

# Economics of Resynchronization with Chemical Tests to Identify Nonpregnant Cows

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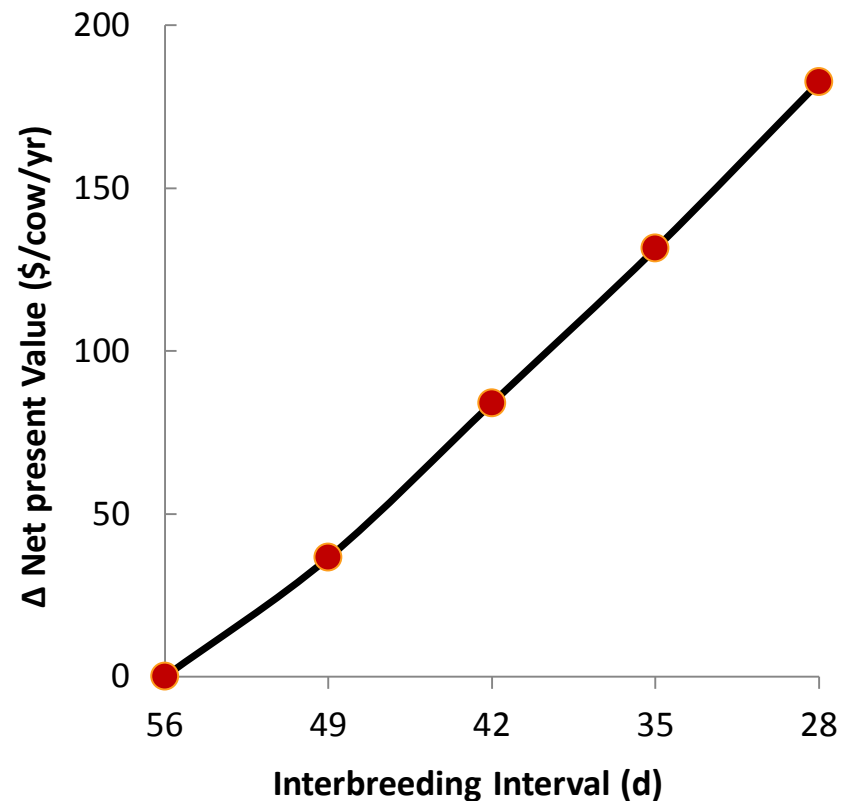
# Earlier Pregnancy: ↑ Profitability

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## Economic benefits

- ↑ Milk productivity
- ↑ Calves per cow
- ↓ Reproductive culling
- ↓ Uncontrolled culling
- ↑ Selective culling

## Value of Early Pregnancy



# Pregnancy Diagnosis

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- Plays critical role on detecting nonpregnant cows post breeding
- The earlier the test the faster cows can be re-submitted to subsequent breedings
- Shortening interbreeding interval improves reproductive performance and profitability



# Tradeoff Early Pregnancy Tests

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## Potential benefits

- ↓ Interbreeding interval
- ↑ Pregnancies
- ↓ Reproductive culling
- ↑ Selective culling
- ↑ Calves per cow
- ↓ Mortality
- ↓ Uncontrolled culling

## Potential drawbacks

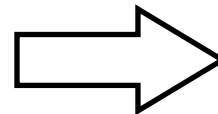
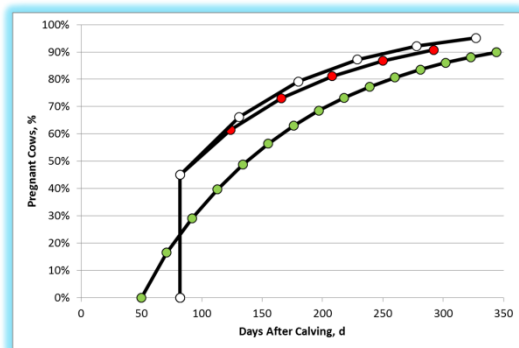
- Affected by pregnancy loss
- Lower sensitivity
- Lower specificity
- More questionable diagnoses
- Additional cost



# Purpose of the Study

## Objectives

- Assess economic value of:
  - Decreased IBI due to **early pregnancy diagnosis**
  - **Early chemical test** compared with transrectal ultrasound and rectal palpation



