Explaining persistence of *Mycobacterium avium* subsp. *paratuberculosis* in dairy herds

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In this work, we use a mathematical model to illustrate MAP transmission dynamics on dairy farms. Following the results of recent analysis of age-and-dose dependent shedding of MAP, we are able to build a model incorporating true values of exit from each infectious category. The model is evaluated with and without an environmental reservoir. This reservoir allows the infectious contribution from animals which have already exited the population to decay over time.

We show the influence of changing assumptions concerning environmental persistence and super-shedder adult animals as well as the relative importance of calf-to-calf transmission. We find that environmental loading could be a contributing factor allowing persistence of MAP on farms, and that calf-to-calf transmission is necessary to produce a spectrum of prevalence observed worldwide. The presence of age- and dose-dependent shedding of MAP among calves creates a bistable prevalence of infection following intervention.