Uterine infections: How to find them, what to do about them?

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Will this cow conceive?
% of cows with uterine infections by days calved
% of cows with endometritis by days partum at examination

McDougall et al 2007 ARS
• Majority of cows infected after calving
• Most infections ‘self-curing’
• However, some are persistent for many months
  – 21% of non-pregnant cows had bacteria isolated from the uterus at slaughter (McDougall, NZVJ, 2005)
  – Cows in negative energy balance more at risk?
    • Ketosis $\rightarrow$ ↓[IGF1] $\rightarrow$ PMN functionality (Foldi et al 2005)
Definitions

• (puerperal) Metritis
  – Systemically ill cow within 2 weeks of calving
  – Foul smelling, bloody discharge

• Endometritis
  – Not ‘sick’
  – Infections within the uterus
  – May or may not have external (vulval) discharge

• Pyometron
  – Uterine infections with a corpus luteum
Bacteriology

• Mixed population of bacteria found in the uterus after calving
• Only some of these are regarded as ‘pathogenic’:
  – Arcanobacterium pyogenes
  – Escherichia coli
  – Fusobacterium necrophorum, and
  – Prevotella melaninogenicus
Risk factors for uterine infections

- Difficult calving
- Caesarean section
- Twins
- Retained placenta
- Milk fever
- Ketosis
- Displaced abomasum
- High milk protein %
Effect of disease on fertility

McDougall 2001 NZ Vet J 49: 60-67
Diagnosis of uterine infections

Metricheck

Vaginoscope
### Scoring system

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No material detected</td>
</tr>
<tr>
<td>1</td>
<td>Clear mucous</td>
</tr>
<tr>
<td>2</td>
<td>A few flecks</td>
</tr>
<tr>
<td>3</td>
<td>Mucopurulent (&lt;50% pus)</td>
</tr>
<tr>
<td>4</td>
<td>Mucopurulent (&gt;50% pus)</td>
</tr>
<tr>
<td>5</td>
<td>Mucopurulent (&gt;50% pus) + odour</td>
</tr>
</tbody>
</table>

(combined for analysis)
What is the relationship between metricheck score and subsequent fertility?

N= 2780 cows, 9 spring-calving herds

Assess pre-mating heat:
Y/N

Metrichell
Apply tailpaint

Optional treatment of non-cyclers

Pregnancy diagnosis

Calving
Artificial mating
Natural mating

Day relative to initial start of breeding program

-35 -10 0 70-84 35-56 days after bull removal

Note: 1 vet at all visits, other vets scored but under direction of 1 vet ignored days calved and history; i.e. all cows examined

McDougall et al 2007 ARS
Frequency of score (4 weeks before breeding start)

N= 2780 cows, 9 spring-calving herds
% score 2+ across entire herds
(n = 9 herds; 2780 cows total)

Average all herds = 21%

McDougall et al 2007 ARS
Score by peripartum disease history

Peripartum disease?  

% endometritis (>score 1)

No  Yes

0  50

McDougall et al 2007 ARS
% of cows ‘not detected in oestrus’ by 10 days before breeding start date

McDougall et al 2007 ARS
In-calf proportion (%) by score

McDougall et al 2007 ARS
Median interval (d) to conception

Median days from PSM to conception

Score

McDougall et al 2007 ARS
Cumulative proportion not conceived

PSM to conception (days)

McDougall et al 2007 ARS
Proportion pregnant

Days from start of breeding programme

- = score 0 + 1
\(\triangledown\) = score 2
○ = score 3
▼ = score 4
\(\blacksquare\) = score 5
\(\square\) = score 5
## Final model P values (relative to score of 1)

<table>
<thead>
<tr>
<th>Score</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preg 28</td>
<td>**</td>
<td>ns</td>
<td>**</td>
<td>*</td>
</tr>
<tr>
<td>Preg 56</td>
<td>ns</td>
<td>*</td>
<td>**</td>
<td>*</td>
</tr>
<tr>
<td>Preg Final</td>
<td>ns</td>
<td>*</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>PSM-conception</td>
<td>*</td>
<td>**</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>

Models include herd, age code
ns = not significant (P>0.05), * = <0.05, ** <0.01, *** P<0.001

McDougall et al 2007 ARS
Other diagnostic approaches

• Detection of PMN’s in the uterus
  – Endometrial cytology (Kasimanickam et al 2004)
  – Uterine flush (Gilbert et al 2005)

• Elevations in serum markers of inflammation
  – Haptoglobulin
  – $\alpha_1$-acid glycoprotein (Regassa et al 2002)

• Ultrasonography (Kasimanickam et al 2004)
What can be done about cows with uterine infections?

