Specific Aim 3:

The impact of mastitis on fertility and pregnancy loss in lactating dairy cows

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Background

- **Mastitis remains the most common and costly disease affecting dairy cows (USDA, 2005; USDA, 2008) and is associated with detrimental effects on fertility including:**
  - **↑ days to first artificial insemination (Barker et al., 1998; Schrick et al., 2001; Santos et al., 2004).**
  - **↑ services per conception (Schrick et al., 2001; Santos et al., 2004; Ahmadzadeh et al., 2009).**
  - **↑ days open (Schrick et al., 2001; Santos et al., 2004; Ahmadzadeh et al., 2009).**
  - **↓ fertility at first AI (Santos et al., 2004; Chebel et al., 2004).**

Background

- The mechanism by which mastitis affects reproduction is unclear
  - Cytokines could lead to $PGF_{2\alpha}$ release causing premature luteolysis of the corpus luteum thereby terminating an otherwise viable pregnancy (Hansen et al., 2004).
- There is a lack of information about specific impact of severity and etiology of CM and the timing of occurrence of mastitis.
  - Varying opinions about the impact of etiology on reproductive performance.
  - Little is known about possible impact of severity of CM on reproductive performance.

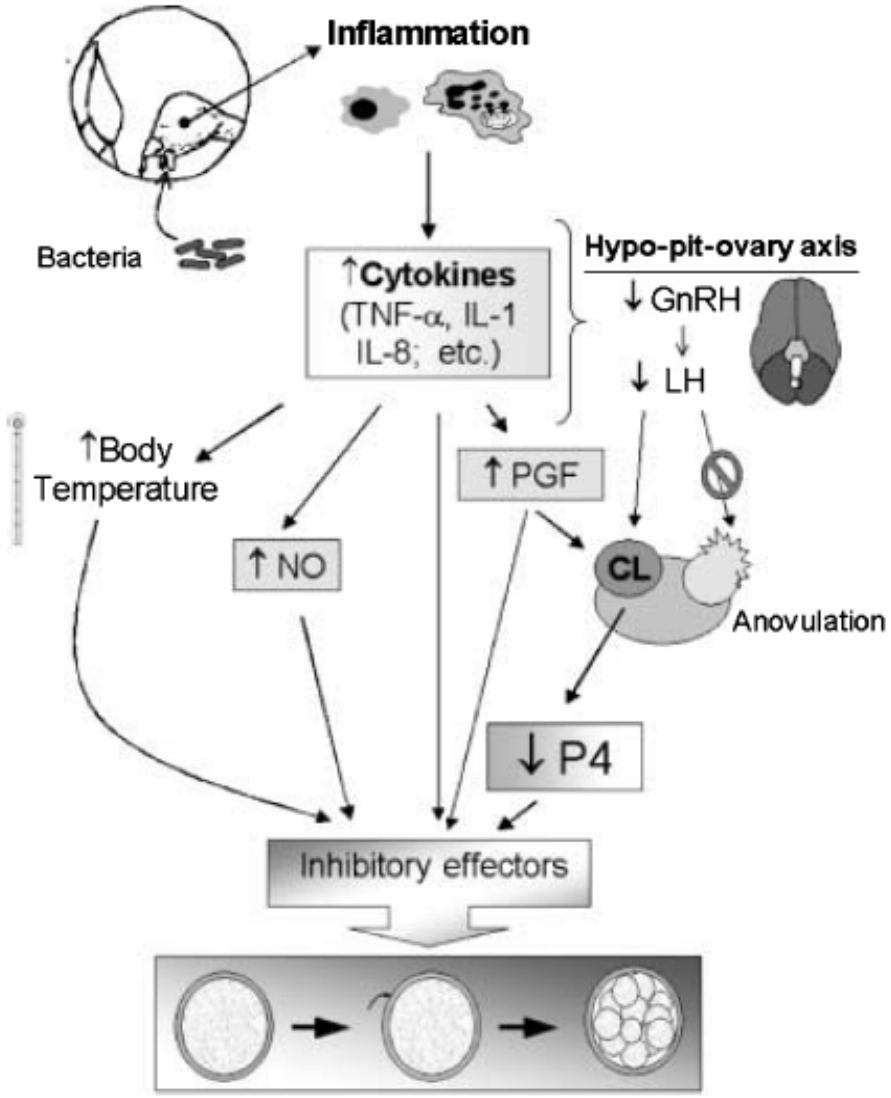


Figure from Hansen et al., 2004

Objective

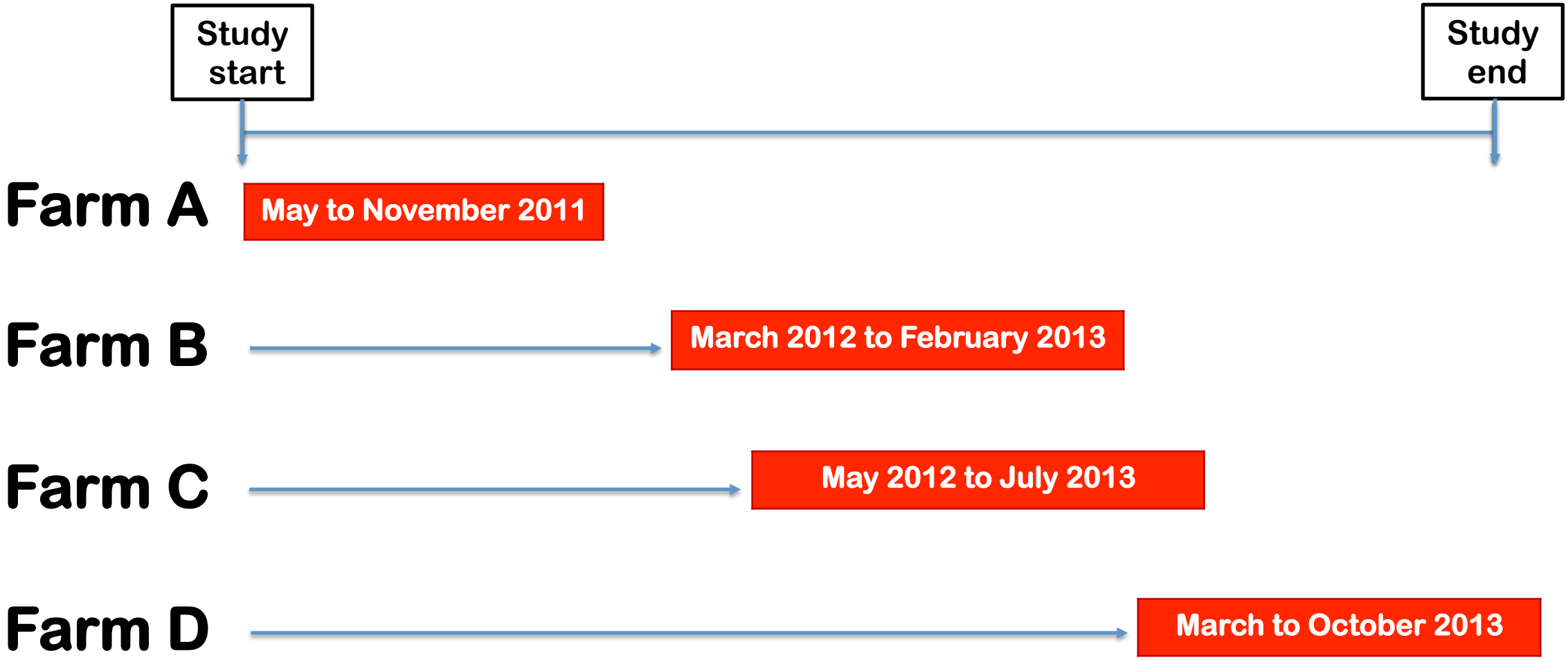
To define associations between the occurrence and severity of subclinical and clinical mastitis occurring during a defined risk period on P/AI at first AI while accounting for severity, etiology, and previous mastitis events.

