Epidemiology Models

i. General: $E[\#events] = Rate \times PT$

ii. Specific way that rates are interrelated (form of 'rate model')

(a) (Additive, Rate Difference): $Rate = Rate_0 + \beta_1 X_1 + \beta_2 X_2 \ldots$

(b) (Multiplicative, Rate Ratio): $Rate = Rate_0 \times \exp\{\beta_1 X_1 + \beta_2 X_2 \ldots\}$

(or, equivalently, ...): $\log(Rate) = \log(Rate_0) + \beta_1 X_1 + \beta_2 X_2 \ldots$

Statistical Fitting of these Models

i. General: $E[\#events] = Rate \times PT$

ii. Specifically, how model is implemented in statistical packages:
In both instances, expand the $Rate \times PT$ product

(a) (Add.): $E[\#events] = \{Rate_0 + \beta_1 X_1 + \beta_2 X_2 \ldots\} \times PT$

$E[\#events] = Rate_0 \times \underline{PT} + \beta_1 \times \underline{X_1 \times PT} + \beta_2 \times \underline{X_2 \times PT} \ldots$

(specify 'no-intercept' ; in `R`, $\#events \sim -1 + ...,$)

(b) (Mult): $E[\#events] = Rate_0 \times \exp\{\beta_1 X_1 + \beta_2 X_2 \ldots\} \times PT$

$\log\{E[\#events]\} = \log(Rate_0) + \beta_1 \times \underline{X_1} + \beta_2 \times \underline{X_2} \cdots + \log(PT)$

(use '$log(PT)$ as 'offset' ; cf worked e.g.'s for `R` / SAS code)