## Hypothesis

- The economic advantage of one week earlier **chemical test** will overcome potential additional costs and losses due to inaccuracy of the earlier test



# The UW-DairyRepro\$



**UW-Dairy Repro\$**  
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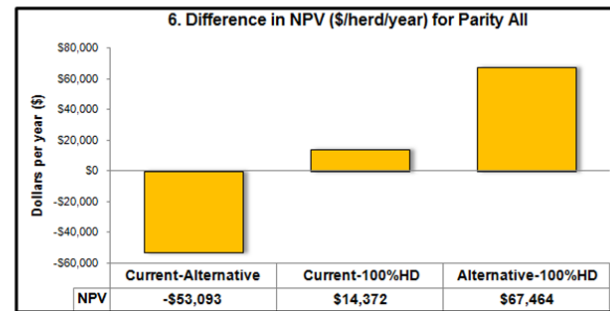
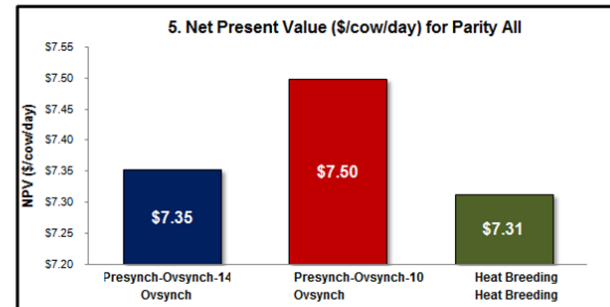
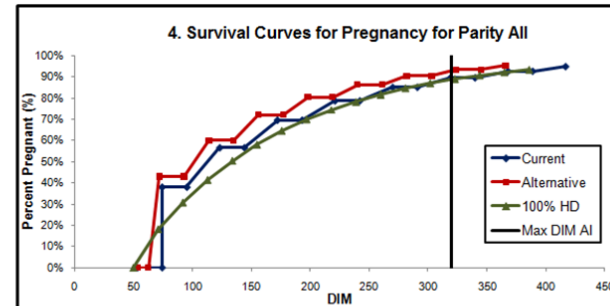
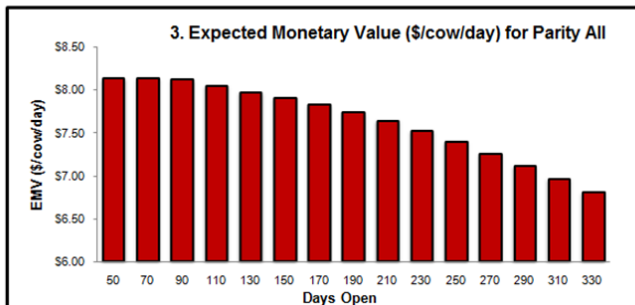
## 1. Productive and Economic Parameters Summary

Lactating Cows in Parity All	(#)	1000
Rolling Herd Average (RHA)	(lb/cow/y)	28000
Milk Price	(\$/cwt)	14.50
Average Value New Born	(\$)	90
Heifer Replacement Value	(\$)	1,000
Salvage Value	(\$)	700

## 2. Reproductive Programs Summary

	Current	Alternative	Baseline
1 <sup>st</sup> Service Postpartum	Presynch-Ovsynch-14	Presynch-Ovsynch-10	Heat Breeding
2 <sup>nd</sup> and Following Services	Ovsynch	Ovsynch	Heat Breeding
Voluntary Waiting Period	53d	53d	50d
Maximum DIM for Breeding		320d	
DIM 1st TAI	74d	72d	
Interbreeding Interval	49d	42d	21d
Heat Bred Before 1 <sup>st</sup> TAI	0%	0%	55%
CR Heat Bred Before 1 <sup>st</sup> TAI	0%	0%	33%
Heat Bred After 1 <sup>st</sup> TAI	0%	0%	55%
CR Heat Bred After 1 <sup>st</sup> TAI	0%	0%	28%
CR 1 <sup>st</sup> Service TAI	38%	43%	
CR 2 <sup>nd</sup> + Services TAI	30%	30%	
Cost 1st Service Breeding	\$34.00	\$33.89	
Cost Resynch Breedings	\$27.33	\$29.33	
Cost Heat Breedings	\$16.61	\$18.16	\$17.00
Pregnancy Diagnosis Method	Palpation	Ultrasound	Palpation
Pregnancy Diagnosis Cost	\$6.56	\$8.16	\$7.00