Herd Enrollment Criteria

Herd enrollment criteria

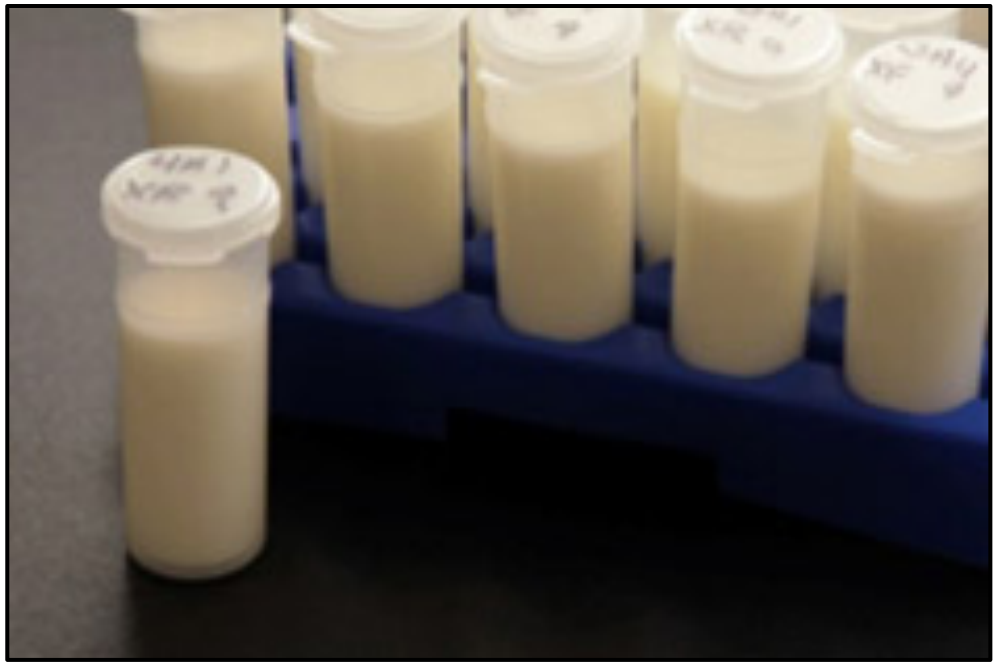
1. Monthly DHIA testing
2. Use of DairyComp 305
3. Use of a consistent AI program
4. Dry cow therapy

Enrollment Period



Data collection

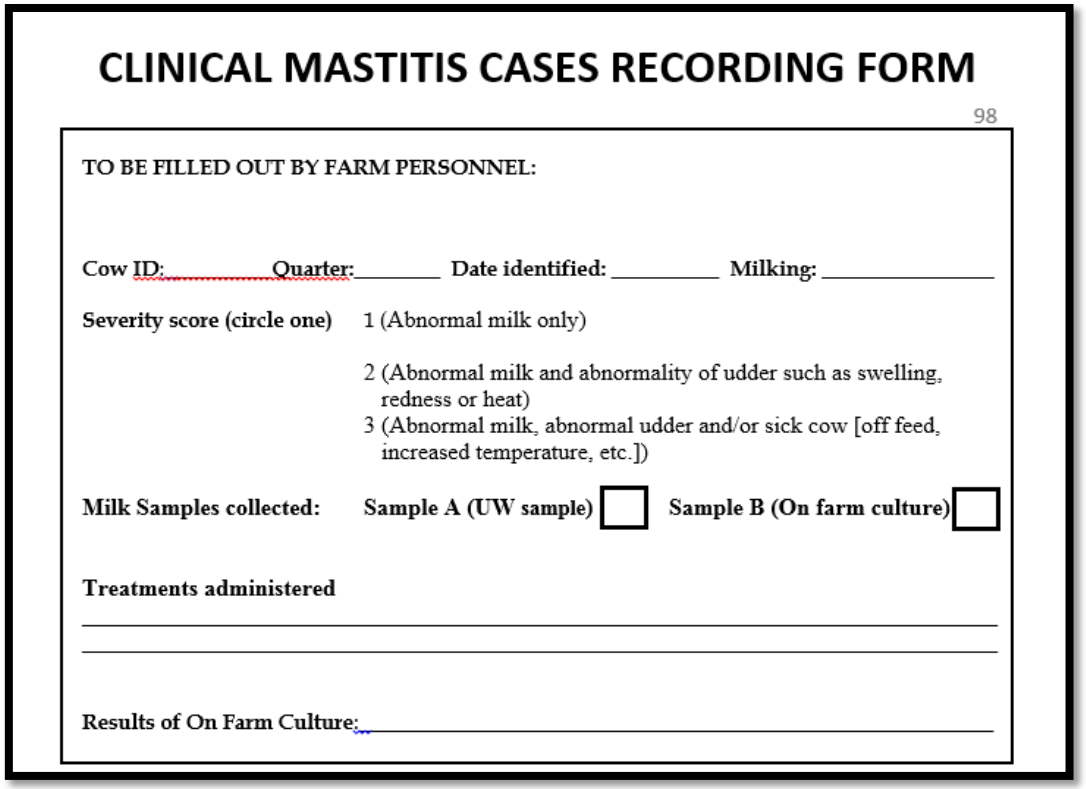
- **Collection period**
  - Weekly farm visit to retrieve milk samples and mastitis recording forms and DairyComp 305 backup during the enrollment period for each farm.



- **Subclinical mastitis (SM)**
  - Individual monthly DHIA data.
  - Definition: Somatic cell count (SCC) exceeded 150,000 cells/mL.

Data collection

- **Clinical mastitis (CM)**
  - Farm personnel were trained by study personnel to conduct:
    - Aseptic duplicate milk samples of CM and detection and recoding of CM
    - Information recorded included
      - Severity of CM
      - Cow ID
      - Date of occurrence
      - Treatment administered
      - Affected quarters



CLINICAL MASTITIS CASES RECORDING FORM

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TO BE FILLED OUT BY FARM PERSONNEL:

Cow ID:_____ Quarter:_____ Date identified: _____ Milking: _____

Severity score (circle one) 1 (Abnormal milk only)

2 (Abnormal milk and abnormality of udder such as swelling, redness or heat)

3 (Abnormal milk, abnormal udder and/or sick cow [off feed, increased temperature, etc.])

Milk Samples collected: Sample A (UW sample) ☐ Sample B (On farm culture) ☐

Treatments administered

_____

_____

Results of On Farm Culture:_____

Mastitis Severity Scoring System

Mild: Presence of abnormal milk without other symptoms.

Moderate: Abnormal milk and local symptoms in the udder.

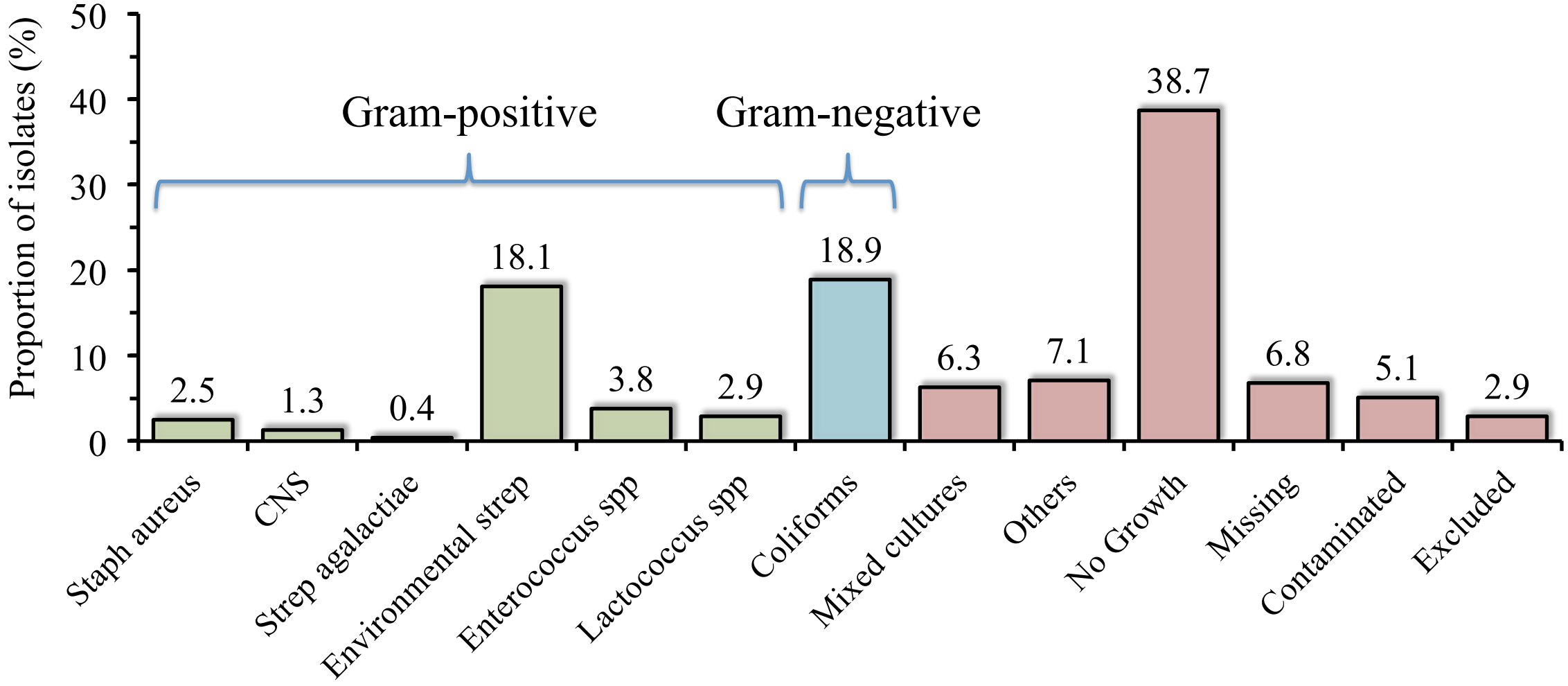
Severe: Systemic symptoms (fever, depression, or cows off-feed).

