Economic Evaluation of Reproductive Programs

Victor E. Cabrera and Julio Giordano

Objectives

- Assess the value of reproductive programs

- Develop a user-friendly decision support tool

- Demonstrate the UW-DairyRepro$ tool

The Value of a Repro Program
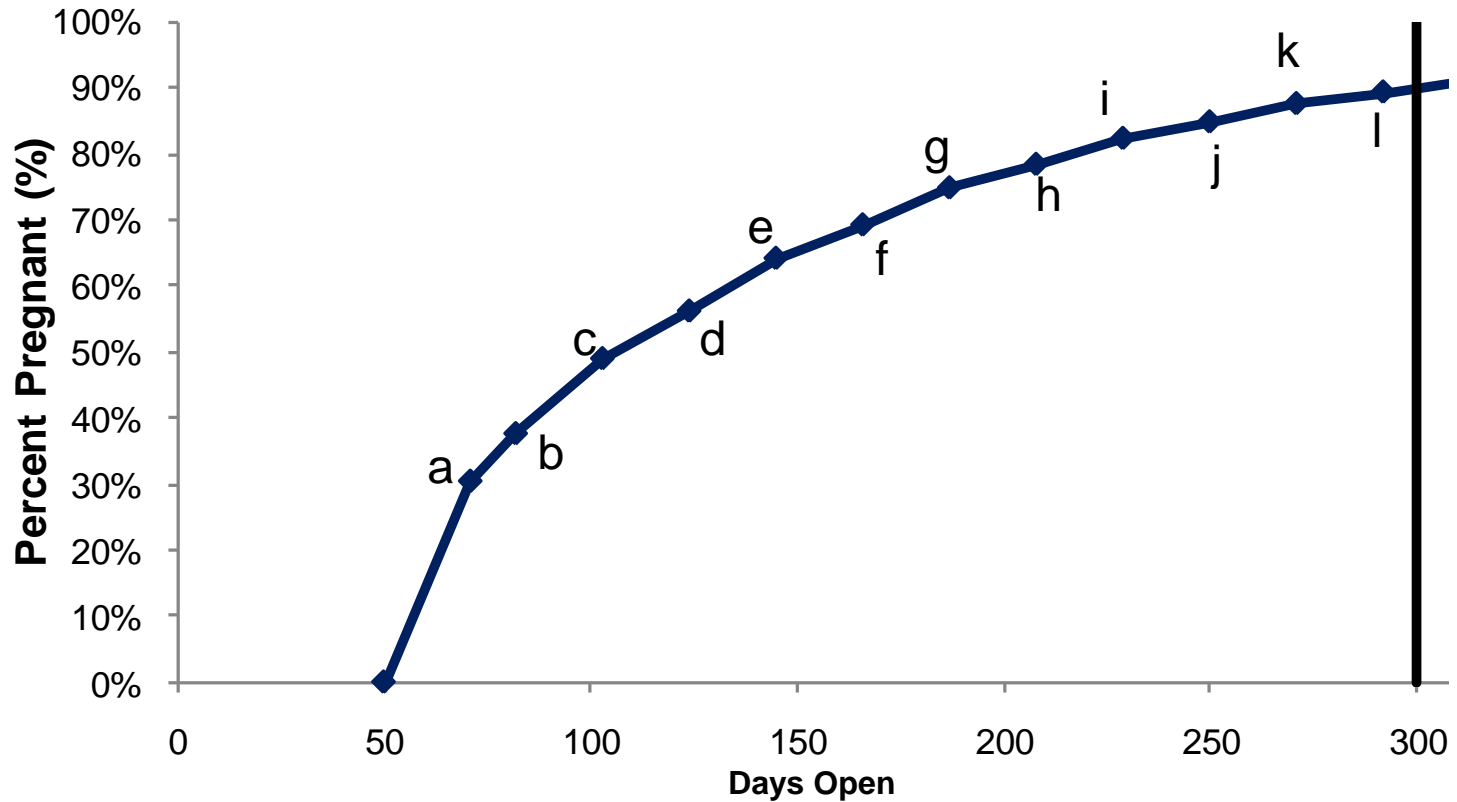
Expected Monetary Value (a, b, c, …) (PREGNANT) + Expected Monetary Value (NON–PREGNANT)

