

# The Risk of Group Housing Calves and Transmitting *Mycobacterium avium* subsp. *paratuberculosis* to Penmates

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Johne's disease (JD) is a progressive, chronic infection and inflammation of the small intestines of ruminants caused by *Mycobacterium avium* subspecies *paratuberculosis* (MAP). It is notoriously difficult to understand the transmission of JD due to the long time from infection to symptoms, insensitivity of diagnostic tests, and lack of long-term experimental studies. A key aspect for controlling the spread of infection is to identify how many new infections are caused maximally by one infectious animal in a group of animals. The aim of the current study was to estimate the calf-to-calf transmission among penmates and to better understand the risk of group housing for transmission of MAP.

**Methods:** 32 newborn Holstein-Friesian bull calves were allocated into pens of 4, where 2 calves were infected and 2 calves were initially free of JD. Calves were group-housed for 3 months during which fecal samples were collected. A general linearized model (GLM) was used to quantify MAP transmission among calves following group housing based on fecal samples.

**Results:** Based on the fecal shedding model, for every calf shedding MAP in the feces introduced into a susceptible group of calves, on average 3.3 susceptible calves will also start shedding MAP in the faeces. The accumulation of MAP in the environment from shedding calves played an important role in the transmission to the negative calves and lead to fecal shedding among penmates.

**Implications:** The results indicate that transmission of infection occurs between penmates, and new infections are the result of direct contact between calves, and indirect contact through the contaminated environment. A clean environment for calf housing may have a large impact on decreasing transmission to penmates. To better control the spread of infection of MAP within dairy herds, it is imperative to understand the impact of all transmission routes resulting in new infections.