Pinzón-Sánchez and Ruegg, 2011

Microbiological analysis

- UW Milk quality laboratory.
- Microbiological diagnosis was defined at the quarter level.
- Bacteria were identified at the species level.
- An intramammary infection was defined as the isolation of 100 cfu/ml of identical colonies.

Microbiological diagnosis of quarter milk samples from clinical mastitis cases (n=279) occurring during the BRP on four WI dairy herds



Presynch Ovsynch for first AI or TAI

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			PGF			
			PGF			
	GnRH					
	PGF		GnRH	TAI		

Double Ovsynch for first TAI

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					GnRH	
					PGF	
	GnRH					
	GnRH					
	PGF		GnRH	TAI		

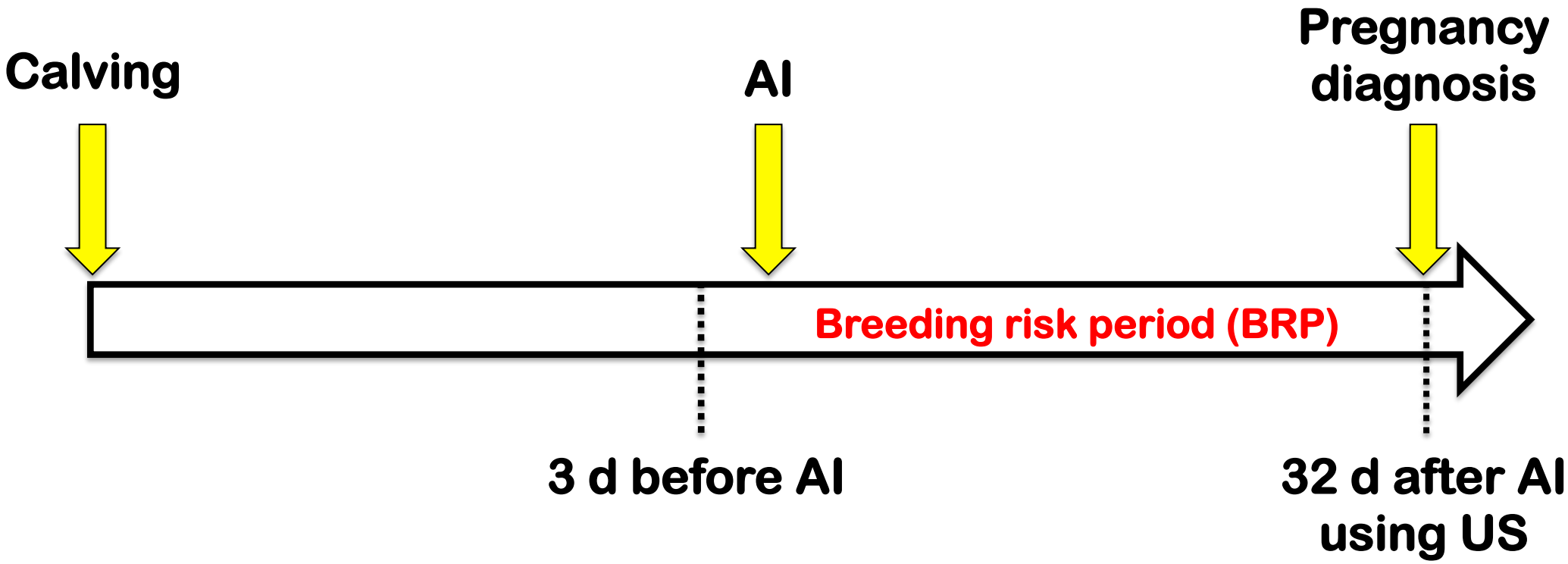
GGPG for first TAI

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	GnRH					
	GnRH					
	PGF		GnRH	TAI		

Breeding Protocols by Farm

Farm	Method of AI	%	VWP
Farm A	TAI after Presynch Ovsynch/Double Ovsynch	90.2%	75 to 85 DIM
	AI after Presynch	6.1%	
Farm B	TAI after Presynch Ovsynch	86.8%	57 to 85 DIM
	AI after Presynch	12.5%	
Farm C	TAI after Double Ovsynch	83.8%	76 to 84 DIM
	TAI after GGPG	14.5%	
Farm D	TAI after Presynch Ovsynch	57.6%	53 to 87 DIM
	AI after Presynch	42.4%	

Breeding Risk Period



Mastitis Risk Groups

Cows were categorized into 5 mastitis risk groups based on occurrence of SM or CM events before and during the BRP.

Mastitis Risk Groups

Mastitis risk group	n	%	Mastitis before the BRP	Mastitis events during the BRP
Healthy	2,103	66.9	No SM or CM	No SM or CM events
Mastitis before BRP	221	7.1	≥1 SM or CM	No SM or CM events
SM during BRP	271	8.6	No SM or CM	1 (n = 260) or 2 (n = 11) SM
Chronic SM	270	8.6	≥1 SM or CM	1 (n = 241) or 2 (n = 29) SM
CM during BRP	207	6.6	No SM or CM	1 (n = 164) or 2 CM (n = 26) or 1 CM and 2 SM (n = 17)
Chronic CM	72	2.3	≥1 SM or CM	1 CM

Herd Characteristics

Table 1. Descriptive characteristics of enrolled cows (n = 3,164) from 4 Wisconsin dairy herds

