An Economic Decision-Making Model for Comparing Reproductive Management Programs in Dairy Herds

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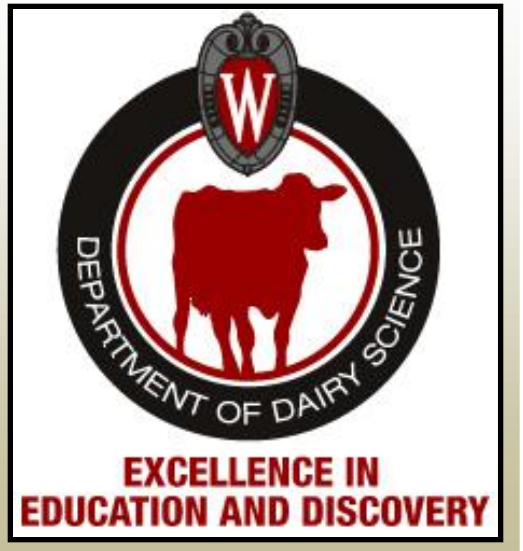

How do I get her pregnant?

Heat Detection

Ovsynch

G-6-G

PREYSNCH-OVSYNCH

- Command : BREDSUM\E

Date	Ht Elig	Heat	Pct	Pg Elig	Preg	Pct	Aborts
9/23/02	74	36	49	74	10	14	1
10/14/02	64	34	53	64	12	19	0
11/04/02	58	40			15	27	3
11/25/02					10	19	3
12/16/02					10	20	2
1/06/03					8	18	0
1/27/03					6	13	0
2/17/03					8	13	2
3/10/03					13	19	0
3/31/03					9	15	0
4/21/03					9	16	3
5/12/03					7	12	1
6/02/03					11	19	1
6/23/03					12	18	3
7/14/03					7	12	0
8/04/03				68	6	9	2
8/25/03	6		43	0	0	0	0
9/15/03	65	44	68	0	0	0	0
Total	952	499	52	940	153	16	21

Labor

Vet Check

Semen

Hormones

MILK

Beef

Calves

Cost

Revenue

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Goal

Create a tool that allows "economic based" decision making for selection of reproductive management programs in dairy farms

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Net Present Value

- Difference between the present value of cash inflows and the present value of cash outflows for different survival curves

$$NPV_{r,DIM} = DEMV(P)_{DIM} + DEMV(NP)_{DIM}$$

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Discounted Expected Monetary Value

$$DEMV(P)_{DIM} = \sum \delta\,(P)_s(EMV(P)_s - CS_s)$$

where:

δ= daily discount rate

s = reproductive service

S = number of reproductive services within defined DIM

EMV(P) = expected monetary value for cows becoming pregnant

CS = Cost of reproductive service

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Breeding Cost

$$CS_{s,r} = HOR + LAB + AI + PD$$

where:

CS = total breeding cost

HOR = hormones required for synchronization ($/service)

LAB = labor required to administer hormones injections ($/cow/day)

AI = cost of insemination (includes semen and labor; $/service)

PD = pregnancy diagnosis ($/cow/service)

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Discounted Expected Monetary Value

$$DEMV(NP)_{DIM} = \delta(NP_s)[EMV(NP_s)+(SV+MVC–HRV)/(DIM)]$$

where:

δ= daily discount rate

EMV(NP) = expected monetary value for cows not becoming pregnant

SV = salvage value of a cow

MVC = market value of a calf (weighted average of male and female offspring)

HRV = heifer replacement value

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Expected Monetary Value

$$EMV(P)_s = (MPV(P)+VNB-CFM(P)-CFD-CC(P)-CD(P))_s$$

$$EMV(NP)_s = (MPV(NP)-CFM(NP)-CC(NP)-CD(NP))_s$$

where:

MPV = milk production value ($/d)

VNB = value of a new born of pregnant cow ($/d)

CFM = cost of feed for milking cows ($/d)

CFD = cost of feed for dry cows ($/d)

CC = cost associated with involuntary culling ($/d)

CD = cost associated with unexpected death ($/d)

