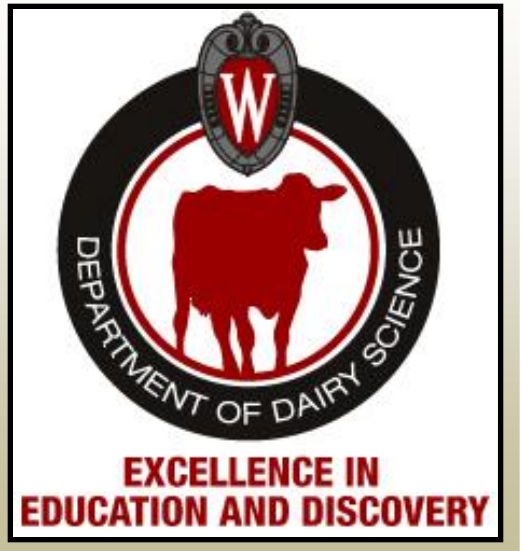
An Economic Decision-Making Model for Comparing Reproductive Management Programs in Dairy Herds

J. O. Giordano, P. M. Fricke,

M. C. Wiltbank, and V. E. Cabrera

Department of Dairy Science

University of Wisconsin-Madison



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

Goal

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

Net Present Value

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

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

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

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)

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

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)

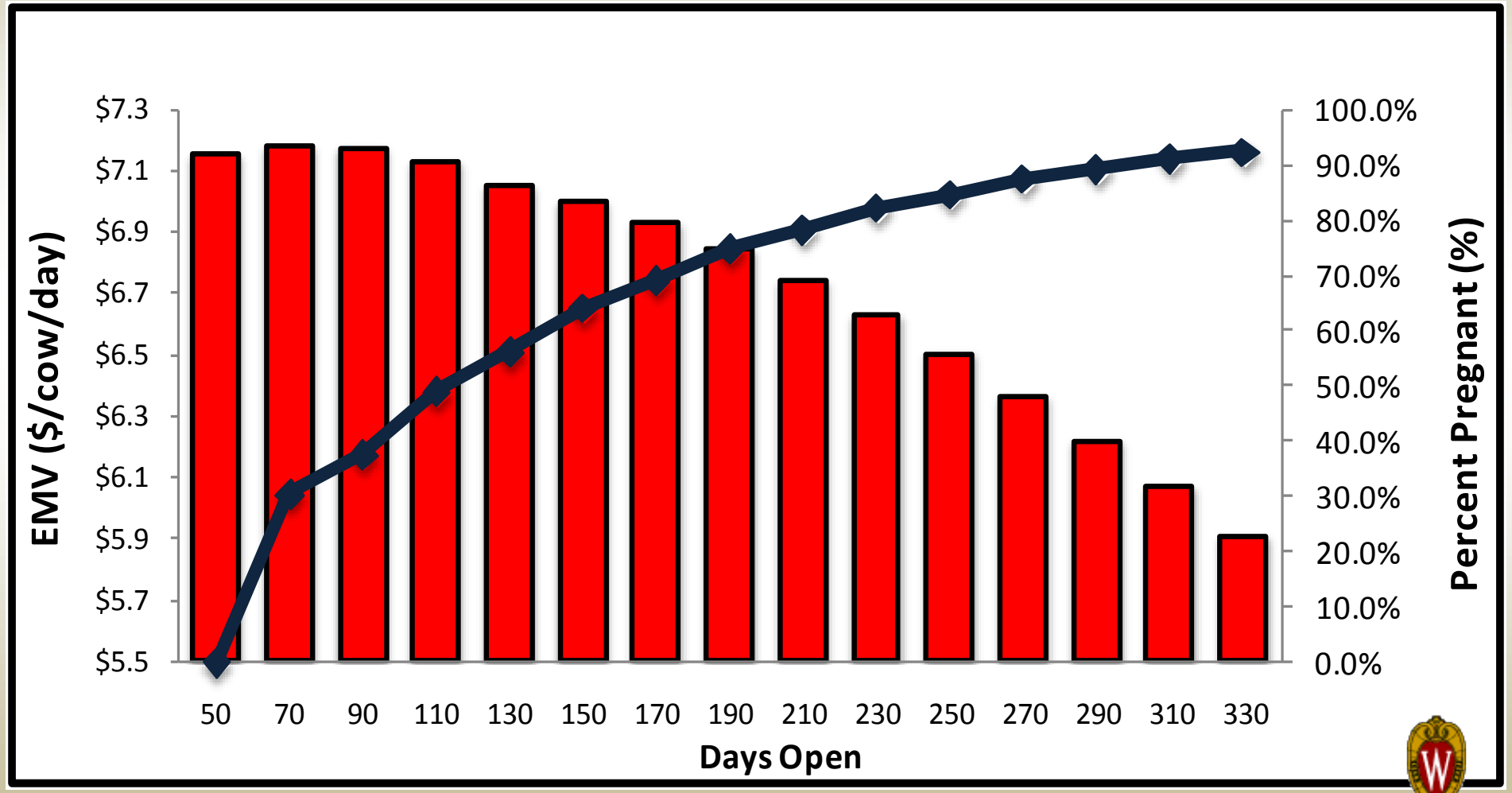
CFM = cost of feed for milking cows ($/d)

