# Cross-sectional study of Kansas beef herds to investigate prevalence of *Anaplasma marginale* infection, and association with host factors, pregnancy status and Bovine Leukemia Virus status

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## Abstract

*Anaplasma marginale* and bovine leukemia virus (BLV) are economically-significant and production-limiting cattle pathogens which establish chronic infections. We hypothesize that maintenance of chronic infections will reduce pregnancy success. Study objectives were to evaluate *A. marginale*, BLV, and co-infection prevalence and investigate associations between infection and pregnancy success. Eastern Kansas cows (n=2,857) were sampled during routine pregnancy screening. Infection status was determined using PCR or ELISA. Infection status, pregnancy status, and host variables were analyzed with logistic and linear regression methods. The prevalence of *A. marginale* and BLV were 28% and 55%, with co-infection significantly associated with cow age. The *A. marginale* prevalence was highest in older, pure bred, and lower body condition cows. Cow open rate (8.5%) was highest in *A. marginale*-only infected cows. Investigating how chronic infections impact beef cattle pregnancy success is important to optimize production.

## Background

***Anaplasma marginale* and bovine leukemia virus are important pathogens of cattle in the U.S. and other cattle producing countries.**

### *Anaplasma marginale*:

- Agent type/Disease: Obligate intracellular rickettsial bacteria that causes bovine anaplasmosis
- Clinical disease signs: include anemia, fever, weigh loss
- Transmission:
  - *Dermacentor* spp. ticks are natural vectors
  - Mechanical transmission by biting flies and contaminated instruments (e.g. needles)
- Cattle that recover from clinical disease remain infected for life (chronic infection), appear healthy, and serve as infection reservoirs
- **Estimated cost to U.S. cattle industry: $300 million/year**

### Bovine leukemia virus:

- Agent type/Disease: Retrovirus that causes bovine leukosis
- Disease stages:
  - Asymptomatic → ~ 60% of cases
  - Persistent lymphocytosis → ~ 30% of cases
  - Leukemia/lymphoma stage → ~ 0.1% -10% of cases
    - Characterized by weight loss, enlarged lymph nodes
    - Leading cause of carcass condemnation in the U.S.
- Transmission: Mechanical transmission by biting flies and contaminated instruments (e.g. needles)
- Eradicated in ~22 countries, however prevalence in U.S. is increasing
- **Estimated cost to U.S. dairy industry: $525 million/year**

### STUDY OBJECTIVES:

1. Examine bovine anaplasmosis prevalence and its association with host factors in Eastern Kansas beef herds
2. Examine the associations of *A. marginale*-BLV co-infection status on host factors and pregnancy success (open rate)

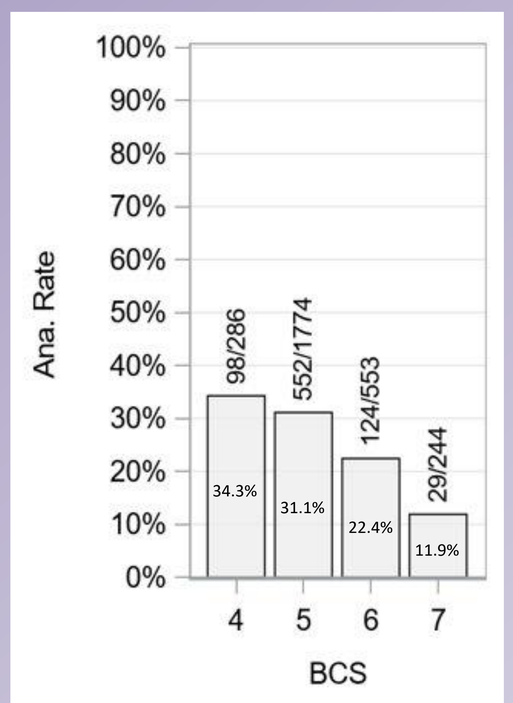
## Methods

This study consisted of **2,857 healthy adult cows**, bred for spring calving and undergoing routine pregnancy diagnosis at Kansas State University, between September 27, 2021, and November 05, 2021.