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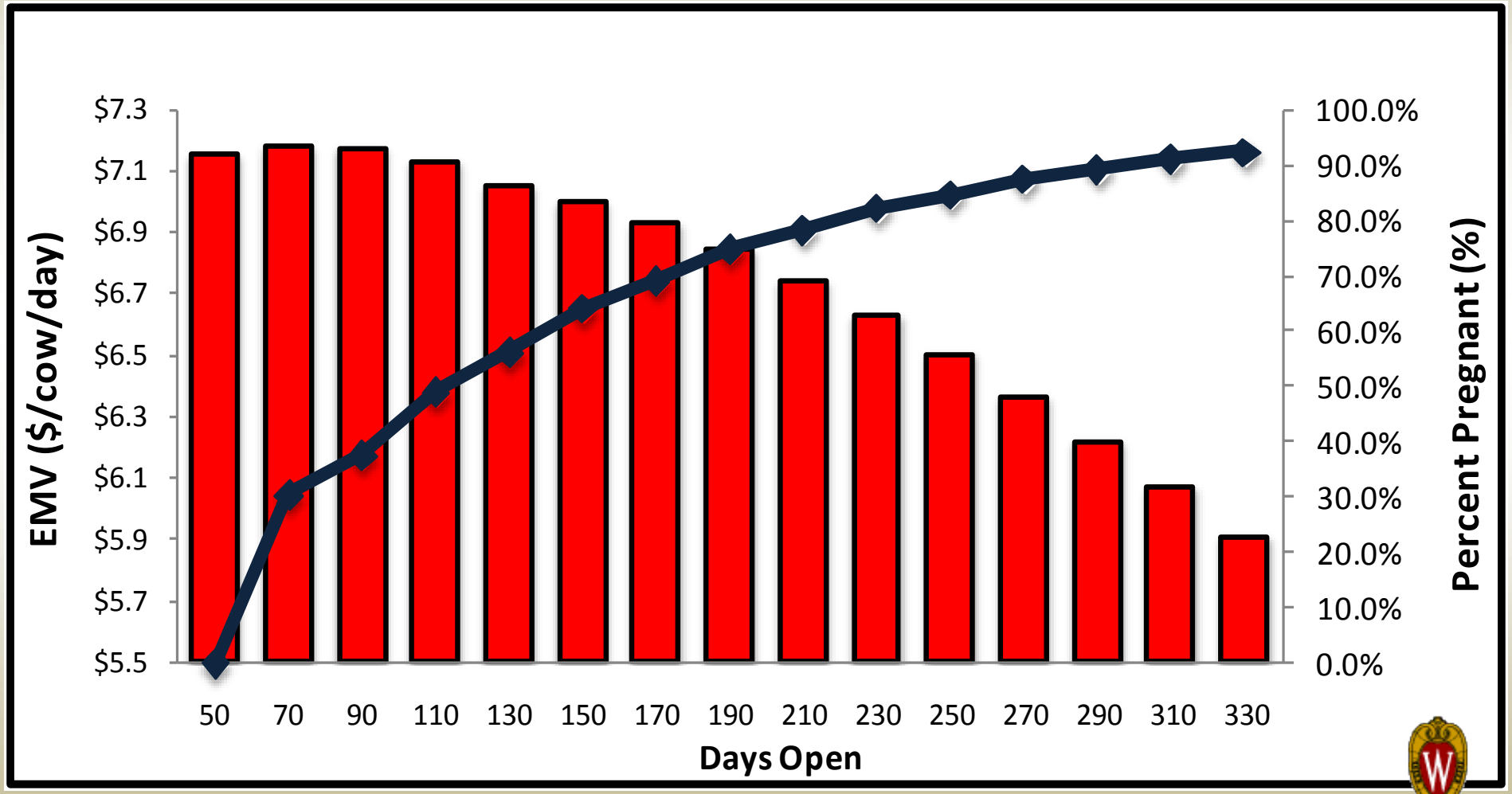
Expected Monetary Value Pregnant Cows



