Mastitis economics and Web-based decision support tools

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Outline

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

Modified from Pinzón-Sánchez et al. (2011)
# Impact of mastitis

Loss for an average case, an example

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

Ahmadzadeh and Dalton (2010)
Milk loss
Clinical mastitis

Adjusted because losses occurred in high producing cows

Seegers et al. (2003)
Milk loss
Clinical mastitis

375 kg (5%) loss
Average case for Holstein 2\textsuperscript{nd} month

Highly variable
10 cases:
• 5 cases: 375 kg (average)
• 4 cases: Little loss
• 1 case: 1,000 kg (high)

Seegers et al. (2003)
Milk loss
Clinical mastitis: First lactation

Effect (kg/d)

Relative days to onset

Grôhn et al. (2004)
Milk loss

Clinical mastitis: 2\textsuperscript{nd} + lactations

Gröh et al. (2004)
Milk loss
Clinical mastitis: 30 to 305 d

Value milk loss (@ $0.33/kg)

- Streptococcus spp.
- Staphylococcus aureus
- Staphylococcus spp.
- Escherichia coli
- Klebsiella spp.
- No patógeno

Lact. 1
Lact 2+

Pinzón-Sánchez et al. (2011)
Milk loss
Subclinical mastitis (in addition to clinical)

\[
y = 0.8656 \ln(x) - 9.3658
\]

\( \geq 2^{\text{nd}} \text{ lactation} \)

0.6 kg/d

(Each double SCC > 50,000)

\[
y = 0.5771 \ln(x) - 6.2439
\]

1\(^{\text{st}}\) lactation

0.4 kg/d

(Each double SCC > 50,000)

Modified from Seegers et al. (2003)
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)

Hortet et al. (1999)
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)

![Graph showing the relationship between SCC Bulk tank (K cell/mL) and premium or penalty ($/kg milk). The graph indicates a linear decrease in premium or penalty as SCC Bulk tank increases.]
Transmission cost

Non cured *Staphilococcus aureus*

Other contagious pathogens
- *Strep. agalactiae*
- *Streptococcus dysgalactiae*
- *Corynebacterium bovis*
  - *Mycoplasma bovis*

Swinkels et al. (2005): 0.25
Pinzón-Sánchez et al. (2011): 0.25
Harmon (1996)
Recurrence cost
Increased risk of additional cases

Risk factors
Lactation
Pathogen
Cure

Possible levels
13% 1st lactation
23% 2\textsuperscript{nd}+ lactation

\begin{itemize}
\item Pinzón-Sánchez et al. (2011)
\item Hoe and Ruegg (2005)
\end{itemize}

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

Pinzón-Sánchez et al. (2011)
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

Seegers et al. (2003)
## Early culling risk

Culling risk is increased

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

Replacement

Cow

Cow Value

Cabrera, 2012
Basic principle of value of a cow
Markov-chain algorithms

Cow Value = $625
PAR=3, MIM=5, MIP=1

Cabrera (2012)
Early culling cost

Tool: The economic value of a dairy cow

Example:
Cost of culling this 2nd 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\textsuperscript{rd} lactation, 5 MIM, 1 MIP
is $627 + $494 = $1,121

Cabrera (2012)
Mastitis and reproduction
Reproductive physiology

Prolonged service time
Energy balance
Fever
Blockage GnRH-LH

Reduced conception risk
Poorer quality oocytes
Fever
Toxins
Pregnancy losses

Chebel (2007)
Mastitis and reproduction
Reduced conception rate

- Control
- Mastitis before 1st TAI
- Mastitis between 1st TAI and pregnancy diagnosis
- Mastitis after pregnancy confirmation

Adapted from Santos et al. (2004) by Chebel (2007)
Mastitis and reproduction
Impacts (mastitis after 1\textsuperscript{st} service)

**Decreased**
Conception rate to 1\textsuperscript{st} 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%

Santos et al. (2004)
Mastitis and reproduction

Survival curve

Mastitis incidence (9,000 lactations) = 35%

Mastitis median to pregnancy = 154 d

No mastitis median to pregnancy = 128 d

1.25 (25% higher)
Hazard ratio for non mastitis cows

Mendonca and Chebel (2011)
Decreased fertility cost
Tool: The economic value of a dairy cow

Decreased net return
Response to decreased 21-d pregnancy rate

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

Cabrera (2012)
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

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

Cabrera (2012)
Diseases and mastitis
Mastitis alone and other diseases

<table>
<thead>
<tr>
<th></th>
<th>Clinical Mastitis + other(^1)</th>
<th>Clinical Mastitis</th>
<th>Other(^1)</th>
<th>Healthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>54</td>
<td>154</td>
<td>187</td>
<td>572</td>
</tr>
<tr>
<td>Days to first breeding</td>
<td>73</td>
<td>66</td>
<td>65</td>
<td>67</td>
</tr>
<tr>
<td>Services per conception</td>
<td>2.8(^a)</td>
<td>2.1(^{ab})</td>
<td>1.9(^{abc})</td>
<td>1.6(^c)</td>
</tr>
<tr>
<td>Days open</td>
<td>155(^a)</td>
<td>140(^a)</td>
<td>97(^b)</td>
<td>88(^b)</td>
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\(^1\)Other=ovarian cyst, retained placenta, left displaced abomasum, ketosis, milk fever, metritis, pyometra.

Ahmadzadeh et al. (2009)
Diseases and fertility

Mastitis alone and other diseases

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Web-based decision support tools
The UW-Dairy Management Website

Menu

Tools

Social media

DairyMGT.info
Web-based decision support tools
The UW-Dairy Management Website

Management Tools
A collection of state-of-the-art dairy management tools 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
- FeedVal 2012
- Grouping Strategies for Feeding Lactating Dairy Cattle
- Optigen® Evaluator
- Income Over Feed Supplement Cost
- Dairy Extension Feed Cost Evaluator
- Corn Feeding Strategies
- Income Over Feed Cost
- Dairy Ration Feed Additive Break-Even Analysis

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

Reproduction
- UW-DairyRepro$:Plus: A Reproductive Analysis Tool that Includes Heat Detection Devices
Web-based decision support tools
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Reproduction

- 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
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**Production**

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