Revenues of Pregnant

Milk
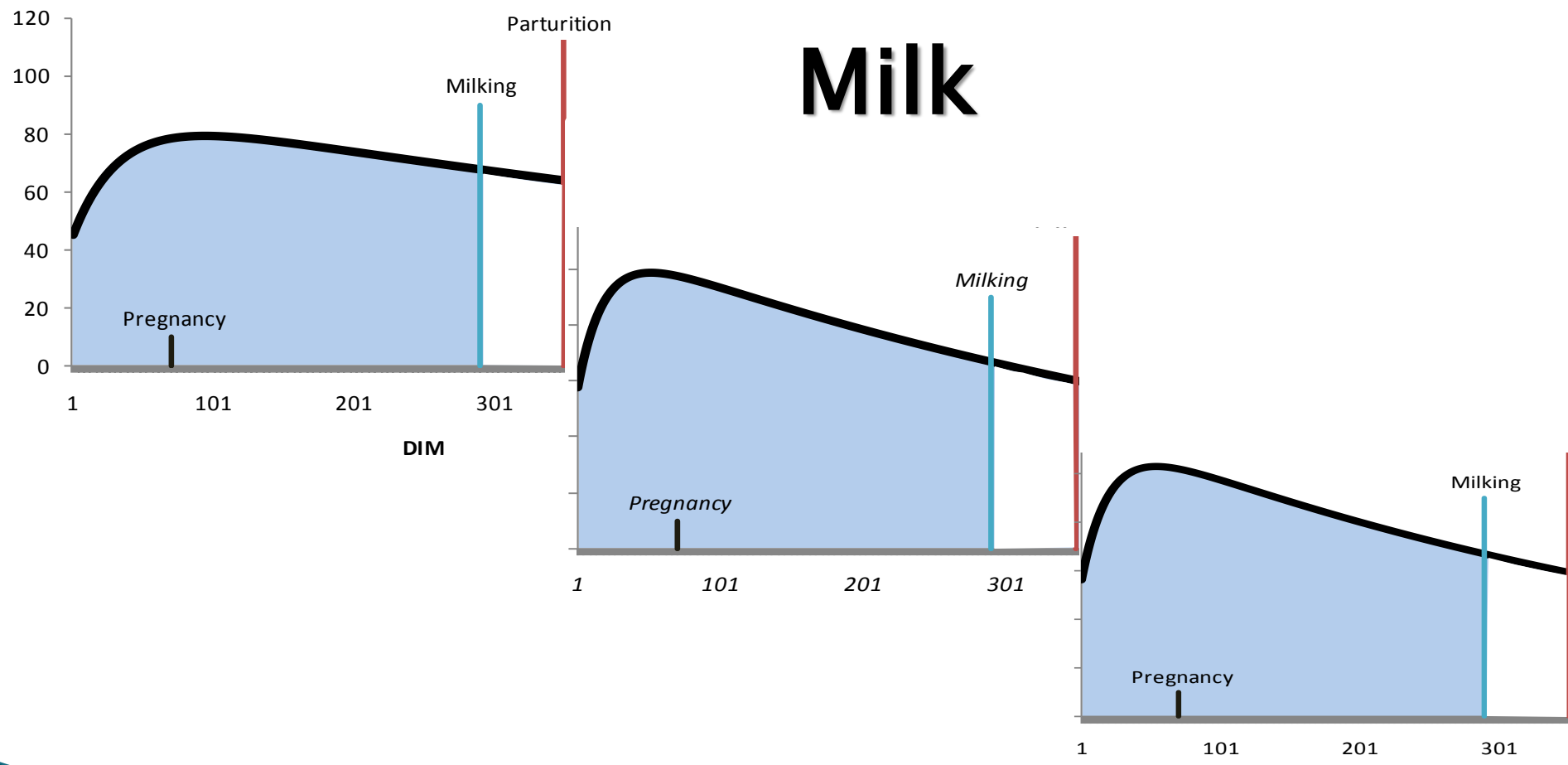
Revenues of Pregnant

➢Value of a new born

➢Value of salvage (involuntary culling)

Expenses of Pregnant

➤ **Repro Costs**

➤ Labor
➤ Pregnancy diagnosis
➤ Semen dose
➤ Hormones

Expenses of Pregnant

➤ Feed for milking period
   ➤ Follows lactation curve

➤ Feed for dry period

➤ Involuntary culling and death

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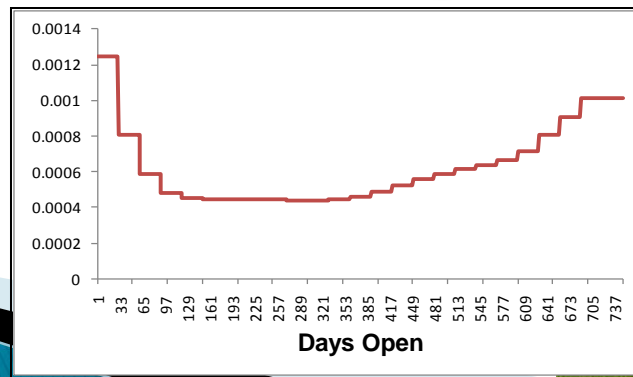
Revenues of Non-Pregnant

➢ **All revenues of pregnant except:**
  - ➢ Value of a new born

Expeneses of Non-Pregnant

➤ **All expenses of pregnant plus:**
  ➤ Cost of replacement
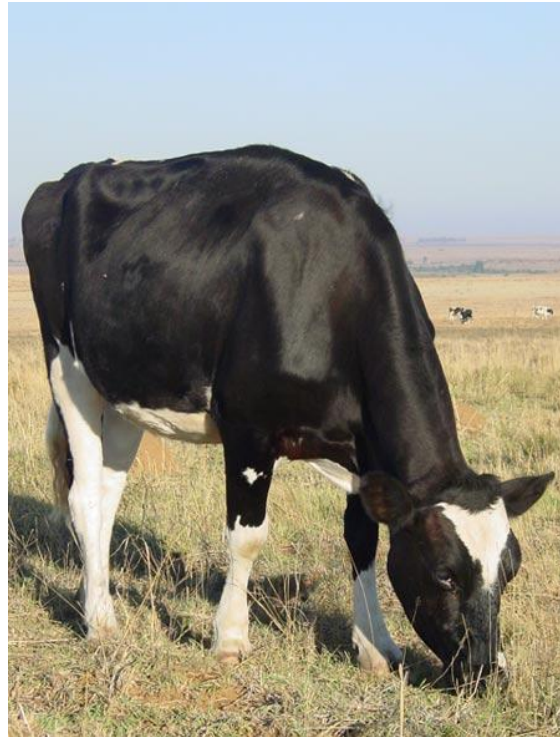
Net Present Value (NPV)

➤ **Discounted Economic Monetary Value (DEMV) of a reproductive program <u>survival curve</u>**

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

r = Reproductive Program   DO = days open

P = pregnant   NP = non-pregnant

Expected Monetary Value

Net Present Value

Expected Monetary Value (a, b, c, …) (PREGNANT) + Expected Monetary Value (NON-PREGNANT)

Net Present Value

Pregnant NPV

Non-Pregnant NPV

$5.74/cow/d

The Value of a Repro Program

Chart showing Percent Pregnant (%) vs Days Open. Red line labeled $5.85/cow/d and blue line labeled $5.74/cow/d.