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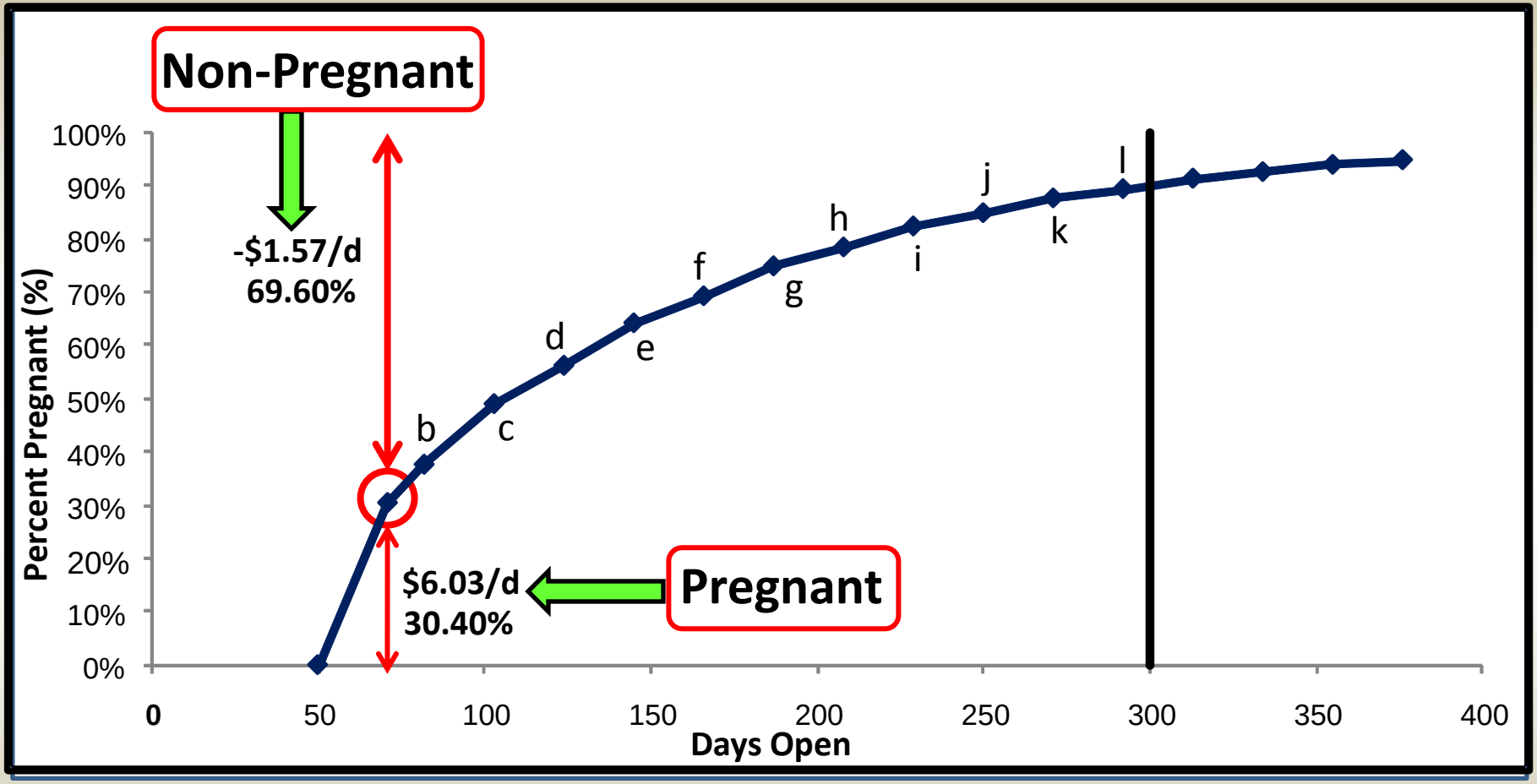
NPV for Repro Program



