$Y_i = (Y_i 1, \ldots, Y_{it} \ldots, Y_{n_i})$
$E(Y_i t) = \mu_{it}$
$X_i = (x_{i1}, \ldots, x_{it}, \ldots, x_{in_i})'$ design matrix
$g(\mu_{it}) = \eta_{it} = x_{it}^T \beta$
$V(Y_{it}) = \phi a_{it} = \phi a(\mu_{it})$
ϕ - dispersion parameter
$V_i = \phi A_i^{1/2} R_i(\alpha) A_i^{1/2}$, where A_i is a diagonal matrix with kth diagonal element a_{ik}
$D_i = A_i \frac{dg^{-1}(\eta_{ik})}{d\eta_{ik}} X_i$ Generalized estimating equations given by

$$\sum_{i=1}^{K} D_i^T V_i^{-1} (Y_i - \mu_i) = 0$$

std error $= 1/a(\mu)$

Algorithm 1 GEE pseudocode

Initialize β, ϕ, α
while ! convergence **do**
  $\eta = \mathbf{X}\beta$
  $\mu = g^{-1}(\eta)$
  $e_{ik} = (y_{ik} - \mu_{ik})/\sqrt{a_{ik}}$
  $\phi = \frac{1}{(\sum n_i) - p} \sum_{i=1}^{K} \sum_{j=1}^{n_i} e_{ij}^2$
  Update α, $R(\alpha)$ using ϕ and e_{ik}
  Calculate $R(\alpha)^{-1}$ numerically
  Update β using estimating equations
end while
Calculate sandwhich variance estimator