A Note on Model Specification: Mixed Model for Repeated Measurement (MMRM)

Mixed Model for Repeated Measurement (MMRM)

Full and Naive Structure

Let

- $C_{s,\,t}$ be the Change from Baseline in Patient **s** at Visit **t**;
- BL_s be the Observation of Patient **s** at Baseline **t=0**;
- V_t be the Visit for C **t**, for example, 21 or 42 days;
- T be the planned treatment group for Patient **s**, for example, Reference vs Test;
- s(t) be the variance-covariance matrix of Patient **s** nesting Visit **t**;
- and a error term present the residual.

The model can be written as:

Full and Dummized Structure

The interaction are preferred to be expanded:

At this step, if you notice, T_s can be simplified by factoring out(additive term for β_2, β_3, β_{41} and β_{42}). However, V_t has to be retained as part of matrix s(t).

Simplified and Dummized Structure

Factoring out T_s

Linear Combination

Let $\bar{\beta}$ be the population mean at Baseline.

Once model converage, β are optimized. Estimations can be obtained through linear combination of terms.

The change from baseline at 21 days for Reference

The change from baseline at 21 days for Test

The change from baseline at 42 days for Reference

The change from baseline at 42 days for Test

Then, the difference between Reference and Test at 42 days

Baseline-contrained Longitudial Data Analysis (cLDA)

To be updated.

Appendix

CodeCogs

$$C_{s,t} = \mu + \beta_{1}\times B_{s} + \beta_{2}\times V_{t} + \beta_{3}\times T_{s} + \beta_{4}\times V_{t} \times T_{s} + \gamma\times s(t) + \varepsilon_{s,t}$$

$$C_{s,t} = \mu + \beta_{1}\times B_{s} + \beta_{2}\times V_{t} + \beta_{3}\times T_{s} + \beta_{41}\times (V_{t}=21)\times T_{s} + \beta_{42}\times (V_{t}=42)\times T_{s} + \gamma\times s(t) + \varepsilon_{s,t}$$

$$C_{s,t} = \mu + \beta_{1}\times B_{s} + \beta_{2}\times V_{t} + \beta'_{41}\times (V_{t}=21)\times T_{s} + \beta'_{42}\times (V_{t}=42)\times T_{s} + \gamma\times s(t) + \varepsilon_{s,t}$$

$$\widehat{C_{21}} = \mu + \beta_{1}\times \overline{B_{s}} + \beta_{2}\times V_{t} + \beta'_{41}\times (V_{t}=21)\times T_{s} + \beta'_{42}\times (V_{t}=42)\times T_{s}$$

Revision #4
Created 2026-09-19 23:53:08 UTC by Colin Wang
Updated 2026-09-20 01:39:11 UTC by Colin Wang