



Bayesian Accuracy Estimates of Milk ELISA-Ab, Blood qPCR, and Lymphocyte Counts for Identifying Dairy Cows Infected with Bovine Leukosis Virus.

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INTRODUCTION

Leukosis

- ❖ Worldwide and incurable disease.
- ❖ Silently deteriorate immunity, overall health, and productivity.
- ❖ Significant economic losses for producers.

Obj. 1

- ❖ **ELISA-Ab tests for individual milk samples are limited in Canada:**
 - ✓ We will adapt an ELISA-Ab test designed for bulk tank milk samples to be used in individual samples, and,
 - ✓ Assess its diagnostic performance using Bayesian latent class models, when comparing to qPCR and lymphocyte counts (LC) within the model for the ELISA-Ab validation.

Obj. 2

- ❖ Dairy herd improvement milk meter sampling would facilitate testing but, **can contamination from one cow to another occur during this sampling?** We will evaluate this potential carryover effect.

METHODOLOGY

Adaptation of an ELISA-Ab test designed for bulk milk:

- ✓ Milk samples diluted to prevent saturation.
- ✓ Optical density (OD) corrected with final dilution.



Sample collection (638 cows, 8 farms; QC, Canada):

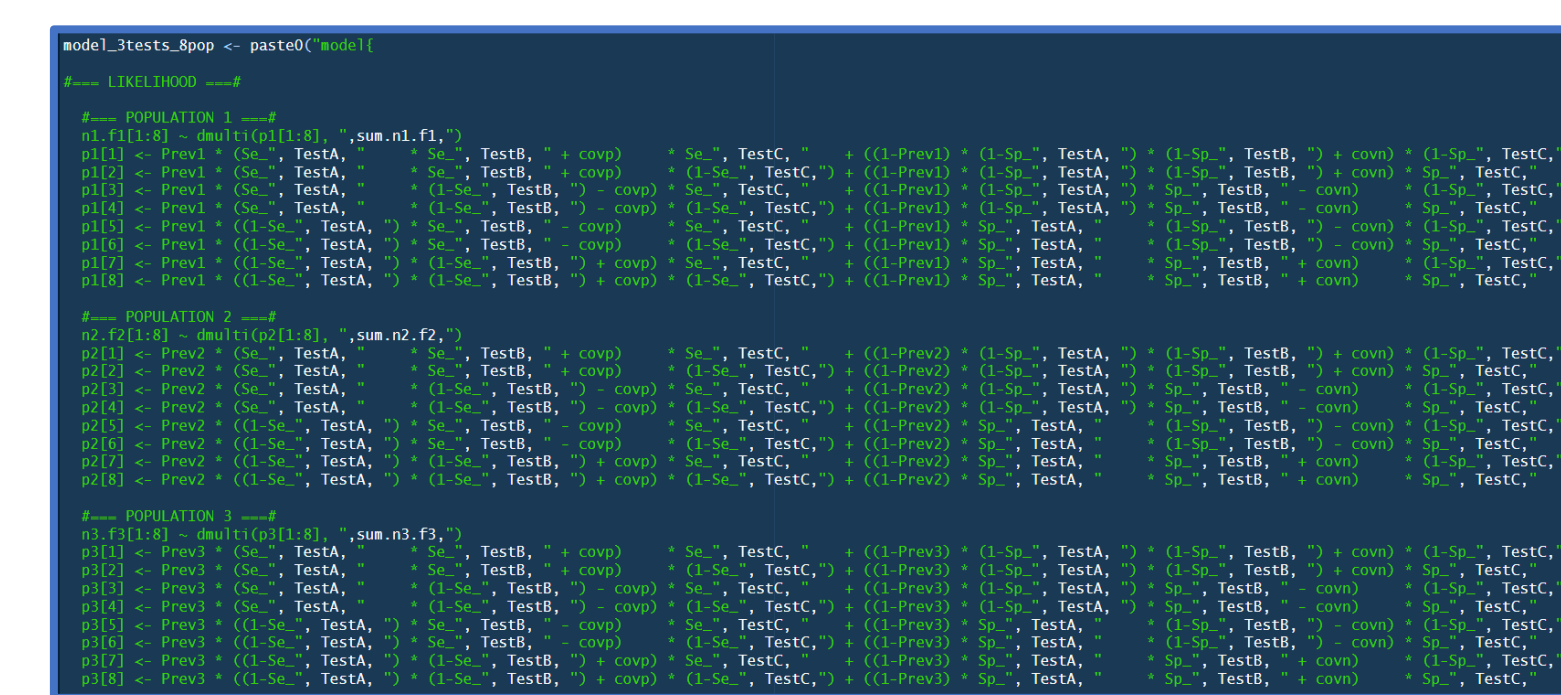
- ❖ Dairy herd improvement:
 - ✓ Milk meter's samples collected on all lactating cows.
 - ✓ Milking order noted to explore carryover effect.
- ❖ Same week:
 - ✓ Blood samples for qPCR and lymphocyte counts (LC).