Expected Monetary Value (a + b + c…) + **Expected Monetary Value (repro culls)**

Pregnant **Non-Pregnant**

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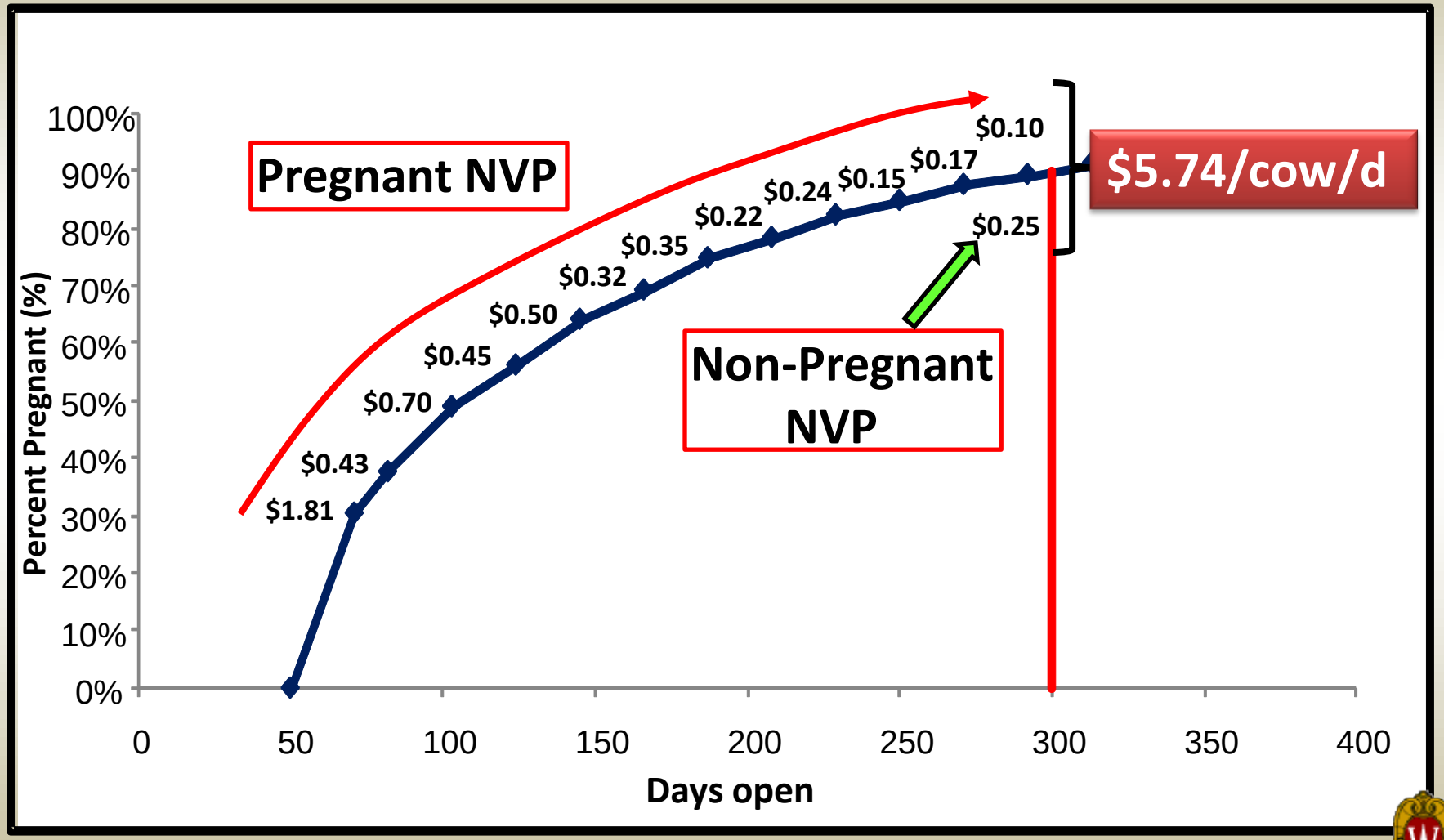
NPV for Repro Program



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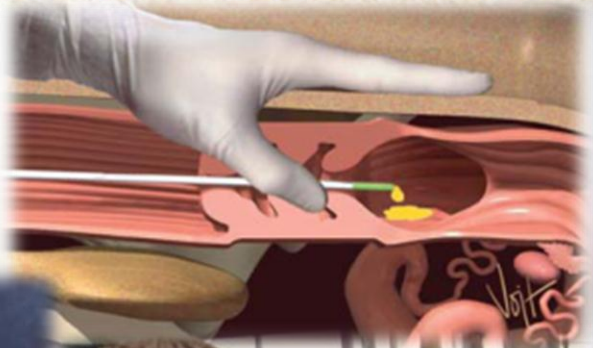
Data Inputs



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General Productive and Economic Parameters

Productive Parameters

- Lactating cows #
- RHA
- Lactation curves
- Involuntary Culling Rate
- Mortality Rate
- Stillbirth Rate

Economic Parameters

- Milk Price
- Cost Feed Lactating
- Dry Period Fixed Cost
- Value New Born
- Replacement Heifer
- Salvage Value
- Interest Rate

Reproduction Related Costs

- Heat Detection
- Artificial Insemination
- Pregnancy Diagnosis
- Hormones
- Labor for injections

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Reproductive Program Selection

	Current	Start day	Desired	Start day
1st Service Postpartum	Presynch-Ovsynch14	Tue	Ovsynch	Mon
2nd + Services	Ovsynch	Tue	Ovsynch	Mon

