

Bayesian latent class analysis to estimate the diagnostic performance of the bull breeding soundness evaluation for classifying *Bos taurus* bulls as satisfactory potential breeders

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Purpose:

- The purpose of this study was to estimate the sensitivity and specificity of the bull breeding soundness evaluation (BSE) for classifying *Bos taurus* bulls as satisfactory potential breeders

Materials and Methods:

- BSEs were performed on 500 bulls at the United States Meat Animal Research Center in Clay Center, Nebraska
- Stained semen slides were evaluated at 1000X magnification by a trained technician (observer A), then independently by a veterinarian (observer B)
- Bulls with slides that had $\geq 70\%$ morphologically normal sperm were classified as satisfactory potential breeders
- Sensitivity, specificity, and true prevalence were estimated using Bayesian latent class analysis
- Prior distributions for Bayesian analysis were obtained from experimental data
- Sensitivity was defined as the probability a bull was classified as a satisfactory potential breeder given that the bull was satisfactory
- Specificity was defined as the probability a bull was classified as non-satisfactory given that the bull was non-satisfactory
- Interobserver agreement was assessed using Cohen's kappa coefficient

Results:

- The estimated true prevalence of satisfactory bulls was 77% (95% C.I. 62-87%)
- The estimated sensitivity and specificity for observer A was 94% (95% C.I. 87-99%) and 46% (95% C.I. 21-75%) respectively
- The estimated sensitivity and specificity for observer B was 90% (95% C.I. 82-98%) and 58% (95% C.I. 29-86%) respectively
- The positive predictive values over the full range of pre-test probabilities are demonstrated in Figure 1
- The kappa coefficient was 0.5 (see results in Figure 2)

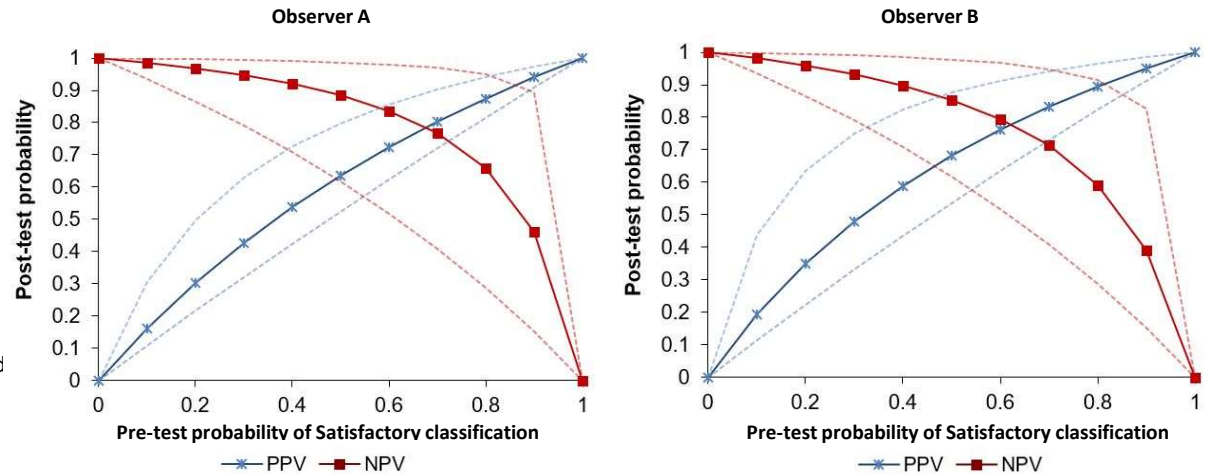


Figure 1. Positive and negative predictive values for the BSE over the full range of pre-test probabilities for both observers. Dashed lines indicate 95% C.I.

	Satisfactory Observer A	Non-satisfactory Observer A	
Satisfactory Observer B	362	20	382
Non-satisfactory Observer B	48	48	96
	410	68	478

Figure 2. 2X2 table comparing results from both observers

Conclusions:

- The positive predictive value of the BSE may not be much more informative than any given pre-test probability for a bull being a satisfactory breeder
- The BSE may have a relatively low negative predictive value at our estimated pre-test probability for a bull being a satisfactory breeder
- The BSE may be most useful for identifying sub-fertile bulls in populations of bulls with a prevalence of satisfactory bulls below (e.g., yearling bulls, underconditioned bulls)

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