MAXIMUM LIKELIHOOD AND BAYESIAN ESTIMATION IN LATENT CLASS MODELS FOR EVALUATION OF SEVERAL CONDITIONALLY DEPENDENT DIAGNOSTIC TESTS

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This research was based on a study to assess the performance of three diagnostic tests for Infectious Salmon Anemia (ISA) in the salmon farming industry in New Brunswick, Canada. A total of 403 fish were sampled from four populations defined to have prevalences ranging from uninfected to highly infected. All fish were subjected to testing by virus isolation (VI), reverse transcriptase polymerase chain reaction (RT-PCR) and indirect fluorescent antibody (IFAT) tests. In addition, the VI and RT-PCR tests were performed in duplicate and triplicate by independent laboratories. As no gold standard test exists for detection of ISA, latent class models were used to estimate the diagnostic test characteristics (sensitivity and specificity). Despite the different biological mechanisms of the tests, conditional independence models showed poor fit to the data. Conditional dependence models with one and two pairs of pairwise dependencies were analyzed by likelihood methods based on the EM-algorithm, and by Bayesian methods based on MCMC estimation using WinBUGS software. The two approaches gave fairly similar parameter estimates, and model selection by likelihood-ratio tests and the Deviance Information Criterion generally lead to the same models. Model identifiability did not seem to be a problem, but some instability in estimates between models was noted. We conclude that for a dataset of this size and structure the limit of feasible model complexity seems to have been reached.