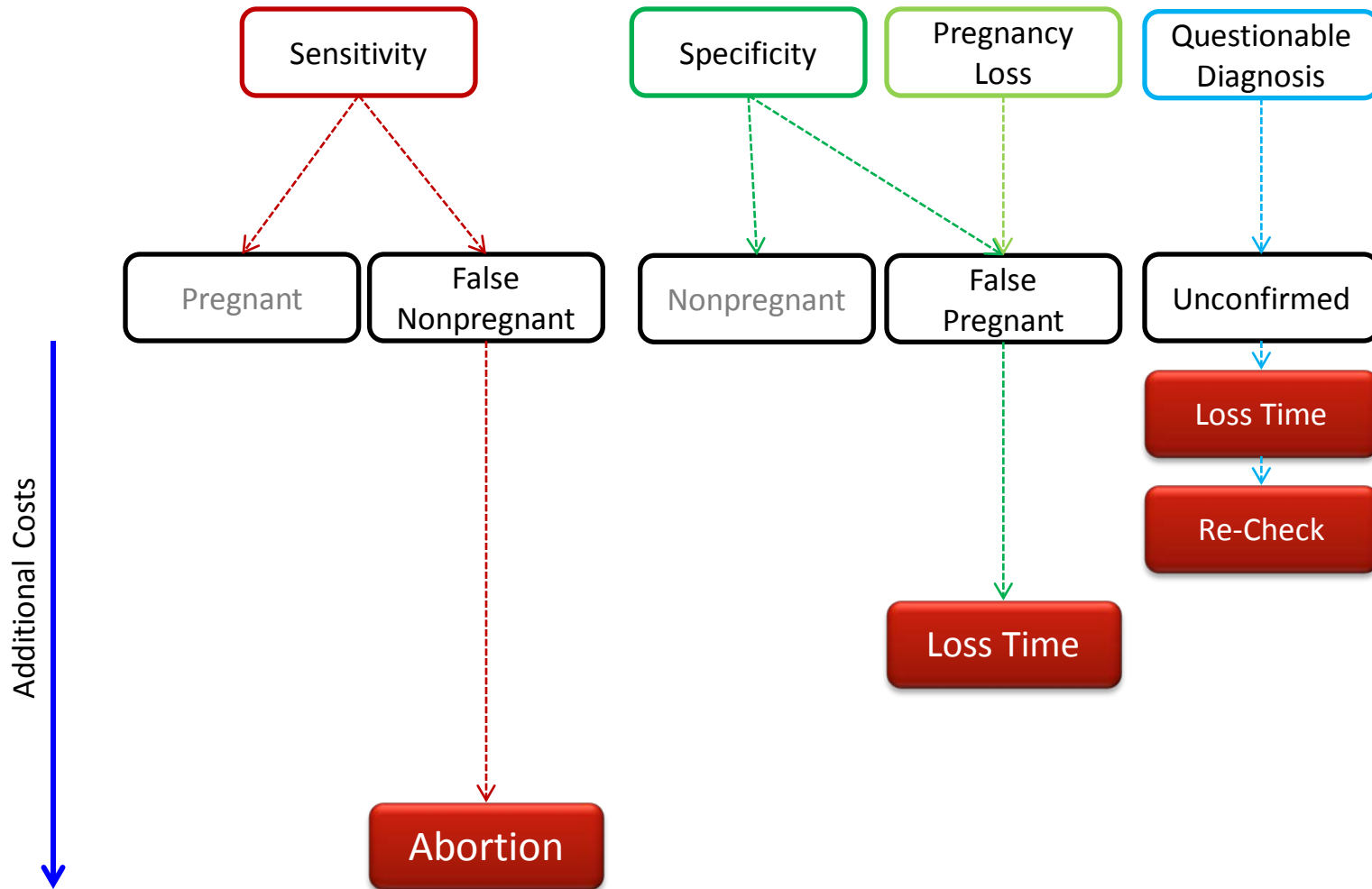
## 3. Expected Monetary Value (\$/cow/day) for Parity All