Reproductive Economic Analysis
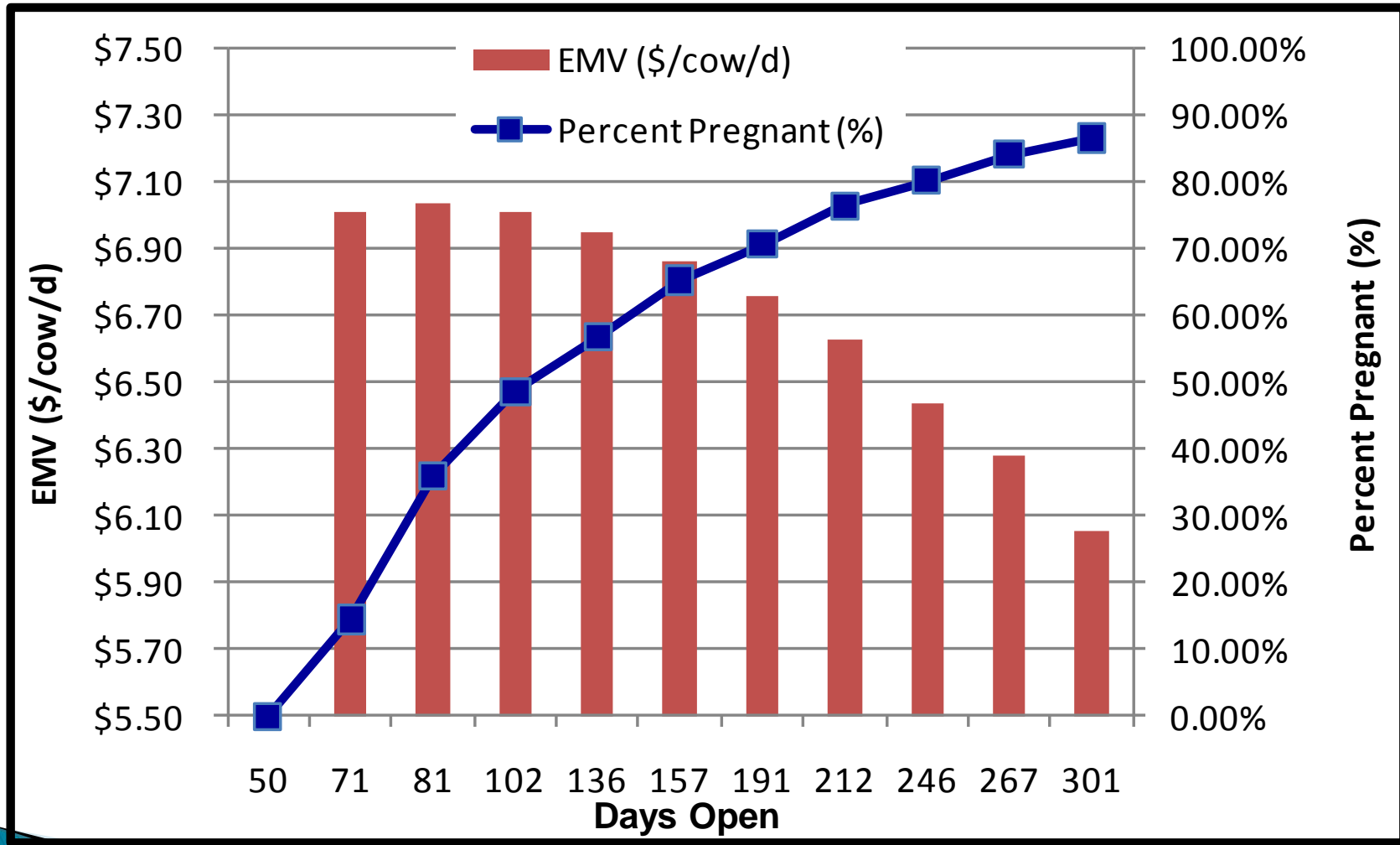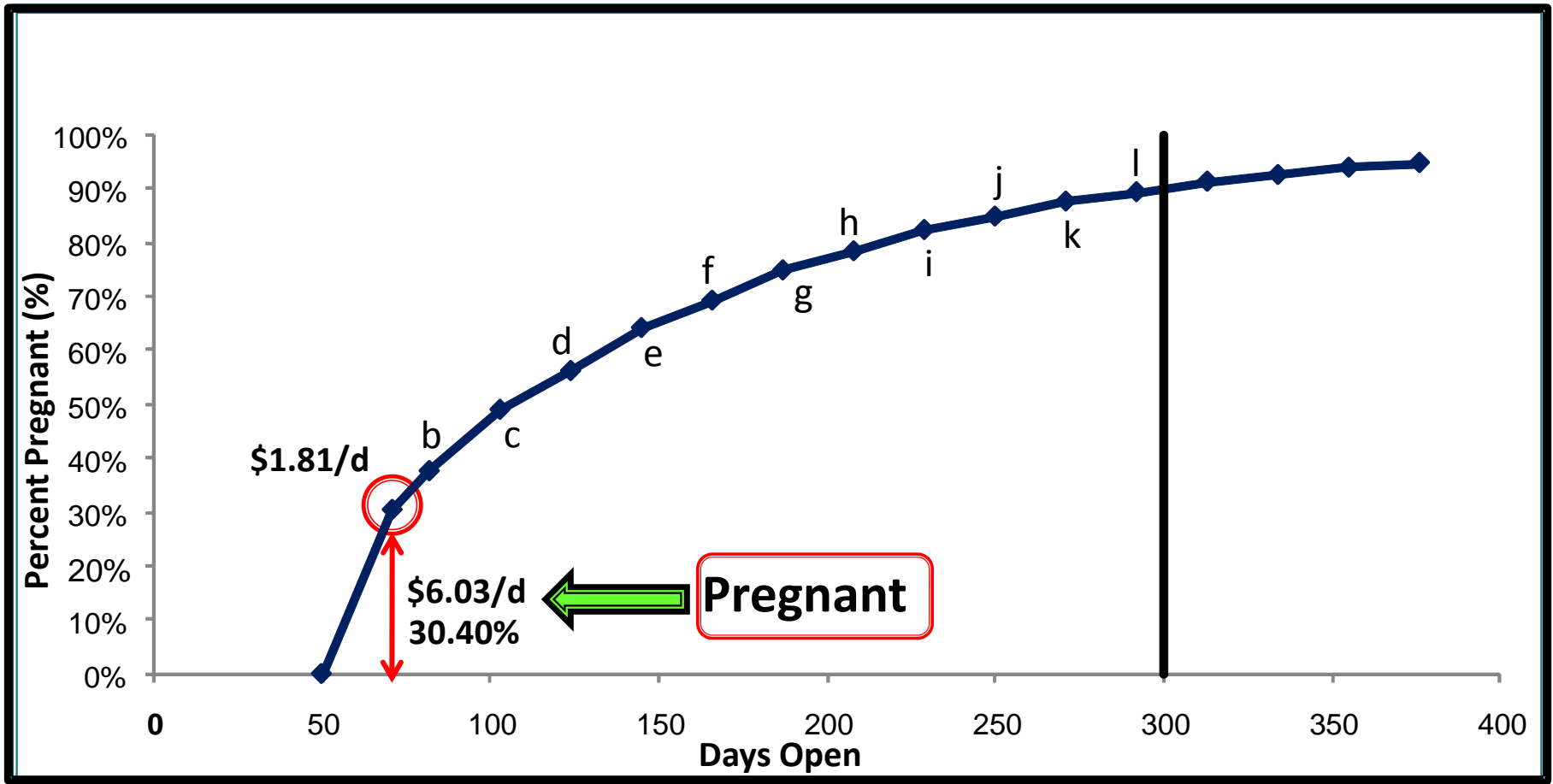
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