1st Service

- Presynch-Ovsynch
- G-6-G
- Double-Ovsynch
- Heat Breeding

2nd Plus Services

- Ovsynch
- Heat Breeding
- G-6-G
- Select Synch

➢ 100% Heat Breeding program used as baseline

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Reproductive Parameters

General

	Current	Desired	100% HD
Estrous Cycle Duration		21 d	
Calving Interval		13.4 mo	
Dry Period Length		65 d	
Maximum DIM for Breeding		300 d	

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Reproductive Parameters

Program Specific

	Current	Desired	100% HD
Voluntary Waiting Period	50 d	80 d	50 d
DIM to 1st TAI	80 d	80 d	
Interbreeding interval	42 d	35 d	

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Reproductive Parameters

Program Specific

	Current	Desired	100% HD
Voluntary Waiting Period	50 d	80 d	50 d
DIM to 1st TAI	80 d	80 d	
Interbreeding interval	42 d	35 d	
Heat Bred before 1st TAI	60%	0%	55%
CR Heat Bred before 1st TAI	33%	0%	33%
Heat Bred after 1st TAI	40%	0%	55%
CR Heat Bred after 1st TAI	28%	0%	30%

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Reproductive Parameters

Program Specific

	Current	Desired	100% HD
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Heat Bred after 1st TAI	40%	0%	55%
CR Heat Bred after 1st TAI	28%	0%	30%
CR 1st service TAI	38%	42%	
CR 2nd + Services TAI	30%	33%	

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Results

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Breeding Costs

	Current	Desired	100% HD
1st Service Postpartum	Presynch-Ovs	Ovsynch	Heat Breeding
2nd + Services	Ovsynch	Ovsynch	Heat Breeding
Cost 1st Service Breeding	$41.0	$32.3	
Cost Resynch Breeding	$35.6	$32.3	
Cost Heat Breeding	$27.8	$23.9	$27.8
Preg. Diagnosis Method	Palpation	Ultrasound	Palpation
Pregnancy Diagnosis Cost	$6.5	$8.9	$6.0

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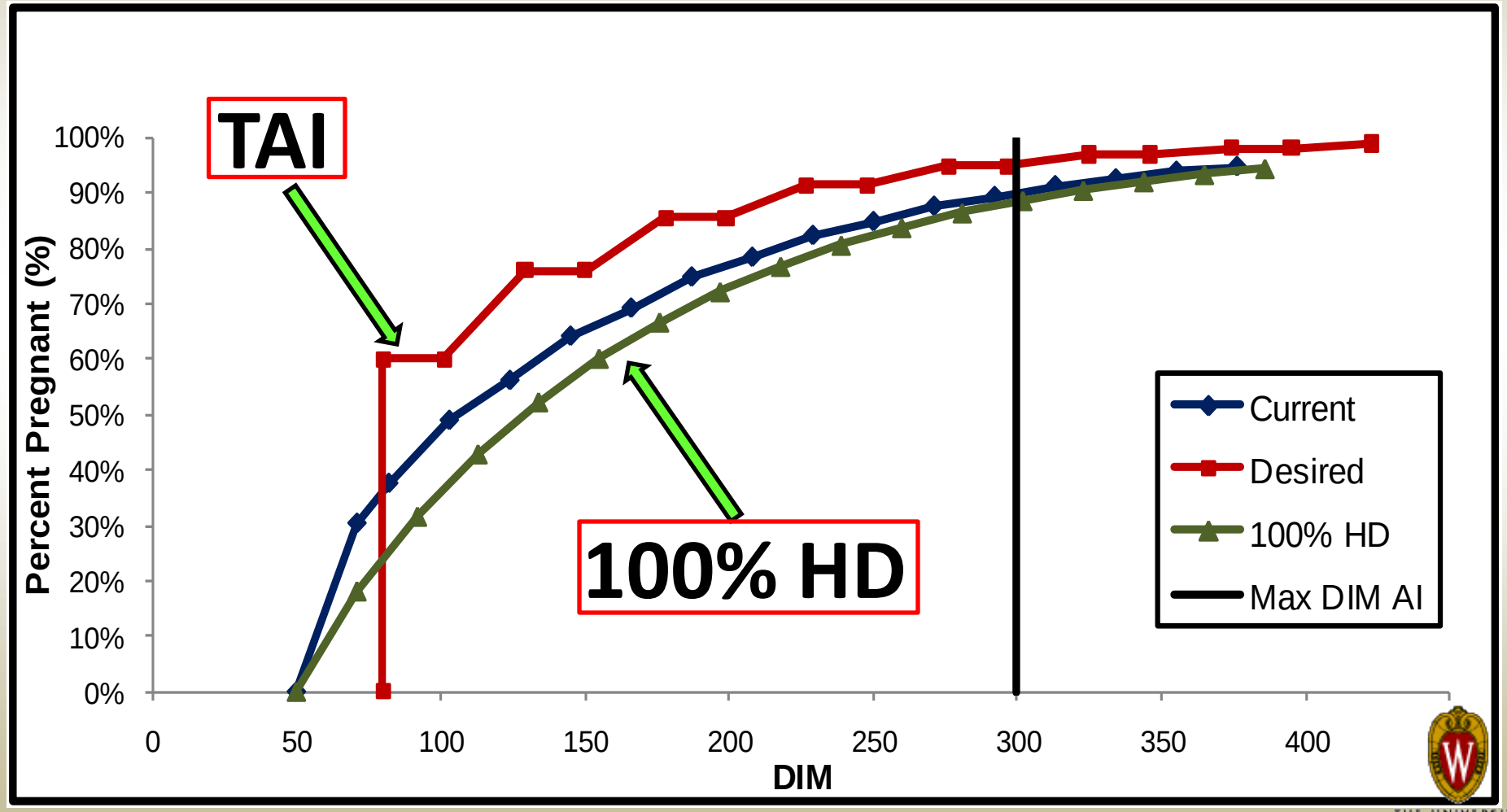
Reproductive Performance
Survival curve



