

BIOSTATISTICS 740 (BIOS7400)
Clinical Trials

Lecture 18

Survival Analysis I
(Introduction, Kaplan-Meier, and Logrank Test)

Comparison-Wise Error Rate (CWER) and Family-Wise Error Rate (FWER)

- Suppose *an experiment* consists of total n *independent* tests (i.e., *comparisons*) — $H_{10}, H_{20}, \dots, H_{n0}$, we have
 - **CWER**: Type I error for *each* test's *null* hypothesis (e.g., for the i^{th} *null* hypotheses $H_{(i)0}$)
 - **FWER**: Type I error for the *grand* (i.e., a *family* of total n *independent* tests) *null* hypothesis (also called overall type I error). It is the probability that we *reject any one of* $H_{10}, H_{20}, \dots, H_{n0}$ if they are *all true*

Expected # of False Positives for Multiple Comparisons

- Suppose we perform n independent tests, each with a fixed, pre-specified **CWER** α . Then, # of false positives (denoted by X) follows a *binomial* distribution:

$X \sim \text{Bin}(n, p)$, where p denotes probability of success (i.e., α)

$$\Pr(X = k) = \frac{n!}{(n-k)!k!} (1-p)^{n-k} p^k = \frac{n!}{(n-k)!k!} (1-\alpha)^{n-k} \alpha^k$$

For n large and α small,

$$\Pr(X = k) \approx \frac{(n\alpha)^k e^{-n\alpha}}{k!} \Rightarrow \begin{cases} E(X) = n\alpha \\ \text{Var}(X) = n\alpha \end{cases}$$