Association of hoof disorders with mobility score in pasture-based dairy cows

A.O'Connor[1,2], E.A.M. Bokkers[2], H. Hogeveen[3], I.J.M. de Boer[2], R. Sayers[1], N. Byrne[1], E. Ruelle[1],and L. Shalloo[1]

[1]Animal and Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, Co. Cork, Ireland
[2]Animal Production Systems, Department of Animal Sciences, Wageningen University & Research, the Netherlands
[3]Business Economics, Department of Social Sciences, Wageningen University & Research, the Netherlands

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Overview

- Introduction
- Objective
- Materials & methods
- Main findings
- Conclusion

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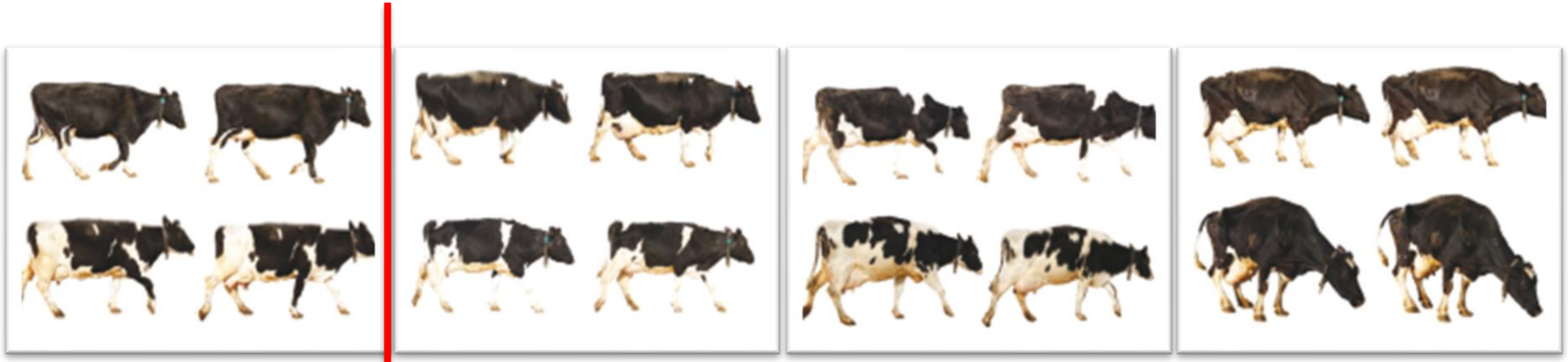
Introduction

- Sub-optimal mobility is one of the most significant disease challenges (Huxley, 2012)

- Sub-optimal mobility → any deviation from the optimal mobility of a cow
- Sub-optimal mobility in dairy cows ranges
- Hoof-disorders



Optimal Mobility

Sub-optimal Mobility

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Objective

To determine the association of hoof disorder presence and severity, with mobility score in pasture-based dairy cows.

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Mobility Scoring *(UK Agriculture and Horticulture Development Board)*

