

Trajectories in multidimensional pathogen space of indigenous calves reared in a smallholder farming system in western Kenya: the IDEAL calf cohort

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Epidemiological studies often focus on single or dual co-infections, however, in real settings animals are assaulted by a range of parasites at different times and stages of their life and in different combinations. These co-infections and their timings have potentially additive or multiplicative detrimental or beneficial effects. Understanding the natural ecology of the pathogen space calves occupy can provide new insights and understanding of pathogen interactions and their impact on key parameters such as growth rates, morbidity and mortality. This study is the first to attempt to describe and quantify the full range of pathogens infecting a naturally reared indigenous cattle population in its first year of life. The IDEAL calf cohort consists of 548 newborn calves sampled using a stratified two-stage cluster sampling design in Western Kenya. Calves were recruited in the first week of life and visited at 5 weekly intervals until 12 months of age or death (or were censored). A range of clinical and laboratory techniques were used to identify as many pathogens as possible at each visit. For some diseases only serological evidence was available from screening at 12 months. This analysis examines patterns and associations in the calves' infection profiles through time. These are represented as trajectories through a multivariate 'pathogen space'. Our analysis identifies calves with similarities in their infection sequences and patterns. These will be related to clinical episodes and ultimately to correlated with clinical signs. This may then help improve disease profiling and clinical diagnosis and can be used to improve decision support tools for use in the field.