Title:

Application of meta-analysis and systematic reviews in veterinary science

Abstract:

Meta-analysis and systematic reviews can be utilised to discuss the rationale of research studies. The scientific investigation of animal health and production seeks to provide findings that can be confidently applied to improve health and production. The classical cycle of observation providing a hypothesis, testing of the hypothesis, and refinement of the hypothesis by further testing can now be extended to include the investigation of hypotheses through production of estimates of effect and confidence in these effects using a series of existing studies.

A substantial benefit of meta-analysis is the potential to investigate new hypotheses using existing data, both through the development of a priori hypotheses and by examination of the heterogeneity in study responses. The most common measures of effect used for dichotomous data are the risk ratio (RR), the odds ratio (OR) and the risk difference (RD). The dominant method used for continuous data are standardised mean difference (SMD) estimation. Bayesian methods are also well suited to meta-analysis. The post-hoc methods used to evaluate heterogeneity and publication bias, which include meta-regression, chi-square ($\chi^2$), $I^2$ statistic, L'Abbe plots, Galbraith plots and influential study analysis. The application of meta-analysis and systematic reviews in Veterinary and Agricultural sciences has increased over the past decade. The meta-analytic methods have been widely used to investigate the efficacy of therapeutic interventions in veterinary medicine, the effect of supplementary diets (fat, protein and minerals) on production conformance, and the impact of hormone administration on reproductive performance of dairy cows. The results of these meta-analyses have helped the veterinarians and farm consultants to make informed decision that have been based on quantitative data rather than qualitative reviews (e.g. expert opinion) which could be prone to bias.

There are a number of concerns and criticisms about the validity of outcome of a meta-analysis, this includes; one number cannot summarise a research field, the file drawer problem invalidates meta-analysis, mixing apples and oranges, garbage in & garbage out, important studies are ignored, meta-analysis can disagree with randomised trials and meta-analyses are performed poorly. After considering each of these questions, we ask whether a traditional narrative review is any better than a meta-analysis or systematic review.