0

- Even weight bearing & rhythm
- Flat back

Optimal Mobility

Sub-optimal Mobility

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Hoof Disorders

Non-infectious

Overgrown claw

Whiteline disease

Sole hamorrhage

Sole ulcer

Infectious

Digital dermatitis

ICAR CLAW HEALTH ATLAS

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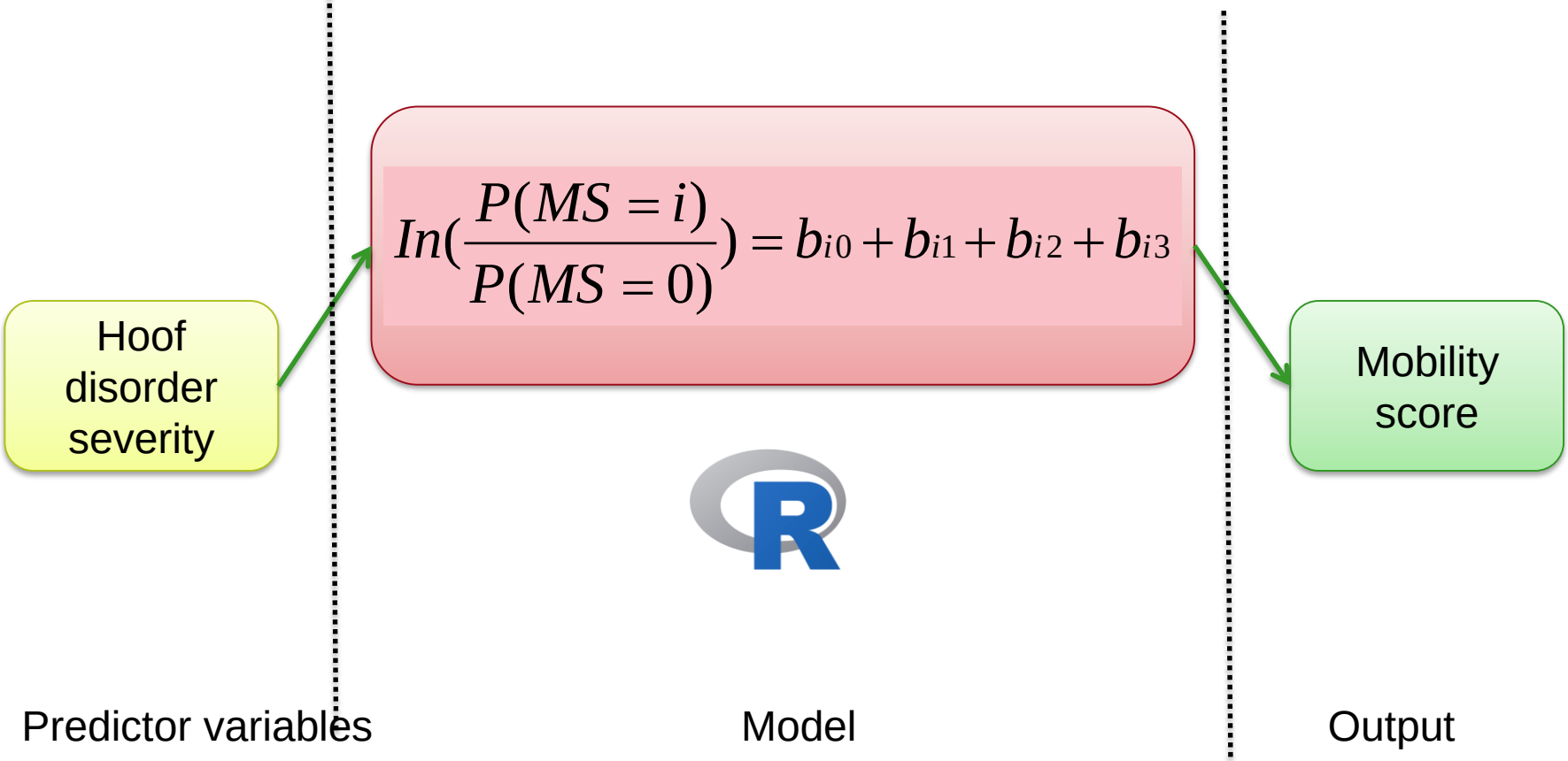
Statistical analysis

- Multinomial logistic regression model
  - Output is a ***probability*** that the given input point belongs to a certain class.



Overgrown Claw (OG) & Mobility score (MS)

Risk factor	Category %
Overgrown claw 0	48.4
Overgrown claw 1	35.5
Overgrown claw 2	13.1
Overgrown claw 3	3.0

- Percentage of cows with each severity score of OG

n = 6,927

- Reference value/baseline – MS = 0
- Odds Ratio (OR) for a cow with an OG severity score 1 for being in MS 1 vs. 0
- OR for a cow with an OG severity score 1 for being in MS 2 vs. 0
- OR for a cow with an OG severity score 1 for being in MS 3 vs. 0
- OR for a cow with an OG severity score 2 for being in MS 1/2/3 vs. 0
- OR for a cow with an OG severity score 3 for being in MS 1/2/3 vs. 0

