

**Department of Biostatistics and Medical Informatics  
School of Medicine and Public Health**

**Improving the Efficiency of the Logrank Test  
Using Auxiliary Covariates**

**Xiaomin Lu**  
**North Carolina State University**  
Joint Biostatistics/Statistics Faculty Candidate

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Abstract:

The logrank test is widely used in many clinical trials for comparing the survival distribution between two treatments with censored survival data. Under the assumption of proportional hazards, it is optimal for testing the null hypothesis of  $H_0 : \beta = 0$ , where  $\beta$  denotes the logarithm of the hazard ratio. In practice, additional auxiliary covariates are collected together with the survival times and treatment assignment. If the covariates correlate with survival times, making use of their information will increase the efficiency of the logrank test. In this paper, we apply the theory of semiparametrics to characterize a class of regular and asymptotic linear estimators for  $\beta$  when auxiliary covariates are incorporated into the model, and derive estimators that are more efficient. The Wald tests induced by these estimators are shown to be more powerful than the logrank test. Simulation studies and a real data from ACTG 175 are used to illustrate the gains in efficiency.