- Leave to ‘self cure’
- Prostaglandins $F_{2\alpha}$
  - For corpus luteum +ve, pyometron
- Infusion of antibiotics into the uterus (e.g. cephapirin; McDougall 2001; LeBlanc et al 2002)
- Others
  - Antiseptics (Knutti et al 2000; Feldman et al 2005)
  - Proteolytic enzymes (Drillich et al 2005)
Results

• Retained foetal membranes
  – (>24 h; RFM; n = 282)
• Dystocia
  – (vet or herdowners assisted; n = 234)
• Metabolic disease/recumbency;
  – (n = 141)
• Vaginal discharge > 2 weeks postpartum
  – (n = 101)
• Calf dead at birth or within 24 hours
  – (n = 169)
• Twins
  – (n = 46)
## All ‘at-risk’ cows

<table>
<thead>
<tr>
<th></th>
<th>Con</th>
<th>Rx</th>
<th>Diff</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. cases</strong></td>
<td>342</td>
<td>348</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Culled (%)</strong></td>
<td>7.7</td>
<td>4.7</td>
<td>3.0</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td><strong>AA (%)</strong></td>
<td>14.6</td>
<td>17.2</td>
<td>3.0</td>
<td></td>
<td></td>
<td>ns</td>
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<tr>
<td><strong>Sub D28 (%)</strong></td>
<td>87.1</td>
<td>93.1</td>
<td>6.0</td>
<td>1.83</td>
<td>1.07-3.02</td>
<td>*</td>
</tr>
<tr>
<td><strong>Con S1 (%)</strong></td>
<td>42.4</td>
<td>46.4</td>
<td>4.0</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td><strong>Preg D28 (%)</strong></td>
<td>48.8</td>
<td>54.0</td>
<td>5.2</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td><strong>Preg D56 (%)</strong></td>
<td>82.5</td>
<td>85.9</td>
<td>3.4</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td><strong>D to conceive</strong></td>
<td>26.2</td>
<td>23.3</td>
<td>-2.9</td>
<td></td>
<td></td>
<td>ns</td>
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<tr>
<td><strong>MT (%)</strong></td>
<td>6.4</td>
<td>7.5</td>
<td>1.1</td>
<td></td>
<td></td>
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</table>

* * p<0.05

McDougall 2001 NZVJ
## Treating cows with a history of an RFM

<table>
<thead>
<tr>
<th></th>
<th>Con</th>
<th>Cephapirin</th>
<th>Diff</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
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<td>136</td>
<td></td>
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<tr>
<td>AA (%)</td>
<td>15.2</td>
<td>16.9</td>
<td>1.8</td>
<td></td>
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</tr>
<tr>
<td>Sub D28 (%)</td>
<td>87.9</td>
<td>94.9</td>
<td>7.0</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Con S1 (%)</td>
<td>40.9</td>
<td>50.0</td>
<td>9.1</td>
<td></td>
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<tr>
<td>Preg D28 (%)</td>
<td>45.5</td>
<td>57.4</td>
<td>11.9</td>
<td>1.64</td>
<td>1.01-2.67</td>
<td>*</td>
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<tr>
<td>Preg D56 (%)</td>
<td>78.4</td>
<td>86.7</td>
<td>8.3</td>
<td>1.79</td>
<td>0.90-3.59</td>
<td>†</td>
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<tr>
<td>D to conceive</td>
<td>33</td>
<td>20</td>
<td>-13</td>
<td>1.28</td>
<td>0.98-1.67</td>
<td>†</td>
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<tr>
<td>MT (%)</td>
<td>9.1</td>
<td>7.4</td>
<td>-1.7</td>
<td></td>
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</tbody>
</table>

* p<0.05, † p<0.1

McDougall 2001 NZVJ
Days to pregnancy (RFM)

Probability of pregnancy

Interval from PSM to conception (days)
• Significant positive treatment effects following treatment of cows with
  – A still-born calf
  – Farmer observed vaginal discharge
• No treatment effect of cows with
  – Milk fever
  – Difficult calving (unless RFM)
### “Dead calf” performance

<table>
<thead>
<tr>
<th></th>
<th>Con</th>
<th>Rx</th>
<th>Diff</th>
<th>OR</th>
<th>95% CI</th>
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<td>86</td>
<td>77</td>
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<tr>
<td>AA (%)</td>
<td>11.6</td>
<td>18.2</td>
<td>6.6</td>
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<tr>
<td>Sub D28 (%)</td>
<td>91.9</td>
<td>93.5</td>
<td>1.6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Con S1 (%)</td>
<td>36.0</td>
<td>42.9</td>
<td>6.8</td>
<td></td>
<td></td>
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<tr>
<td>Preg D28 (%)</td>
<td>41.9</td>
<td>59.7</td>
<td>17.9</td>
<td>2.06</td>
<td>1.10-3.85</td>
<td>*</td>
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<tr>
<td>Preg D56 (%)</td>
<td>78.1</td>
<td>89.1</td>
<td>11.0</td>
<td>2.29</td>
<td>0.87-5.98</td>
<td>†</td>
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<tr>
<td>D to conceive</td>
<td>35</td>
<td>21</td>
<td>-14</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MT (%)</td>
<td>4.7</td>
<td>13.0</td>
<td>8.3</td>
<td>15.8</td>
<td>1.8-141</td>
<td>**</td>
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</table>