Giordano et al., 2011, JDS



# UW-DairyRepro\$ Modifications



# The Value of Shorter IBI

**Experiment 1**

Program	Interbreeding Interval (d)	First AI			Second and subsequent AI		
		<sup>1</sup> ED before 1 <sup>st</sup> TAI <sup>3</sup>	<sup>2</sup> CR ED before 1 <sup>st</sup> TAI	CR TAI	ED before TAI	CR ED before TAI	CR TAI
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	30	35	40	30	35	30
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	40	35	38	40	35	30
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	50	35	36	50	35	30
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	60	35	34	60	35	28
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	70	35	32	70	35	28
Presynch-Ovsynch & Resynch	28, 35, 42, 49, 56	80	35	30	80	35	28

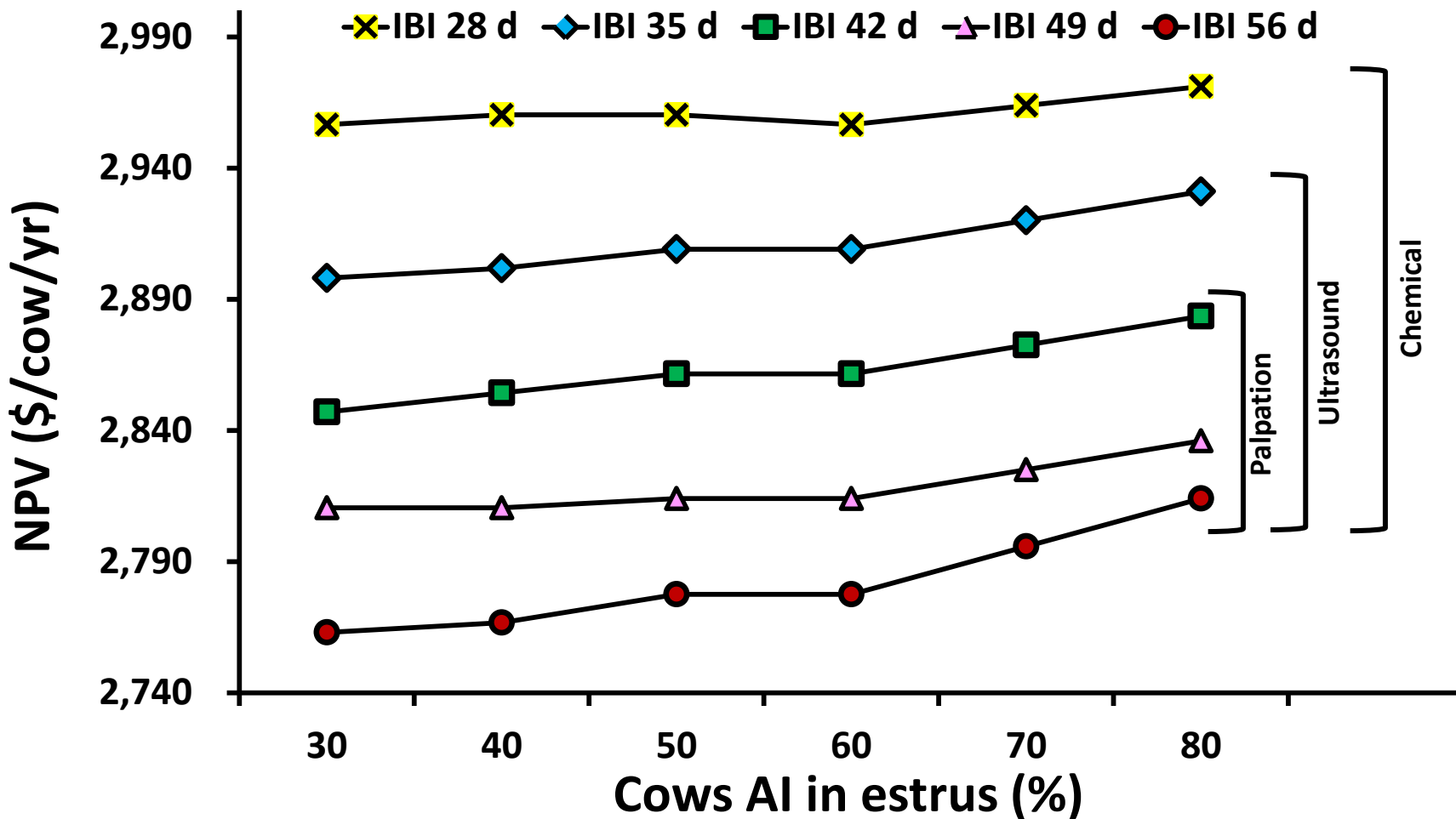
<sup>1</sup>Percentage of cows AI after estrous detection before first TAI.