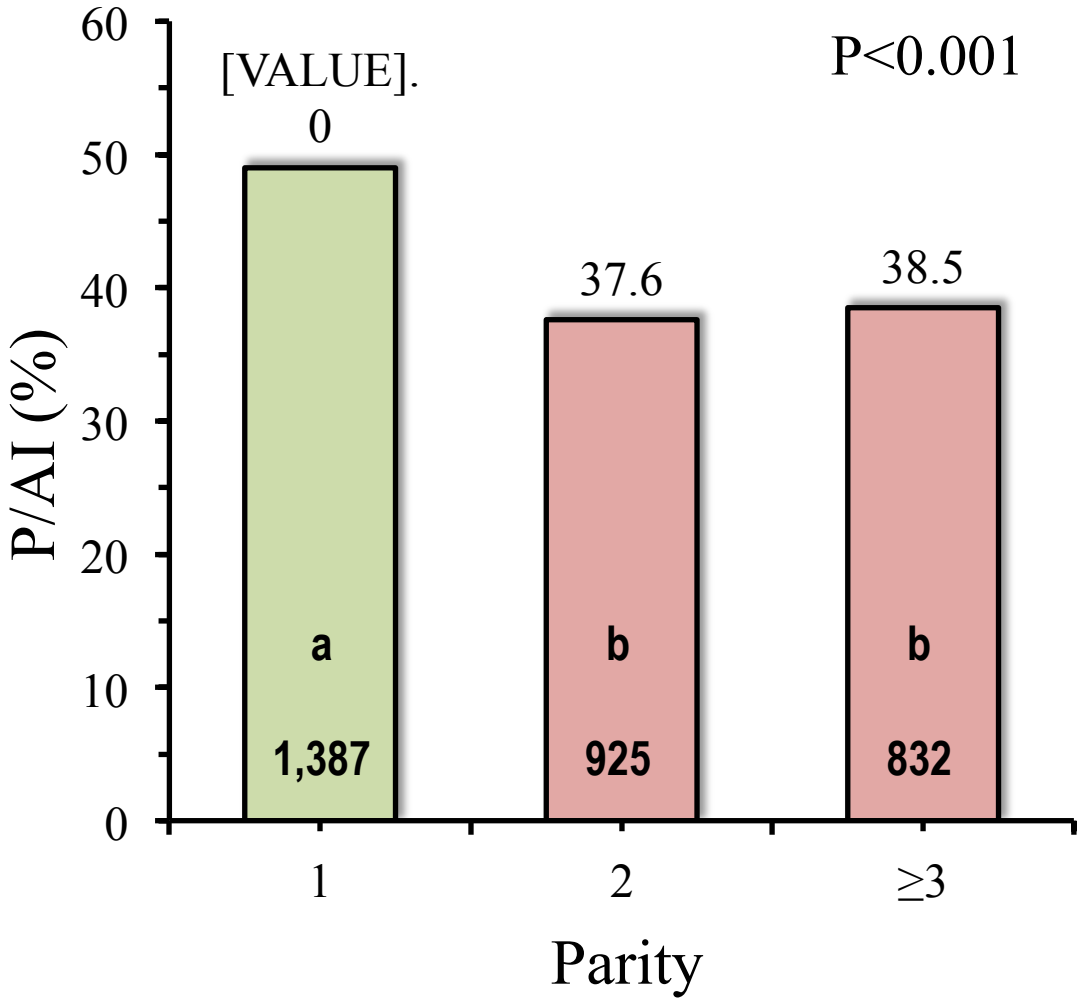
Farm	Number of cows per herd	Eligible for the study	Enrolled in the study	Used for analysis	P/AI (%)	Use of TAI (%)	Milk yield (kg per cow)	SCC (cells per mL)
A	1,429	913	889	888	39.0[a]	93.9[c]	46.1[b]	51,823[b]
B	1,382	1,017	981	965	44.7[b]	87.6[b]	46.0[b]	47,492[ab]
C	817	761	735	734	48.7[b]	99.5[d]	48.6[c]	44,723[a]
D	750	586	559	557	38.6[a]	57.6[a]	43.0[a]	72,639[c]
Overall	4,378	3,277	3,164	3,144	42.9	86.7	46.1	51,788

Statistical Analyses

Univariate relationships between P/AI and various risk factors

- **Cochran-Mantel-Haenszel analysis using PROC FREQ of SAS.**
- **After adjusting for farm effect, differences in probability of P/AI among levels of selected risk factors were assessed using logistic regression using PROC LOGISTIC of SAS.**