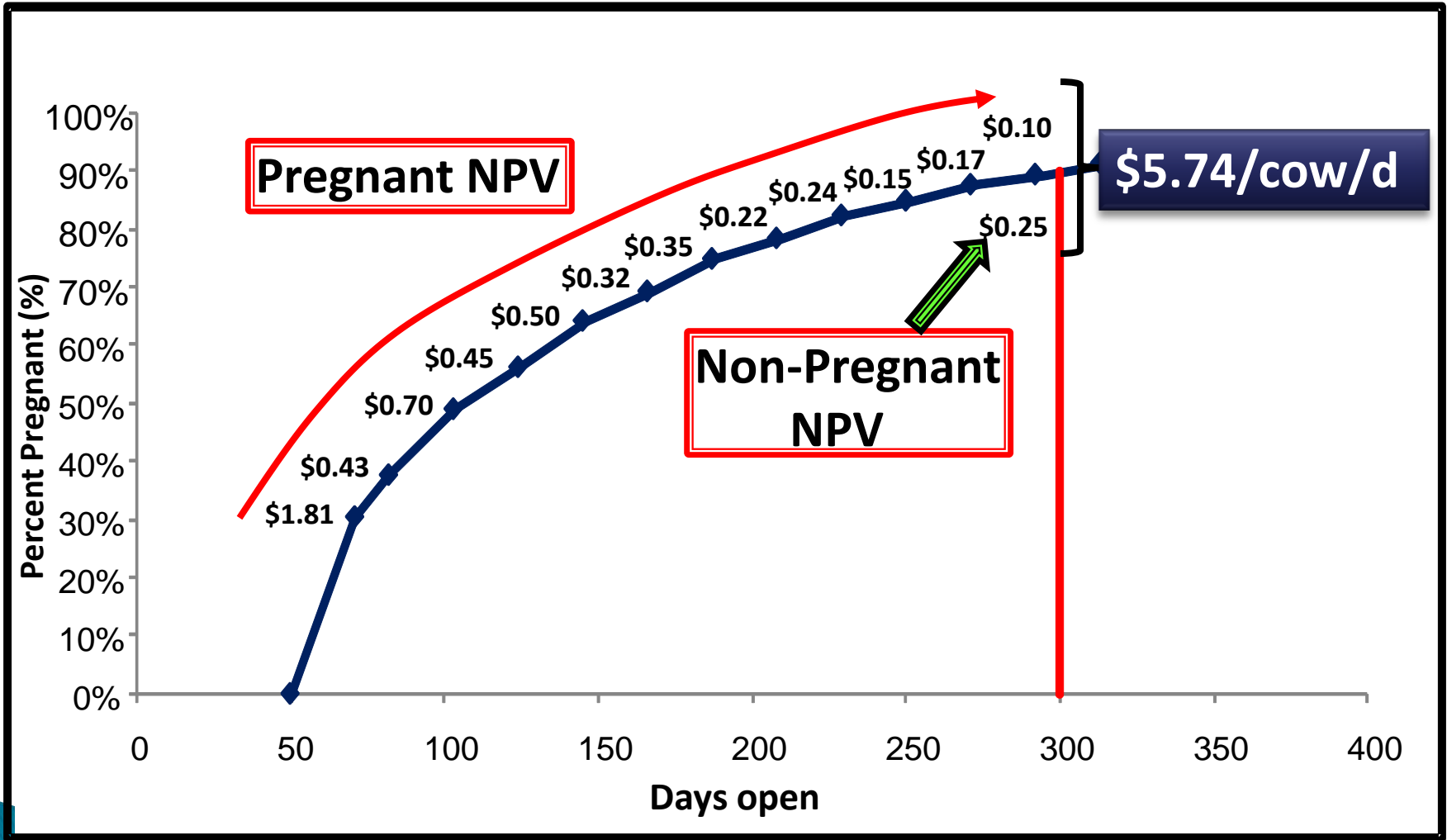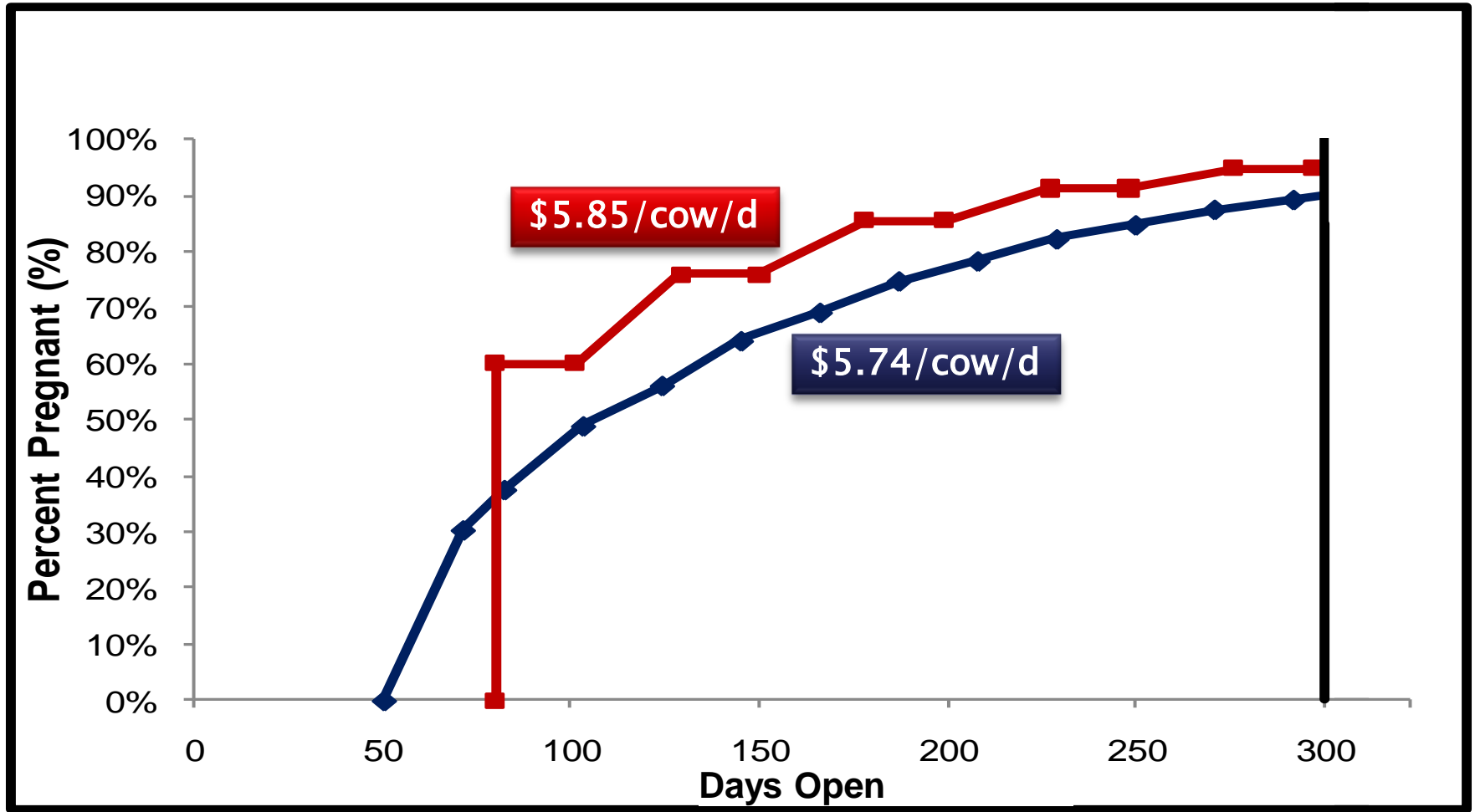
UW-Dairy Repro$
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UW-Extension
University of Wisconsin–Extension