* p<0.05, † p<0.1
Days to pregnancy (dead calf)

Probability of pregnancy

Interval from PSM to conception (days)

Metricure

Control
<table>
<thead>
<tr>
<th></th>
<th>Con</th>
<th>Rx</th>
<th>Diff</th>
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<th>P</th>
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<td>48</td>
<td>48</td>
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</tr>
<tr>
<td>AA (%)</td>
<td>16.7</td>
<td>10.4</td>
<td>-6.3</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sub D28 (%)</td>
<td>81.3</td>
<td>85.4</td>
<td>4.2</td>
<td></td>
<td></td>
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<tr>
<td>Con S1 (%)</td>
<td>29.2</td>
<td>45.8</td>
<td>16.7</td>
<td>2.81</td>
<td>0.96-8.29</td>
<td>†</td>
</tr>
<tr>
<td>Preg D28 (%)</td>
<td>35.4</td>
<td>52.1</td>
<td>16.7</td>
<td>3.13</td>
<td>1.02-9.59</td>
<td>*</td>
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<tr>
<td>Preg D56 (%)</td>
<td>65.9</td>
<td>83.3</td>
<td>17.4</td>
<td>2.87</td>
<td>1.00-8.22</td>
<td>*</td>
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<td>D to conceive</td>
<td>40</td>
<td>27</td>
<td>-13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MT (%)</td>
<td>8.3</td>
<td>8.3</td>
<td>0.0</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

* p<0.05, † p<0.1
Days to pregnancy (Vaginal discharge)
Others

- No significant effect of treatment on reproductive outcomes for
  - Hypocalceamia
  - Dystocia
Vaginal and rectal exam findings

- Rectal and vaginal speculum exam:
  - 28.6% of cows had a palpable CL
  - 20.9% had purulent discharge at cervix os
Reproductive performance of ‘nil/mucous’ vs. ‘purulent’ cows

<table>
<thead>
<tr>
<th></th>
<th>Nil</th>
<th>Purulent</th>
<th>P</th>
<th>Not at risk*</th>
</tr>
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<tbody>
<tr>
<td>N</td>
<td>72</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub D 28 (%)</td>
<td>94.4</td>
<td>73.7</td>
<td>*</td>
<td>94.0</td>
</tr>
<tr>
<td>Preg D 28 (%)</td>
<td>51.4</td>
<td>26.3</td>
<td>*</td>
<td>67.5</td>
</tr>
<tr>
<td>D to conceive</td>
<td>25</td>
<td>68</td>
<td>**</td>
<td>18</td>
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<tr>
<td>MT</td>
<td>6.9</td>
<td>26.3</td>
<td>**</td>
<td>5.9</td>
</tr>
</tbody>
</table>

* Derived from McDougall, 2001 NZ Vet J 49: 60-67
Days to pregnancy for discharge cows

Interval from PSM to conception (days)

Probability of pregnancy

- Mucopurulent
- Nil/mucous
## Milk production

<table>
<thead>
<tr>
<th></th>
<th>Treated</th>
<th></th>
<th>Control</th>
<th></th>
<th>P</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Volume L/cow/D</td>
<td>16.3</td>
<td>0.3</td>
<td>16.3</td>
<td>0.2</td>
<td>0.97</td>
</tr>
<tr>
<td>Milk solids Kg/cow/D</td>
<td>1.32</td>
<td>0.2</td>
<td>1.34</td>
<td>0.2</td>
<td>0.91</td>
</tr>
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</table>
Median days open (calving-conception) after treatment for endometritis

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Cephapirin</th>
<th>PG</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>178</td>
<td>134</td>
<td>164</td>
<td>0.13</td>
</tr>
<tr>
<td>20-26 DIM</td>
<td>137</td>
<td>134</td>
<td>150</td>
<td>0.65</td>
</tr>
<tr>
<td>27-33 DIM</td>
<td>205</td>
<td>133</td>
<td>171</td>
<td>0.07</td>
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</tbody>
</table>

Leblanc et al 2002 J Dairy Sci
### Hazard (HR) of pregnancy

(All cows)

