MARGINAL CAPTURE-RECAPTURE MODELLING

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We consider epidemiologic capture-recapture studies for which covariate data are available. The primary goal of such studies is to estimate the total population, while a desirable secondary goal is the estimation of the population covariate distribution. We develop a new marginal model to attain these goals, in which we account for heterogeneity through a covariate-based coefficient of source dependence (CSD) and for so-called pure dependence between sources using random effects. We call the resulting model an augmented marginal log-linear model (AMLLM).The CSDs are formed by two components: the distributions of the covariates 1) within each source and 2) within the population. The first are estimated empirically and the second estimated along with the unknown population size by including the CSDs into the AMLLM. We discuss the flexibility of the Bayesian approach in dealing with the challenges associated with parameter estimation subject to constraints, some of which arise from the nature of the likelihood function based on the cell means, rather than the marginal means, others which ensure that the population covariate distribution is a properly defined probability mass function. Advantages of the AMLLM include limited model selection and decreased sensitivity to random zeros, which are a considerable gain over the challenges of model estimation. As an example we discuss prevalence estimation of Multiple Sclerosis in the Province of Québec.