

1. **Ordinal variable:**  $X_{ord(1)}$  has 3 categories (i.e., drug treatment) and is the same in each equation
2. **Continuous variables:**
  - a)  $X_{cont}$  is a time-varying covariate (subject-level term) with an AR(1,  $p = 0.5$ ) correlation structure
    - i.  $X_{cont(11)}$  has a Chisq(df = 2) distribution
    - ii.  $X_{cont(21)}$  has a Chisq(df = 4) distribution
    - iii.  $X_{cont(31)}$  has a Chisq(df = 8) distribution
  - b)  $X_{mix}$  is a normal mixture time-varying covariate (subject-level term), components have an AR(1,  $p = 0.4$ ) correlation structure across Y
3. **Poisson variable:**  $X_{pois(1)}$  is a zero-inflated Poisson variable with  $\lambda = 15$ , the probability of a structural zero set at 0.10, and is the same in each equation
4. **Negative Binomial variable:**  $X_{nb(1)}$  is a regular NB time-varying covariate (subject-level term) with an AR(1,  $p = 0.3$ ) correlation structure and increasing mean and variance
  - a)  $X_{nb(11)}$  has a size of 10 and mean of 3
  - b)  $X_{nb(21)}$  has a size of 10 and mean of 4
  - c)  $X_{nb(31)}$  has a size of 10 and mean of 5
5. **Error terms** have a Beta(4, 1.5) distribution with an AR(1,  $p = 0.4$ ) correlation structure. These require a sixth cumulant correction of 0.03.

There is an interaction between  $X_{ord(1)}$  and  $X_{pois(1)}$  for each Y. Since they are both group-level covariates, the interaction is also a group-level covariate that will interact with the subject-level covariates. However, only  $X_{ord(1)}$  and  $X_{pois(1)}$  interact with time. The ordering in the equations below reflects the ordering in the simulation process.

$$\begin{aligned}
Y_1 &= \beta_0 + \beta_1 * X_{ord(1)} + \beta_2 * X_{cont(11)} + \beta_3 * X_{mix(11)} + \beta_4 * X_{pois(1)} + \beta_5 * X_{nb(11)} + \beta_{int} * X_{ord(1)} * X_{pois(1)} \\
&\quad + \beta_{subj1} * X_{ord(1)} * X_{cont(11)} + \beta_{subj2} * X_{pois(1)} * X_{cont(11)} + \beta_{subj3} * X_{ord(1)} * X_{pois(1)} * X_{cont(11)} \\
&\quad + \beta_{subj4} * X_{ord(1)} * X_{mix(11)} + \beta_{subj5} * X_{pois(1)} * X_{mix(11)} + \beta_{subj6} * X_{ord(1)} * X_{pois(1)} * X_{mix(11)} \\
&\quad + \beta_{subj7} * X_{ord(1)} * X_{nb(11)} + \beta_{subj8} * X_{pois(1)} * X_{nb(11)} + \beta_{subj9} * X_{ord(1)} * X_{pois(1)} * X_{nb(11)} \\
&\quad + \beta_{tint1} * X_{ord(1)} * Time_1 + \beta_{tint2} * X_{pois(1)} * Time_1 + \beta_t * Time_1 + E_1 \\
Y_2 &= \beta_0 + \beta_1 * X_{ord(1)} + \beta_2 * X_{cont(21)} + \beta_3 * X_{mix(21)} + \beta_4 * X_{pois(1)} + \beta_5 * X_{nb(21)} + \beta_{int} * X_{ord(1)} * X_{pois(1)} \\
&\quad + \beta_{subj1} * X_{ord(1)} * X_{cont(21)} + \beta_{subj2} * X_{pois(1)} * X_{cont(21)} + \beta_{subj3} * X_{ord(1)} * X_{pois(1)} * X_{cont(21)} \\
&\quad + \beta_{subj4} * X_{ord(1)} * X_{mix(21)} + \beta_{subj5} * X_{pois(1)} * X_{mix(21)} + \beta_{subj6} * X_{ord(1)} * X_{pois(1)} * X_{mix(21)} \\
&\quad + \beta_{subj7} * X_{ord(1)} * X_{nb(21)} + \beta_{subj8} * X_{pois(1)} * X_{nb(21)} + \beta_{subj9} * X_{ord(1)} * X_{pois(1)} * X_{nb(21)} \\
&\quad + \beta_{tint1} * X_{ord(1)} * Time_2 + \beta_{tint2} * X_{pois(1)} * Time_2 + \beta_t * Time_2 + E_2 \\
Y_3 &= \beta_0 + \beta_1 * X_{ord(1)} + \beta_2 * X_{cont(31)} + \beta_3 * X_{mix(31)} + \beta_4 * X_{pois(1)} + \beta_5 * X_{nb(31)} + \beta_{int} * X_{ord(1)} * X_{pois(1)} \\
&\quad + \beta_{subj1} * X_{ord(1)} * X_{cont(31)} + \beta_{subj2} * X_{pois(1)} * X_{cont(31)} + \beta_{subj3} * X_{ord(1)} * X_{pois(1)} * X_{cont(31)} \\
&\quad + \beta_{subj4} * X_{ord(1)} * X_{mix(31)} + \beta_{subj5} * X_{pois(1)} * X_{mix(31)} + \beta_{subj6} * X_{ord(1)} * X_{pois(1)} * X_{mix(31)} \\
&\quad + \beta_{subj7} * X_{ord(1)} * X_{nb(31)} + \beta_{subj8} * X_{pois(1)} * X_{nb(31)} + \beta_{subj9} * X_{ord(1)} * X_{pois(1)} * X_{nb(31)} \\
&\quad + \beta_{tint1} * X_{ord(1)} * Time_3 + \beta_{tint2} * X_{pois(1)} * Time_3 + \beta_t * Time_3 + E_3
\end{aligned}$$