(>1 = faster; <1 = slower)

<table>
<thead>
<tr>
<th></th>
<th>CL palpable (n = 125)</th>
<th>No CL palpable (n = 184)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>P</td>
</tr>
<tr>
<td>Cephapirin</td>
<td>1.75 (1.2 to 2.5)</td>
<td>0.003</td>
</tr>
<tr>
<td>PGF2α</td>
<td>1.43 (0.8 to 2.4)</td>
<td>0.21</td>
</tr>
<tr>
<td>Contrast P</td>
<td>0.36</td>
<td></td>
</tr>
</tbody>
</table>

Leblanc et al 2002 J Dairy Sci
<table>
<thead>
<tr>
<th></th>
<th>Treated 20 to 26 DIM (n = 168)</th>
<th>26 DIM (n = 110)</th>
<th>Treated 27 to 33 DIM (n = 141)</th>
<th>33 DIM (n = 74)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CL palpable (n = 58)</td>
<td>No CL palpable</td>
<td>CL palpable (n = 67)</td>
<td>No CL palpable (n = 74)</td>
</tr>
<tr>
<td>HR (95% CI)</td>
<td>P (95% CI)</td>
<td>P (95% CI)</td>
<td>P (95% CI)</td>
<td>P (95% CI)</td>
</tr>
<tr>
<td>Cephapirin</td>
<td>1.13 (0.5 to 2.8)</td>
<td>0.96 (0.5 to 1.9)</td>
<td>2.1 (1.2 to 3.6)</td>
<td>1.26 (0.7 to 2.3)</td>
</tr>
<tr>
<td>PGF2α</td>
<td>1.17 (0.5 to 2.9)</td>
<td>0.50 (0.3 to 0.9)</td>
<td>1.45 (0.7 to 2.9)</td>
<td>1.03 (0.5 to 2.1)</td>
</tr>
<tr>
<td>Contrast P</td>
<td>0.93</td>
<td>0.03</td>
<td>0.29</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Leblanc et al 2002 J Dairy Sci
Cost/benefit of treatment

- 15% of cows in 300 cow herd ‘at risk’
- Milk production 1.2 kg MS/cow/day
- Payment for milk $ 5.60/kg milk solids
- Return per extra day in milk = $6.84
- Extra DIM after treatment (all) = 10
- Extra DIM after treatment (Dx +ve) = 20
- Cost of ‘metrichecking’ ($/cow) = $2
- Treatment cost ($/cow) = $25
Check?

- Yes
  - +ve (0.3)
    - Treat
  - -ve (0.7)
    - Inf (0.2)
    - Uninf (0.5)
      - None
        $0 0 0$
      - All
        $1125 450 1955$

- No
  - Treat
  - None
    $428 270 1511$
  - Cost DIM Benefit-cost
    $428 270 1511$
    $1125 450 1955$
    $0 0 0$

Cost DIM Benefit-cost

Health centre
**EMV ($)**

<table>
<thead>
<tr>
<th></th>
<th>RX all</th>
<th>Dx + Rx</th>
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<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>1017</td>
<td>886</td>
</tr>
<tr>
<td><strong>St Dev</strong></td>
<td>1101</td>
<td>1845</td>
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<tr>
<td><strong>SEM</strong></td>
<td>49</td>
<td>83</td>
</tr>
<tr>
<td><strong>1st ¼</strong></td>
<td>263</td>
<td>-19</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>820</td>
<td>399</td>
</tr>
<tr>
<td><strong>3rd ¼</strong></td>
<td>1656</td>
<td>1562</td>
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</tbody>
</table>

**Estimated monetary value**

- **Treat all**
  - Estimated monetary value range:
    - -2000 to 0
    - 0 to 2000
    - 2000 to 4000
    - 4000 to 6000
  - Frequency distribution:
    - 0 to 50
    - 50 to 100
    - 100 to 200
    - 200 to 250

**Frequency**

- **Treat all**
  - Estimated monetary value range:
    - -2000 to 0
    - 0 to 2000
    - 2000 to 4000
    - 4000 to 6000
  - Frequency distribution:
    - 0 to 50
    - 50 to 100
    - 100 to 200
    - 200 to 250
$/cow (benefit-cost)
Conclusions

• Uterine infections have negative effects on fertility
  • Poorer pregnancy rate by day 28, 56 and final where score >2
• Uterine infections are common (10-20% of cows)
• Treatment of uterine infections by intrauterine infusion of antibiotics (cephapirin) results in improved fertility and is cost-effective
• Prevention of intrauterine infections involves minimising
  – Calf deaths
  – Retained foetal membranes
  – Appropriate sire selection
  – Minimise ketosis
Thanks

Any questions?
Thanks; questions?