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

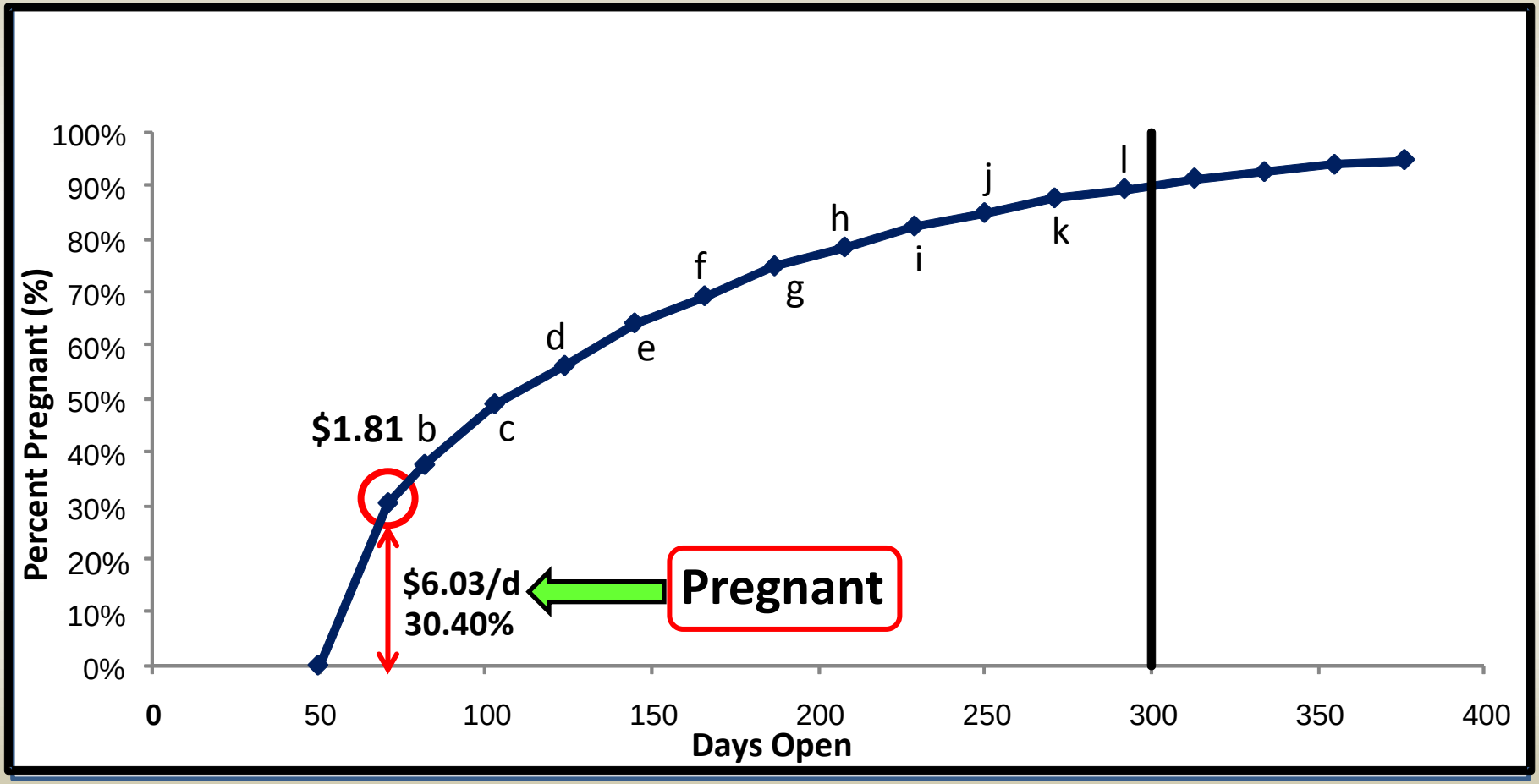
CC = cost associated with involuntary culling ($/d)

