Development of a tool for the overall assessment of animal welfare at farm level

Raphaëlle BOTREAU (INRA),
J. CAPDEVILLE (Institut de l’Elevage),
P. PERNY (Univ. Paris 6),
I. VEISSIER (INRA)
The primary aims of Welfare Quality® (2004-2009) are:

- To develop a European welfare assessment system for cattle, pigs and poultry
- To transform it into a European animal welfare information system
- To develop practical strategies to improve animal welfare
The primary aims of Welfare Quality® (2004-2009) are:

- To develop a European welfare assessment system for cattle, pigs and poultry (on-farm, during transport & at slaughter)
- To transform it into a European animal welfare information system
- To develop practical strategies to improve animal welfare

Elaborate a model for the overall assessment of animal welfare on a pilot animal-type: Dairy Cows

leading to results useful for a certification scheme while remaining transparent so as to help farmers define the most appropriate remedial solutions
Overall assessment of animal welfare: 
Problem statement

Going from a simple description of the animals' state to an overall assessment at farm level

Animal welfare comprises several dimensions which do not fully compensate each other (e.g. health, behaviour, absence of stress...)

Measures describing each dimension of welfare

Measures on:
- animals
- resources
- management

Multicriteria evaluation
The integration of data into an overall evaluation of the farm raises several ethical questions:

- Should the average state of animals or the worst animals matter?
- Should welfare criteria compensate each other?
- Should we take into account societal aspirations for high welfare levels or the realistic likelihood of achieving such levels in practice?

Science alone cannot solve ethical issues

⇒ Model tuned according to ‘expert’ opinion:

- animal scientists (for their knowledge of the measures)
- social scientists (for their knowledge on expectations of societal groups)
- stakeholders (as potential users of the overall assessment)
1- Definition of welfare criteria

<table>
<thead>
<tr>
<th>Principles</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good feeding</td>
<td>1. Absence of prolonged hunger</td>
</tr>
<tr>
<td></td>
<td>2. Absence of prolonged thirst</td>
</tr>
<tr>
<td>Good housing</td>
<td>3. Comfort around resting</td>
</tr>
<tr>
<td></td>
<td>4. Thermal comfort</td>
</tr>
<tr>
<td></td>
<td>5. Ease of movement</td>
</tr>
<tr>
<td>Good health</td>
<td>6. Absence of injuries</td>
</tr>
<tr>
<td></td>
<td>7. Absence of diseases</td>
</tr>
<tr>
<td></td>
<td>8. Absence of pain due to management procedures</td>
</tr>
<tr>
<td>Appropriate behaviour</td>
<td>9. Expression of social behaviours</td>
</tr>
<tr>
<td></td>
<td>10. Expression of other behaviours</td>
</tr>
<tr>
<td></td>
<td>11. Good Human-Animal relationship</td>
</tr>
<tr>
<td></td>
<td>12. Absence of general fear</td>
</tr>
</tbody>
</table>
Definition of welfare criteria: necessary to identify measures that cover all welfare criteria

- Body condition
- Lying down
- Cleanliness
- Access to pasture
- Injuries
- Social behaviour
- Social behaviour
- Fear of humans
- Lameness
- Etc...

~ 40 measures
Sequential evaluation structure

- **Measures**
  - Raw data
  - Scale 0 - 100
  - WORST
- **Criteria**
  - Scale 0 - 100
  - BEST
- **Principles**
  - Scale 0 - 100
- **Overall assessment**
  - Welfare categories
    - Not classified
    - Acceptable
    - Enhanced
    - Excellent
2- Construction of criteria

Measures → Criteria → Principles → Overall assessment

Raw data → Scale 0 - 100 → Scale 0 - 100 → Welfare categories
Construction of the criteria from the measures

What needs to be done:

- Identify the measures that can be used to check compliance of the farm to a given criterion.
- Pool information from the various measures of the criterion (according to the number of measures, their nature, precision and relative importance ⇒ several methods are used).
- Interpret the data collected on the farm in terms of welfare. For example, 10% very lean cows: is that very bad, bad, OK, good???

How:
Consultation of experts (animal scientists): datasets of virtual farms on which they have to react (i.e. rank farms and assign scores).
Construction of the criteria from the measures

Example:
Criterion "Absence of injuries"

Two measures taken at individual level:

- Tegument alterations
- Lameness

At farm level:
- % of severely lame cows
- % of moderately lame cows
- % of normal cows

Score = \( f(100 - \% \text{ ‘lame’ cows}) \)

with \( f \) a non linear function determined by least-square minimisation between experts' and calculated scores.
Construction of the criteria from the measures

Back to the ethical question:

Should the average state of animals or the worst animals matter?

