Analysing data at the herd level to optimise individual animal interventions: applications to parasite control and rumen pH monitoring

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More information can often be extracted by combining individual animal monitoring data into a herd level dataset. However, this shift of emphasis can reduce the effectiveness of monitoring at the individual level unless an appropriate analysis method is used. We present two such statistical analyses with examples of application to data.Anthelminthic resistance is a herd problem, and results of faecal egg count reduction test data are usually interpreted at this level. However, accounting for variation within and between individuals allows a greater understanding of the problem. Bayesian Markov chain Monte Carlo (MCMC) methods allow multiple sources of related information to be combined in the same statistical model. This facilitates inference at every level of the observed system by incorporating hierarchical variance components, and allows full use to be made of different types of relevant data, including those collected at individual and herd level. We have used these models to evaluate anthelmintic efficacy, whilst also partitioning observed variability in egg counts, and estimating the variability in anthelmintic efficacy between individuals. Using MCMC also allows the probability of reduced efficacy in individual animals to be estimated using the combined information available from the group. Where large datasets are available from continuous monitoring of biological parameters, rather different analysis methods are required. Complex and non-linear relationships between monitored parameters and animal productivity make these datasets difficult to interpret, so summary statistics are often used which might not capture the important features of the data. We have used an algorithmic approach to relate the temporal pattern of rumen pH and temperature data obtained from rumen boluses to dairy cow productivity as measured by milk yield and dry matter intake. This approach allows the most relevant of a series of relational forms (with unknown parameterisation) to be identified using retrospective data. Once the important patterns and variation in these signals between individuals are identified, automatic monitoring systems can be set up to detect these features. Using this approach, short-term predictions of herd productivity, as well as early warning systems for problems in individual animals, can be generated in real time.

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