



# **Mastitis economics and Web-based decision support tools**

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# Outline

90 minutes

## Impact of mastitis

Performance and  
profitability

Primary and secondary

## **Mastitis and reproduction**

Fertility and  
pregnancy loss



## **Economic value of a dairy cow**

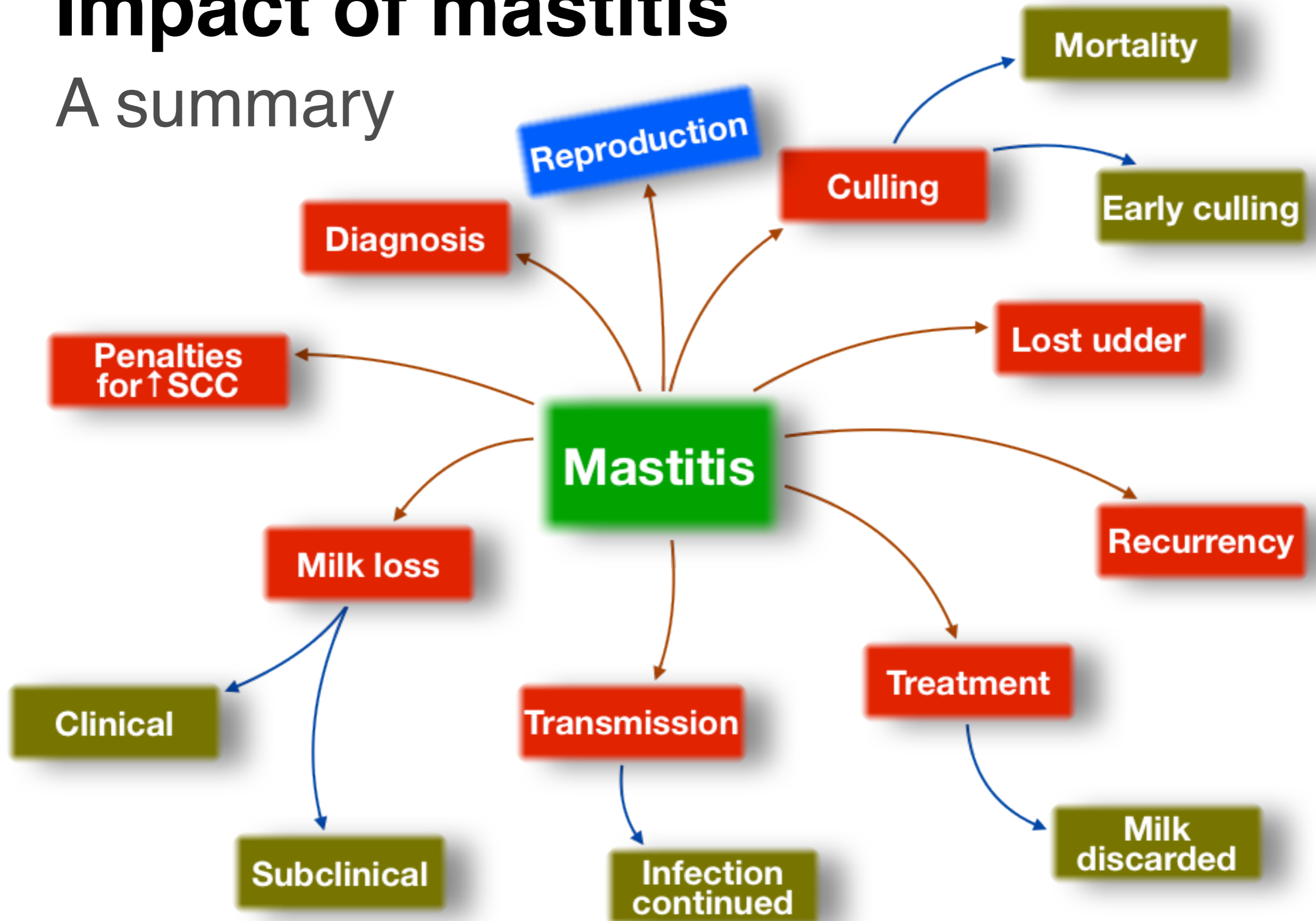
Basic principles and  
applications

## **Web-based decision support tools**

Nutrition, reproduction,  
replacement, etc...

# Impact of mastitis

A summary



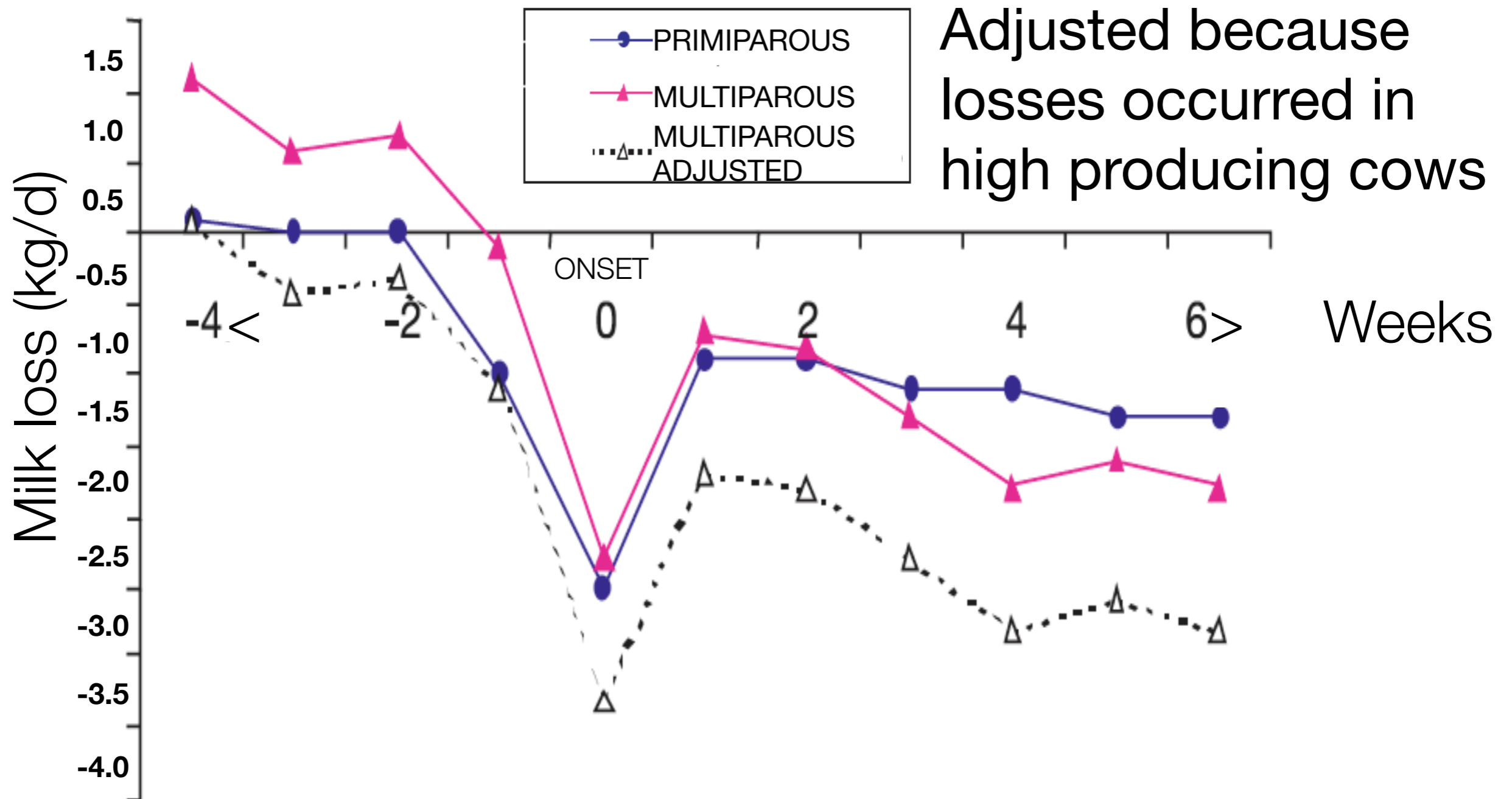
# Impact of mastitis

Loss for an average case, an example

<b>Source of loss</b>	<b>\$/cow per yr</b>	<b>% total</b>
Reduced milk	121.00	66.0
Discarded milk	10.45	5.7
Early replacement	41.73	22.6
Extra labor	1.14	0.1
Drugs	7.36	4.1
Veterinary Services	2.72	1.5
<b>Total</b>	<b>184.4</b>	<b>100</b>