<sup>2</sup>Conception rate of cows AI after estrous detection.

<sup>3</sup>TAI = Timed artificial insemination



# The Value of Shorter IBI



# Data to Analyze Early Chemical Test

## Experiment 2

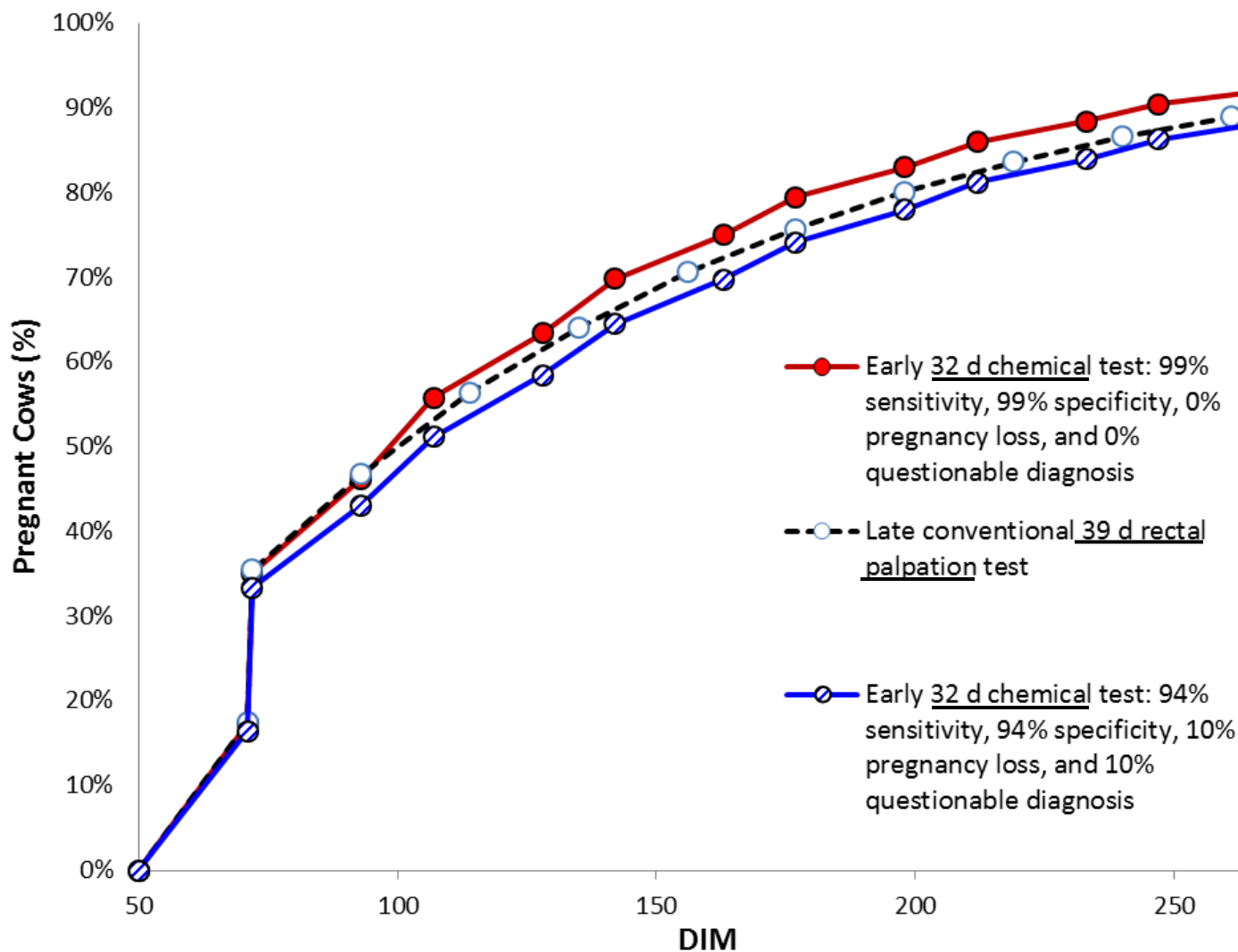
	<u>32 d Chemical test vs.</u>			<u>25 d Chemical test vs.</u>		
	<u>39 d Palpation test<sup>1</sup></u>			<u>32 d Ultrasound test<sup>2</sup></u>		
	Baseline	Minimum	Maximum	Baseline	Minimum	Maximum
Sensitivity (%)	98	94	99	97	94	99
Specificity (%)	98	94	99	97	94	99
Pregnancy loss (%) <sup>3</sup>	5.25	0	10	5.25	0	10
Questionable diagnosis (%)	3.3	0	10	8.5	0	10
Heat detection rate (%)	50	30	80	50	30	80
Cost chemical pregnancy test (\$/test) <sup>4</sup>	2.4	0.5	5.0	2.4	0.5	5.0

