company that owns several hundred retail stores. Approximately 50 of the stores are selected at random, and employees in each store was asked to evaluate management. The company is NOT interested in just the 50 stores chosen – it wants to generalize the results to ALL of its stores. Further, suppose that employees were asked from each department (e.g., clothing, kitchen, etc.) in all 50 stores. Therefore, the company is interested in the employee evaluations of management by *department* and *store*.

Is store fixed or random?

- Were stores randomly selected?

- Do we care about only these 50 stores?

- If repeated, would we choose the same stores?

Is department fixed or random?

- Were departments randomly sampled?
- Do these departments represent all *possible* departments?
- If repeated, would we choose different departments?

It turns out that whether a factor is fixed or random:

Does NOT change the design much

But...Changes the analysis.