EFFECT OF EXTRA BINOMIAL VARIATION ON PARAMETER ESTIMATES AND STANDARD ERRORS IN APPLICATION OF MULTIPLE LOGISTIC REGRESSION TO VETERINARY EPIDEMIOLOGY

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Multiple logistic regression (LR) is often used for drawing conclusions about the impact of specific factors on disease occurrence. However, in veterinary epidemiology the animals often are grouped into herds or flocks. This leads to difficulties with the statistical analysis since observations are not independent. Ignoring the dependency may result in an underestimation of standard errors (s.e.), possibly resulting in overestimation of the significance of the.factors. The most appropriate way to account for dependency may be to include a random effect in the model (LRRE) (Curtis, 1988). The impact of inclusion of a random effect in the logistic model will be illustrated using data originating from a cross-sectional survey on lameness in dairy cattle in the Netherlands. Data of 2537 cows (parity>=1) (58 farms) were used for the analysis of Dermatitis Digitalis (Italian footrot). Effect of cow (parity, breed, stage of lactation, presence of other lameness symptoms) and environmental factors (e.g. herd size, herd production level, certain hygiene measures, cubicle size, cubicle type, condition of slatters, access to pasture) were evaluated. The full model showed that the between-herd variance was about 26% of the total variance.
Comparison of the standard errors shows a marked difference between LR and LRRE with respect to variables measured at the farm level. Using LRRE standard errors of variables measured at farm level show an average increase of 42.57% [range 0-100.00]. Standard errors of animal level variables changed by 8.34% [range 2.33-9.91]. Inclusion of a random effect affected the standard errors of parameters, but also the parameter estimates. Cow level parameter estimates changed by 13.95% [range 0.58-50.22], farm level parameter estimates changed by 46.10% [0-132.80]. For one (farm level) variable the sign of the estimate changed from positive to negative. Thus, the status of this factor changed from risk to preventive. Conclusions about the significance changed for 11 variables (out of 37 variables). Ten of these variables were farm level variables.
It is concluded that in this situation differences between two approaches are not only in standard errors, but also in parameter estimates. It is stated that for proper judgement of risk factors on farm level, control for confounding by cow factors is necessary.

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