Skewed random effects in AD Model Builder

Goal

- Analyse model in Section 14.2 of Skrondal and Rabe-Hesketh (2004) *Generalized Latent Variable Modeling: Multilevel, Longitudinal and Structural Equation Models*. Chapman & Hall
- Replace normal distribution with a skewed distribution for the random effects.

14.2 Diet and heart disease

- Covariate measurement error model
- 337 middle aged men (bank, transportation)
- At requirement: weigh their food
  - Repeated measurement for 76 men
- Heart disease or not?
- Covariates:
  - age (numeric)
  - bus (0,1)

Model description

- Exposure model (true fiber intake)

$$\eta_j = \gamma_1 \cdot \text{age}_j + \gamma_2 \cdot \text{bus}_j + \gamma_3 \cdot \text{age*bus}_j + \zeta_j,$$

$$\zeta_j \sim N(0, \psi)$$

- Measured fiber intake ($i = 1,2$)

$$y_{ij} = \eta_j + \alpha_0 + (i\text{-}1) \cdot \alpha_1 + \varepsilon_{ij}, \quad \varepsilon_{ij} \sim N(0, \theta)$$

- Disease model ($D = 0,1$)

$$\text{logit}(D_j|\eta_j) = \beta_0 + \beta_1 \cdot \text{age}_j + \beta_2 \cdot \text{bus}_j + \beta_3 \cdot \text{age*bus}_j + \lambda \cdot \eta_j$$

Setting up and running the model

- Prepare data in R: ”diet.s”
- Compiling the model
  - `admb -re diet`
- Running the model (Laplace approx.)
  - `diet -est`
- Running the model (Gauss-Hermite appr.)
  - `diet -est -gh 20`

Skewed distributions for ζ

- Skrondal and Rable-Hesket:
  - Replace $N(0,\psi)$ distribution for ζ_j by non-parametric distribution (Fig. 14.2)
- Skewed distribution for ζ_j

$$\zeta_j = [a \cdot u_j + (1-a)[\exp(u_j)-\exp(0.5)]/c_1]/c_2,$$

$$0 < a < 1$$

$$u_j \sim N(0, \psi)$$

$$c_1 = \text{sqrt}[e(e-1)],\ c_2 = \text{sqrt}(a^2 + (1-a)^2)$$