1. Productive and Economic Parameters Summary

Lacating 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
1st Service Postpartum	Presynch-Ovsynch-14	Presynch-Ovsynch-10	Heat Breeding
2nd 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 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%	28%
CR 1st Service TAI	38%	43%	
CR 2nd+ 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

4. Survival Curves for Pregnancy for Parity All

(Legend: Current, Alternative, 100% HD, Max DIM AI; X-axis: DIM, Y-axis: Percent Pregnant (%))

3. Expected Monetary Value ($/cow/day) for Parity All
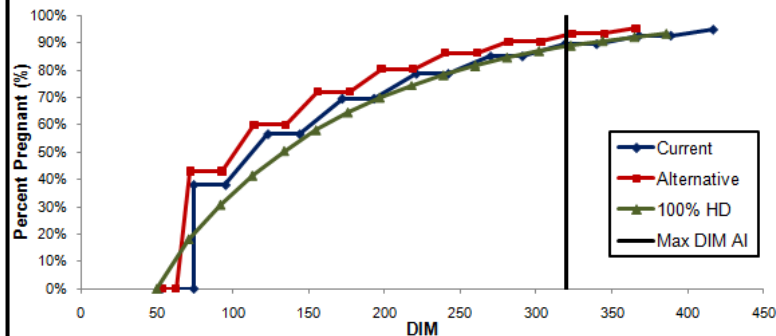
(X-axis: Days Open; Y-axis: EMV ($/cow/day))

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

(Y-axis: NPV ($/cow/day))

Presynch-Ovsynch-14 Ovsynch	Presynch-Ovsynch-10 Ovsynch	Heat Breeding Heat Breeding
$7.35	$7.50	$7.31

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

	Current-Alternative	Current-100%HD	Alternative-100%HD
NPV	-$53,093	$14,372	$67,464
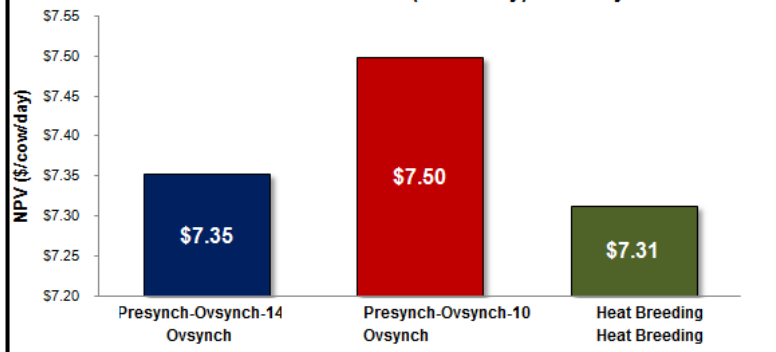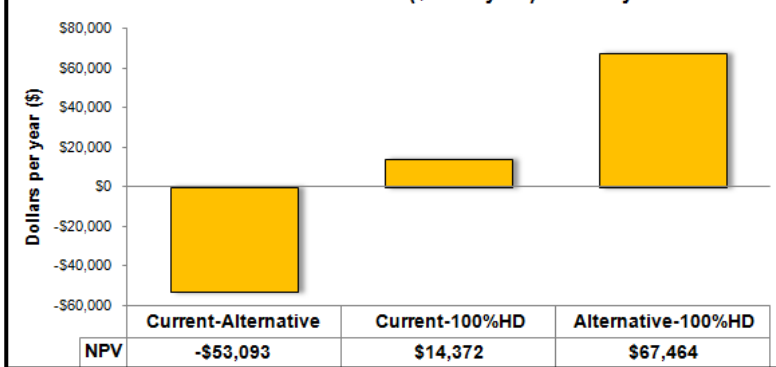
Data Inputs

Productive 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

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	27

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%

4. Pregnancy Diagnosis Cost		Current	Alternative	100% HD
Palpation	($/hr)	90		90
Ultrasound	($/hr)		90	
Blood Test	($/cow)			