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

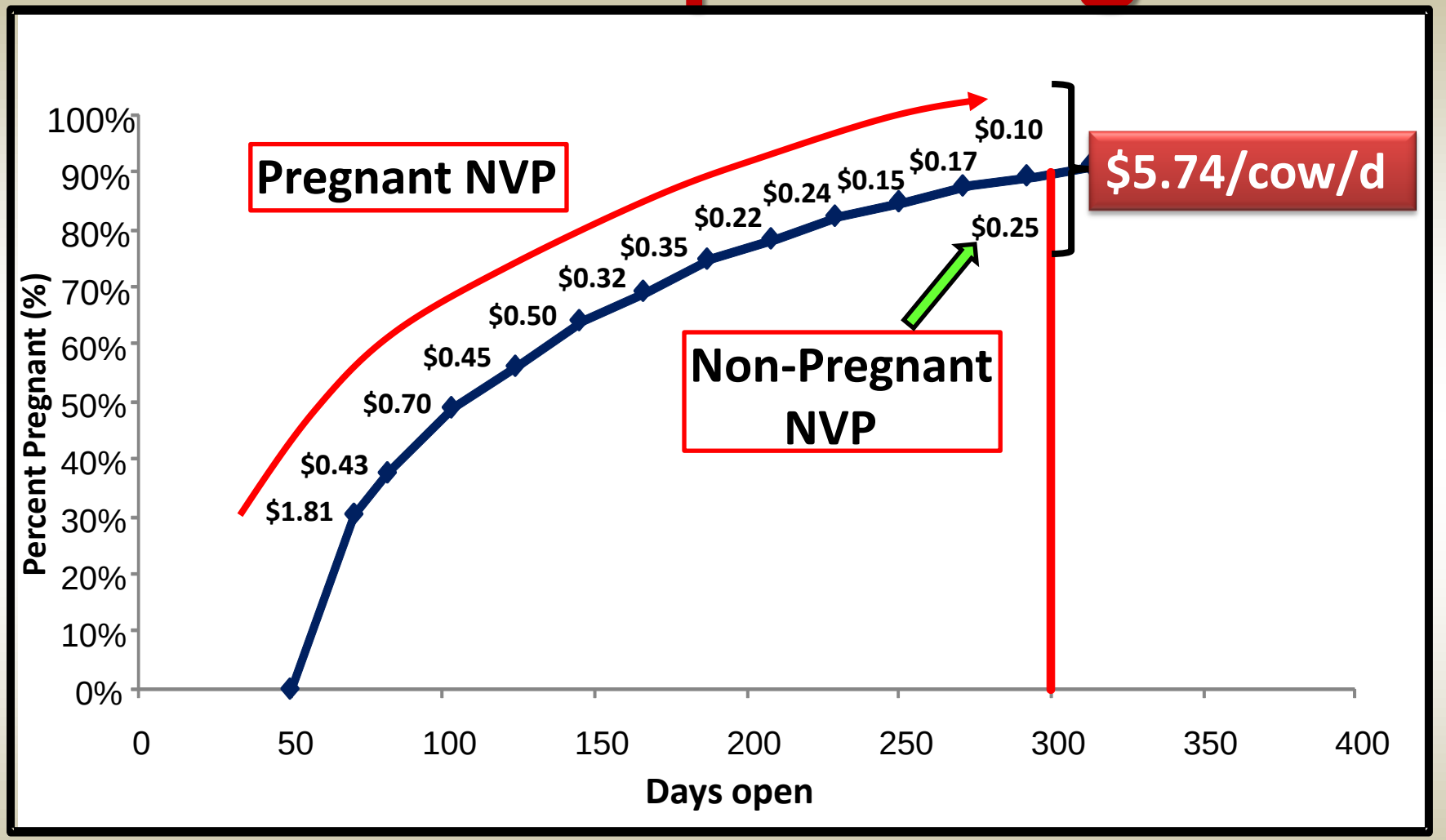
Expected Monetary Value Pregnant Cows



NPV for Repro Program

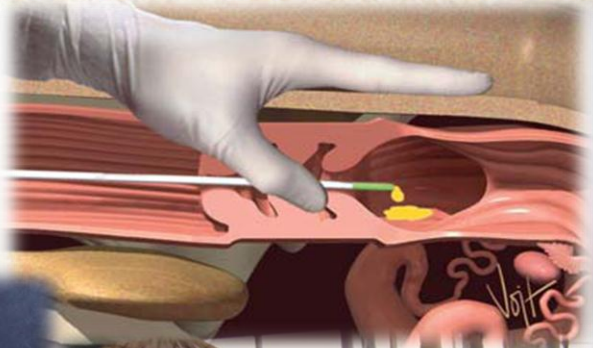


NPV for Repro Program



NPV = **EMV (a + b + c…)** **Pregnant** **+** **EMV (repro culls)** **Non-Pregnant**

Data Inputs Case Study



THE UNIVERSITY of WISCONSIN MADISON

General Productive and Economic Parameters

1. Productive Parameters		
Lactating Cows	(#)	960
Rolling Herd Average (RHA)	(lb/cow/y)	29000
Involuntary Culling Rate	(%/y)	14.3%
Mortality Rate	(%/y)	8.00%
Stillbirth Rate	(%)	9.4%

2. Lactation Curves		Lact. 1	Lact. 2	Lact. > 2
Cow Number		363	244	353
Body Weight (lb/cow)		1,350	1,400	1,450
Test	DIM ☑	Define Lactation Curves Below		
1	15	77	105	107
2	45	91	120	126
3	75	94	120	128
4	105	94	116	125
5	135	93	112	120
6	165	91	107	112
7	195	89	98	104
8	225	87	91	94
9	255	83	82	86
10	285	79	75	81
11	315	76	68	71
12	345	72	61	61
13	375	70	57	60
14	405	60	53	55
17	495	56	45	40
18	525	57	45	55
19	555	54	29	2

General Productive and Economic Parameters

3. Economic Parameters ☐ Check if total breeding costs are known

Milk Price	($/cwt)	16.00
Cost Feed Lactating (DM)	($/lb)	0.10
Dry Period Fixed Cost	($/d)	2.20
Female Calf Value	($/calf)	300
Male Calf value	($/calf)	75
Heifer Replacement Value	($/heifer)	1,600
Salvage Value	($/cow)	780
Labor Cost for Injection	($/hr)	15.00
Heat Detection Cost	($/hr)	15.00
Artificial Insemination Cost	($/cow)	17.00
Interest Rate	(%/y)	6.5%

THE UNIVERSITY of WISCONSIN MADISON

Reproductive Program Selection

5.a. Reproductive Program

	Current	Start day	Alternative	Start day
1st Service Postpartum	Double-Ovsynch	Sat	Double-Ovsynch	Sat
2nd and Subsequent Services	Resynch-39	Tue	Resynch-25	Tue
Resynch before preg check	NO		YES	