<sup>2</sup>Early test performed using chemical blood test at 25 d resulted in an interbreeding interval of 28 d whereas late test performed by transrectal ultrasound at 32 d resulted in an interbreeding interval of 35 d.

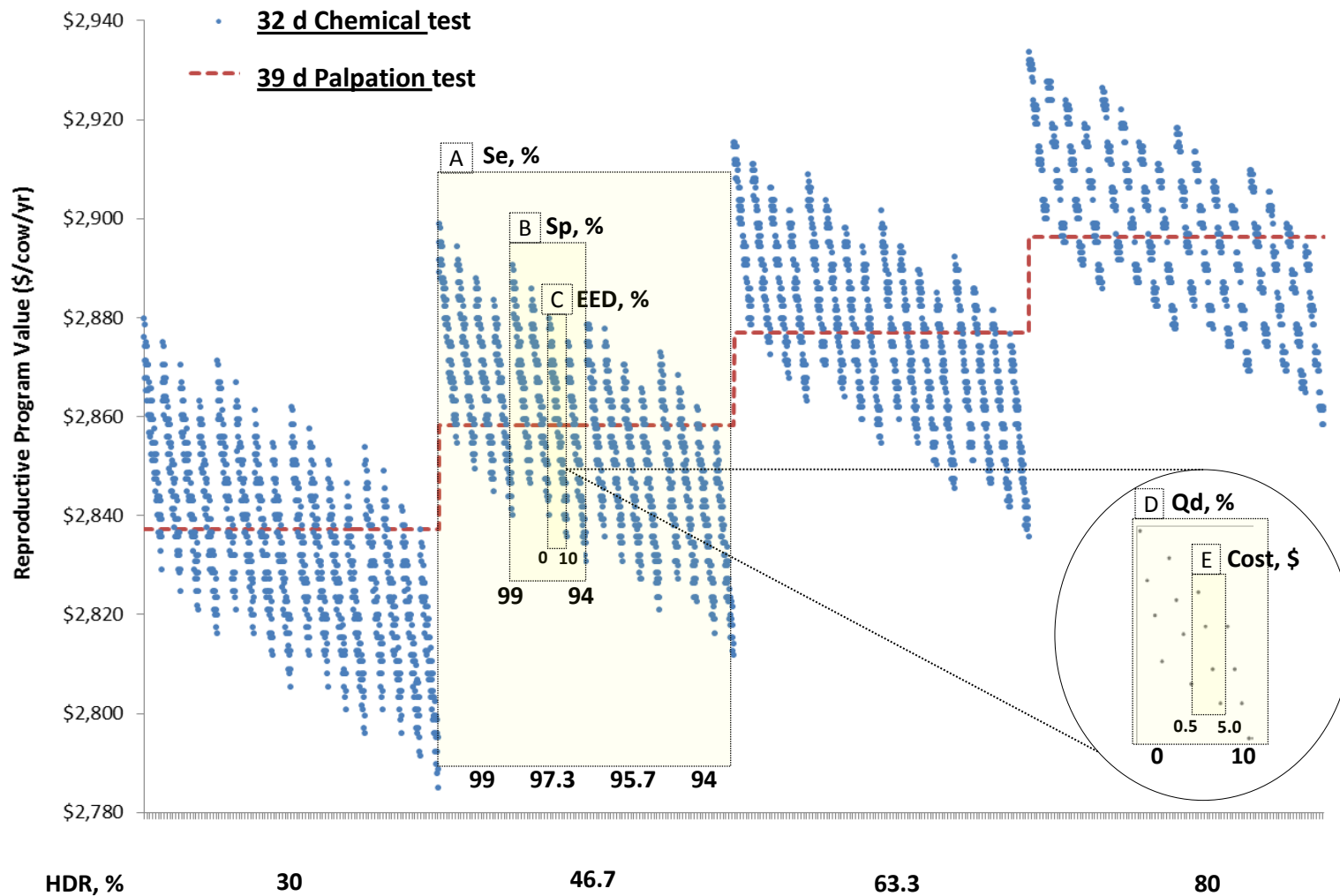
<sup>3</sup>During the 7 d period between early and late pregnancy tests (32 vs. 39 d and 25 vs. 32 d) based on Vasconcelos et al. (1997).

