# CONSTRAINT MAXIMUM LIKELIHOOD ESTIMATION OF RELATIVE RISKS IN A BINOMIAL REGRESSION MODEL

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The last decade has witnessed an engaged debate in epidemiological journals on regression models for binary outcomes. Several authors have argued in favor of models which yield estimates of relative risks, as alternatives to logistic regression which yields odds ratios. The model which suggests itself for relative risks is the generalized linear model for binomially distributed outcomes with the logarithm as link function. This model implies inequality constraints on the parameters. Statistical software packages usually do not take these constraints into account and consequently often fail to converge if the maximum of the likelihood is close to the boundary of the parameter space. For these situations it has been suggested to resort to other approaches, like Poisson regression, but these alternatives suffer from other weaknesses. One may instead implement the binomial model with appropriate algorithms for constrained maximum likelihood methods, as they can for example be found in the NLP procedure of the "Statistical Analysis System" (SAS). A simulation study indicates that the resulting estimates for the model parameters and their standard errors are nearly unbiased. These results are remarkable, since the computations of SAS NLP are based on asymptotic theory for models with equality rather than inequality constraints. Therefore I elaborate on how asymptotic theory for constrained maximum likelihood techniques applies to and can be utilized for the model considered here.