5.b. Reproductive Program Parameters

		Current	Alternative	100% HD
Voluntary Waiting Period	(d)	85	85	50
Estrus Cycle Duration	(d)	22		
Maximum DIM for Breeding		330		
DIM to 1st TAI	(d)	85	85	
Interbreeding Interval	(d)	49	35	
Heat Bred Before 1st TAI	(%)	0%	0%	55%
CR Heat Bred Before 1st TAI	(%)	0%	0%	33%
Heat Bred After 1st TAI	(%)	0%	0%	55%
CR Heat Bred After 1st TAI	(%)	0%	0%	30%
CR 1st Service TAI	(%)	47%	47%	
CR 2nd+ Services TAI	(%)	32%	29%	
Calving Interval	(mo)	14.1		
Dry Period	(d)	62		

- **100% Heat Breeding program used as baseline**

THE UNIVERSITY of WISCONSIN MADISON

Hormone Injections and Heat Detection Labor Cost

5.c. Hormones Cost

Hormone	Brand	Vial Cost	Doses Vial
GnRH	Fertagyl	19	10
PGF	Lutalyse	40	20
CIDR			
hCG	Chorulon	17.4	5

5.d. Injections and Pregnancy Diagnosis Labor Cost: *Current Program*

		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Inject.	Laborers		3		1		2	
	hr/d		3		1.5		1	
	Cows Treated		120		45		20	
Preg.	# Cows		45		0		0	
Diag.	hr/d		2.75		0		0	

5.e. Injections and Pregnancy Diagnosis Labor Cost: *Alternative Program*

		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Inject.	Laborers		3		1		2	
	hr/d		3.5		1.5		1	
	Cows Treated		165		45		20	
Preg.	# Cows		45		0		0	
Diag.	hr/d		2.75		0		0	

5.f. Heat Detection Labor Cost

		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Heat	Laborers	1	1	1	1	1	1	1
Detect.	hr/d	3	3	3	3	3	3	3
Preg.	# Cows	30	0	0	0	0	0	0
Diag.	hr/d	2	0	0	0	0	0	0