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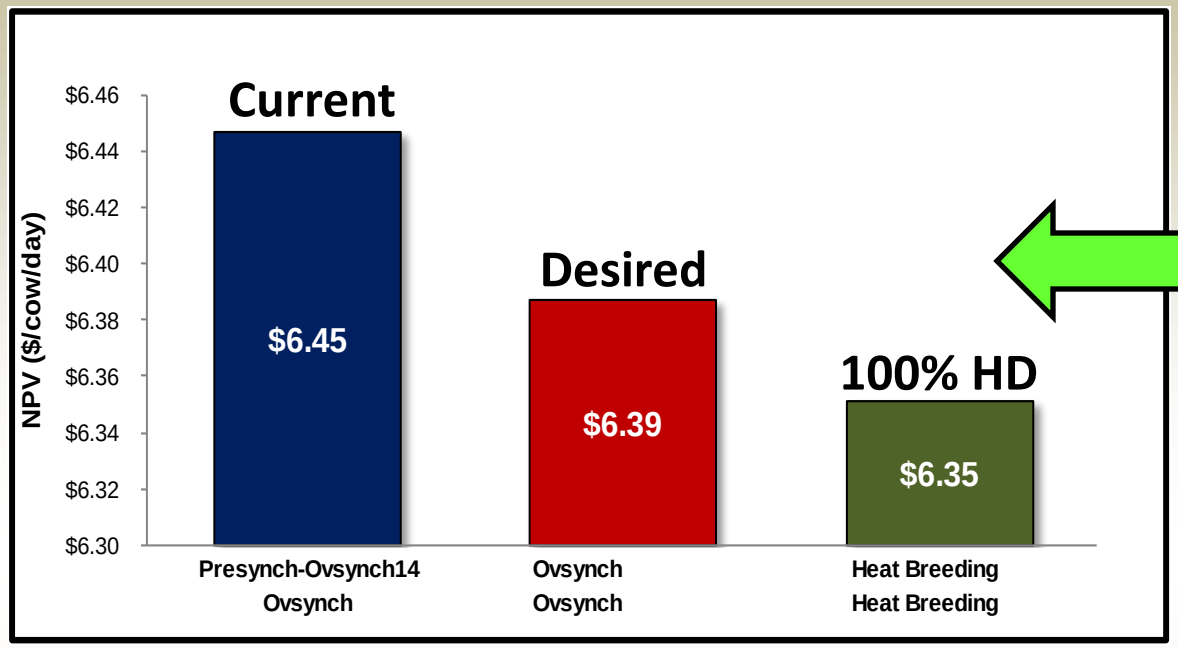
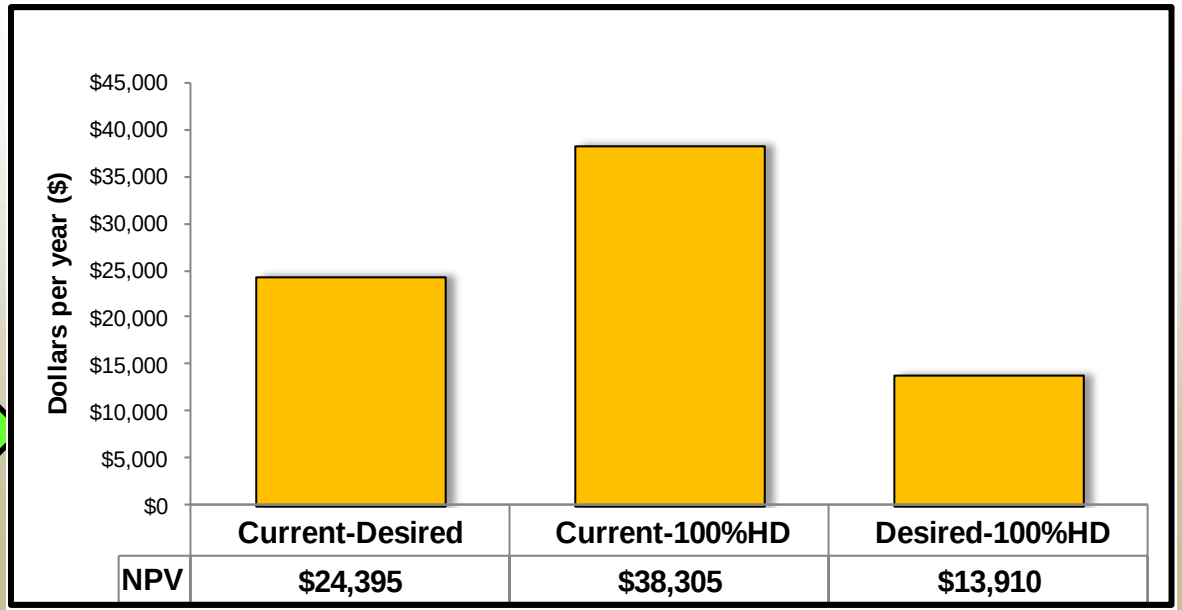
Economical Outcomes