Reproductive Program

Resynch–39   Resynch–32

5.a. Reproductive Program

	Current	Start day	Alternative	Start day
1st Service Postpartum	Double-Ovsynch	Sat	Double-Ovsynch	Sat
2nd and Subsequent Services	Ovsynch	Tue	Ovsynch	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	42	
Heat Bred Before 1st TAI	(%)	55%	55%	55%
CR Heat Bred Before 1st TAI	(%)	33%	33%	33%
Heat Bred After 1st TAI	(%)	55%	55%	55%
CR Heat Bred After 1st TAI	(%)	30%	30%	30%
CR 1st Service TAI	(%)	47%	47%	
CR 2nd+ Services TAI	(%)	32%	30%	
Calving Interval	(mo)		14.1	
Dry Period	(d)		62	

Hormone and Labor Costs

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		3.5		1.5		1	
	Cows Treated		165		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		3.75		1.5		1	
	Cows Treated		195		40		20	
Preg.	# Cows		40		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

Results

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	$40.46	$40.95	
Cost Resynch Breedings	$30.71	$31.28	
Cost Heat Breedings	$22.56	$23.19	$23.00
Pregnancy Diagnosis Method	Palpation	Ultrasound	Palpation
Pregnancy Diagnosis Cost	$5.50	$6.19	$6.00

Reproductive Performance

4. Survival Curves for Pregnancy for Parity All
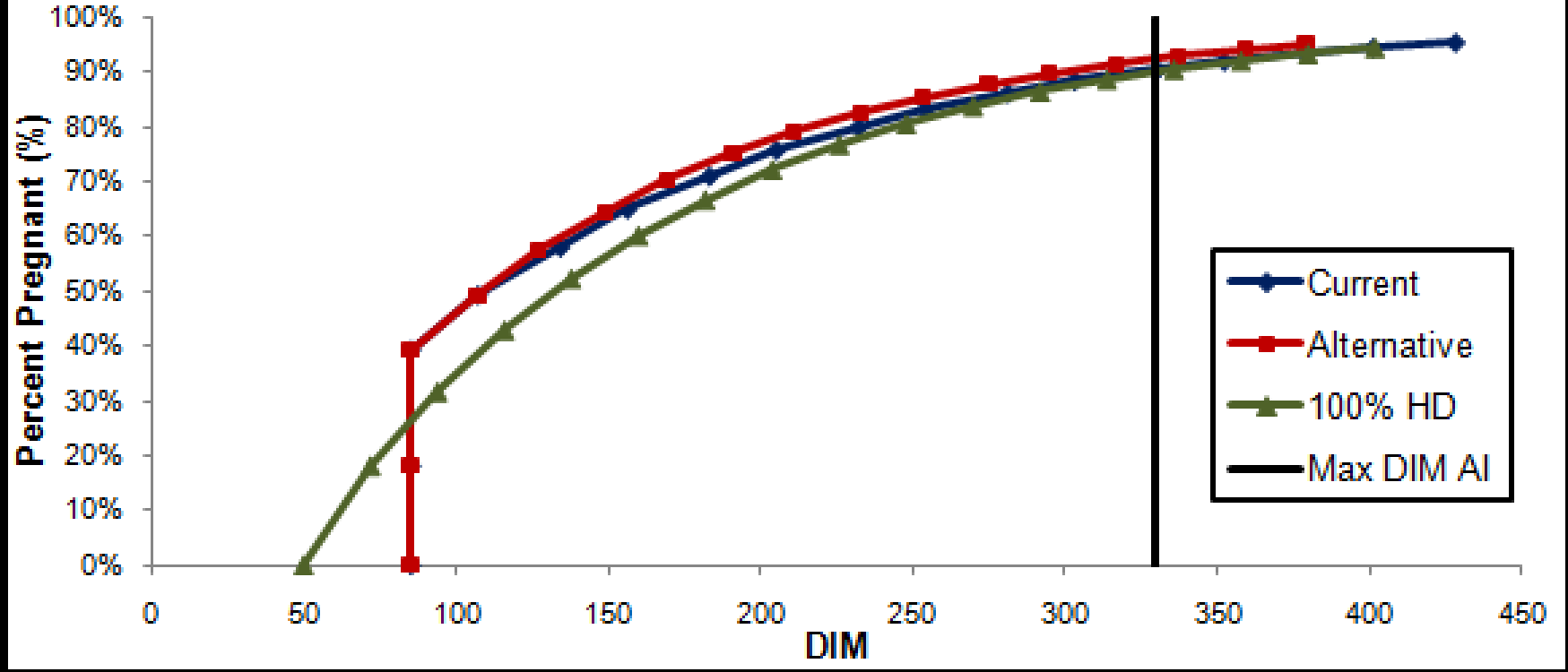
Economic Performance

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

Per Cow per Day

Double-Ovsynch Ovsynch	Double-Ovsynch Ovsynch	Heat Breeding Heat Breeding
$8.81	$8.90	$8.71
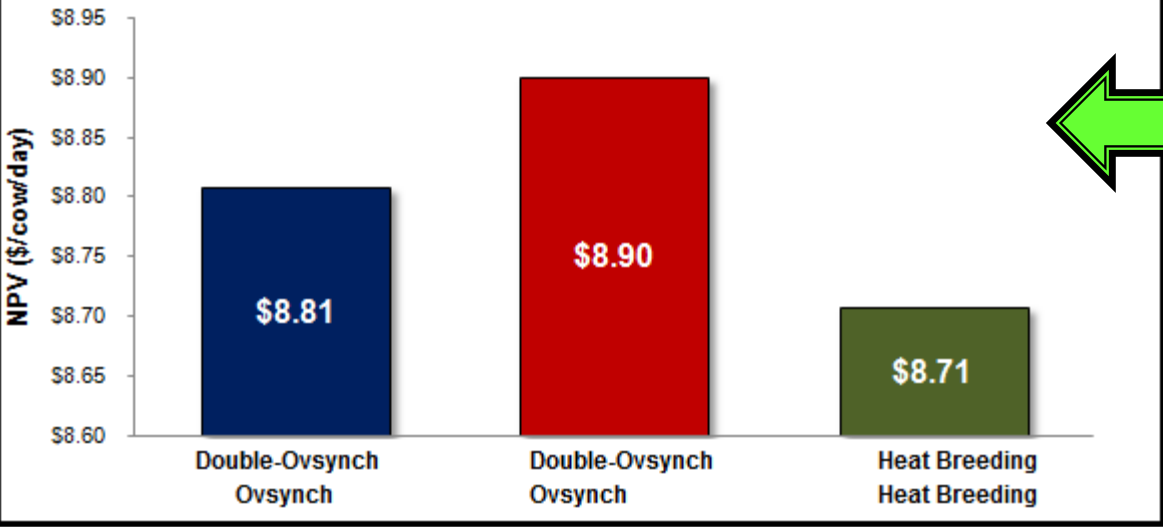
6. Difference in NPV ($/herd/year) for Parity All

