Analysis of Censored Data
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Comparing Cause-Specific Hazard Rates of a Competing Risks Model with Censored Data

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Abstract

In this paper, we develop a simple test procedure for comparing the cause-specific hazard rates of a competing risks model based on a right censored (competing risks) data. Asymptotic distributions of the test statistic under both the null and alternative hypotheses are shown to be normal by expressing the statistic in terms of counting processes and using martingale central limit theory. These results enable us to assess the power of the test analytically rather than through simulations. The power comparison of the test with some existing tests shows that the proposed test performs better in the presence of censoring. An application of the test for comparing the risks of two types of cancer mortality (thymic lymphoma and reticulum cell carcinoma) in a strain of laboratory mice is illustrated.

1 Introduction

The term "competing risks" applies to problems in which a system or an organism is exposed to two or more causes of failure or death, but its eventual failure or death can be attributed to precisely one of the causes. These problems arise quite frequently in reliability life testing, public health, demography, and experiments in medical therapeutics.

In reliability life testing, to compare the quality of two types of components, by testing them in pairs (cf. Froda, 1987), an experimenter may identify the weak component early on, thus saving valuable time and accelerating the experiment. An epidemiologist trying to assess the benifit of reducing exposure to an enviromental carcinogen, may analyze not only the reduced incidence rate of cancer but also effects on other competing causes of death. Benichou and Gail (1990) considered time to recurrence in patients

[1] *Key words and Phrases.* Hypothesis testing, Cumulative incidence function, Product-limit estimator, Right censored data, Counting processes