Profit differences (NPV)
"per cow per year "

Profit differences (NPV)
"per herd per year "



Conclusions

- Intended to compare different reproductive programs within the same farm
- NPV differences between programs and not absolute value are of importance
- Great flexibility to accommodate numerous reproductive programs and productive scenarios

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Final Remarks

- Breeding costs become trivial compared with revenues realized with pregnancy
- Reproductive performance has a strong influence on final results

Limitations

- All calculations for one lactation only
- Model does not account for pregnancy losses
- Assumes all heat breedings occur every 21 days

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Questions ?

Reproductive Economic Analysis

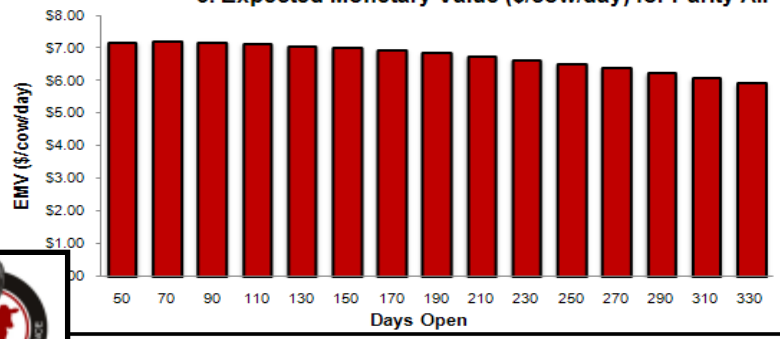
1. Productive and Economic Parameters Summary

Lacating Cows in Parity All	(#)	1000
Rolling Herd Average	(lb/cow/y)	25000
Milk Price	($/cwt)	15.00
Average Value New Born	($)	175
Heifer Replacement Value	($)	1,600
Salvage Value	($)	450