Per Herd per Year

	Current-Alternative	Current-100%HD	Alternative-100%HD
NPV	-$32,285	$35,278	$67,563
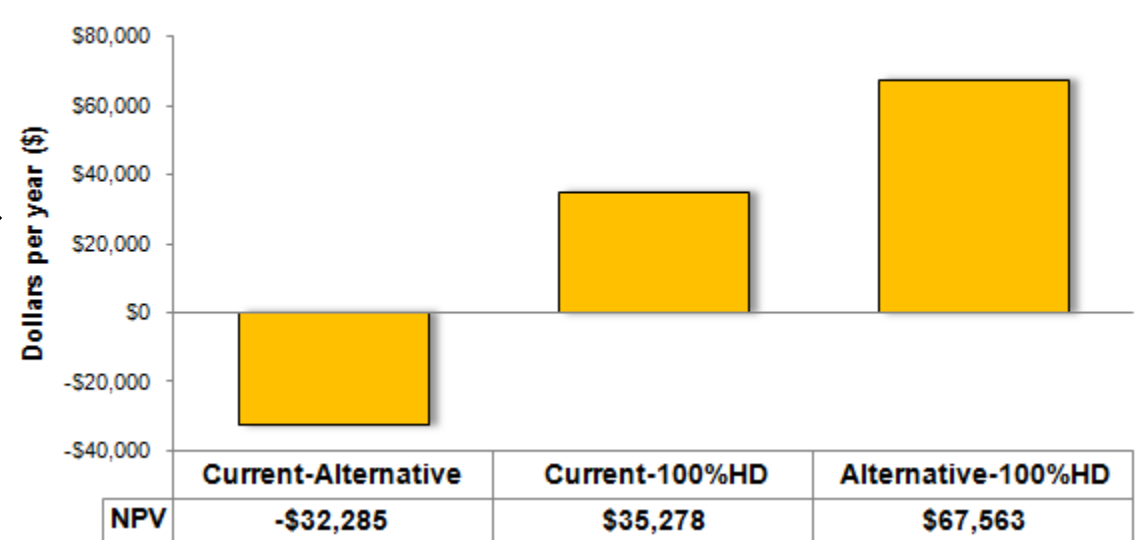
What if ?

➢ Heat Breeding is removed:

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	
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Calving Interval	(mo)		14.1	
Dry Period	(d)		62	

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Heat Breeding Removed

4. Survival Curves for Pregnancy for Parity All

TAI Breeding Only

Heat Breeding Only

TAI and Heat Breeding

Legend:
- Current
- Alternative
- 100% HD
- Max DIM AI

Y-axis: Percent Pregnant (%)
X-axis: DIM
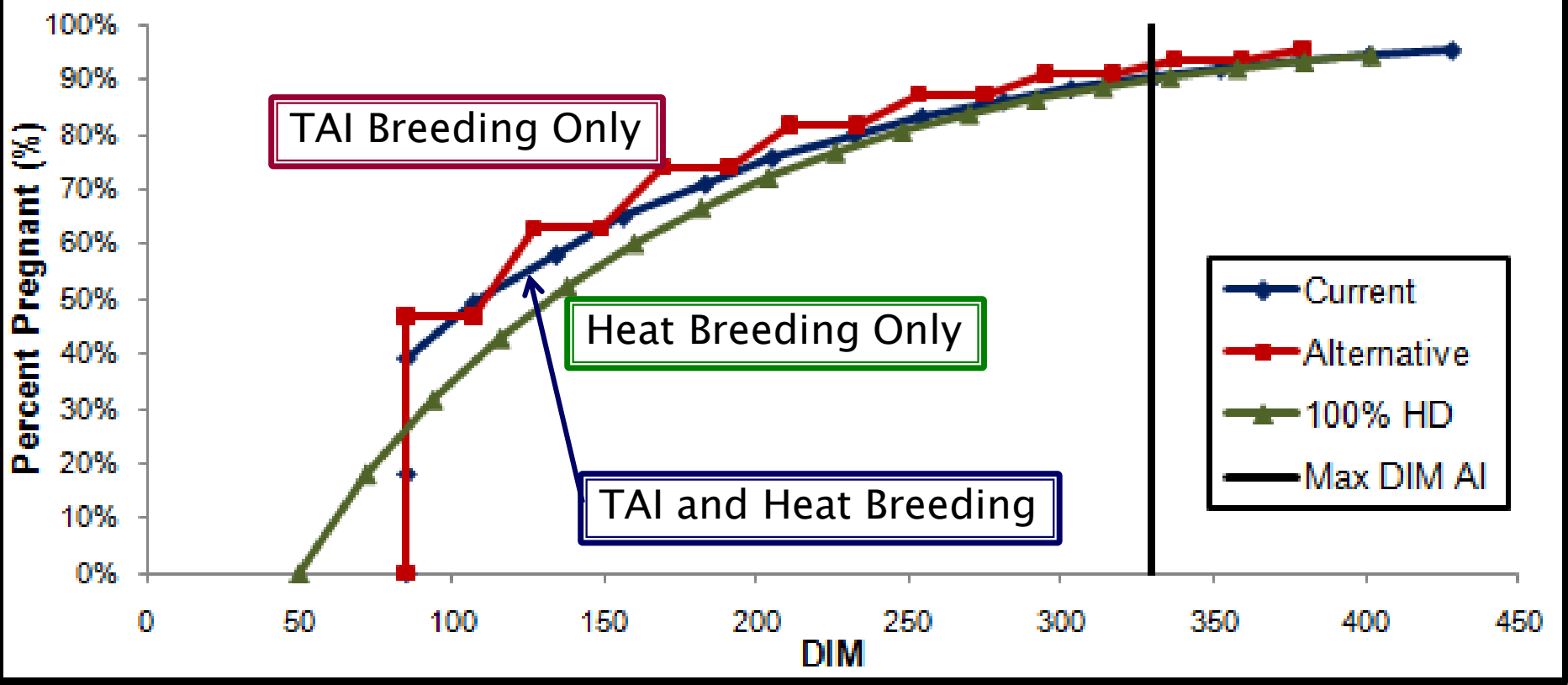
➤ Net Gain = $4,397 / herd per yr

What if ?