Show Results for Parity All **Run ANALYSIS**

THE UNIVERSITY of WISCONSIN MADISON

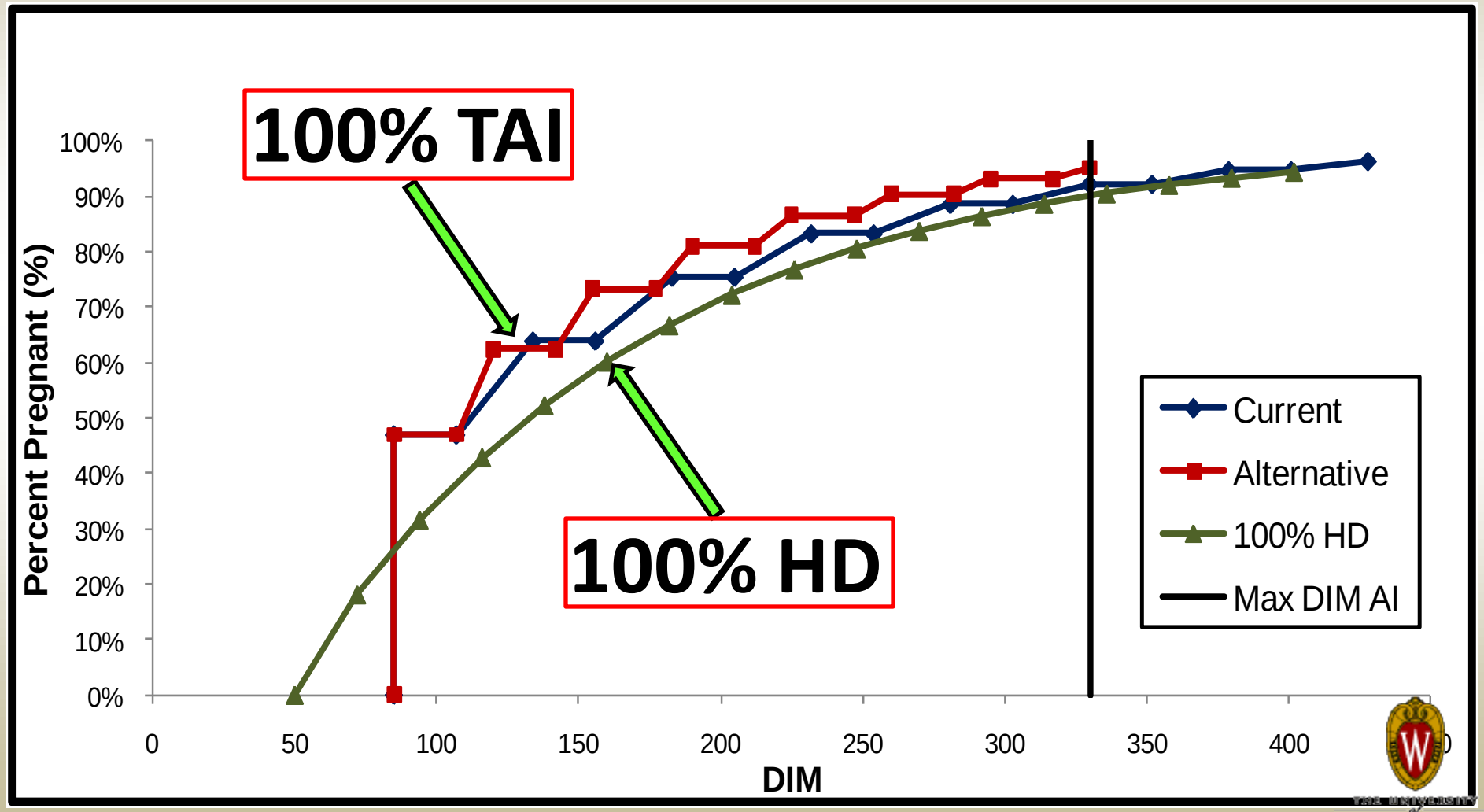
Results

THE UNIVERSITY of WISCONSIN MADISON

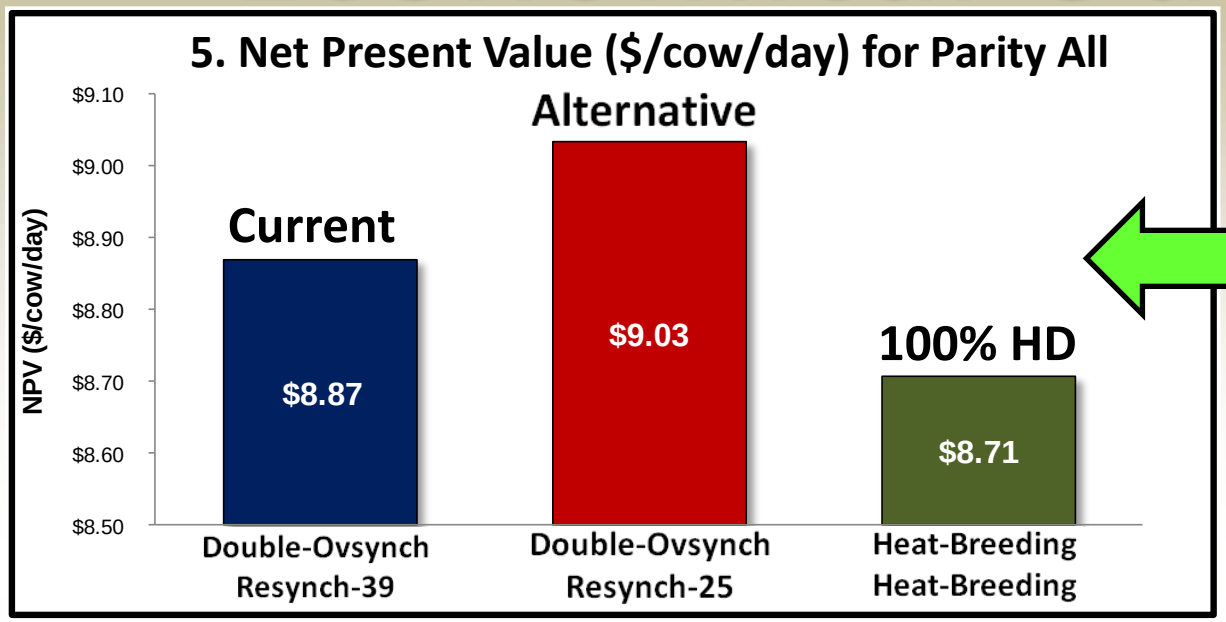
Breeding Costs

2. Reproductive Programs Summary	Current	Alternative	Baseline
1st Service Postpartum	Double-Ovsynch	Double-Ovsynch	Heat Breeding
2nd and Following Services	Ovsynch	Ovsynch	Heat Breeding
Cost 1st Service Breeding	$40.98	$42.30	
Cost Resynch Breedings	$31.05	$32.54	
Cost Heat Breedings	$22.56	$24.33	$23.00
Pregnancy Diagnosis Method	Palpation	Ultrasound	Palpation
Pregnancy Diagnosis Cost	$5.50	$7.33	$6.00