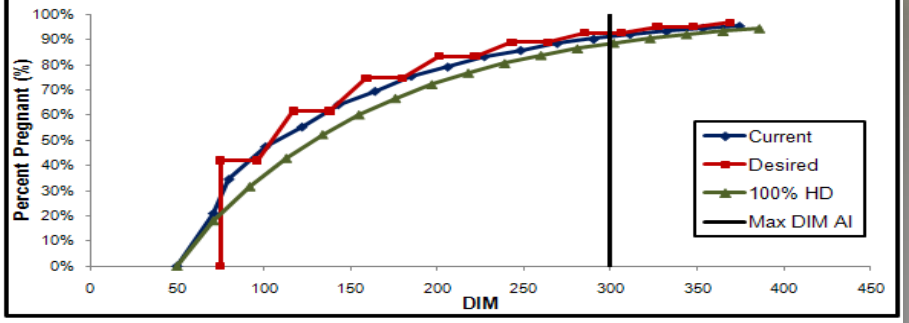
2. Reproductive Programs Summary

	Current	Desired	Baseline
1st Service Postpartum	Ovsynch	Presynch-Ovsynch-12	Heat Breeding
2nd and Following Services	Ovsynch	Ovsynch	Heat Breeding
Voluntary Waiting Period	50d	75d	50d
Maximum DIM for Breeding		300d	
DIM 1st TAI	80d	75d	
Interbreeding Interval	42d	42d	21d
Heat Bred Before 1st TAI	60%	0%	55%
CR Heat Bred Before 1st TAI	0%	0%	33%
Heat Bred After 1st TAI	60%	0%	55%
CR Heat Bred After 1st TAI	33%	0%	30%
CR 1st Service TAI	34%	42%	
CR 2nd+ Services TAI	30%	34%	
Cost 1st Service Breeding	$30.62	$37.09	
Cost Resynch Breedings	$30.62	$31.09	
Cost Heat Breedings	$23.89	$23.89	$27.80
Pregnancy Diagnosis Method	Palpation	Palpation	Palpation
Pregnancy Diagnosis Cost	$8.89	$8.89	$12.80

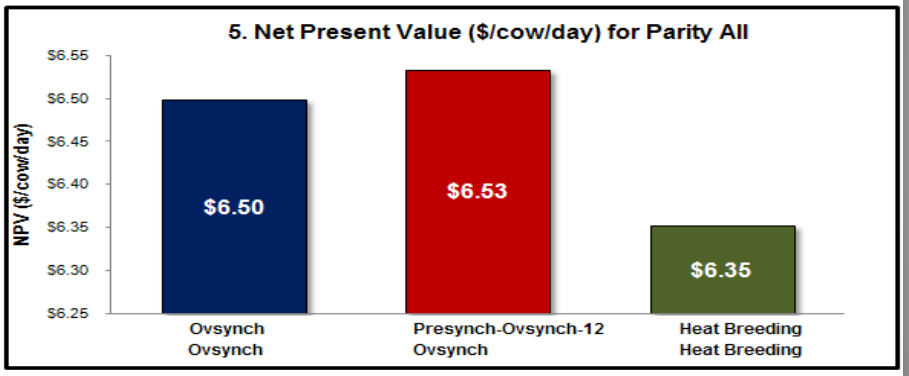
3. Expected Monetary Value ($/cow/day) for Parity All



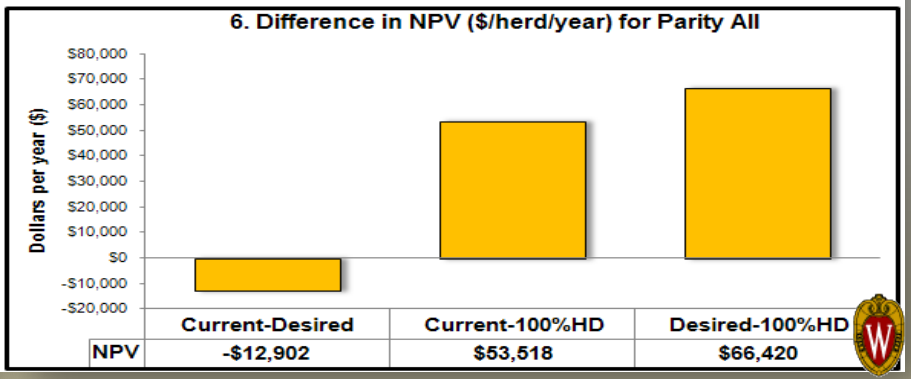
4. Survival Curves for Pregnancy for Parity All



5. Net Present Value ($/cow/day) for Parity All



6. Difference in NPV ($/herd/year) for Parity All



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