Relationship between P/AI and Parity and Season of AI



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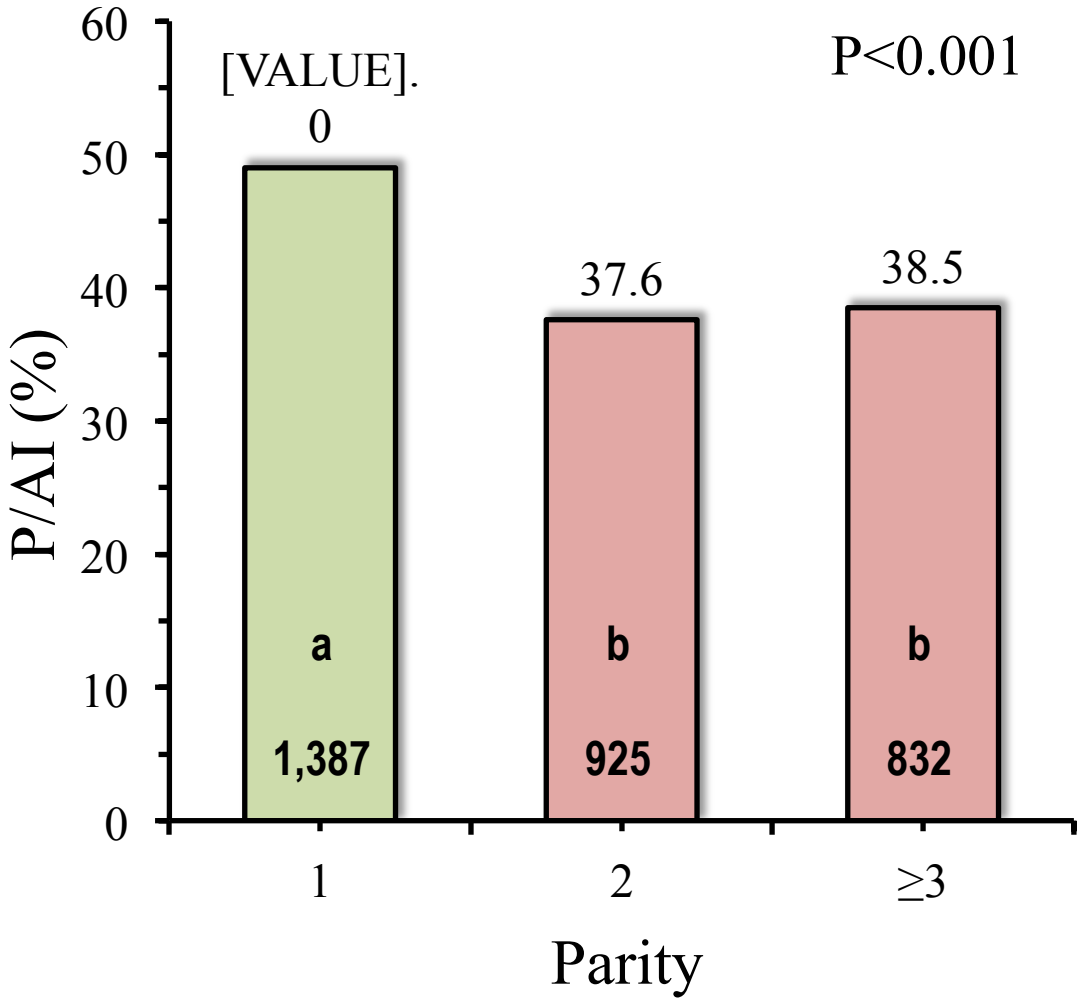
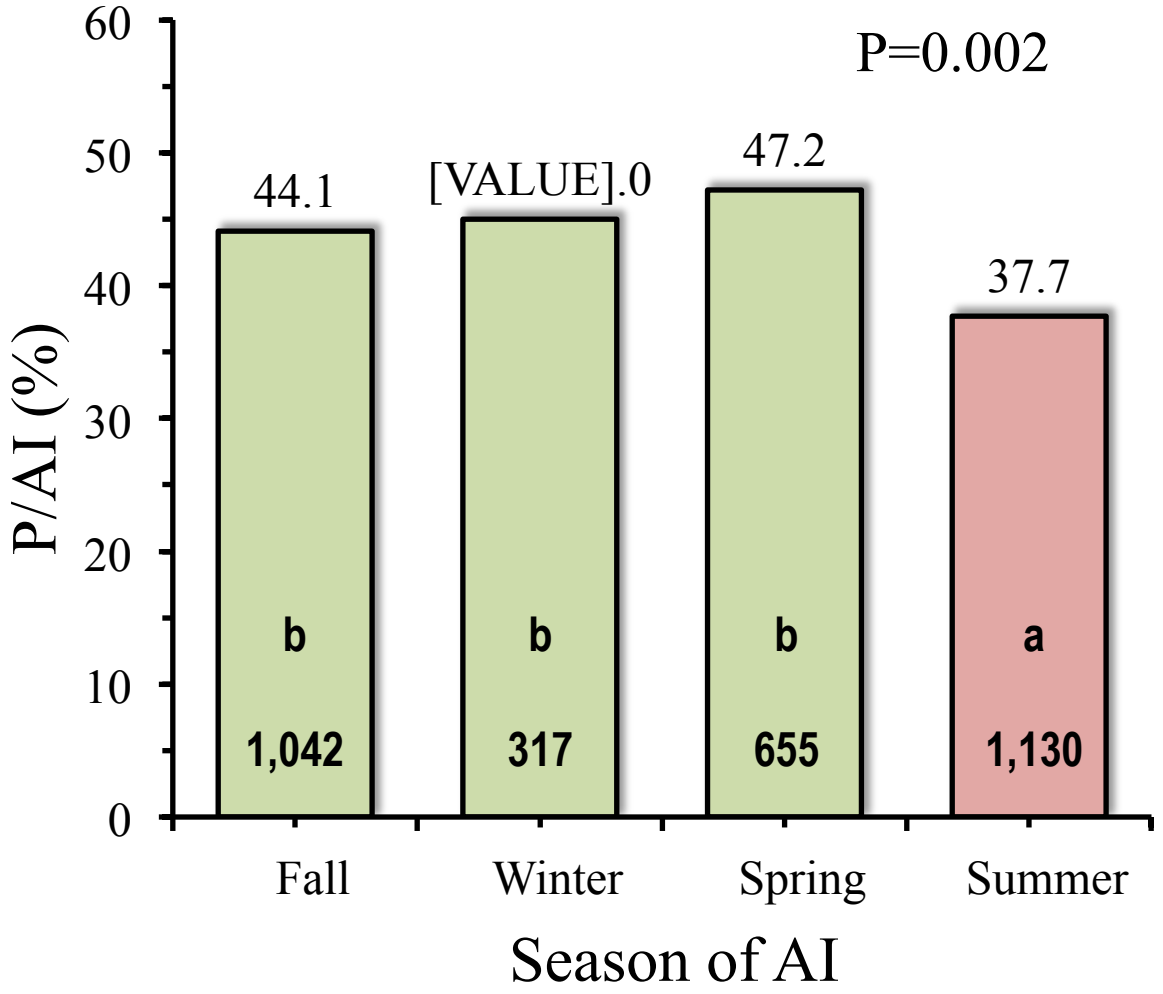
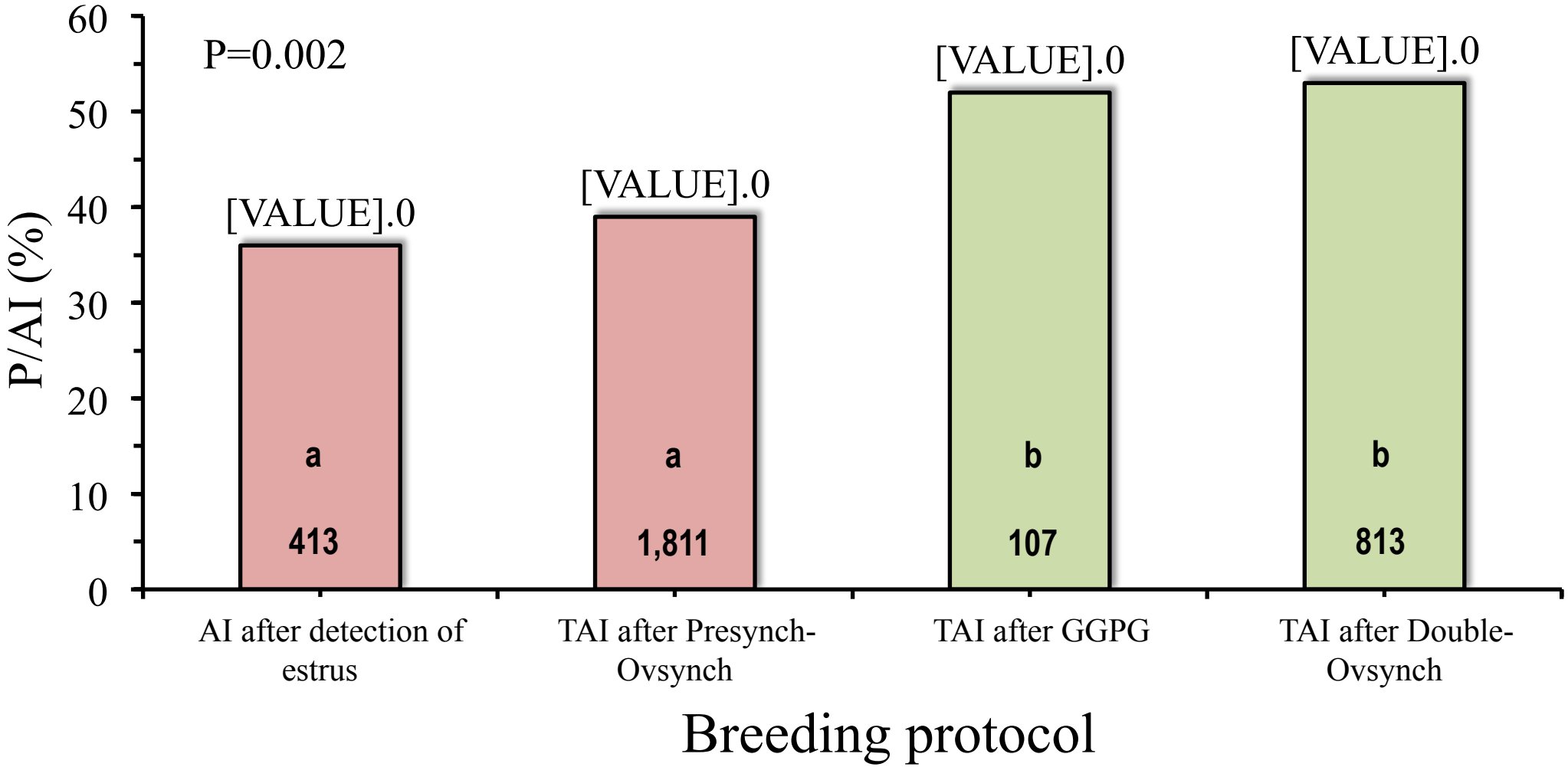
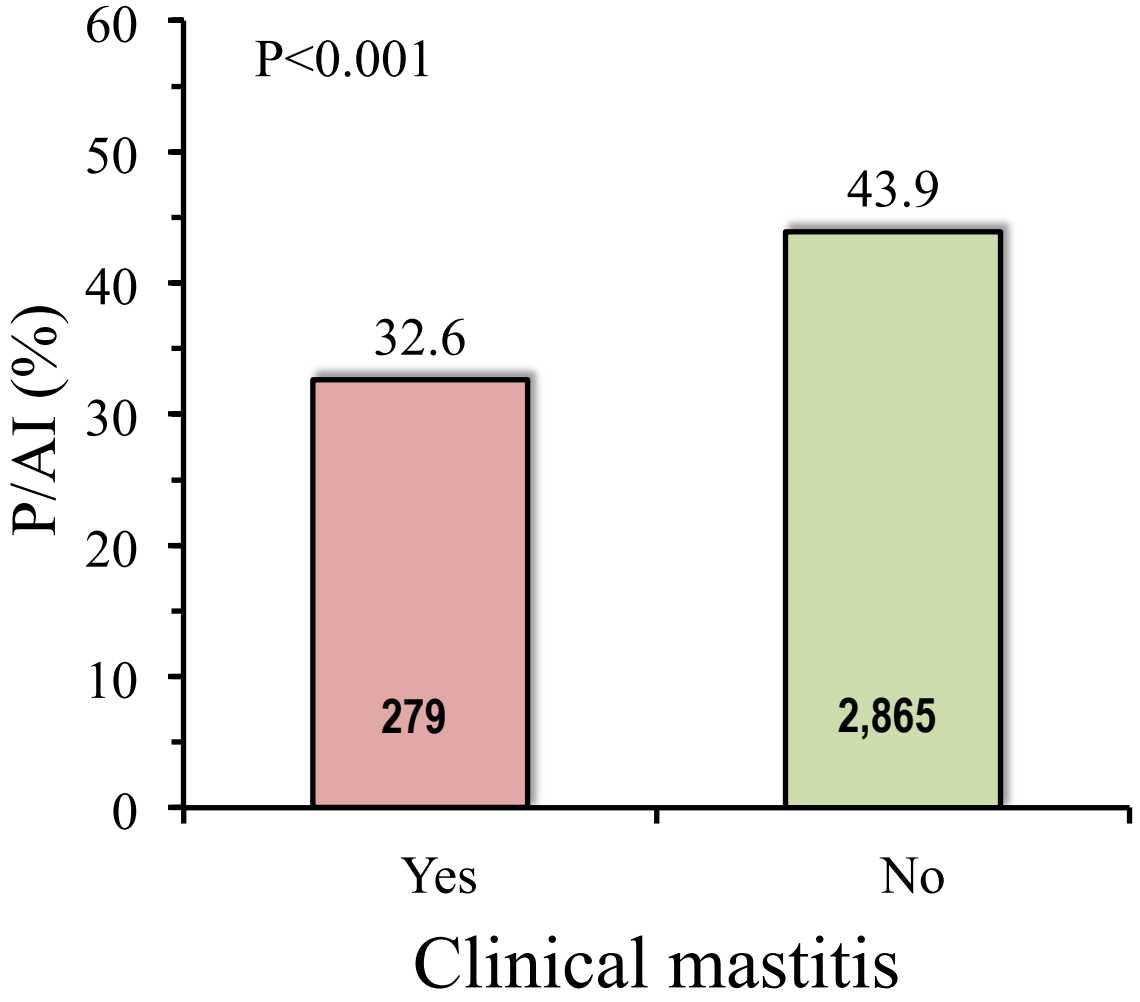