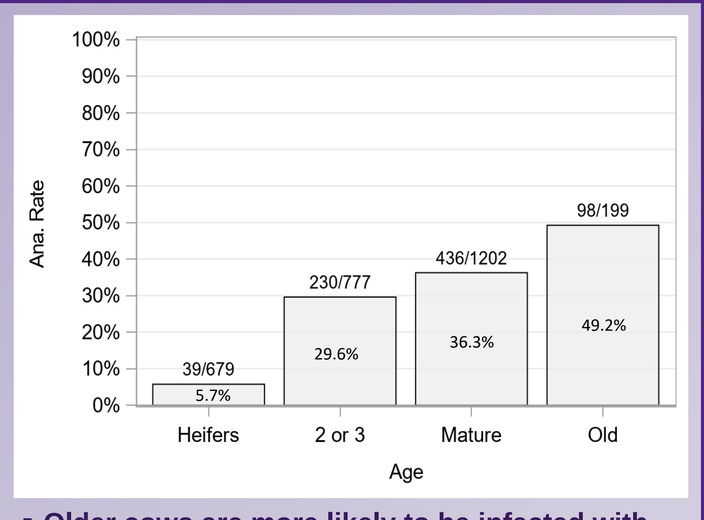
- Pregnancy diagnosis performed via uterine palpation or ultrasound
- Body condition score (BCS) determined using a 1-9 score
  - 1 = emaciated and 9 = extremely fat
- Age and breed obtained from farm records
- Blood samples were collected to determine:
  - Packed cell volume
  - Differential white blood cell counts (QScout)
  - BLV infection status determined using ELISA
  - *Anaplasma marginale* status determined using PCR
- Statistical analysis: Infection status, pregnancy status, and host variables analyzed using logistic regression and linear regression

## Results: Anaplasmosis prevalence and association with host factors

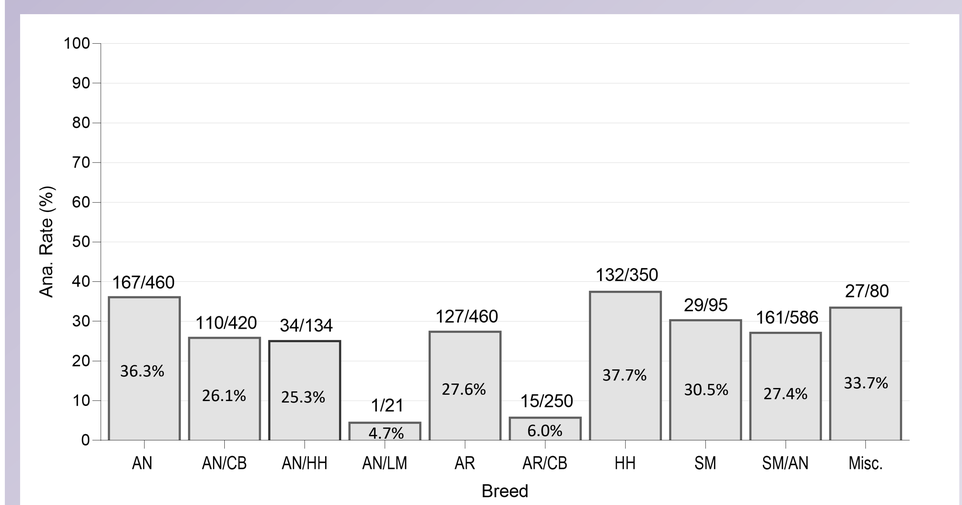
| Level | Level prevalence | Within-level Prevalence |
|---|---|---|
| Individual animal | 28.1% (803/2,857) | n/a |
| Ranch | (95%) (19/20) | 0% - 84.5% |
| Herd | 97.8%) (45/46) | 0% - 96% |




- ***A. marginale* infection rates were lowest for cattle with higher body condition scores.**

