Recap of Central Results

- Longitudinal modeling of non-Gaussian outcomes is hard!
- **Generalized Estimating Equations:** Marginal model (Population average model)
  - Model mean of response
  - Deals easily with non-gaussian outcomes: GLM
  - Mean model with *working* covariance (nuisance)
- **Properties**
  - Consistency and normality of $\widehat{\beta}$
  - Do NOT need to get the working correlation correct (valid)
  - Efficiency gain when working correlation is closer
  - Relies heavily on asymptotics!

Recap of Central Results (2)

- **Inference:**
  - Sandwich estimator for variance
  - Robust Wald and Score Tests
  - Naive tests when empirical covariance hard to work with
  - Relies heavily on asymptotics!
- **GEE2:** Beyond mean model
  - Add in addition estimating equations for correlation parameters
  - OR instead of correlation
  - Similar results as before (keep mean and correlation models separate)
  - ALR is useful implementation

Key References

- Liang KY. and Zeger S.L. (1986)
- Rotnitzky and Jewell (1990)
- Prentice R.L. (1988).
- Zhao and Prentice (1990) and Prentice and Zhao (1991)
- Fitzmaurice, Laird and Rotnitzky (1993)
- Lipsitz, Laird and Harrington (1991)
- Liang, Zeger and Qaqish (1992)
- Carey, Zeger and Diggle (1993)

Where we are in 571...

1. Introduction to Correlated Data
2. **Linear Mixed Models** (HW1)
3. Review of GLMs and Quasi-likelihood
4. **Generalized Estimating Equations** (HW2)
5. Final project description (HW 4)
6. **Generalized Linear Mixed Models** (HW3)
7. Missing Data
8. Classical and Modern Multivariate Analysis
9. Group Papers Due