Data analyses:

❖ Bayesian latent class model (3 tests, 8 pop., vague priors):

- ✓ Conditional dependence allowed between qPCR and LC.
- ✓ Multiple OD thresholds evaluated for milk ELISA-Ab.



Parameters

- ✓ Accuracy: sensitivity (Se) and specificity (Sp).
- ✓ Positive (PPV) and negative (NPV) predictive values.
- ✓ Misclassification cost term at different false-:false+ costs ratios.

For different prevalence scenarios

❖ ELISA-Ab carryover effect:

- ✓ Sp in cows milked immediately after a negative vs. positive cow, and false+ probability when :

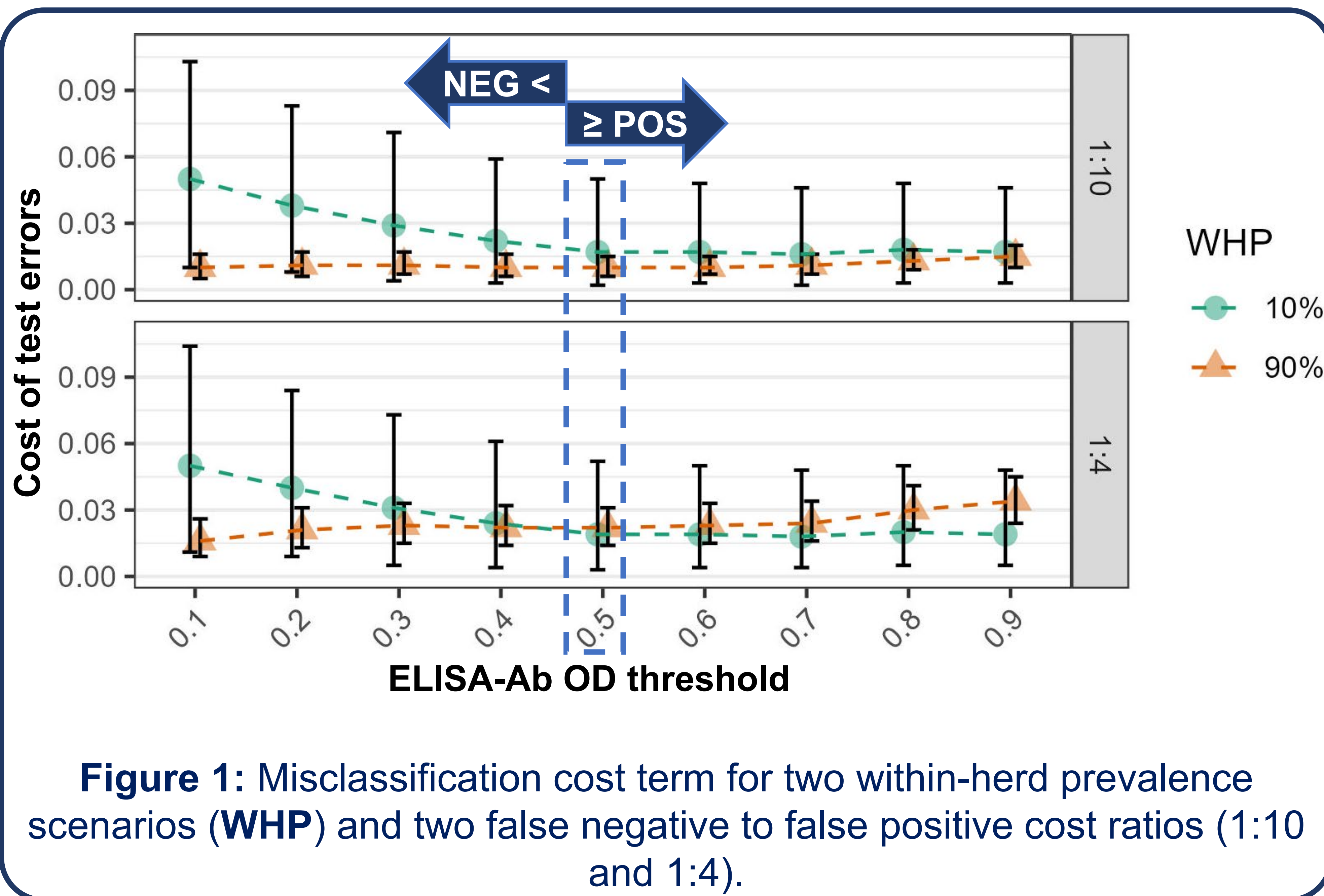
Worst carryover effect scenario

Vs.

Ignoring carryover effect



RESULTS



The **ELISA-Ab** OD threshold of 0.5 minimized costs of diagnostic errors. The median (95% BCI) accuracy estimates at 0.5 were:

Se = 91.3%
(87.2% to 94.6%)
Sp = 98.2%
(94.5% to 99.9%)

Median (95% BCI) accuracy estimates (same cutoff) for:

qPCR:	LC:
Se = 81.0% (75.7% to 85.9%)	Se = 51.0% (45.1% to 56.8%)
Sp = 99.6% (98.2% to 99.9%)	Sp = 95.9% (93.0% to 97.9%)