Odds Ratio > 1 means an increase in the predictor variable = an increase in risk of MS 1/2/3 vs. 0

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Sole Hemorrhage (SH) & MS

Risk factor	Category %	OR MS 1 vs. 0	OR MS 2 vs. 0	OR MS 3 vs. 0
Sole hemorrhage 0	47.0	1.00	1.00	1.00
Sole hemorrhage 1	14.8			
Sole hemorrhage 2	17.9			
Sole hemorrhage 3	13.8			

OR > 1 means an increase in the predictor variable = an increase in risk of MS 1/2/3 vs. 0

- Percentage n = 6,927
- Reference value
- SH 1
- SH 2
- SH 3

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Whiteline Disease (WL) & MS

OR > 1 means an increase in the predictor variable = an increase in risk of MS 1/2/3 vs. 0

Risk factor	Category %
Whiteline 0	51.2
Whiteline 1	16.6
Whiteline 2	14.2
Whiteline 3	10.2

n = 6,927

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Sole Ulcer (SU) & MS

Risk factor	Category %
Sole ulcer 0	98.9
Sole ulcer 1	1.1

n = 6,927

OR > 1 means an increase in the predictor variable = an increase in risk of MS 1/2/3 vs. 0

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Digital Dermatitis (DD) & MS

Risk factor	Category %
Digital dermatitis 0	97.3
Digital dermatitis 1	2.7

n = 6,927

OR > 1 means an increase in the predictor variable = an increase in risk of MS 1/2/3 vs. 0

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Results – Odds Ratio (OR)

Risk factor	Category %	OR MS 1 vs. 0	OR MS 2 vs. 0	OR MS 3 vs. 0
Overgrown claw 0	48.4	1.00	1.00	1.00
Overgrown claw1	35.5	1.32***	0.92ł	0.82ł
Overgrown claw 2	13.1	1.67***	2.49***	1.71ł
Overgrown claw 3	3.0	3.73***	15.52***	27.99***
Sole hemorrhage 0	47.0	1.00	1.00	1.00
Sole hemorrhage 1	14.8	1.27***	0.95ł	0.87ł
Sole hemorrhage 2	17.9	1.31***	1.19ł	1.27ł
Sole hemorrhage 3	13.8	1.43***	1.97***	1.07*
Whiteline disease 0	51.2	1.00	1.00	1.00
Whiteline disease 1	16.6	1.25***	1.63***	0.68ł
Whiteline disease 2	14.2	1.63***	2.70***	0.49ł
Whiteline disease 3	10.2	2.05***	7.96***	7.66***
Sole ulcer 0	98.9	1.00	1.00	1.00
Sole ulcer 1	1.1	2.16*	9.20***	18.19***
Digital dermatitis 0	97.3	1.00	1.00	1.00
Digital dermatitis 1	2.7	1.87**	5.88***	22.34***

- Relatively greater OR values for more severely scored HD
- Certain types of HD and infectious types have relatively greater OR values
- Mild forms of HD increase the risk of being MS 1 vs. 0 but not MS 2/3 vs. 0

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Conclusion

- Hoof disorder presence and severity is associated with sub-optimal mobility in pasture-based dairy cows

  - Mildly scored hoof disorders have an association with an increased risk for being mobility score 1 versus 0

  - Severely scored of hoof disorders have an association with an increased risk for being mobility score 2, 3 versus 0

  - Infectious hoof disorders have an association with a increased risk for being mobility score 1, 2, and 3 versus 0

Future Implications

- Mobility score can be used to identify ‘problem’ cows at an earlier stage

  - Further analysis → mobility score can be used;

    - » To quantify (re) productive impacts of sub-optimal mobility

    - » To quantify economic and environmental impacts of sub-optimal mobility

Thank you for your attention, any questions?

