Genetic analysis of calf survival in Dutch Holstein calves

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Animal Evaluation Unit

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• Definition of calf survival

• Material and methods

• Results

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Introduction

• **Current situation**
  – Survival around birth (BVE livability/still birth)
  – Survival after first calving (BVE longevity)

• **Nothing is known about survival in the rearing period**
  – Economically important
  – Monitoring

• **Breeding goal is calf survival of replacement heifers in the first year of rearing**

• **Aim: Development of a genetic evaluation for calf survival**
Distribution of calf mortality
Trait definition of calf survival

Day 3-14
E. Coli Enteritis

Day 15-30
Other Enteritis

Day 31-90
Respiratory Diseases

Day 91-365
Various Reasons

Day 3-365 Calf survival during first year
Death at day 67

Day 3-365 Calf survival during first year
0
Data selection

- Female herdbook calves with known sire
- At least 75% Holstein Friesian
- Sire is an AI-bull
- Born and culled in the same herd
- Calves born between 2002-2009
- Herds with at least 100 calves
- Herds with conventional rearing policy
- Bulls with at least 25 progeny in at least 10 herds

- In total 522,335 records from 3,253 herds and 4,258 sires
## Results

### Survival per period

<table>
<thead>
<tr>
<th>Period</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>day 3 – 365</td>
<td>93.55</td>
</tr>
<tr>
<td>day 3 – 14</td>
<td>97.41</td>
</tr>
<tr>
<td>day 15 – 30</td>
<td>98.81</td>
</tr>
<tr>
<td>day 31 – 90</td>
<td>98.56</td>
</tr>
<tr>
<td>day 91 – 365</td>
<td>98.65</td>
</tr>
</tbody>
</table>
Statistical model

Linear sire model

\[ Y = \text{HERD} + \text{YM} + P + \text{sire} + e \]

- \( Y \): observation of calf survival
- \( \text{HERD} \): herd of birth (fixed)
- \( \text{YM} \): year x month of birth (fixed)
- \( P \): parity of dam (fixed)
- \( \text{sire} \): additive genetic effect (random)
- \( e \): residual (random)
## Results

### Genetic parameters

<table>
<thead>
<tr>
<th></th>
<th>d 3 - 365</th>
<th>d 3 - 14</th>
<th>d 15 - 30</th>
<th>d 31 - 90</th>
<th>d 91 - 365</th>
<th>gen.sd. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>day 3 - 365</td>
<td>0.011</td>
<td>0.62</td>
<td>0.63</td>
<td>0.83</td>
<td>-2</td>
<td>2.49</td>
</tr>
<tr>
<td>day 3 - 14</td>
<td>0.85</td>
<td>0.006</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.20</td>
</tr>
<tr>
<td>day 15 - 30</td>
<td>1.00&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.90</td>
<td>0.002</td>
<td>0.00</td>
<td>0.00</td>
<td>0.46</td>
</tr>
<tr>
<td>day 31 - 90</td>
<td>0.97</td>
<td>0.44</td>
<td>0.71</td>
<td>0.001</td>
<td>0.00</td>
<td>0.45</td>
</tr>
<tr>
<td>day 91 - 365</td>
<td>-2&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.19</td>
<td>0.51</td>
<td>0.67</td>
<td>0.005</td>
<td>0.82</td>
</tr>
</tbody>
</table>

*blue = genetic correlation; red = error correlation*

<sup>1</sup> fixed at boundary

<sup>2</sup> did not converge
Predictor traits

- **Veal calves**
  - Day 3 – 14 together with replacement heifers
  - Day 15 – 180

- **Data from all calves could be used potentially**

- **Use in genetic evaluation**

<table>
<thead>
<tr>
<th></th>
<th>day 3 - 365</th>
<th>day 3 - 14</th>
<th>day 15 - 180</th>
<th>gen.sd.(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>day 3 – 365</td>
<td><strong>0.011</strong></td>
<td>0.62</td>
<td>0.00</td>
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<td>0.37</td>
<td><strong>0.005</strong></td>
<td>1.12</td>
</tr>
</tbody>
</table>

*blue = genetic correlation; red = error correlation*
## Results

### Reliability of bulls

<table>
<thead>
<tr>
<th>Status</th>
<th>Number of progeny</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>day 3-365</td>
<td>day 3-14</td>
</tr>
<tr>
<td>test 1</td>
<td>0</td>
<td>319</td>
</tr>
<tr>
<td>test 2</td>
<td>0</td>
<td>324</td>
</tr>
<tr>
<td>test 3</td>
<td>184</td>
<td>411</td>
</tr>
</tbody>
</table>

**First daughters in production**

<table>
<thead>
<tr>
<th>Proven</th>
<th>Number of progeny</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>day 3-365</td>
<td>day 3-14</td>
</tr>
<tr>
<td>proven 1</td>
<td>313</td>
<td>810</td>
</tr>
<tr>
<td>proven 2</td>
<td>4,889</td>
<td>10,913</td>
</tr>
<tr>
<td>proven 3</td>
<td>24,849</td>
<td>51,388</td>
</tr>
</tbody>
</table>
Conclusions

• Possible to estimate genetic parameters for calf survival
  – $h^2$ is 0.011 for day 3-365

• Genetic variation exists
  – $\sigma_g$ is 2.5%

• Day 3-14 is a good early predictor

• Data of veal calves can be used as predictor

• Reliability of progeny tested bulls will be around 60%

• Genetic evaluation enables monitoring of calf survival
Follow up

• Introduction breeding value estimation
  – Probably April 2013
  – Enough data available
    – Around 1 million calves per year
Thank you for your attention

Questions?