Improving the genetic evaluation for longevity in the Netherlands

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Aim

• Set up new genetic evaluation for longevity
• Compare with current genetic evaluation
Genetic parameters

**New**
- Linear random regression model
- Animal model
- Different trait across cow’s life
- $h^2 = 0.12$
- Gen.SD = 7.1 mo

**Current**
- Proportional hazards model
- Sire-mgs model
- Same trait across cow’s life
- $h^2 = 0.12$
- Gen.SD = 9.0 mo
Statistical model

- Random regression animal model
  \[ Y = X\beta + Za + e \]
- \( Y \): Survival per month after first calving (month 1 – 72)
- \( \beta \): Fixed effects
  1. Herd-year-season x lactation-stage
  2. Year-season x AFC x prod x lactation-stage
  3. Herdsise change
  4. Heterosis
  5. Recombination
- \( a \): Additive genetic effect, 5th order Legendre polynomial
- \( e \): Residual

- Year-season of calving
- Lactation: 1, 2, 3+ for 1. and 1, 2, 3, 4, 5+ for 2.
- Stage: month 1-2, 3-9, 10+ and dry period
- AFC: age at first calving in months: 21, 22,…,34, 35+
- Prod: within-herd production level, 5 classes of 20%
Correlation between total life (1-72 mo) and accumulated intervals
Comparison of new with current genetic evaluation

- One run per year from 2007 to 2017

- Compared on:
  - Reliability
  - Mean difference with latest EBV (2017)
  - Genetic correlations between EBV (2007 to 2017)

- For first crop and second crop bulls
  - With first EBV in 2007 or later
Reliability per birthyear

**New**: Higher reliability for bulls with incomplete information
Difference of $n^{th}$ run of bull with latest EBV for first crop bulls

**New:** 1st EBV is less overestimated
Difference of $n^{th}$ run of bull with latest EBV for second crop bulls

**New:** 1$^{st}$ EBV is less overestimated and stable in 3$^{rd}$ year
New: smaller and shorter overestimation for latest birthyears with incomplete information
## Correlations between first EBV and later EBV

<table>
<thead>
<tr>
<th>EBV run</th>
<th>current</th>
<th>new</th>
<th>difference</th>
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<tbody>
<tr>
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<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
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<tr>
<td>2</td>
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<td>3</td>
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<tr>
<td>8</td>
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<tr>
<td>9</td>
<td>0.58</td>
<td>0.70</td>
<td>+0.12</td>
</tr>
<tr>
<td>10</td>
<td>0.59</td>
<td>0.69</td>
<td>+0.10</td>
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<tr>
<td>11</td>
<td>0.63</td>
<td>0.71</td>
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</table>

Correlations between runs higher with **new** → less reranking
Presentation of new breeding value

- Current EBV is for productive longevity
  - New EBV should be comparable with current EBV

- Expand EBV based on 72 months to total life
  - Same ranking
- Convert EBV from functional to productive longevity
- Add predictor traits
  - To increase reliability
- Correlation current EBV – publishable EBV ~0.90
Conclusions

New genetic evaluation for longevity
- Multiple traits across cow’s life
- Improved calculation of reliability
  - Information of living animals is also used
- Smaller overestimation of $1^{\text{st}}$ EBV
  - More stable EBV from run to run
- Less reranking

Thank you for your attention!
## Description of compared test/proven bulls

<table>
<thead>
<tr>
<th>EBV run</th>
<th>Test bulls</th>
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