<sup>4</sup>First pregnancy test after AI.

# Pregnancy Survival Curves: Early vs. Late Test



# Sensitivity Analysis



# Regression Parameters

	<u>32 d Chemical test vs.</u> <u>39 d Palpation test<sup>1</sup></u>			<u>25 d Chemical test vs.</u> <u>32 d Ultrasound test<sup>2</sup></u>		
	Regression Coefficient	Quantitative Impact (\$/+1% or +\$0.1)	Relative Impact to Sensitivity <sup>3</sup>	Regression Coefficient	Quantitative Impact (\$/+1% or +\$0.1)	Relative Impact to Sensitivity <sup>3</sup>
Constant	<b>-795.39</b>			<b>-637.71</b>		
Sensitivity (%)	<b>534.48</b>	<b>+5.34</b>	<b>---</b>	<b>450.33</b>	<b>+4.50</b>	<b>---</b>
Specificity (%)	<b>305.43</b>	<b>+3.05</b>	<b>1.75</b>	<b>253.35</b>	<b>+2.53</b>	<b>1.78</b>
Pregnancy loss (%)	<b>-305.51</b>	<b>-3.05</b>	<b>-1.75</b>	<b>-253.51</b>	<b>-2.54</b>	<b>-1.78</b>
Questionable diagnosis (%)	<b>-39.04</b>	<b>-0.39</b>	<b>-13.69</b>	<b>-33.73</b>	<b>-0.34</b>	<b>-13.35</b>
Estrous detection rate (%)	<b>9.72</b>	<b>0.097</b>	<b>55.0</b>	<b>-22.01</b>	<b>-0.22</b>	<b>-20.46</b>
Cost chemical pregnancy test (\$)	<b>-1.75</b>	<b>-0.175</b>	<b>-305.75</b>	<b>-1.92</b>	<b>-0.019</b>	<b>-235.10</b>

ultrasound at 32 d resulted in an interbreeding interval of 35 d.

<sup>3</sup>Quantitative impact of factor analyzed divided by quantitative impact of sensitivity.

# Breakeven Analysis

	<u>32 d Chemical test vs.</u> <u>39 d Palpation test</u> <sup>1</sup>		<u>25 d Chemical test vs.</u> <u>32 d Ultrasound test</u> <sup>2</sup>	
	Baseline	Breakeven <sup>3</sup>	Baseline	Breakeven
Sensitivity (%)	98	95.9	97	94.3
Specificity (%)	98	94.2	97	92.0
Pregnancy loss(%)	5.25	8.9	5.25	10.5

<sup>1</sup>Early test performed using chemical blood test at 32 d resulted in an interbreeding interval of 35 d whereas late test performed by rectal palpation at 39 d resulted in an interbreeding interval of 42 d.

<sup>2</sup>Early test performed using chemical blood test at 25 d resulted in an interbreeding interval of 28 d whereas late test performed by transrectal ultrasound at 32 d resulted in an interbreeding interval of 35 d.

<sup>3</sup>When all other baseline parameters remained unchanged.