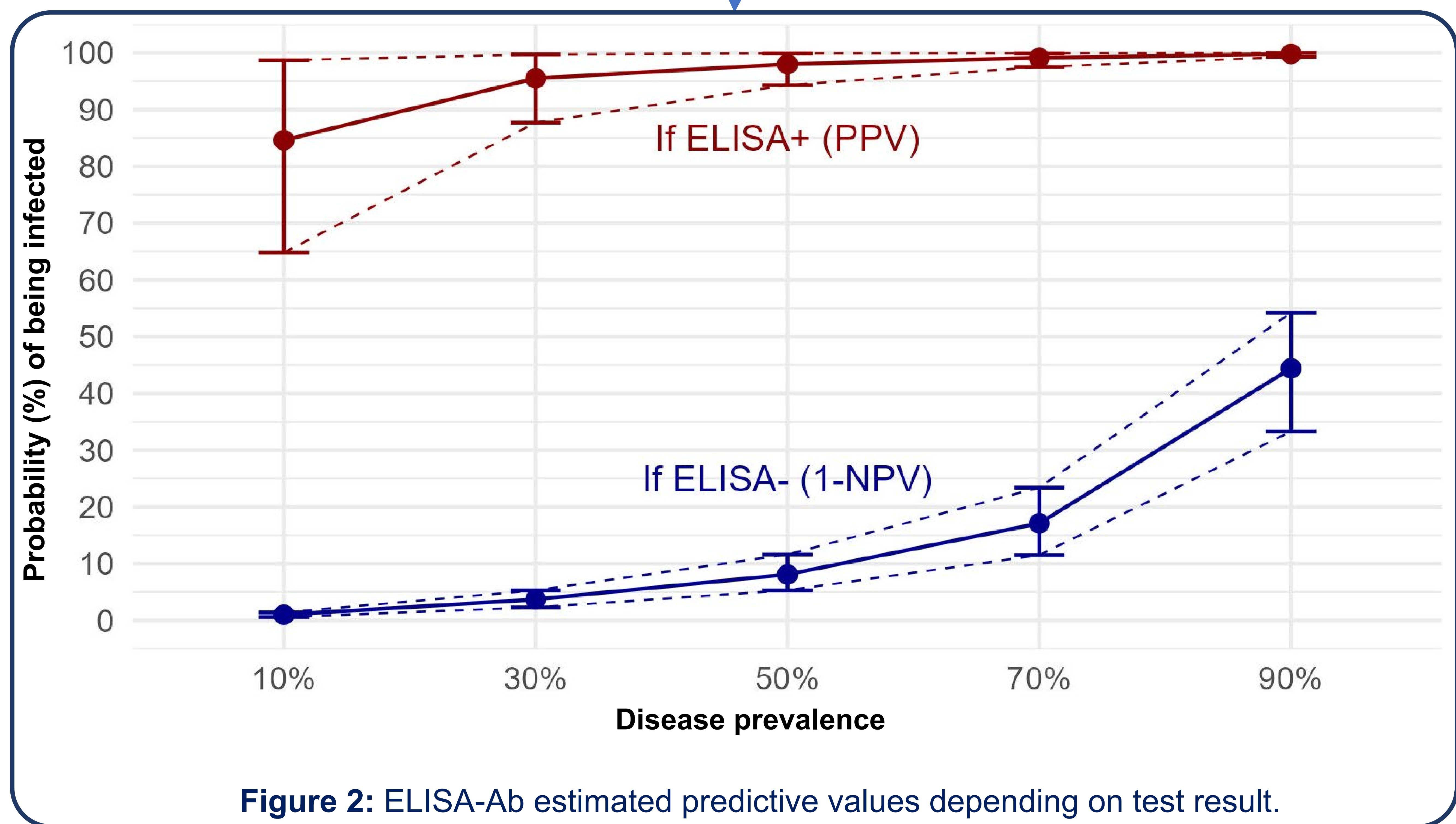


Figure 2: ELISA-Ab estimated predictive values depending on test result.



RESULTS

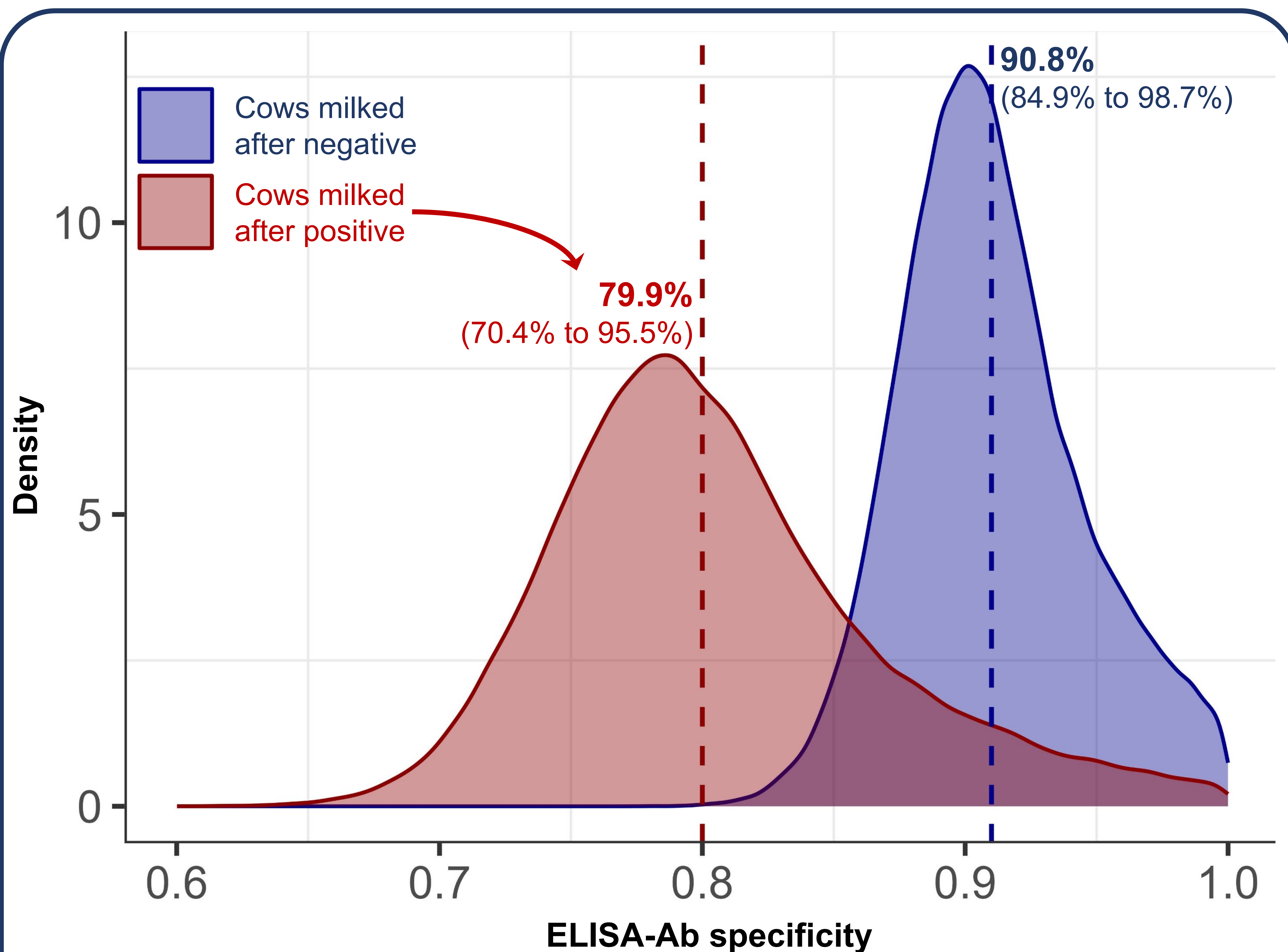


Figure 3: ELISA-Ab specificity posterior distributions for cows milked or not after a positive cow. Dashed lines represent the median Sp estimate in each distribution.