# Milk loss

## Clinical mastitis



# Milk loss

## Clinical mastitis

**375 kg (5%) loss**

Average case for Holstein  
2<sup>nd</sup> month



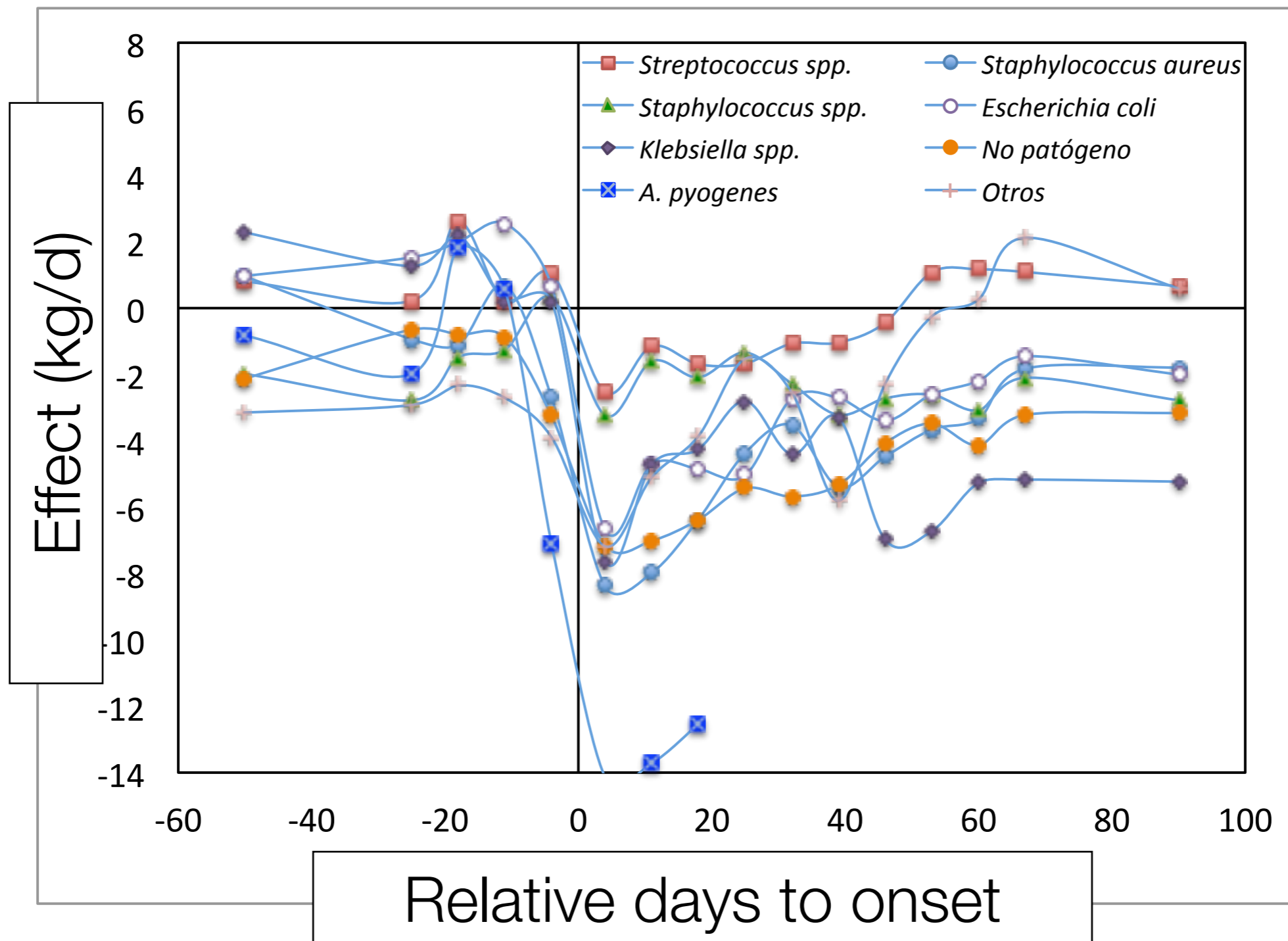
### Highly variable

10 cases:

- 5 cases: 375 kg (average)
- 4 cases: Little loss
- 1 case: 1,000 kg (high)

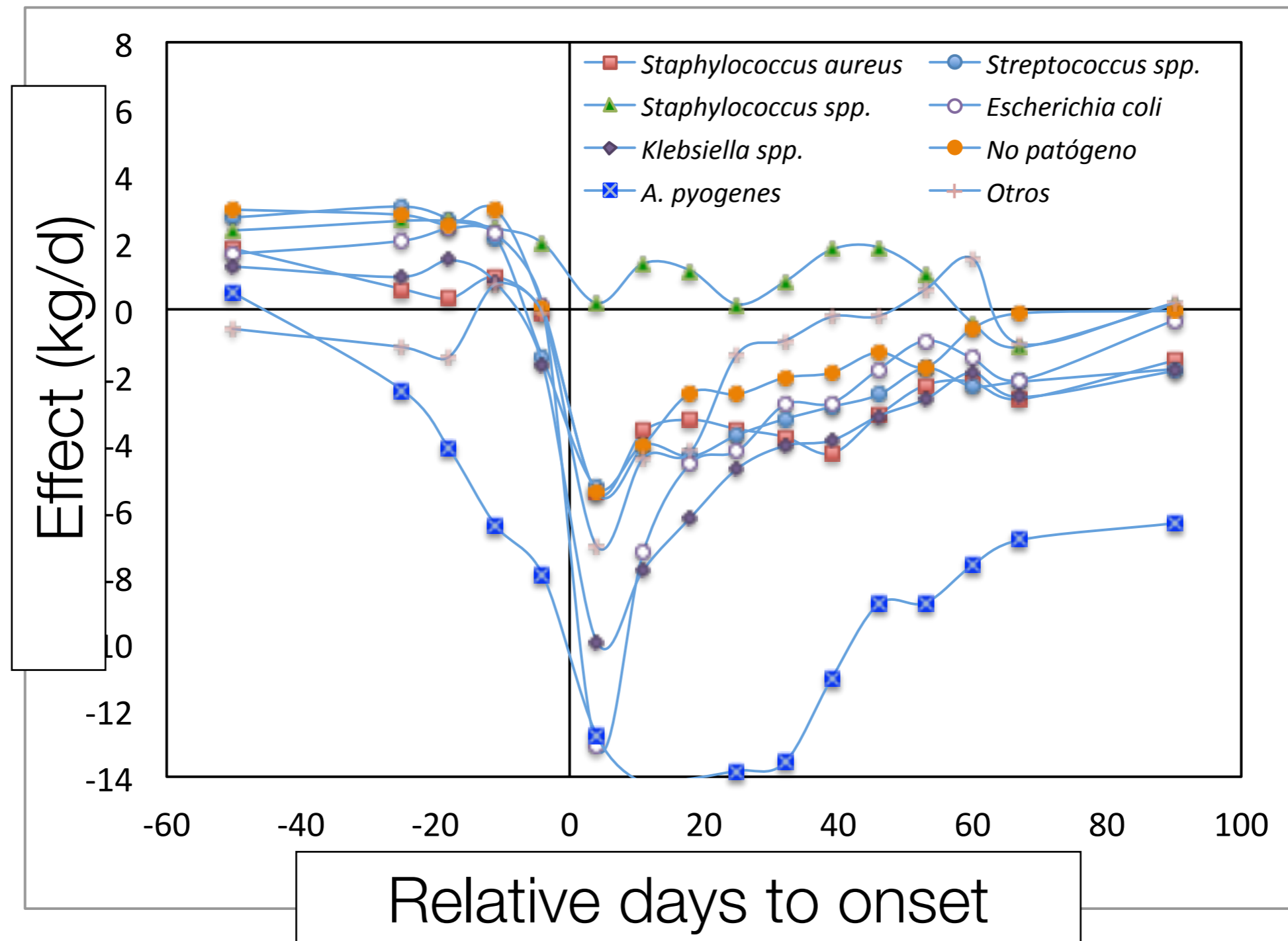
# Milk loss

## Clinical mastitis: First lactation



# Milk loss

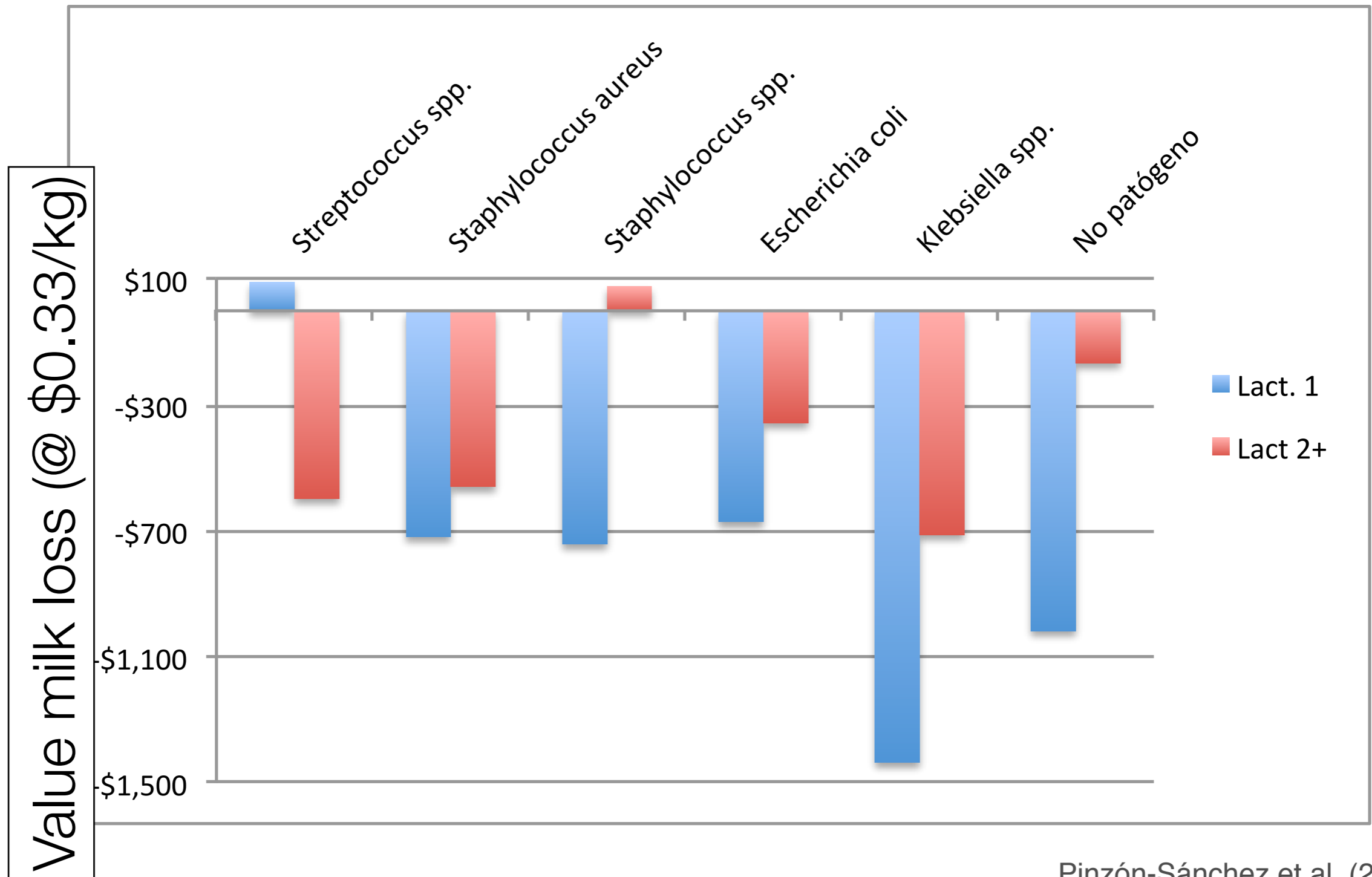
## Clinical mastitis: 2<sup>nd</sup> + lactations