# Discussion

## Economic Value

- ✓ The value of a **CT** could be positive or negative and depends largely on the test parameters and expected pregnancy loss
- ✓ For baseline parameters the value of **CT** was **\$11.06** and **\$13.08** greater than the value of palpation or ultrasound, respectively

## Sensitivity

- ✓  $\uparrow \mathbf{Se} \rightarrow \uparrow \text{Value}$
- ✓ Most important factor
- ✓ **1.8** times more important than **Sp**
- ✓ To be at least 94%

## Specificity

- ✓  $\uparrow \mathbf{Sp} \rightarrow \uparrow \text{Value}$



# Discussion

## Pregnancy loss

- ☑  $\uparrow$  **Pregnancy loss**  $\rightarrow$   
 $\downarrow$  Value
- ☑ Same impact as **Sp**

## Heat Detection Rate

- ☑  $\uparrow$  **HDR**  $\rightarrow$   $\downarrow$  Value (32 d CT vs. 39 d P)
- ☑  $\uparrow$  **HDR**  $\rightarrow$   $\uparrow$  Value (25 d CT vs. 32 d U)
- ☑ Second to last influencing value

## Questionable diagnosis

- ☑  $\uparrow$  **Qd**  $\rightarrow$   $\downarrow$  Value
- ☑ Much lower impact than **Se** and **Sp**
- ☑ **Qd** preferable to misdiagnosis

## Cost of chemical test

- ☑  $\uparrow$  Cost **CT**:  $\downarrow$  Value
- ☑ Least impact of all factors



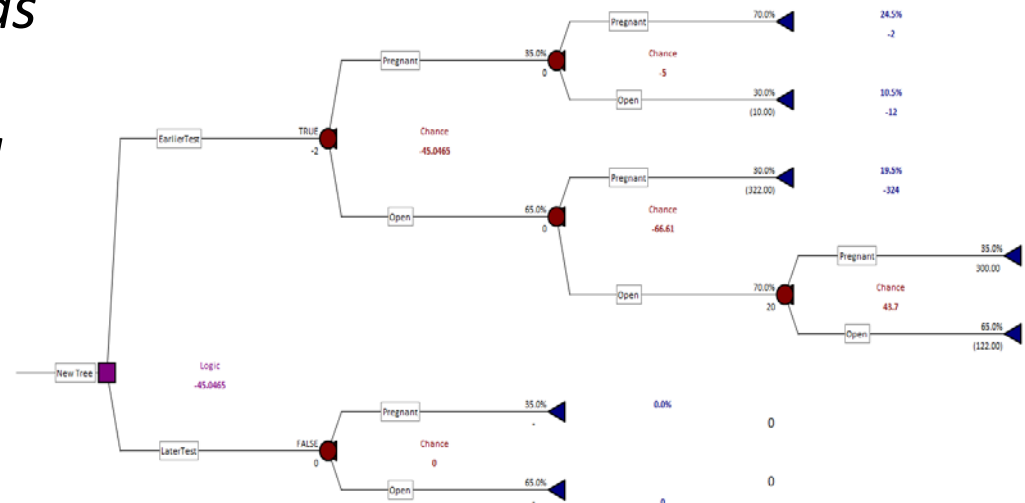
# Some Previous Findings

## Ferguson & Galligan, 2011

- ☒  $Se = 4 \times Sp$
- ☑  $\uparrow HDR \rightarrow \downarrow Value$
- ☑  $+\$0.80 - \$2.04$  (vs. ultrasound)
- ☑  $+\$2.70 - \$0.14$  (vs. palpation)
- ☑ ...Not a strong \$ difference
- ☑ ...**Chemical test** to be used as early as possible, combined with resynchronization, and should have  $\uparrow$  sensitivity

## Galligan et al., 2009

- ☑ **Se** dominated **Sp**
- ☒  $\downarrow CR \rightarrow \uparrow Value$
- ☒ **Day open** value  $\rightarrow \uparrow$  Impact
- ☑  $+\$1.70$
- ☑ ...**Early test valuable option**



# Conclusions

- ☑ The economic value of a early **chemical test** compared with a late **palpation** or **ultrasound** tended to be positive, but negative values were also observed
- ☑ More important than pregnancy testing alone is the **integration** of the test within an efficient reproductive management
- ☑ Involvement of a **veterinarian** in the reproductive management program may provide valuable information beyond a simple pregnancy diagnosis
- ☑ Our analysis approach seems to be a **solid framework** to study early pregnancy tests within reproductive programs as they continue to evolve

# Acknowledgement

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