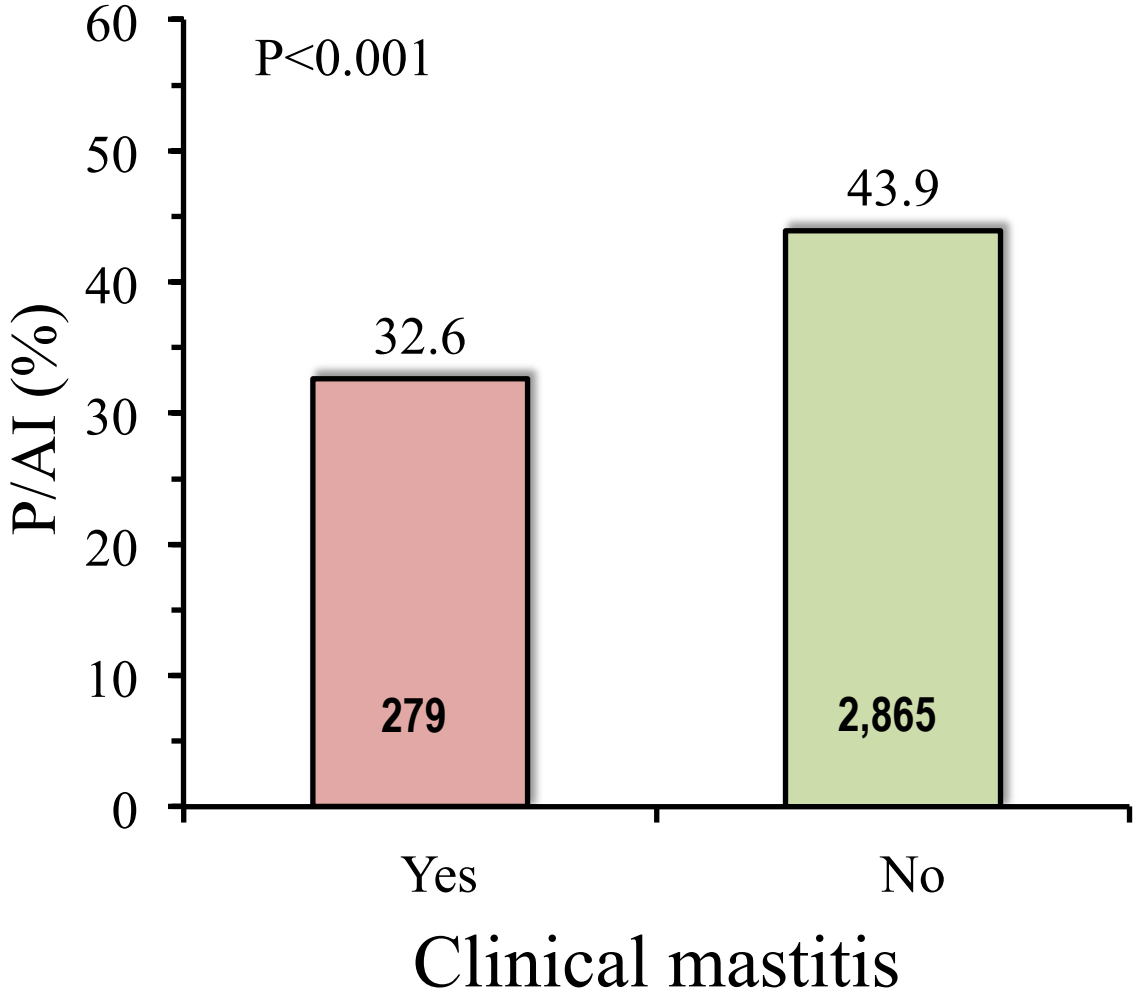
Relationship between P/AI and Breeding Protocol