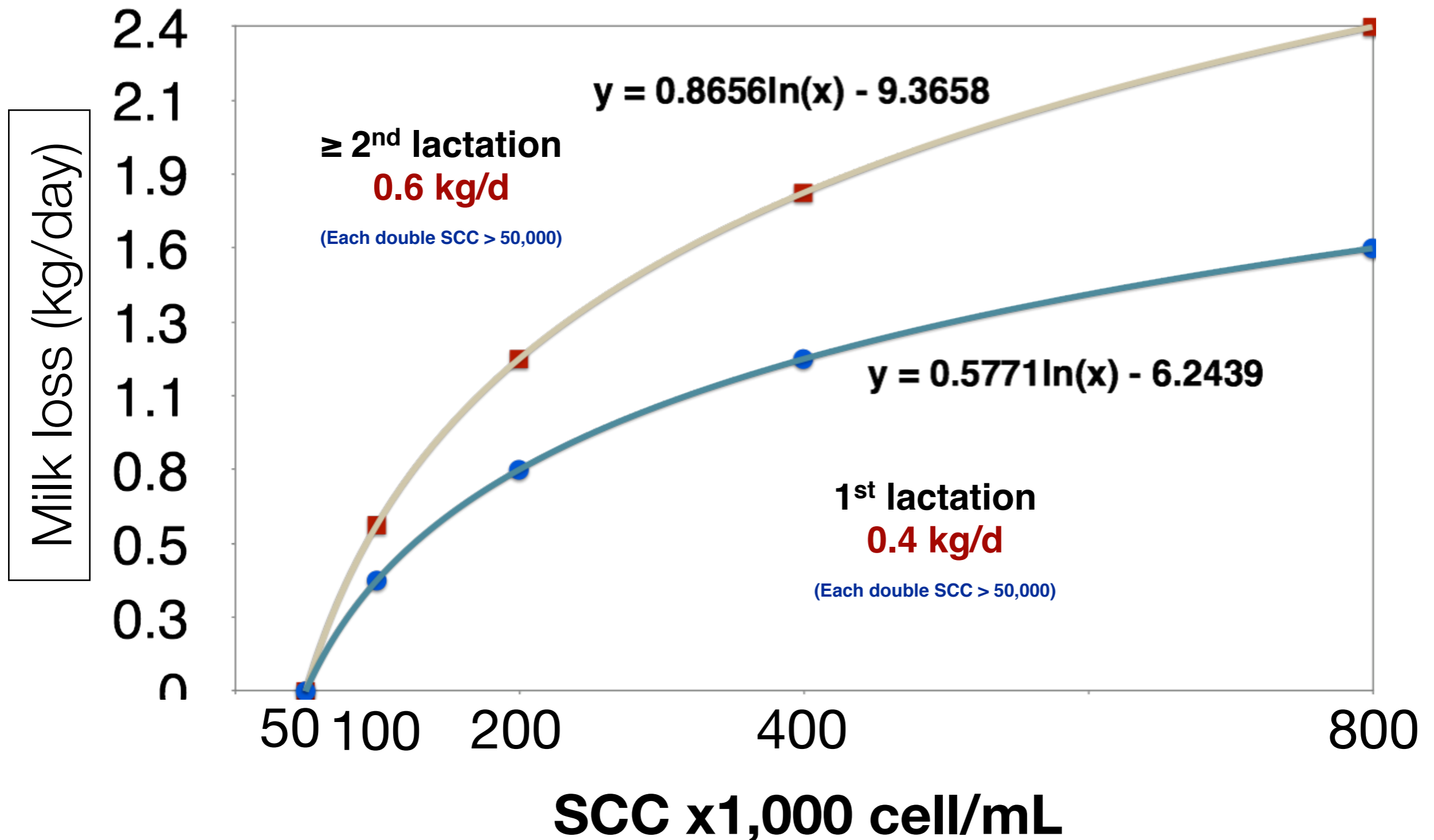
# Milk loss

Clinical mastitis: 30 to 305 d



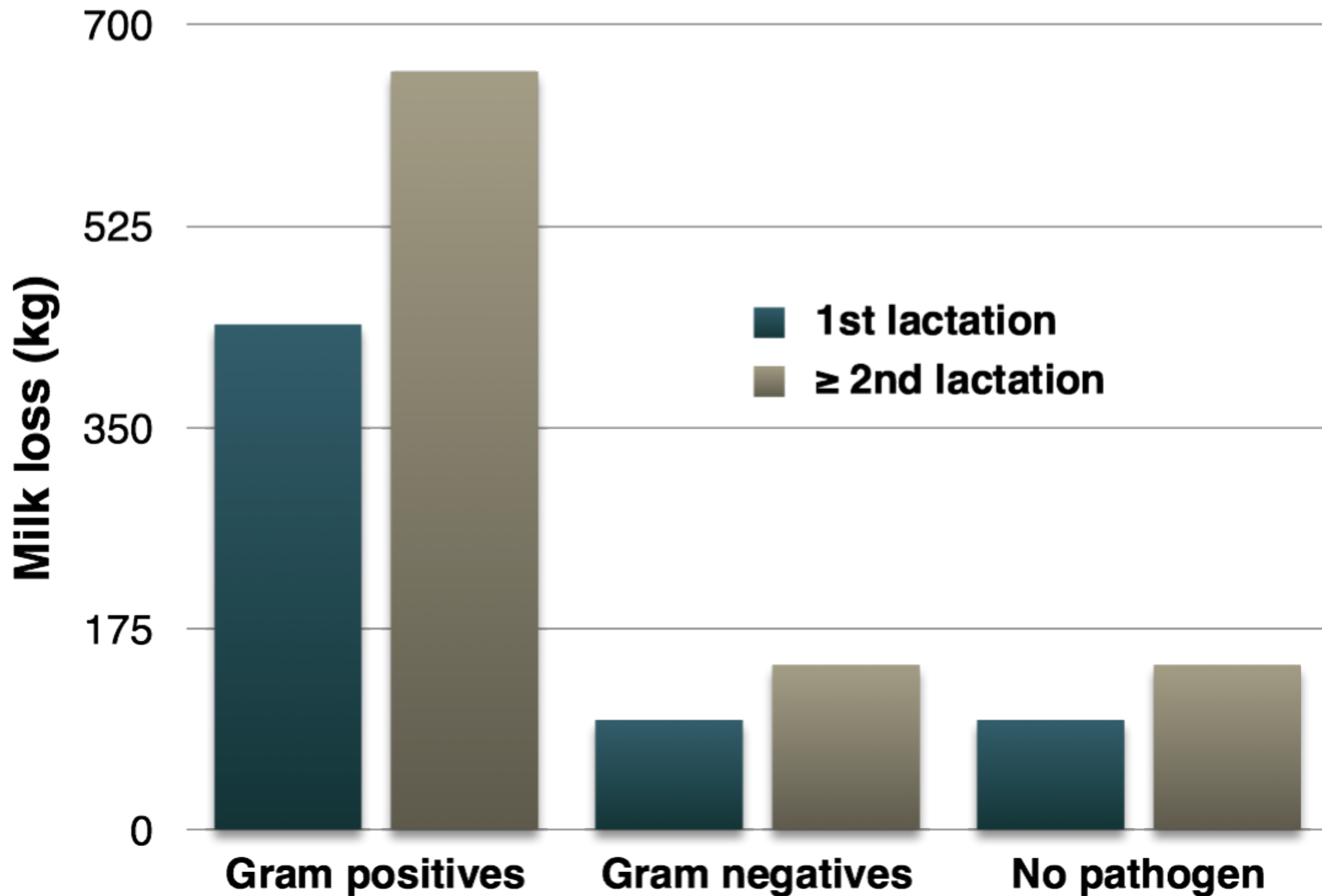
# Milk loss

Subclinical mastitis (in addition to clinical)



