



On the proportional hazards model with last observation carried forward covariates

Hongyuan Cao^{1,2} · Jason P. Fine³

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Abstract

Standard partial likelihood methodology for the proportional hazards model with time-dependent covariates requires knowledge of the covariates at the observed failure times, which is not realistic in practice. A simple and commonly used estimator imputes the most recently observed covariate prior to each failure time, which is known to be biased. In this paper, we show that a weighted last observation carried forward approach may yield valid estimation. We establish the consistency and asymptotic normality of the weighted partial likelihood estimators and provide a closed form variance estimator for inference. The estimator may be conveniently implemented using standard software. Interestingly, the convergence rate of the estimator is slower than the parametric rate achieved with fully observed covariates but the same as that obtained with all lagged covariate values. Simulation studies provide numerical support for the theoretical findings. Data from an Alzheimer’s study illustrate the practical utility of the methodology.

Keywords Convergence rates · Kernel weighted estimation · Last value imputation · Partial likelihood · Time-varying covariates

Program codes to reproduce numerical results in the paper are given in supplementary material.

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✉ Hongyuan Cao
hongyuanco@gmail.com

¹ School of Mathematics, Jilin University, 2699 Qianjin Street, Changchun 130012, China

² Department of Statistics, Florida State University, 117 N. Woodward Avenue, Tallahassee, FL 32306, USA

³ Department of Biostatistics, University of North Carolina at Chapel Hill, 3103B McGavran-Greenberg Hall, CB #7420, Chapel Hill, NC 27599, USA