A balance between both rationales

A score of 50 corresponds to:

- 10% severely lame cows (90% normal cows)
  ⇒ Assessment focused on worst animals

- 5% severely lame cows + 18% moderately lame (77% normal cows)
  ⇒ All animals in an impaired welfare state count

Experts' answers on a virtual dataset

Score

% of lame cows (weighted for severity)

0 10 20 30 40 50 60 70 80 90 100

50

10

Experts: Expert 1, Expert 2, Expert 3, Expert 4, Expert 5, Function f

EAAP 2009 – August 24-27 2009 – Barcelona (Spain)
3- Construction of criteria

Raw data  Scale 0 - 100  Scale 0 - 100  Welfare categories
From criteria to principles

What needs to be done:
To be able to produce principle-scores from scores obtained at criterion level, while respecting the ways of reasoning adopted by the experts to aggregate criteria

How:
Consultation of experts (animal and social scientists): virtual datasets with different combinations of criterion scores on which they have to react (i.e. assign a principle score)
Results from consultation:

- More importance assigned to some criteria
- More importance assigned to bad scores (i.e. no full compensation between good and bad scores)

We use Choquet integral, an operator that allows to follow simultaneously these two rationales

Example: principle 'Good feeding', composed of 2 criteria:

- Hunger: 40
- Thirst: 60

< 50
4- Aggregation of **principles**

**Measures** → **Criteria** → **Principles** → **Overall assessment**

- Raw data
- Scale 0 - 100
- Scale 0 - 100
- Welfare categories
Aggregation of criteria into the overall assessment

Objective = To assign farms to ordered welfare categories

- **Excellent**: very high welfare \(\Rightarrow\) may correspond to a niche market, e.g. within a specific voluntary scheme
- **Enhanced**: farms with good farming practices but not excellent \(\Rightarrow\) may serve to guarantee good level of welfare within a more general quality voluntary scheme
- **Acceptable**: acceptable welfare level, but insufficient to be used within a voluntary scheme
- **Not classified**: very poor welfare considered as unacceptable

*Defined in accordance with stakeholders' expectations about the potential uses of the evaluation system - Consulted experts: representatives of producers, breeders, retailers, vets, animal protectors, and institutions*
Aggregation of criteria into the overall assessment

Objective = To assign farms to ordered welfare categories

while limiting compensations between principles

⇒ Comparison to pre-defined profiles that delimit the categories,

**Definition of:**

⇒ reference profiles

⇒ membership rules

⇒ UNANIMITY

Distribution of 69 dairy farms visited within Welfare Quality®
Aggregation of criteria into the overall assessment

Objective = To assign farms to ordered welfare categories while limiting compensations between principles
⇒ Comparison to pre-defined profiles that delimit the categories,

Definition of:
⇒ reference profiles
⇒ membership rules
⇒ UNANIMITY
⇒ Set of different rules

Submitted to and discussed with potential users of the evaluation system
Objective = To assign farms to ordered welfare categories

while limiting compensations between principles

⇒ Comparison to pre-defined profiles that delimit the categories,

Aggregation of criteria into the overall assessment
Aggregation of criteria into the overall assessment

Distribution of 69 dairy farms visited within Welfare Quality®

<table>
<thead>
<tr>
<th>Category</th>
<th>% of farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not classified</td>
<td>14%</td>
</tr>
<tr>
<td>Acceptable</td>
<td>67%</td>
</tr>
<tr>
<td>Enhanced</td>
<td>19%</td>
</tr>
<tr>
<td>Excellent</td>
<td>0%</td>
</tr>
</tbody>
</table>

Significant relationship between categories and assessors' overall impression of the visited farms (Likelihood-Ratio test, $\chi^2 = 5.56$, $P = 0.02$)

Ethical question on societal aspirations vs. realistic levels?

A balance between societal aspirations and what can be realistically achieved in practice
The construction of the evaluation model respects multidimensionality of animal welfare.

The model for an overall assessment of animal welfare proposed in Welfare Quality® formalises the reasoning followed by:

- Scientists (in animal and social science)
- And potential users

to assign scores to the observed farms.

⇒ Can be easily standardised and automated for routine use.

Software tool in preparation

P. Champciaux,
A. Lamadon,
J.P. Brun [INRA]
**Conclusion**

- **Transparency**
  Intermediate scores are available
  ⇒ They can help producers understand their final result and encourage them to take efficient remedial measures
Work extended to the other animal types considered in Welfare Quality®
Thanks for your attention...
5- A software tool

Objective:
To facilitate the implementation of the assessment system

 دمشق of a software chain to ease the collection of data, their storage, the calculations of scores, the synthesis of results, and simulations of potential improvements

Different users: ... with different objectives

Farmers & Slaughterhouses
To visualise their own results (measures and scores) and simulate possible improvements

Assessors / Advisors
To visualise the results of the units they assessed and simulate possible improvements

Certification bodies
To visualise the results of the units they certified

Administrators
To manage database

Visitors
To get an overview of the assessment system
Design of the software tool
General organisation

Data acquisition tool
On farm / at slaughter

Web-based tool
At office (Internet)

Module 1
Acquisition of data farms and slaughterhouses

Module 2
Storage of data farms and slaughterhouses

Module 3
Calculation of scores farms & slaughterhouses (criteria, principles and overall assessment)

Module 4
Interface, possible interactions with measures and scores

Information flows (by Internet)