# Milk loss

Subclinical for SCC=800K cell/mL

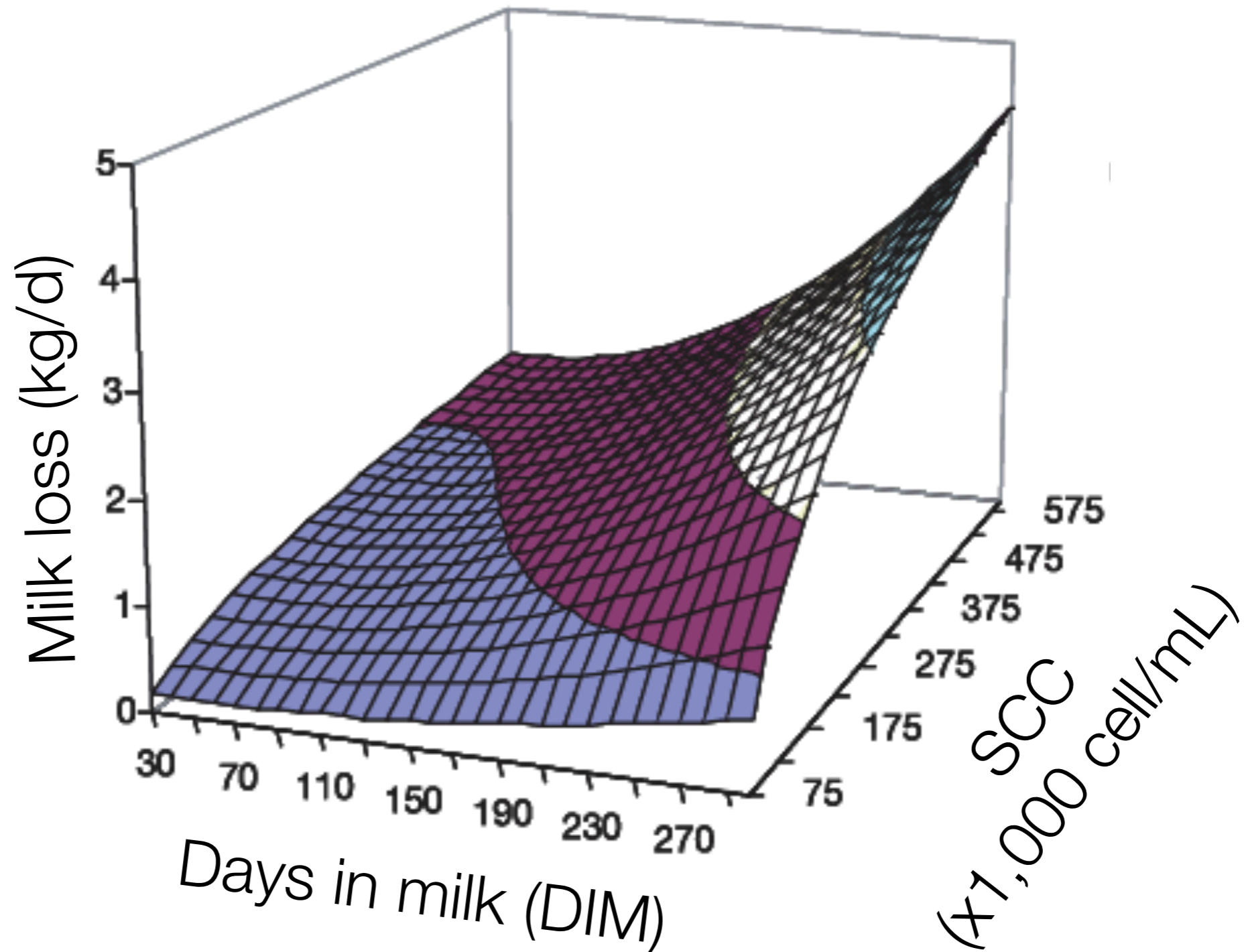


30-305 d,  
Pinzón-Sánchez et al., 2011

30-90 d (de Hass et al., 2004)

# Milk loss

Relationship SCC & DIM (vs. 50K cell/mL)



# Milk price lost

Penalty or price premium losses

## Very specific

Region

Market

Economic context

Negotiations

## Bulk tank

Herd weighted average

Dilution effect

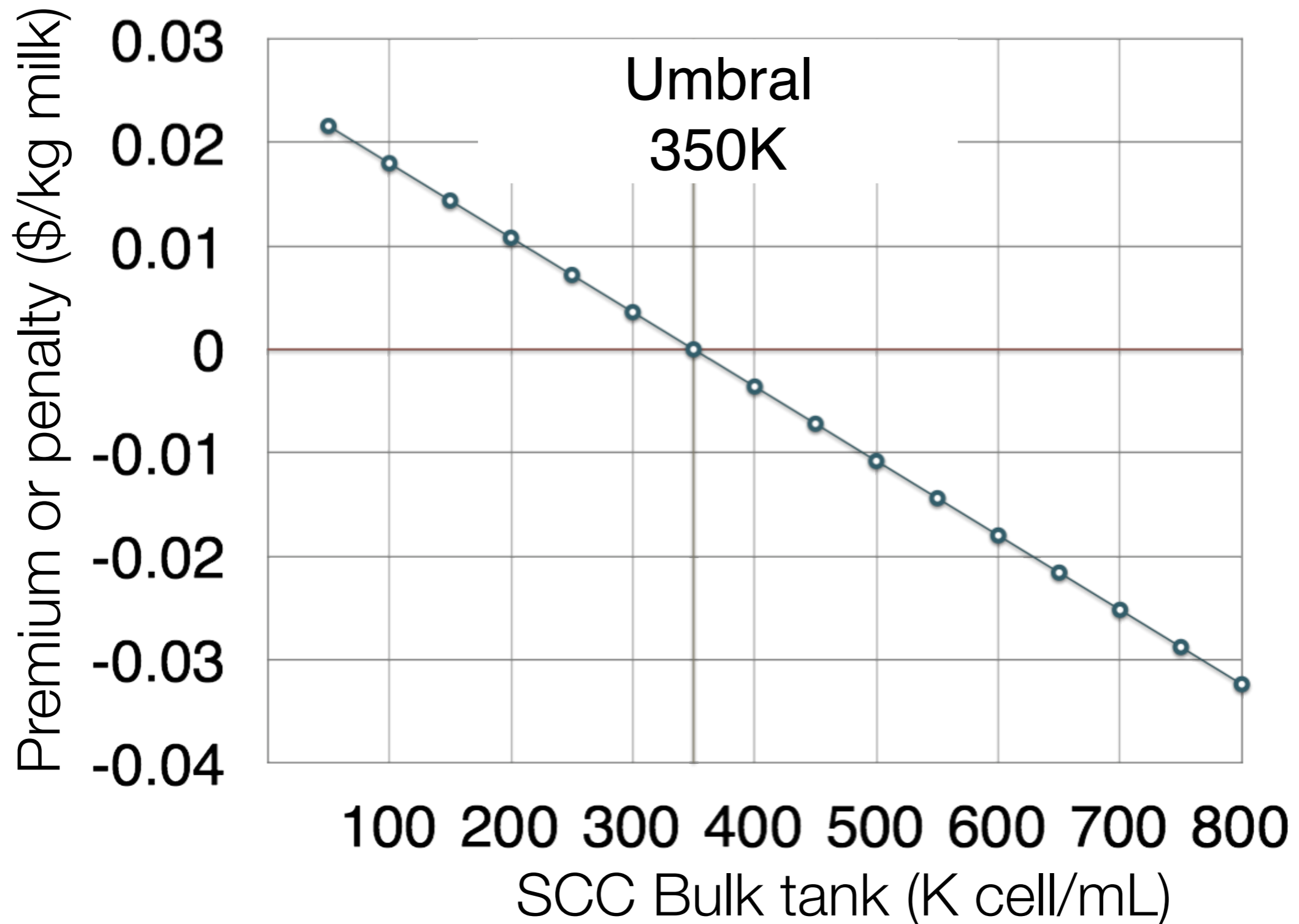
## Thresholds

Combined effect of clinical  
and subclinical mastitis



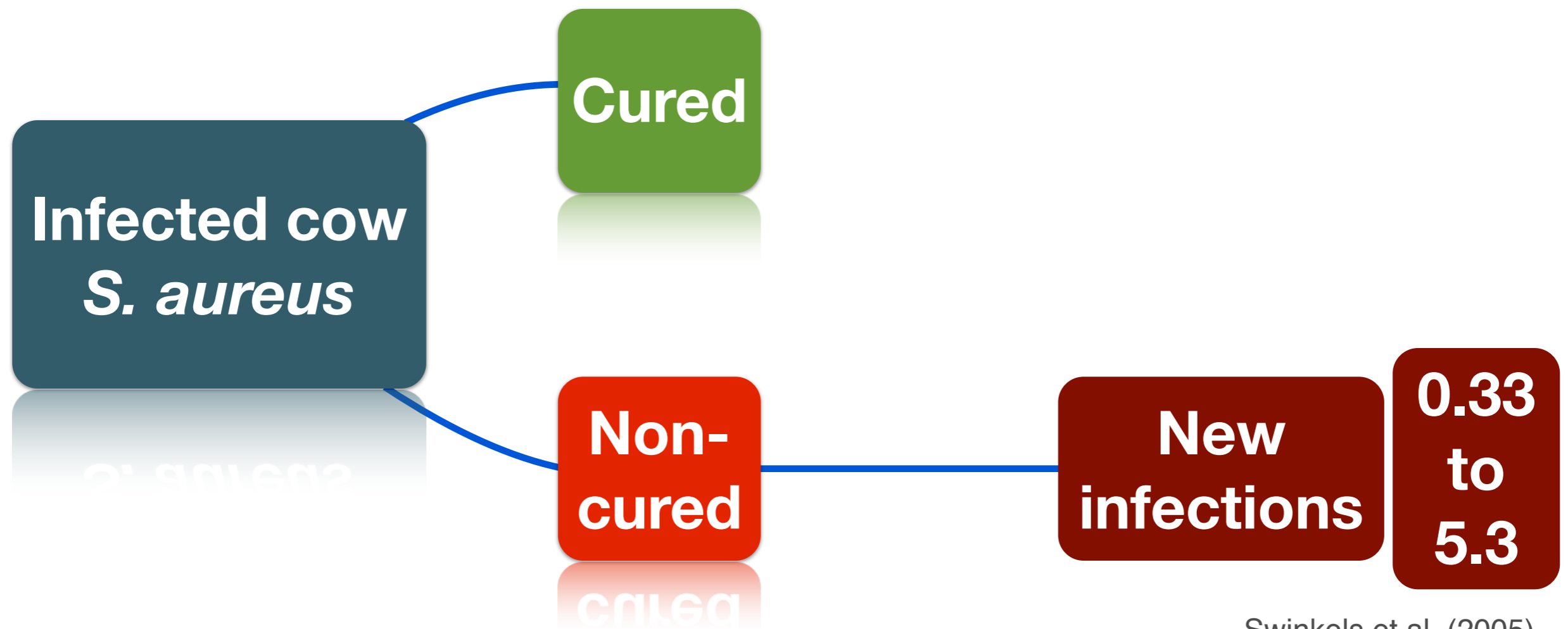
# Milk price lost

Price premium or penalty (Wisconsin)



# Transmission cost

Non cured *Staphylococcus aureus*



Swinkels et al. (2005)

Pinzón-Sánchez et al. (2011): 0.25

## Other contagious pathogens

- *Strep. agalactiae*
- *Streptococcus dysgalactiae*
- *Corynebacterium bovis*
- *Mycoplasma bovis*

Harmon (1996)

# Recurrence cost

Increased risk of additional cases

## Risk factors

Lactation

Pathogen

Cure



## Possible levels

13% 1st lactation

23% 2<sup>nd</sup>+ lactation

Pinzón-Sánchez et al. (2011)