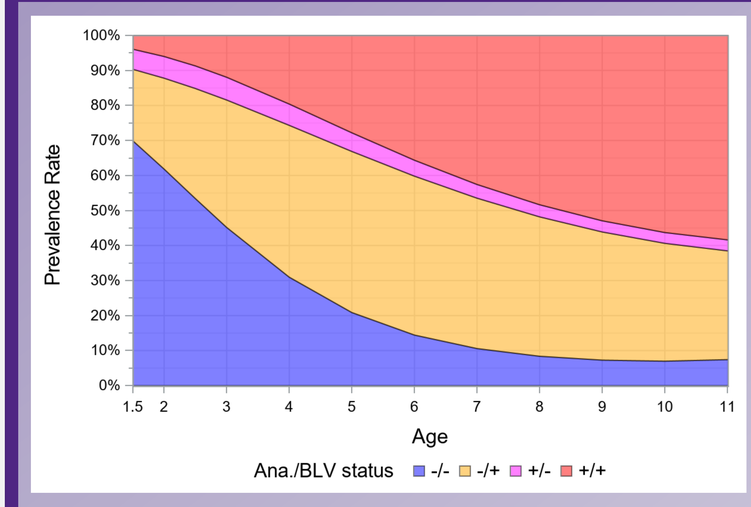



- **Older cows are more likely to be infected with *A. marginale*.**

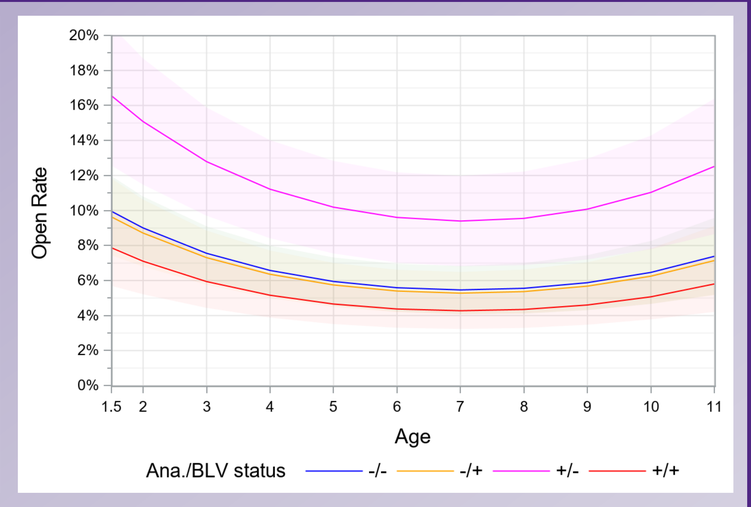



- **Chronic *A. marginale* infection was observed in all pure breeds and cross-breeds evaluated in this study.**

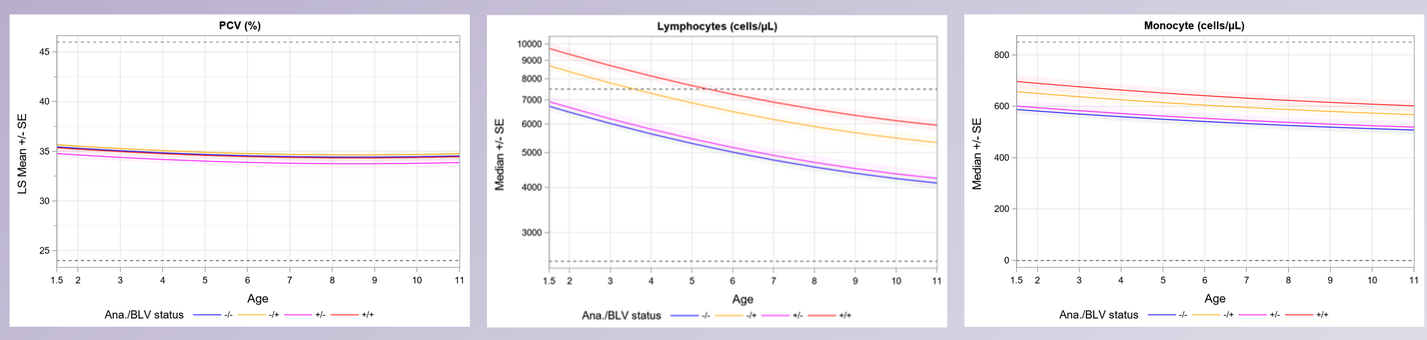
## Results: Association of *A. marginale*-BLV co-infection status with host factors and pregnancy success




- **Older cows are more likely to be infected with both *A. marginale* and BLV.**




- **Open rate significantly higher in *A. marginale*-only infected cows.**




- **PCV were within normal range for all groups, but significantly lower for *A. marginale*-only positive cows.**
- **BLV infection was associated with significantly higher lymphocyte counts (above normal range in cows ≤5 years) and monocyte counts. The highest lymphocyte counts observed were in co-infected cows.**
- **BLV and *A. marginale* co-infected animals had the greatest lymphocyte and monocyte counts.**

## Conclusions

- **Bovine anaplasmosis and leukosis are common chronic cattle diseases in Eastern Kansas beef cattle herds.**
- **Cows with chronic anaplasmosis had higher open rates compared to uninfected, BLV-only infected, and co-infected cows.**

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