Discussion of "Survival Models and Health Sequences"

Setup:

- Subjects indexed by i
  - Standard independence assumption relaxed to exchangeable.
  - Exchangeable within covariate pattern, if applicable.
- Status variables $Y_i(t)$
  - t represents time
  - $Y \in \Re^K \cup \{\flat\}$, where $\flat$ represents an absorbing state, generally representing death.
  - $Y_i(t)$ includes time-dependent covariates.
- Survival time $T_i = \sup_{T \geq 0}\{Y_i(t) \neq \flat\}$.
- Let $Z_i(s) = Y_i(T_i - s)$
  - Runs time backwards from time of death
  - Called *revival process*.

Objective

Model $Z_i(s)$

- Look for pattern in $\mathrm{E}\left[Z_i(s)\right]$ predicting death
  - Model $Z_i(s)$ as a Gaussian process

Key Observation

$Z_i(s)$ should be independent of T_i

- Assumption is called *revival assumption.*
- Heuristically, time reversal captures all dependence of Y on T
- Survival processes are aligned at failure time, rather than at randomization
  - Avoids extra variability induced by heterogeneity in disease stage at enrollment.

Place of common survival analysis concepts in revival framework

- Treatment: modeled as time-dependent
  - In this framework the only change is at randomization.
  - Assume value of Z depends on treatment only through current treatment arm
- Censoring: Stratify based on whether censoring has occurred.
  - Pattern of interest should be apparent in the uncensored individuals
  - Pattern should be attenuated in censored individuals

Open Questions

- Can we use the information in censored observations more intensively?
  - If one reverses at censoring times, the expectation of covariates should be a mixture of the expectations for observations near failure, and less extreme observations.
  - Can we model this?