±20%

Hoe and Ruegg (2005)

## Cure

According to etiology



# Lost udder cost

Increased risk because of mastitis

## Risk factor

Recurrence

## Possible levels

10% recurrent cases

## Milk loss

15% additional milk loss



# Early culling risk

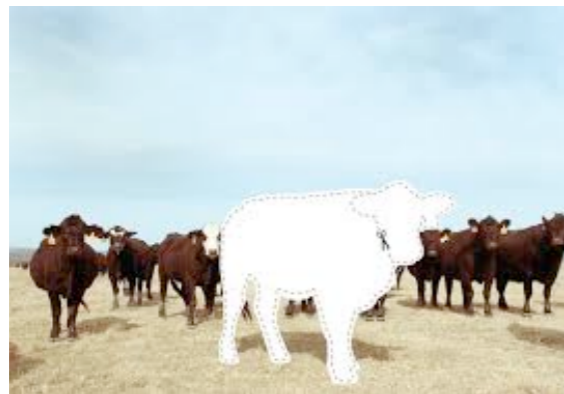
Culling risk is increased

## Higher risk

Early in lactation

Dry period

Udder damaged



## Higher risk

1.5 to 5 % more risk  
after a clinical case

# Early culling risk

Culling risk is increased

<b>Higher early culling risk, %</b>	<b>Affection</b>	<b>Reference</b>
1.5 - 4.0	Clinical mastitis	Beaudeau et al. (1994; 1995)
1.9 - 3.0	Clinical mastitis	Gröhn et al. (1998)
1.4 - 2.6	Clinical mastitis	Rajala-Schultz et al. (1999)
1.2 - 2.7	Elevated SCC	Beaudeau et al. (1995)

# Early culling cost

Complex calculation

## Economic value of affected cow

Compared with a replacement

## State of the cow

Lactation

Days in milk

Days in pregnancy



## Important factors

Cow productivity

Genetics of replacement

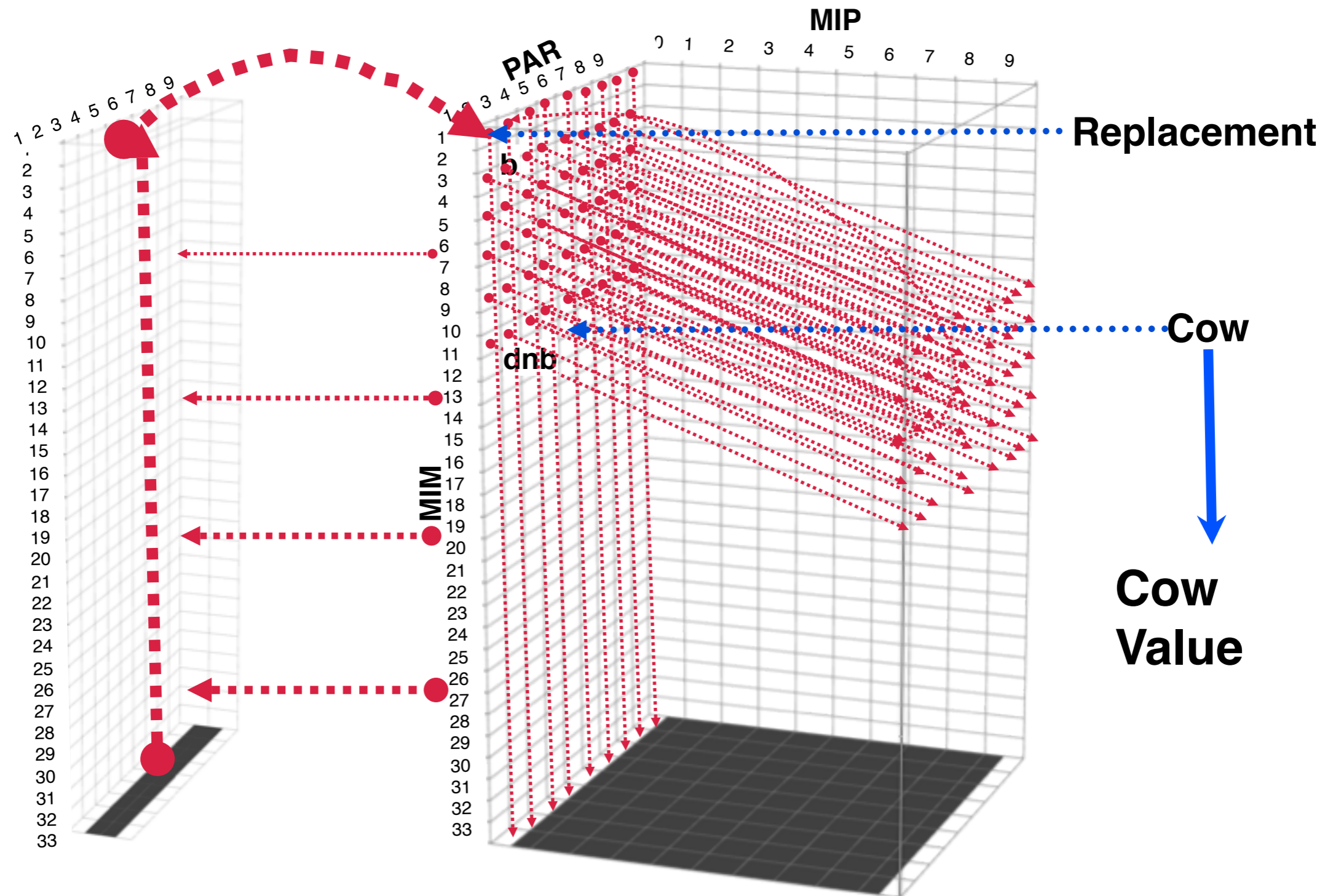
## Other factors

Herd characteristics

Market/economic conditions

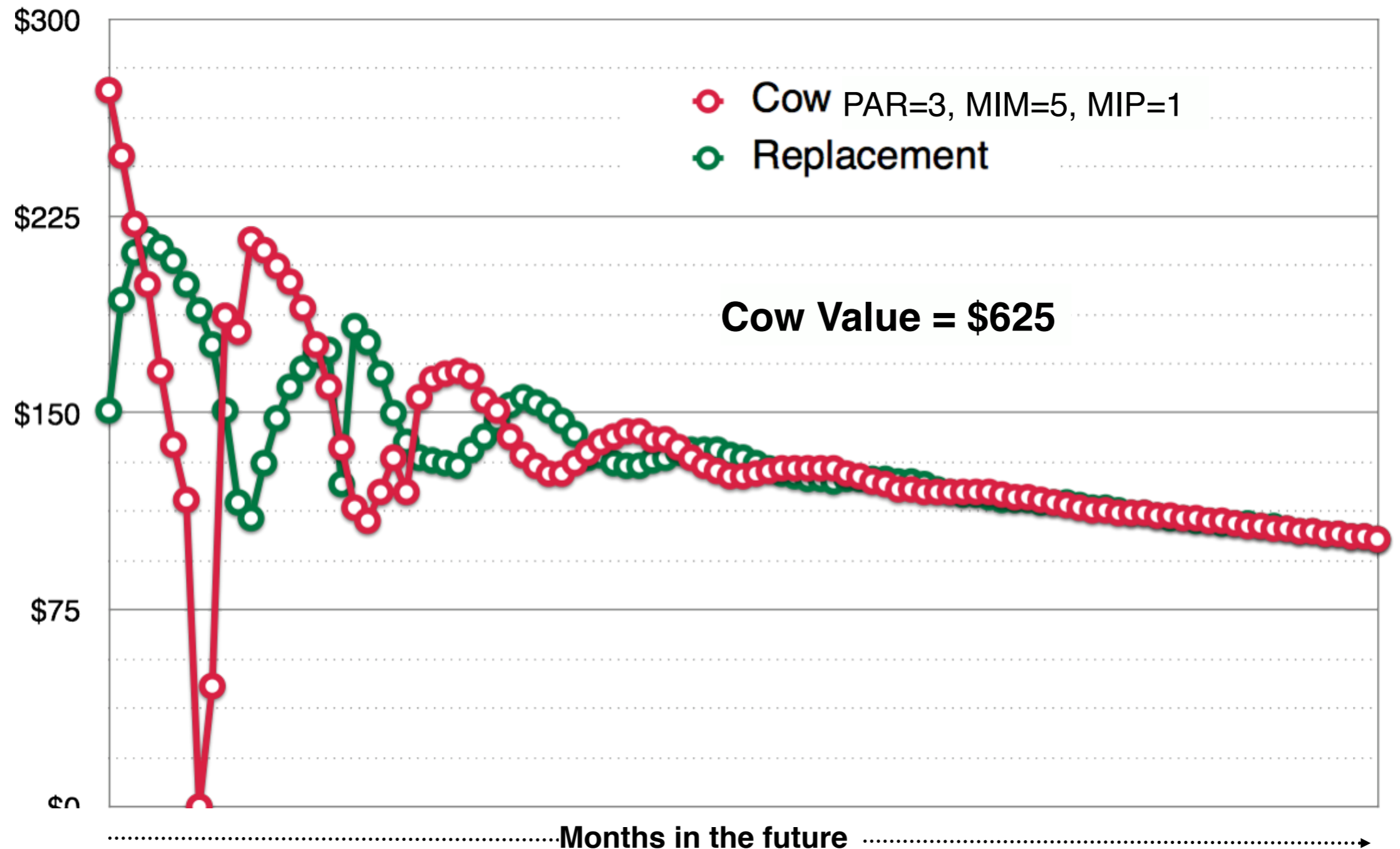
# Markov chains

## An application




# Basic principle of value of a cow

## Markov-chain algorithms




# Early culling cost

Tool: The economic value of a dairy cow



**The Economic Value of a Dairy Cow**  
Victor E. Cabrera, Department of Dairy Science



Overview
**Single Cow Analysis**
Herd Analysis
 US English
 US Metric
 UK

**INPUTS - Edit Values in This Block**

**Evaluated Cow Variables**

Current Lactation:

Current Months after Calving:

Current Months in Pregnancy:

Expected Milk Production Rest of Lactation, %:

Expected Milk Production Next Lactations, %:

**Replacement Cow Variable**

Expected genetic improvement, % additional milk:

**Herd Production and Reproduction Variables**

Herd Turnover Ratio, %/year:

Rolling Herd Average, lb/cow per year:

21-d Pregnancy Rate, %:

Reproduction Cost, \$/cow per month:

Last Month After Calving to Breed a Cow:

Do-not-Breed Cow Minimum Milk, lb/day:

Pregnancy Loss after 35 Days Pregnant, %:

Average Cow Body Weight, lb:

**Herd Economic Variables**

Replacement Cost, \$/cow:

Salvage Value, \$/lb live weight:

Calf Value, \$/calf:

Milk Price, \$/cwt:

Milk Butterfat, %:

Feed Cost Lactating Cows, \$/lb dry matter:

Feed Cost Dry Cows, \$/lb dry matter:

Interest Rate, %/year:

**OUTPUTS - Interactive Results**

**Value of the Cow, \$** 897

**Compared Against a Replacement, \$**

Milk Sales, \$	535
Feed Cost, \$	-238
Calf Value, \$	-2
Non-reproductive Cull, \$	-85
Mortality Cost, \$	-16
Reproductive Cull, \$	4
Reproduction Costs, \$	-5
Replacement Transaction, \$	704

**Herd Structure at Steady State**

Days in milk	224
Days to Conception	122
Percent of Pregnant	52
Reproductive Culling, %	8
Mortality, %	3
1st Lactation, %	43
2nd Lactation, %	27
> 3rd Lactation, %	30

**Economics of an Average Cow, \$/year**

Net Return, \$	1969
Milk Sales, \$	3806
Feed Cost, \$	-1522
Calf Sales, \$	60
Non-Reprod. Culling Cost, \$	-198
Mortality Cost, \$	-38
Reproductive Culling Cost, \$	-59
Reproductive Cost, \$	-80

**Example:**  
Cost of culling this 2<sup>nd</sup> lactation, 1 MIM, open cow is \$897

# Mortality risk

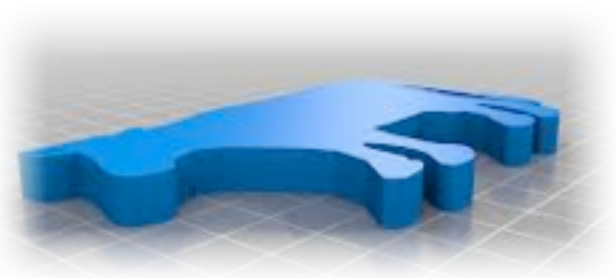
Mortality risk is increased

## Mortality risk increased in Holsteins

0.22% (W France)

0.19% (N Ireland)

Seegers et al. (2003)



## Risk according to pathogens

Gram negatives = +3 times

Bradley & Green (2001)

*E. coli* = +74%

*Klebsiella sp.* = +8%

*S. aureus* = +8%

Hazlett et al. (1984)

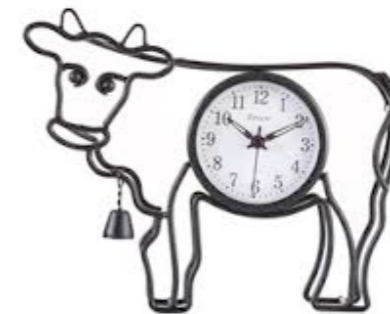


# Mortality cost

## Calculating the cost of mortality

### Mortality cost

Value of the cow before dying +  
Value of meat



### Example:

Mortality cost of a 3<sup>rd</sup>  
lactation, 5 MIM, 1 MIP  
is **\$627 + \$494 = \$1,121**

# Mastitis and reproduction

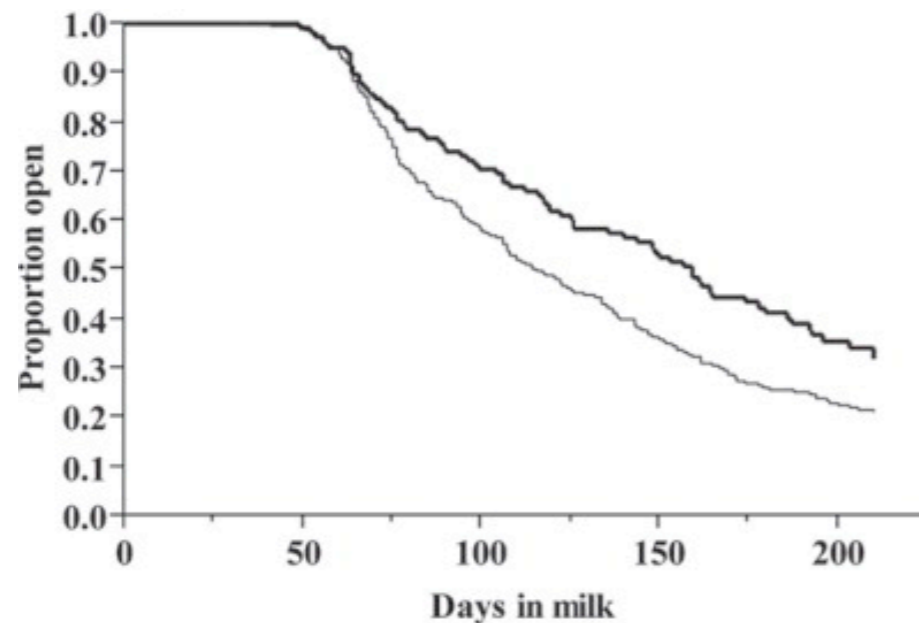
## Reproductive physiology

### Prolonged service time

Energy balance

Fever

Blockage GnRH-LH



### Reduced conception risk

Poorer quality oocytes

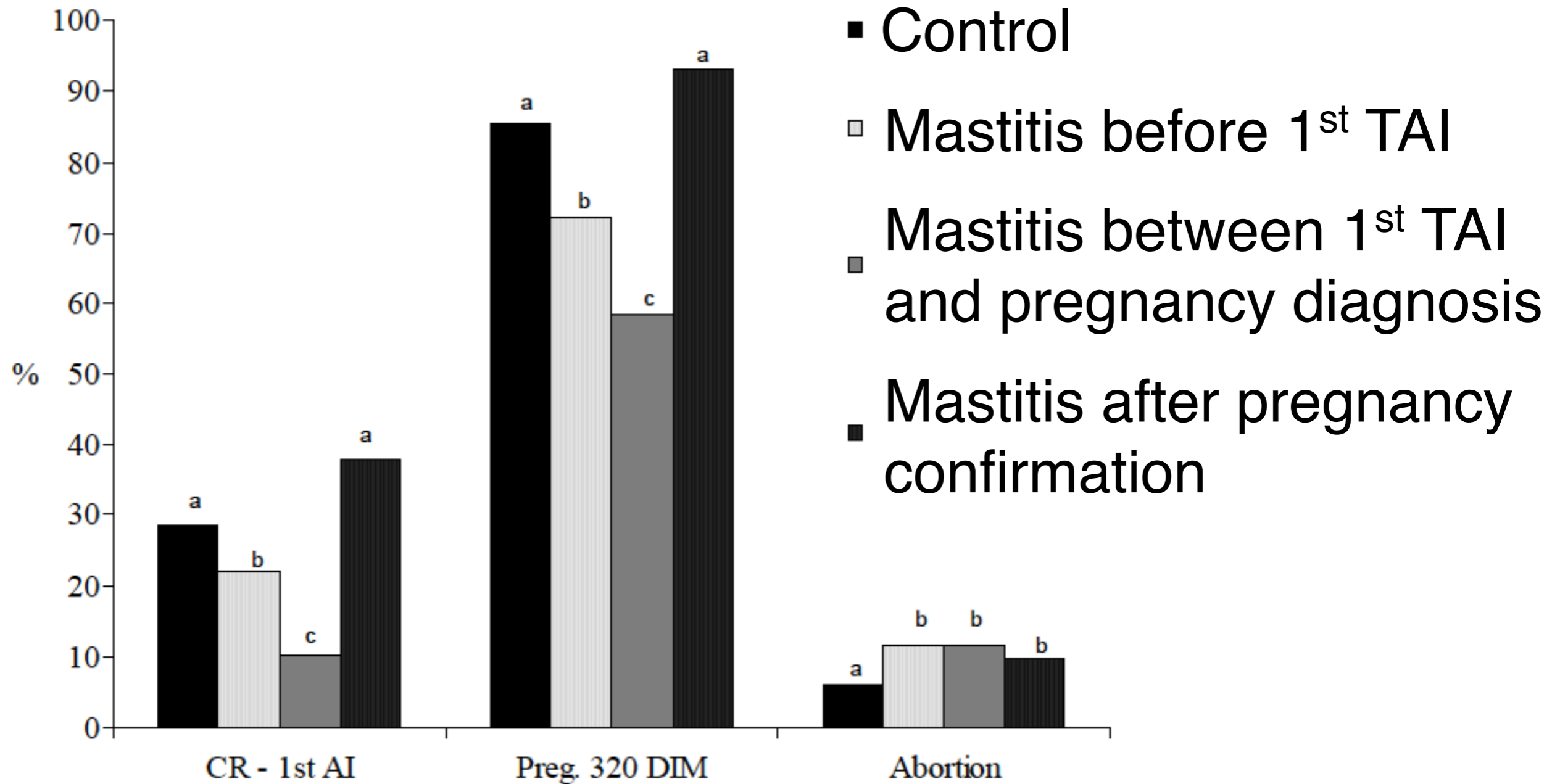
Fever

Toxins

Pregnancy losses

# Mastitis and reproduction

## Reduced conception rate



# Mastitis and reproduction

Impacts (mastitis after 1<sup>st</sup> service)