➤ Reduce Interbreeding 7 d more:

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	(%)	55%		55%
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Heat Bred After 1st TAI	(%)	55%		55%
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CR 1st Service TAI	(%)	47%	47%	
CR 2nd+ Services TAI	(%)	32%	28%	
Calving Interval	(mo)		14.1	
Dry Period	(d)		62	

Reduced Interbreeding Time

4. Survival Curves for Pregnancy for Parity All

TAI Breeding Only

Heat Breeding Only

TAI and Heat Breeding

Current
Alternative
100% HD
Max DIM AI

Percent Pregnant (%) vs DIM
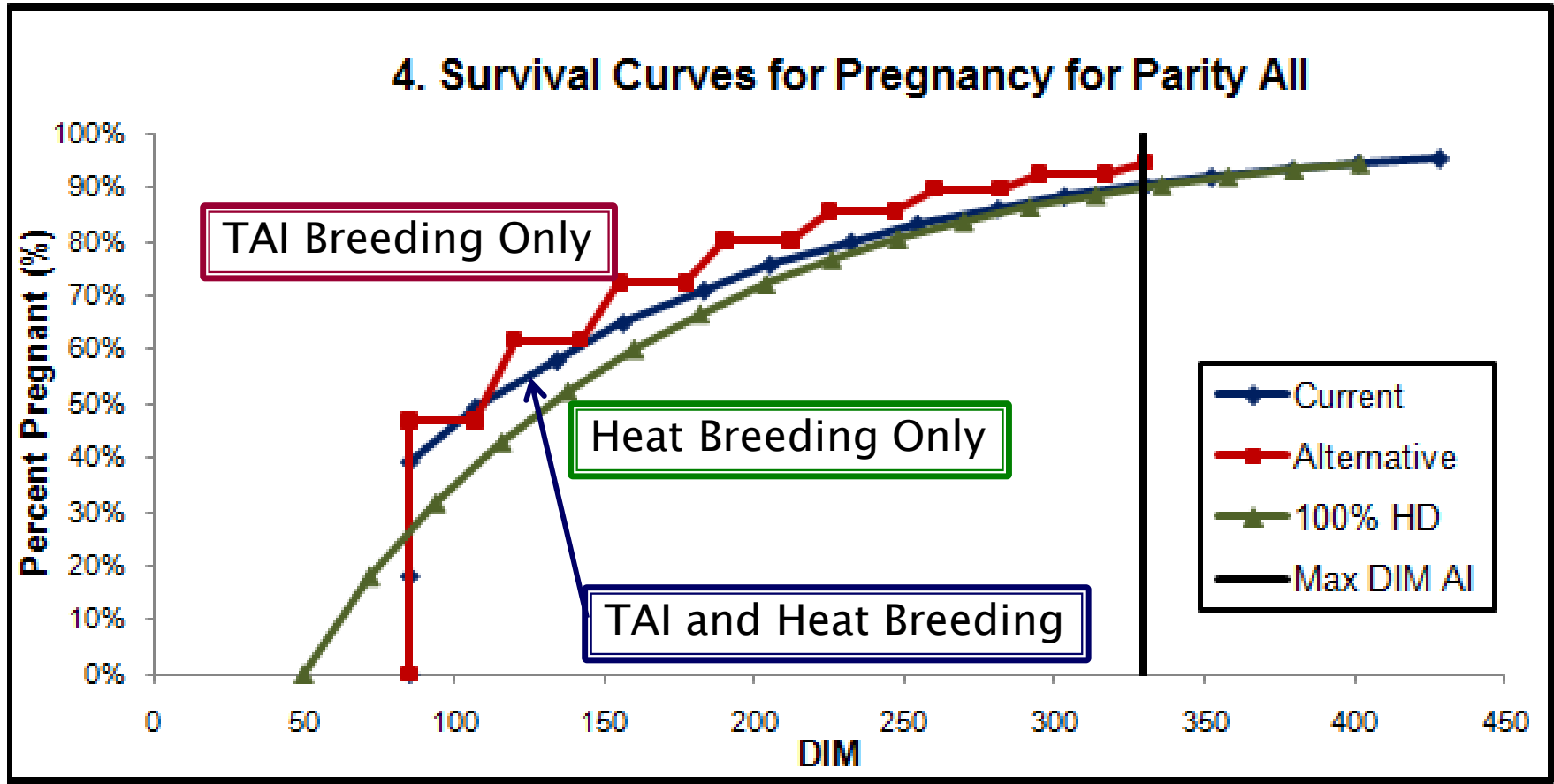
➤ Net Gain = $33,594 / herd per yr

Summing Up

➢ **Data from Wisconsin Commercial Dairy Farm**

➢ **Potential Gains (herd/year)**
  ➢ Remove Heat Breeding: $4,397
  ➢ Reduce Interbreeding 14 d: $65,879
  ➢ Total: $70,276

Conclusions

➤Breeding costs become trivial with respect to revenues of pregnancy

➤Most important factor: difference NPV between repro programs

➤Great flexibility of analysis

Limitations

➢Calculations based on single lactation

➢Pregnancy losses not included

➢Breeding to estrus occurring at the same interval

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UW–DairyRepro$

UW-DairyRepro$: A Reproductive Economic Analysis Tool

Calculates and compares the economic value of dairy reproductive programs including timed artificial insemination (TAI), heat detection (HD), and combinations of TAI and HD programs. It applies probabilistic reproduction survival curves with expected monetary values to assess the net present value (NPV) of defined reproductive programs. The overall NPV of a specific reproduction program is the aggregation of the expected monetary values (EMV) of reproductive events according to defined economic parameters.

Excel Spreadsheet (Download)

Instructions and Documentation (Download)

Slides of Power Point Presentation (Download)

Instrument for Data Collection (Download)

Press Release (Read)

Podcast (Listen)

Demo (Click to View the Video)

Thanks