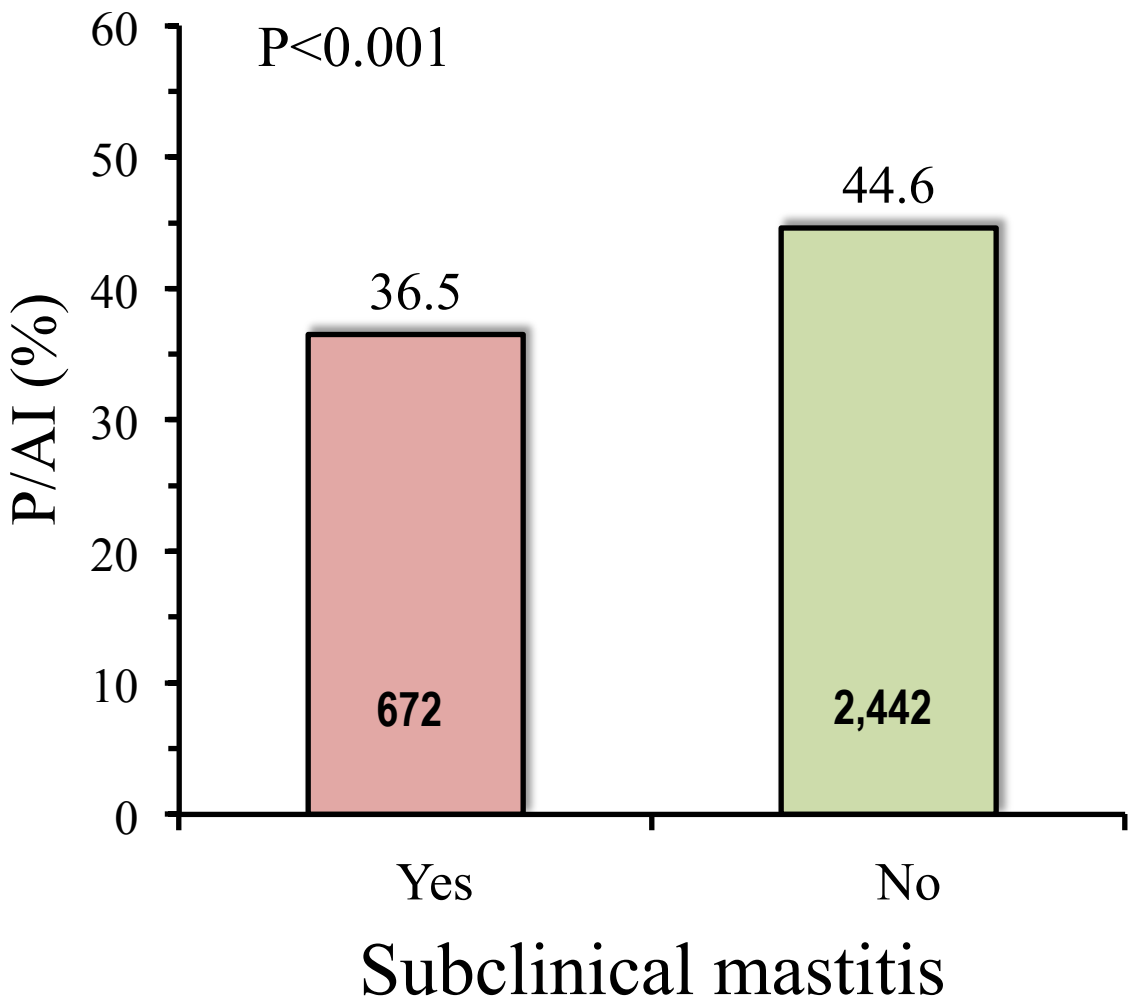
Relationship between P/AI and Mastitis



Relationship between P/AI and Mastitis

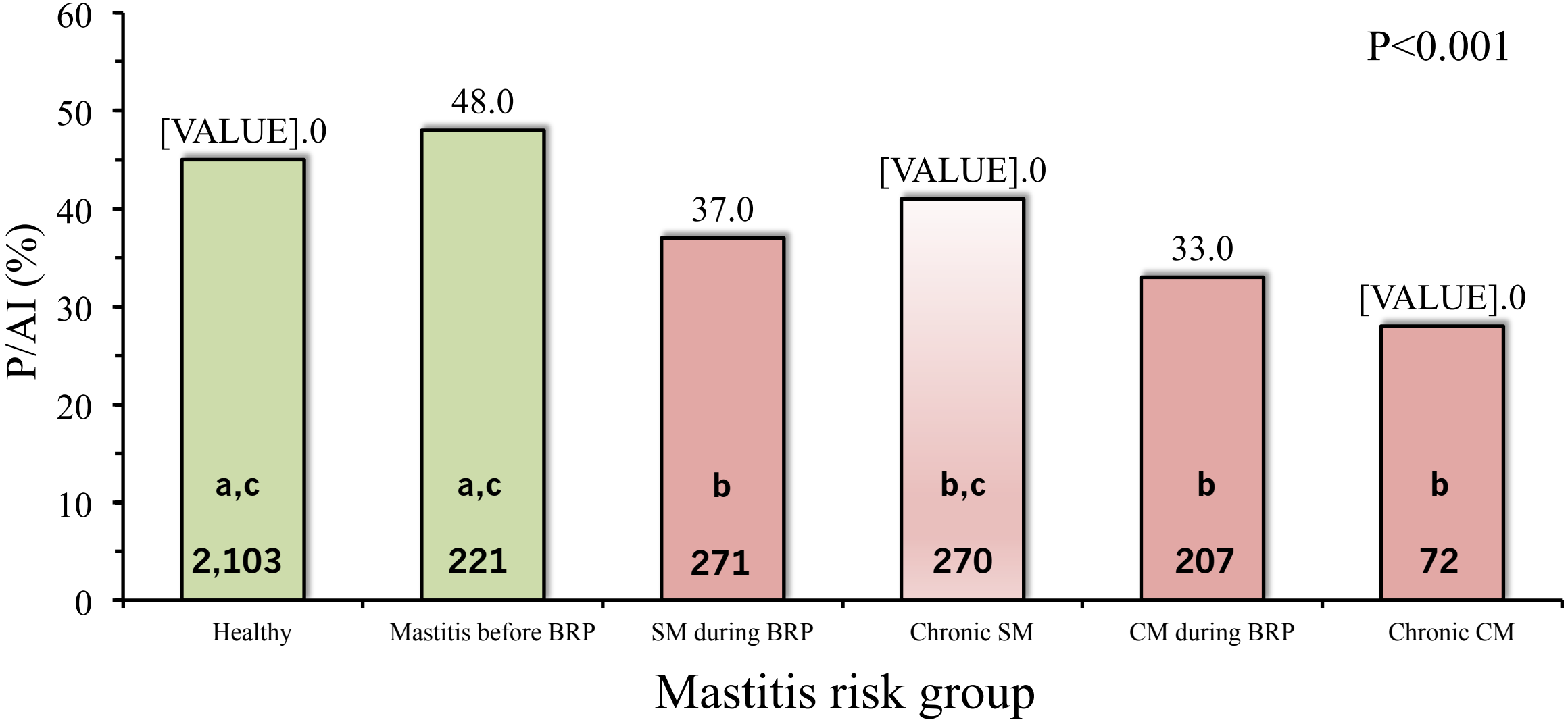


Clinical mastitis

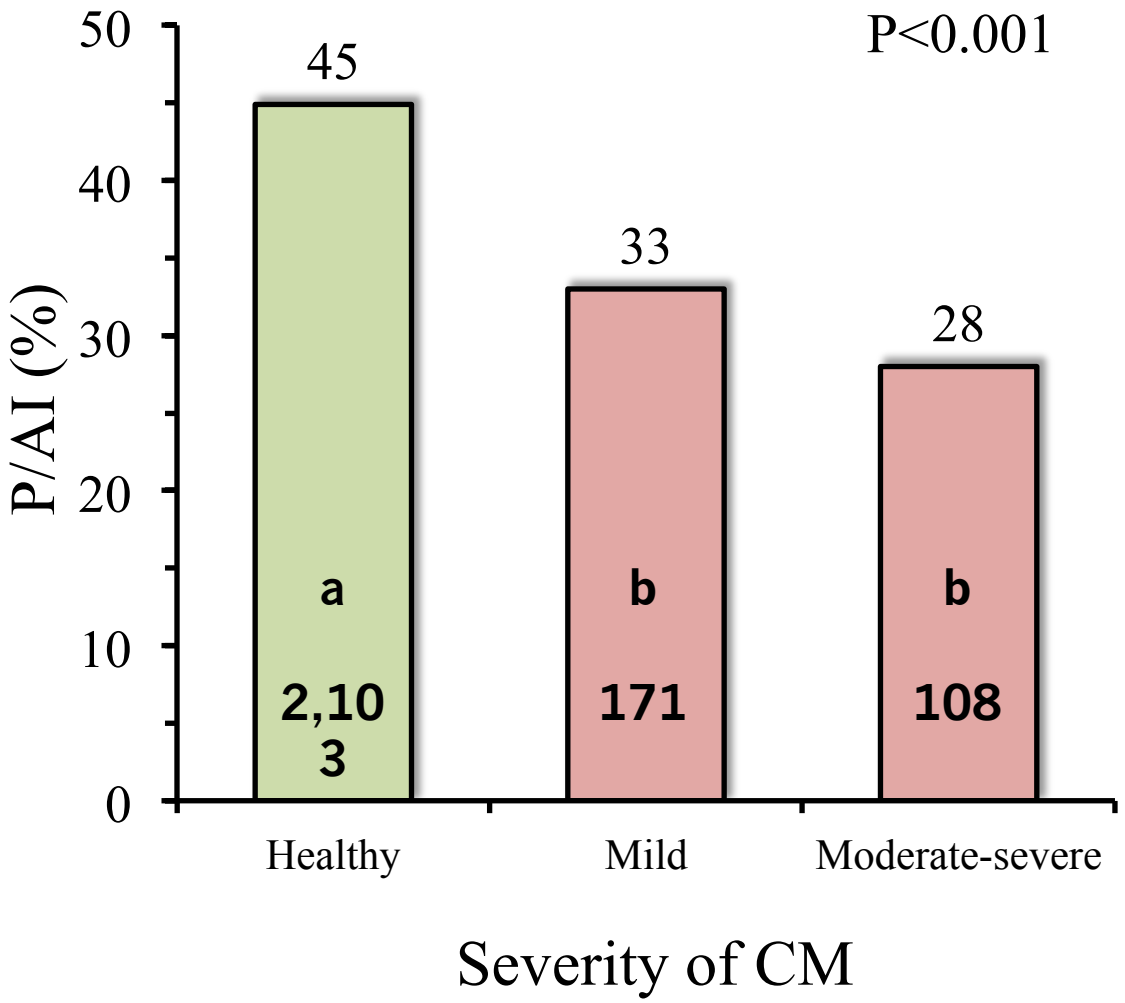


Subclinical mastitis

Relationship between P/AI and Mastitis Risk Group



Relationship between P/AI and Severity and Etiology of CM



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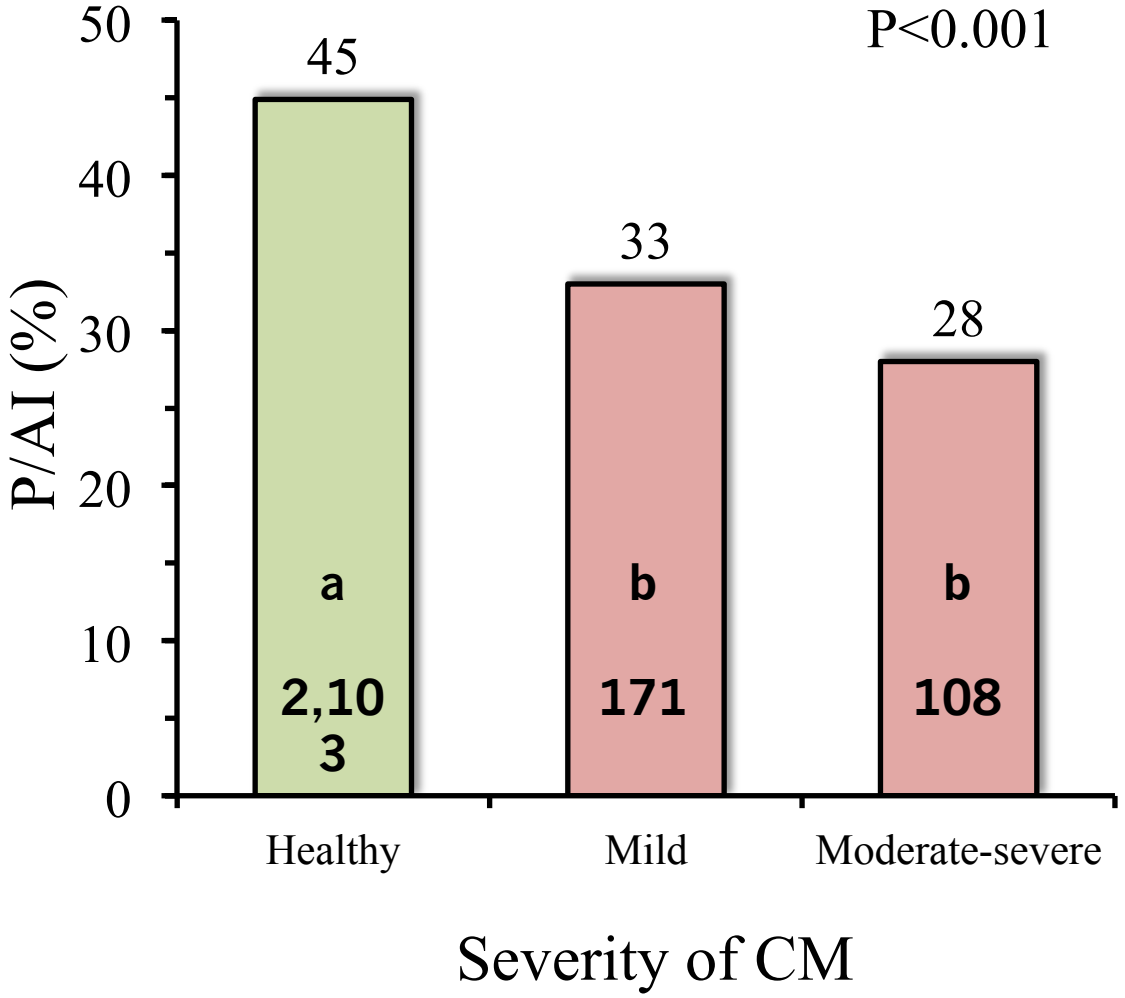

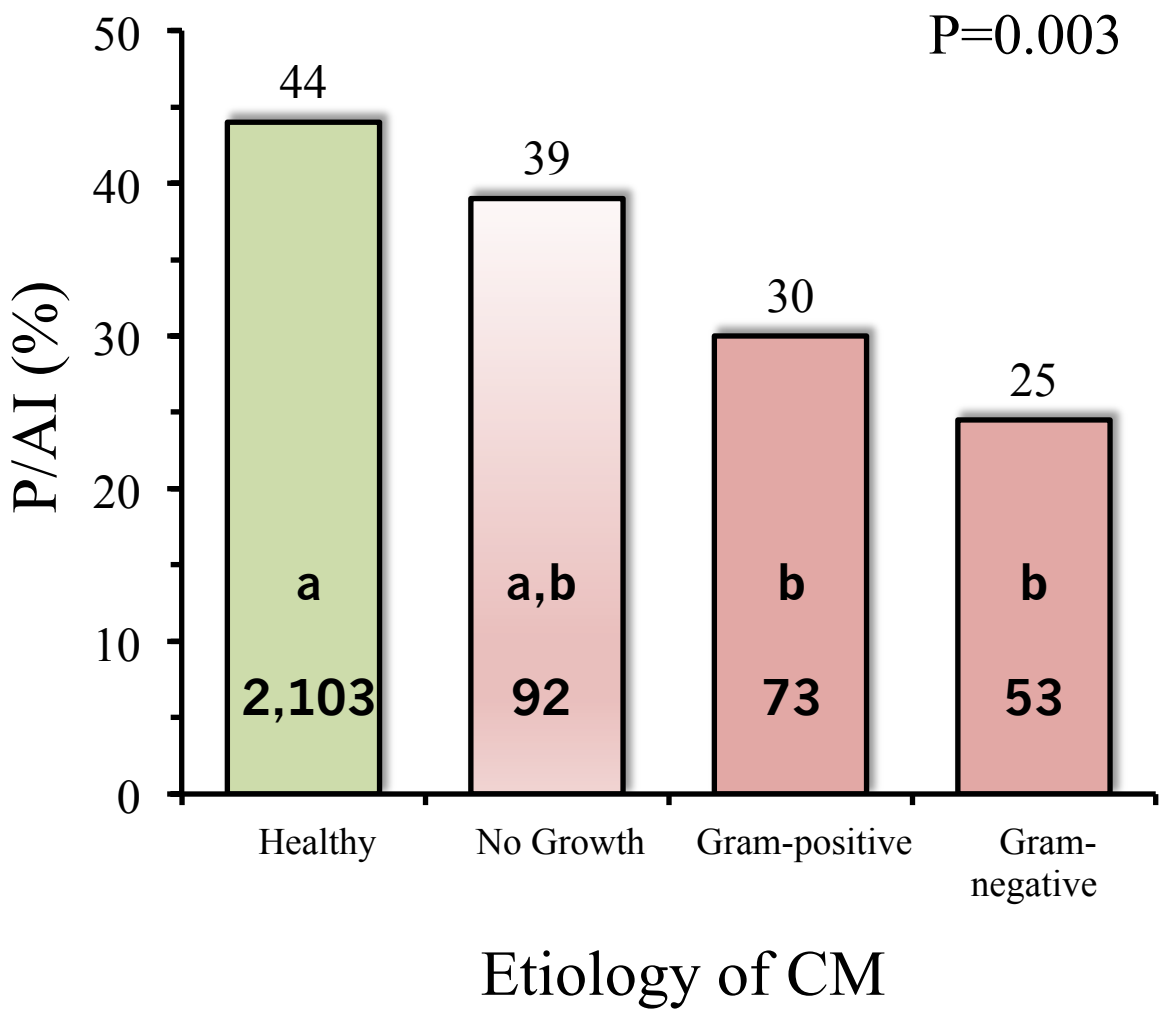

Summary

- Similar to other studies, mastitis occurring during the BRP was associated with a decreased probability of pregnancy.
- Fertility of cows that experienced chronic subclinical mastitis did not differ from healthy cows which differs from previous studies (Schrick et al., 2001; Lavon et al., 2011).
- Occurrence of CM cases caused by Gram-negative bacteria induced the greatest decrease in the probability of pregnancy compared to no growth or healthy cows (Hertl et al., 2010).

Summary cont.

- A novel finding from this experiment was that the probability of pregnancy for cows that experienced CM caused by no growth did not differ from healthy cows. This has not been described or studied previously.
- There was a negative relationship between severity of CM cases and probability of pregnancy. This observation is novel because other studies have not evaluated the association between severity of CM and P/AI to first AI.

Conclusions

- Characterization of CM by etiology and severity is important for assessing the probability of success of the first artificial insemination.
- To maximize the success of breeding programs, it is important that farmers recognize the impact that mastitis can have on pregnancy outcomes.
- Farms should focus on preventive mastitis programs especially targeted to reduce the occurrence of mastitis during the breeding risk period.

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