Estimation of the extent of clustering of faecal egg counts within horses over time

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Anthelmintic resistance is widespread among small strongyles. The ability to identify whether individual horses contribute disproportionately to pasture contamination might facilitate the development of novel approaches to control of these parasites. Faecal samples were collected monthly from 56 horses on 9 farms in south east Queensland over 11 months. When the mean faecal egg count (FEC) for horses on a farm exceeded 200 eggs per gram (epg), all horses were treated with an anthelmintic. FECs following recent anthelmintic treatment were excluded from analyses as were horses with only one eligible FEC. FEC followed a zero-inflated negative binomial distribution based on the Vuong statistic and the dispersion factor ($\alpha$). As methods to estimate intra-class correlation co-efficients (ICCCs) for data with negative binomial distributions are still under development, FECs were recoded to dichotomous outcome variables using cutpoints of 0, 50, 100, 200 and 500 epg. Random effects logistic regression models were then fitted for each of these outcome variables, with horse included as a random effect. Null models were fitted initially then several explanatory variables were fitted in univariable models to assess effects of these fixed effects on ICCC estimates. ICCCs were calculated as random intercept variance divided by the sum of intercept variance plus $\pi^2/3$.

ICCCs for the null models were high for each of the selected outcome variables (range 0.569 – 0.800, decreasing with increasing cutpoint) indicating substantial clustering of FECs within horses across a wide range of FEC cutpoints throughout the sampling period. Age, breed, sex or season had little effect on ICCCs but a small proportion of the clustering may be explained at the farm level as ICCCs for most cutpoints were a little smaller after fitting farm as a fixed effect (range 0.564 – 0.778). The high ICCCs were reflected in the distributions of percentage of FECs for each horse that were $\leq$50 epg and $\leq$100 epg; both distributions were bimodal with most horses having either <10% or >90% of FECs above the cutpoint.

These findings support the hypothesis that, within a farm, individual horses contribute disproportionately to pasture contamination, with some horses consistently shedding larger numbers of small strongyle eggs onto the pasture compared to their herd-mates. Horse-level factors appear to contribute more to this clustering of FEC than farm-level factors. These results suggest that there is an opportunity to more strategically target anthelmintic use within groups of horses by identifying those contributing disproportionately more to pasture contamination.