## **Decreased**

Conception rate to 1<sup>st</sup>  
service

28.7 vs. 10.2%

## **Increased**

Services per conception

2.59 vs. 3.05

## **Prolonged**

Interval from calving to  
conception

139.7 vs. 189.4

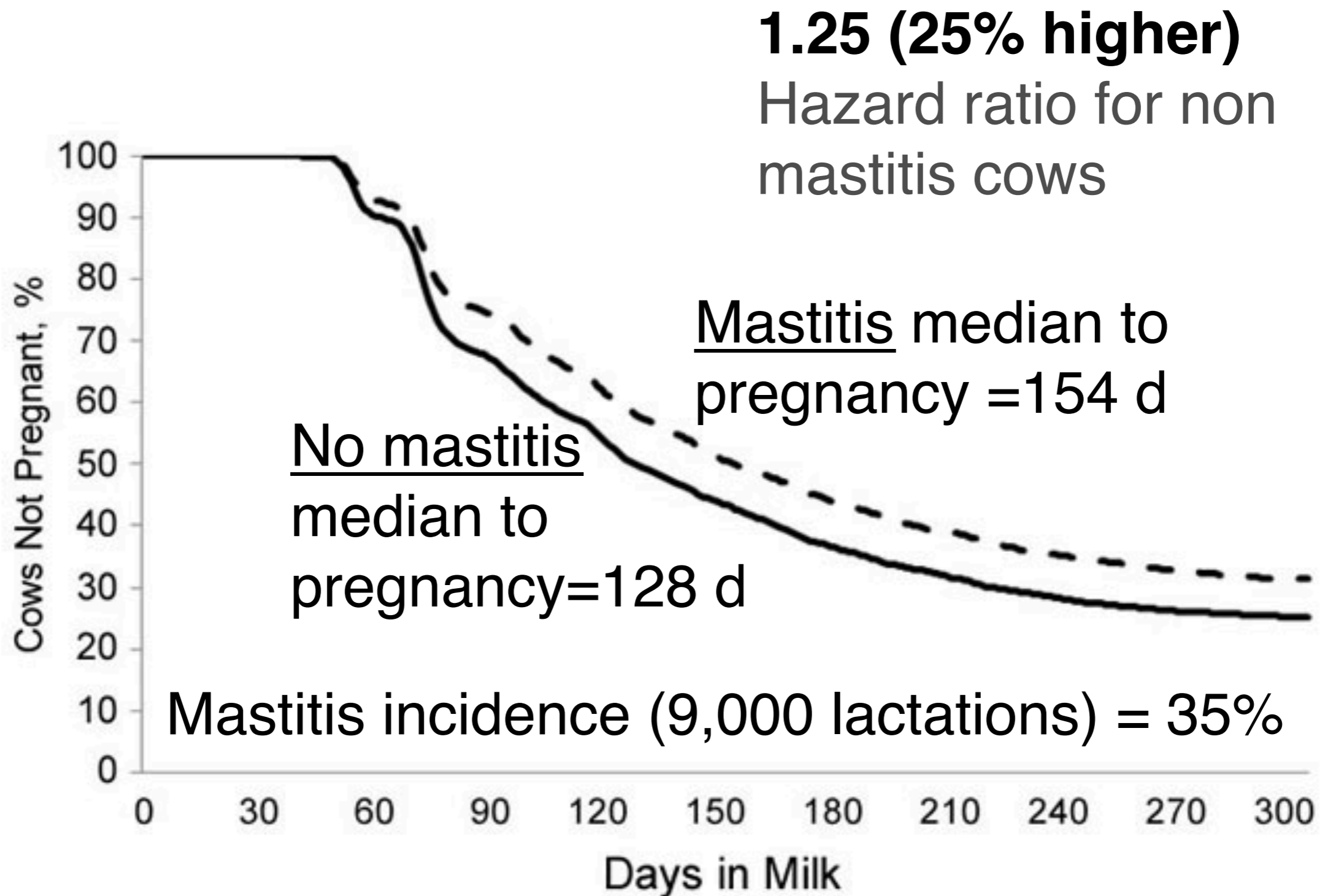
## **Higher likelihood**

Abortion

5.8 vs. 11.6%

# Mastitis and reproduction

## Survival curve



# Decreased fertility cost

Tool: The economic value of a dairy cow

## Decreased net return

Response to decreased  
21-d pregnancy rate

### Economics of an Average Cow, \$/year

Net Return, \$	1969
Milk Sales, \$	3806
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Reproductive Cost, \$	-80

### Herd Production and Reproduction Variables

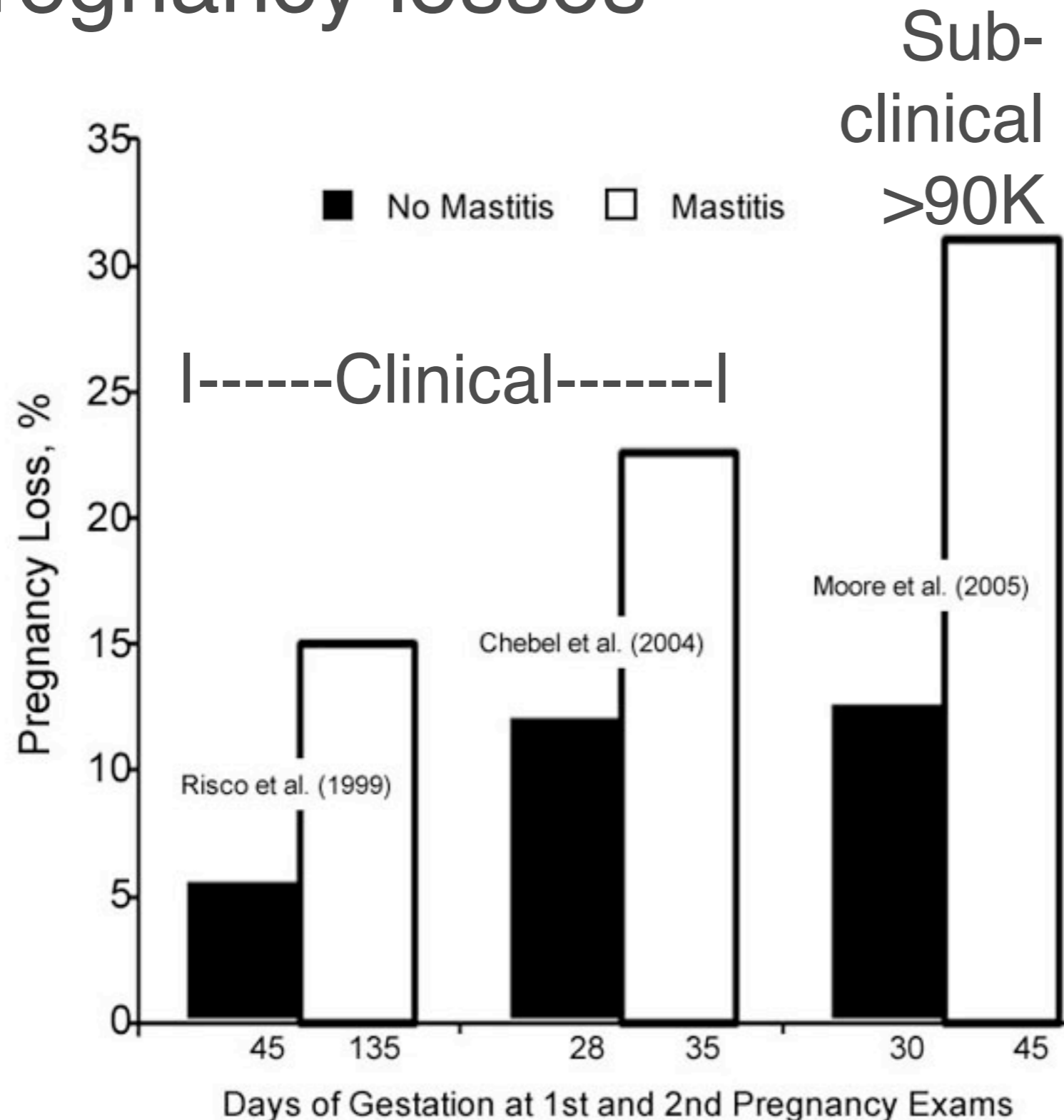
Herd Turnover Ratio, %/year	35
Rolling Herd Average, lb/cow per year	24,000
21-d Pregnancy Rate, %	18
Reproduction Cost, \$/cow per month	20
Last Month After Calving to Breed a Cow	10
Do-not-Breed Cow Minimum Milk, lb/day	50
Pregnancy Loss after 35 Days Pregnant, %	22.6
Average Cow Body Weight, lb	1306

## Example

Decreased 21-d PR from  
18 to 14% = \$1,969 - \$1,924  
= \$45/cow per year lost

# Mastitis and reproduction

## Pregnancy losses

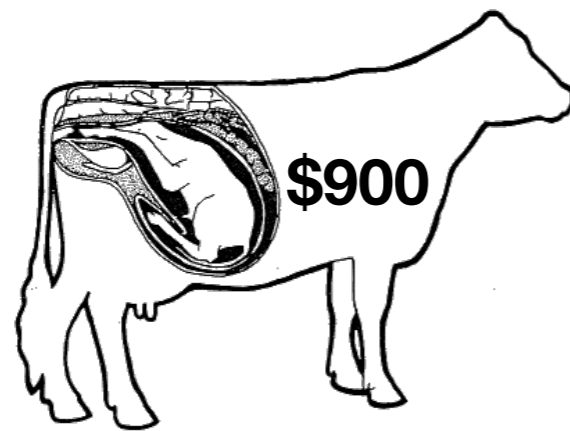


### **Mastitis cause pregnancy losses**

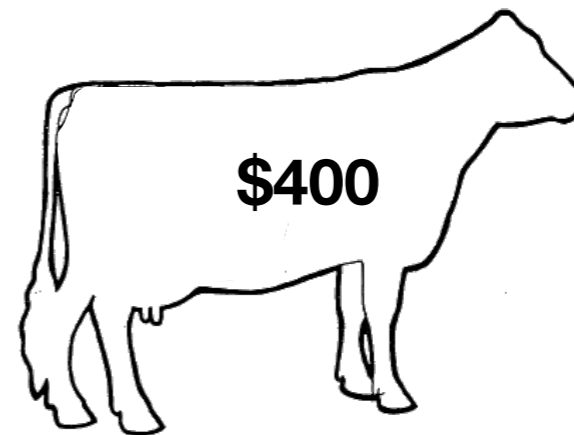
Cows diagnosed with mastitis before pregnancy diagnoses have a higher risk of pregnancy loss later in gestation

# Pregnancy loss cost

Tool: The economic value of a dairy cow



Vs.



