COX REGRESSION MODELS WITH NONPROPORTIONAL HAZARDS APPLIED TO LUNG CANCER SURVIVAL DATA

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Received 02 : 08 : 2006 : Accepted 28 : 09 : 2007

Abstract
The Cox regression model, which is widely used for the analysis of treatment and prognostic effects with censored survival data, makes the assumption of constant hazard ratio. In the violation of this assumption, different methods should be used to deal with non-proportionality of hazards. In this study, the stratified Cox regression model and extended Cox regression model, which uses time dependent covariate terms with fixed functions of time are discussed. The results are illustrated by an analysis of lung cancer data in order to compare these methods with respect to Cox regression model in the presence of nonproportional hazards.

Keywords: Cox regression model, Hazard ratio, Non-proportional hazards, Stratified Cox regression model, Extended Cox regression model, Time dependent-covariate, Lung cancer.


1. Introduction

Survival analysis is a class of statistical methods for studying the occurrence and timing of events and is useful for studying many kinds of events in both the social and natural sciences.

Survival data have some features that are difficult to handle with traditional statistical methods: censoring and time-dependent covariates. Regression models for survival data have traditionally been based on the Cox regression model, which assumes that the underlying hazard function for any two levels of some covariates are proportional over the period of follow-up time. If hazard ratios vary with time, then the assumption of

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