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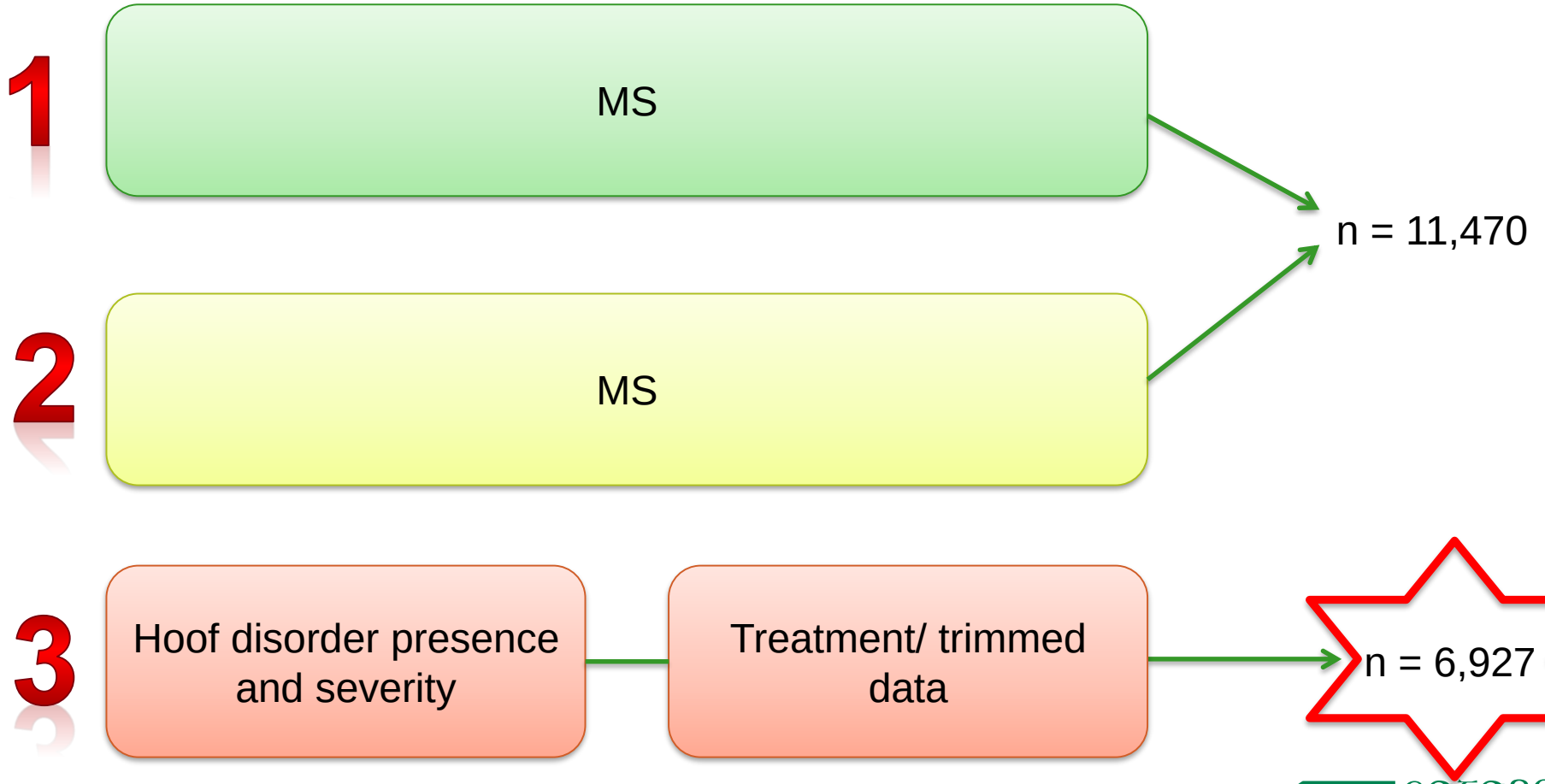
Materials and methods

Large data base collected as part of the 'Healthy Genes' Project



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Results *(interpretation)*

- exponential of the coefficient

- OR > 1
  - indicates that an increase in the independent variables *(HD)* increases the risk of occurrence of a specific category *(MS 1)* rather than the occurrence of the reference category *(MS 0)*

- OR < 1
  - indicates than an increase in the independent variable *(HD)* decreases the risk of occurrence of a specific category *(MS 1)* rather than the occurrence of the reference category *(MS 0)*