Using the whole cohort in the analysis of countermatched samples

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Abstract

This article discusses a survey estimation approach for the Cox model under countermatched designs. The main result is the implementation of calibrated weights to fit countermatched data to the Cox model. The sample can be seen as a two–phase sample using inclusion probabilities. Pseudolikelihood estimating equations are used to find the estimates. Weights can be calibrated by using the estimated influence functions. This implies that we are able to use all first phase variables to improve efficiency and not just the countermatching variable as in partial likelihood. This is very useful when more than one variable is of interest, for instance, in the presence of confounders. On the other hand, if only one variable is of interest and a surrogate is used for countermatching, partial likelihood may turn out to be more efficient.

We make a comparison with simple case cohort studies. Our simulation results show that for some situations of interest, for example, when we happen to have a surrogate for a rare exposure or when there is a potential partially–known confounder, we obtain large improvements in efficiency using calibrated weights, particularly for countermatching. One of the reason why it happens is that countermatching provides a more informative sample. When exposure is rare, the countermatched sample has individuals from all the exposure factors, whereas a case cohort sample may have very few of some of them. We also show that calibration for two–phase countermatched sample can be much more efficient than calibration with simple case cohort for the coefficients of the phase–II variables, and more efficient than standard partial likelihood–based analysis of countermatched samples or the standard pseudolikelihood method. Findings are illustrated with data from the National Wilms' Tumour Study and the Welsh nickel refinery workers study. Countermatching turns out to work better for the exposure of interest and most of the coefficients.

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