Reproductive Performance Survival Curve

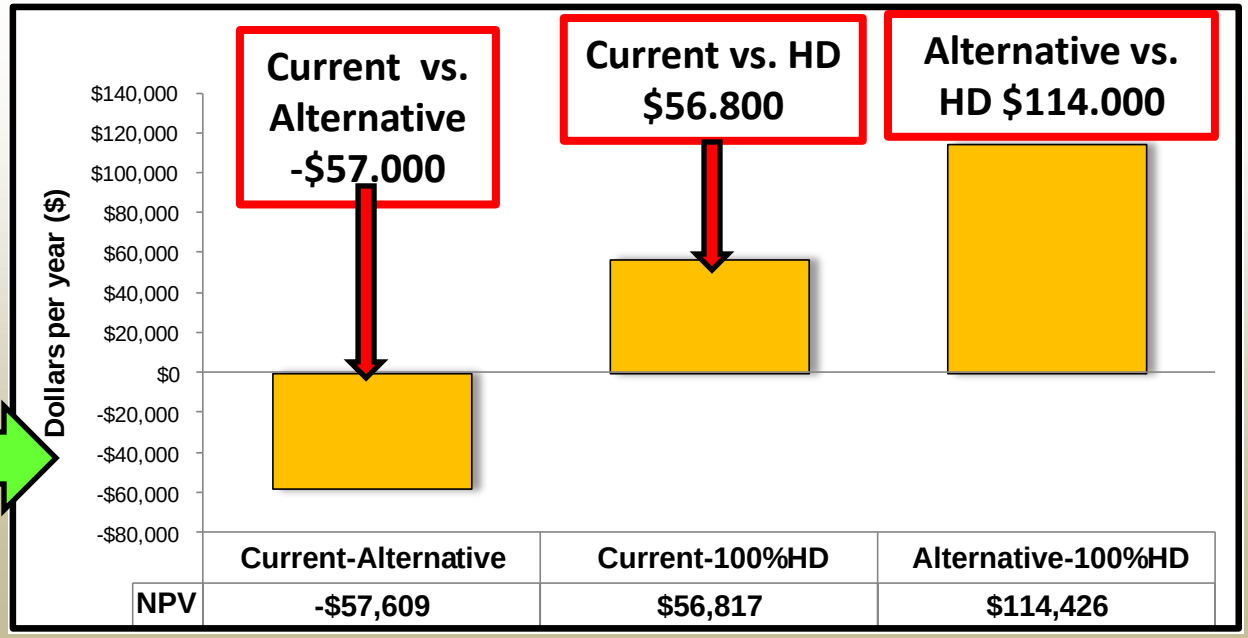


Economical Outcomes



Profit differences (NPV)
"per cow per day "

Profit differences (NPV)
"per herd per year "



Conclusions

- Intended to compare different reproductive programs within the same farm
- Evaluate NPV differences between programs rather than absolute values
- Great flexibility to accommodate numerous reproductive programs and productive scenarios

Final Remarks

- Breeding costs become trivial when compared to revenues realized by generating pregnancies
- Reproductive efficiency is the biggest driver of the economic outcome in the model

Limitations

- All calculations are based on a single lactation
- Model does not account for pregnancy losses
- Assumes all breedings to estrus occur at a fixed interval

Questions ?

On the web: http://dairymgt.uwex.edu/tools.php#1

DEPARTMENT OF DAIRY SCIENCE
EXCELLENCE IN EDUCATION AND DISCOVERY

THE UNIVERSITY of WISCONSIN MADISON