## Abortion cost

Decreased cow value of cow when pregnant vs. when open

## Example

Cow value of \$900 when pregnant - cow value of \$400 when open = **\$500**



# Diseases and mastitis

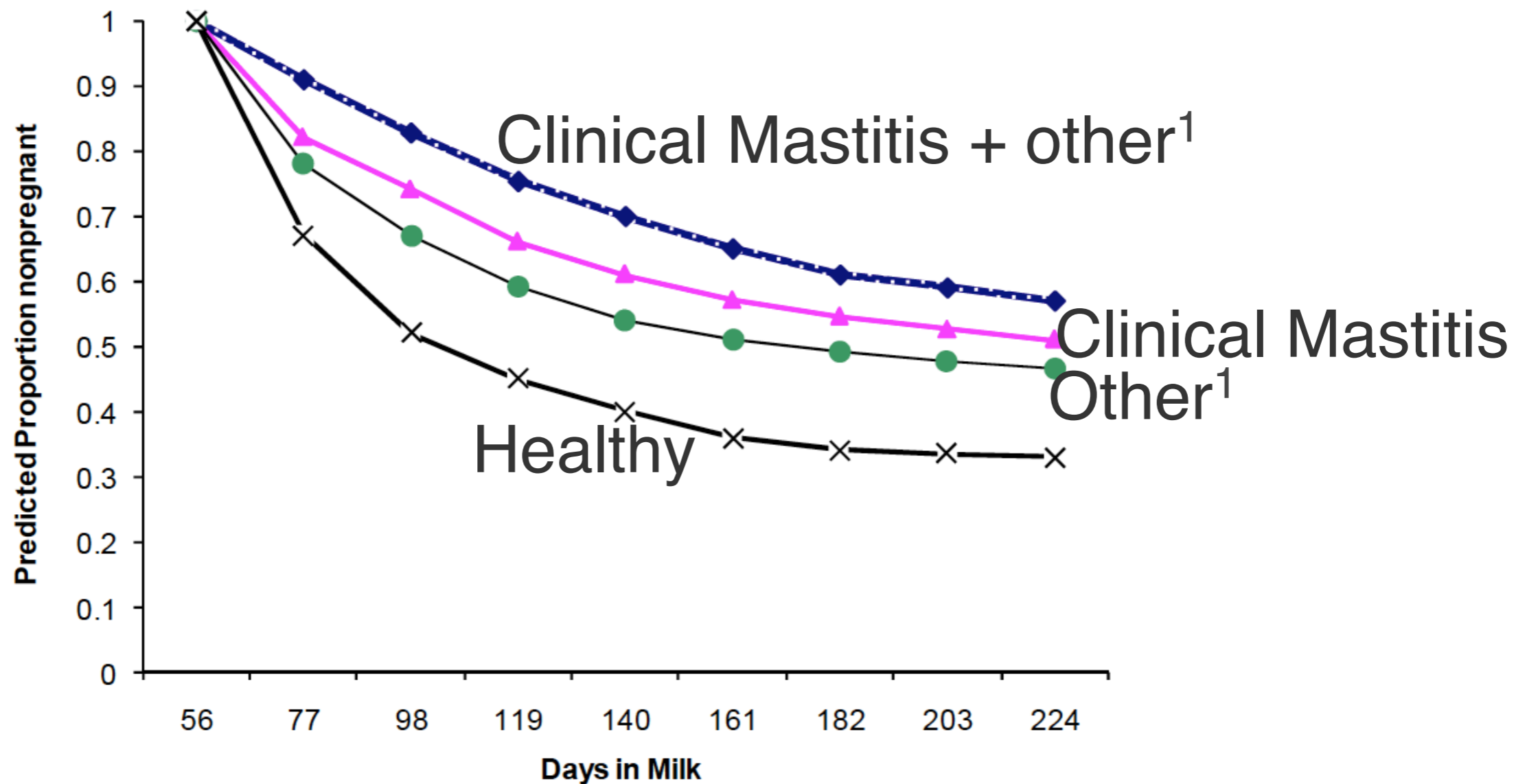
## Mastitis alone and other diseases

	<b>Clinical Mastitis + other<sup>1</sup></b>	<b>Clinical Mastitis</b>	<b>Other<sup>1</sup></b>	<b>Healthy</b>
n	54	154	187	572
Days to first breeding	73	66	65	67
Services per conception	2.8 <sup>a</sup>	2.1 <sup>ab</sup>	1.9 <sup>abc</sup>	1.6 <sup>c</sup>
Days open	155 <sup>a</sup>	140 <sup>a</sup>	97 <sup>b</sup>	88 <sup>b</sup>

<sup>1</sup>Other=ovarian cyst, retained placenta, left displaced abomasum, ketosis, milk fever, metritis, pyometra.

# Diseases and fertility

## Mastitis alone and other diseases



<sup>1</sup>Other=ovarian cyst, retained placenta, left displaced abomasum, ketosis, milk fever, metritis, pyometra.

# Web-based decision support tools

## The UW-Dairy Management Website

Menu

Dairy Management UW-Extension  
University of Wisconsin-Madison

THE UNIVERSITY OF WISCONSIN MADISON  
UW Extension

Home Tools Projects Publications Presentations Links  
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### Dairy Management

Dairy Management site is designed to support dairy farming decision-making focusing on model-based scientific research. The ultimate goal is to provide user-friendly computerized decision support systems to help dairy farms improve their economic performance. Dr. Victor Cabrera focuses on model-based decision support in dairy cattle and in dairy farm production systems. Dr. Cabrera's primary interest is to improve cost-efficiency and profitability along with environmental stewardship in dairy farms by using simulation techniques, artificial intelligence, and expert systems. Dr. Cabrera's research and Extension programs involve interdisciplinary and participatory approaches towards the creation of user-friendly decision support systems. As an Extension Specialist, Dr. Cabrera works in close relationships with county-based Extension faculty, dairy producers, consultants, and related industry.

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More...

**Victor E. Cabrera, Ph.D.**

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Click Above to reach the Administrator Portal.

**Tools**  
UW-Dairy Management Decision Support TOOLS

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Victor E. Cabrera @vecabrera 16h  
Nice program for the 2014 International Cow Fertility Conference, Westport, Ireland. [fb.me/2hu6pvQf](#)  
Victor E. Cabrera @vecabrera 27 Jun  
[fb.me/20nA7B1Bk](#)

DairyMGT.info

Tools

Social media

# Web-based decision support tools

## The UW-Dairy Management Website

### Management Tools

A collection of state-of-the-art dairy management tool that are: user-friendly, interactive, robust, have clear or self-explanatory instructions and technical support available.

Click on the Tool title to learn more.

#### Feeding

- ④ FeedVal 2012
- ④ Grouping Strategies for Feeding Lactating Dairy Cattle
- ④ Optigen® Evaluator
- ④ Income Over Feed Supplement Cost
- ④ Dairy Extension Feed Cost Evaluator
- ④ Corn Feeding Strategies
- ④ Income Over Feed Cost
- ④ Dairy Ration Feed Additive Break-Even Analysis

#### Heifers

- ④ Heifer Pregnancy Rate
- ④ Cost-Benefit of Accelerated Liquid Feeding Program for Dairy Calves
- ④ Economic Value of Sexed Semen Programs for Dairy Heifers
- ④ Heifer Replacement
- ④ Heifer Break-Even

#### Reproduction

- ④ UW-DairyRepro\$Plus: A Reproductive Analysis Tool that Includes Heat Detection Devices

**DairyMGT.info:  
Tools**

# Web-based decision support tools

## The UW-Dairy Management Website

### Feeding

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# Web-based decision support tools

## The UW-Dairy Management Website

### Heifers

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- Heifer Pregnancy Rate
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# Web-based decision support tools

## The UW-Dairy Management Website

### Reproduction

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- UW-DairyRepro\$Plus: A Reproductive Analysis Tool that Includes Heat Detection Devices
- The Economic Value of a Dairy Cow
- Economic Value of Sexed Semen Programs for Dairy Heifers
- UW-DairyRepro\$: A Reproductive Economic Analysis Tool
- Exploring Timing of Pregnancy Impact on Income Over Feed Cost
- Dairy Reproductive Economic Analysis
- Heifer Pregnancy Rate

# Web-based decision support tools

## The UW-Dairy Management Website

### Production

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- Milk Curve Fitter
- Decision Support System Program for Dairy Production and Expansion
- Economic Analysis of Switching from 2X to 3X Milking
- Lactation Benchmark Curves for Wisconsin
- Economic Evaluation of using rbST
- Alfalfa Yield Predictor: Using a Computer Application to Predict Irrigated Alfalfa Yield



# Web-based decision support tools

## The UW-Dairy Management Website

### Replacement

- The Economic Value of a Dairy Cow
- Value of a Springer
- Heifer Replacement
- Heifer Break-Even
- Herd Structure Simulation

# Web-based decision support tools

## The UW-Dairy Management Website

### Financial

- ◉ LGM-Dairy Analyzer
- ◉ Working Capital Decision Support System
- ◉ The Wisconsin Dairy Farm Ratio Benchmarking Tool
- ◉ Decision Support System Program for Dairy Production and Expansion
- ◉ Least Cost Optimizer
- ◉ LGM-Dairy Premium Sensitivity
- ◉ Return to Labor
- ◉ Estimate Your Mailbox Price
- ◉ LGM Dairy Feed Equivalent Calculator
- ◉ Net Guarantee Income Over Feed Cost for LGM-Dairy

# Web-based decision support tools

## The UW-Dairy Management Website

### Environment

- Dairy Nutrient Manager
- Grazing-N: Application that Balances Nitrogen in Grazing Systems
- Seasonal Prediction of Manure Excretion
- Dynamic Dairy Farm Model



**Thanks**