# Conditional likelihood estimation and efficiency comparisons in proportional odds model with missing covariates

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**Abstract**    In this article, a conditional likelihood approach is developed for dealing with ordinal data with missing covariates in proportional odds model. Based on the validation data set, we propose the Breslow and Cain (Biometrika 75:11–20, 1988) type estimators using different estimates of the selection probabilities, which may be treated as nuisance parameters. Under the assumption that the observed covariates and surrogate variables are categorical, we present large sample theory for the proposed estimators and show that they are more efficient than the estimator using the true selection probabilities. Simulation results support the theoretical analysis. We also illustrate the approaches using data from a survey of cable TV satisfaction.

**Keywords**    Missing value · Proportional odds model · Ordinal categorical data · Conditional likelihood