An 11% drop in median Sp was observed for cows milked immediately after a positive cow, suggesting the potential transfer of milk antibodies from the previous cow. This leads to false positive results when using dairy herd improvement sampling from milk meters.

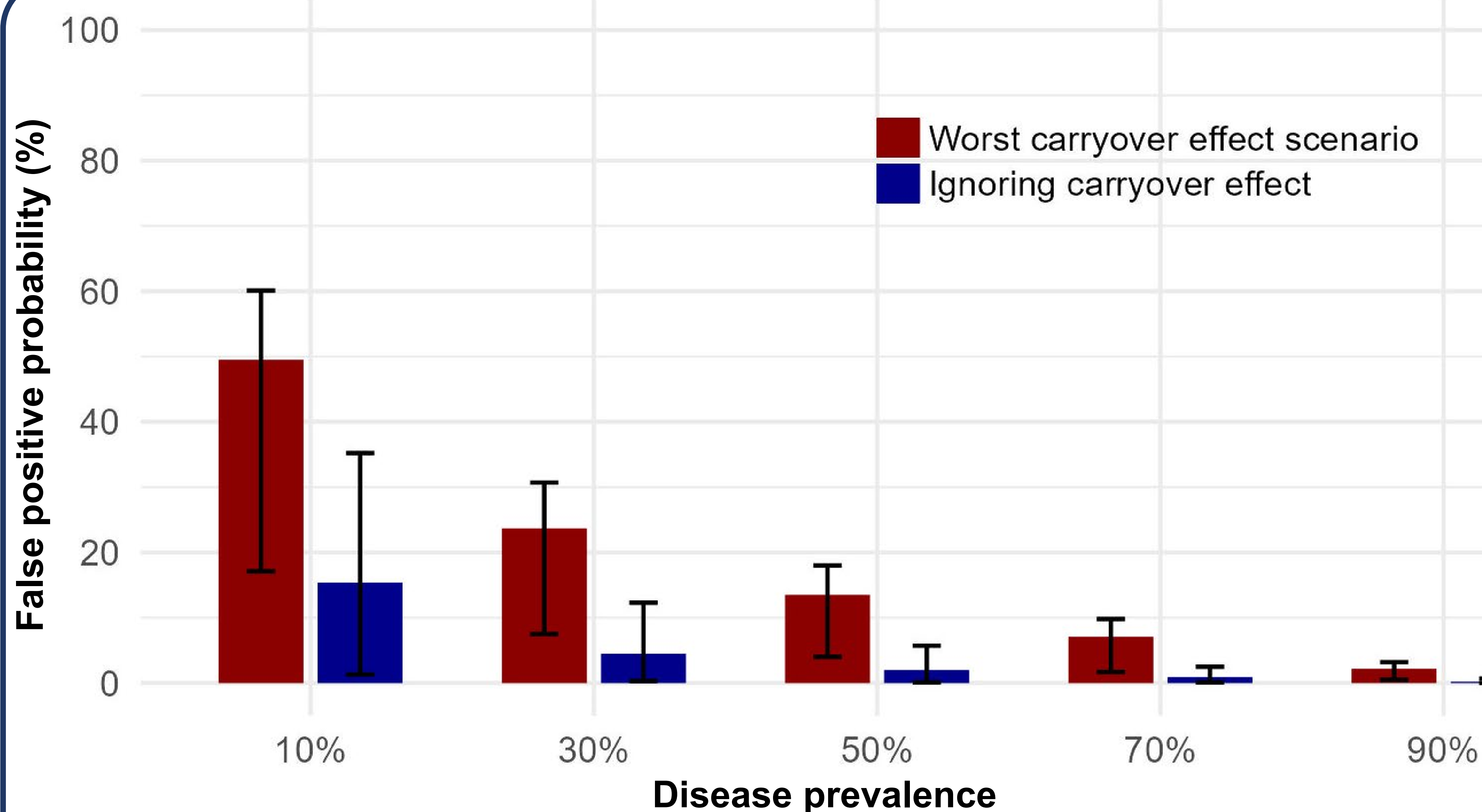
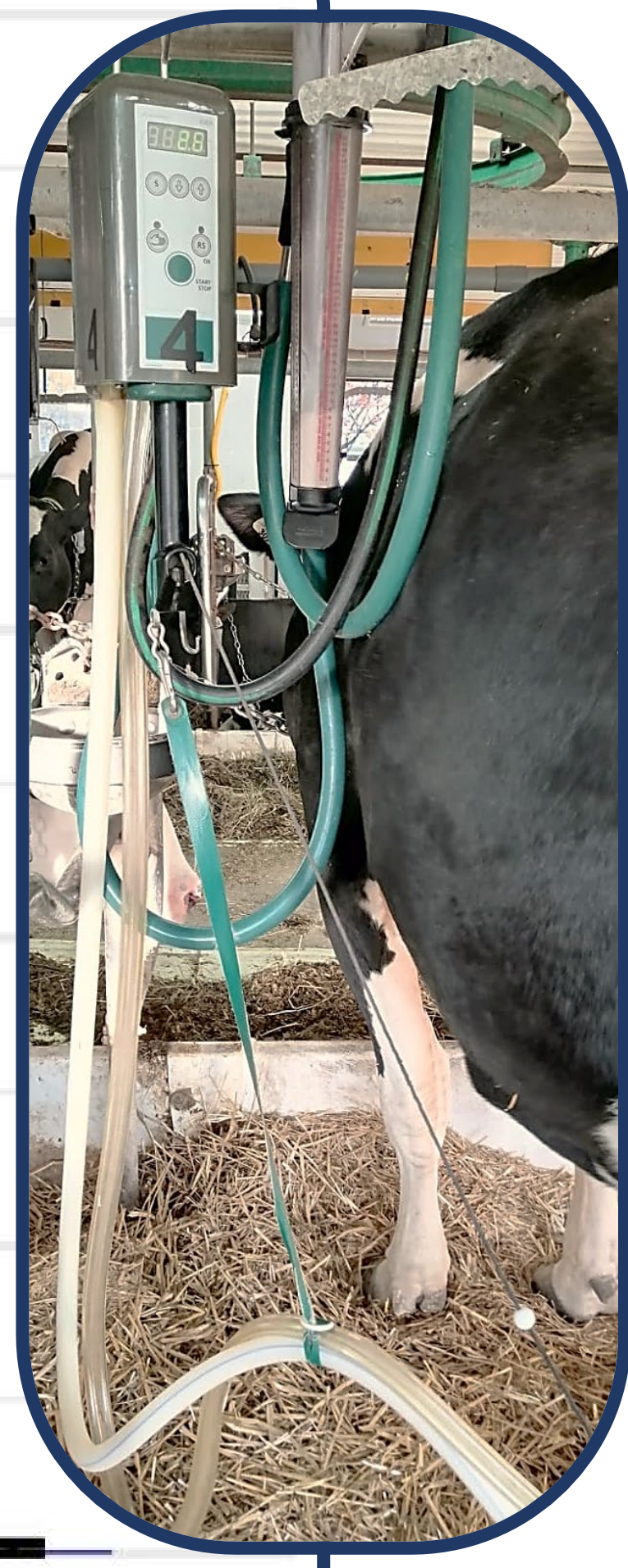


Figure 4: False positive rate (1 - PPV) when ignoring carryover effect vs. assuming the worst carryover effect scenario.

False positive probability increased when assuming the worst potential carryover effect scenario (i.e., when the maximum number of true negative cows is milked after true positive cows). The issue is more pronounced when the prevalence is lower.





CONCLUSIONS

Accuracy

- ❖ The adapted ELISA-Ab test appears to be quite accurate (Se = 91%; Sp = 98% at 0.5 OD cutoff).
- ❖ Se estimates of qPCR and LC were 81% and 51%, respectively, and both tests had Sp estimates > 95%.

PVs

- ❖ The ELISA-Ab predictive values were relatively high (PPV > 85% and NPV ranging from 55 to 98%).

Carryover effect

- ❖ The ELISA-Ab Sp is affected by the preceding cow's status, when samples are collected as part of dairy herd improvement programs (i.e., using milk meters).
- ❖ Depending on the producer's goals, it may be recommended to confirm a cow's status using a manually collected sample.

ACKNOWLEDGEMENTS

