How to define good mothering ability using computer vision of free farrowing sows?

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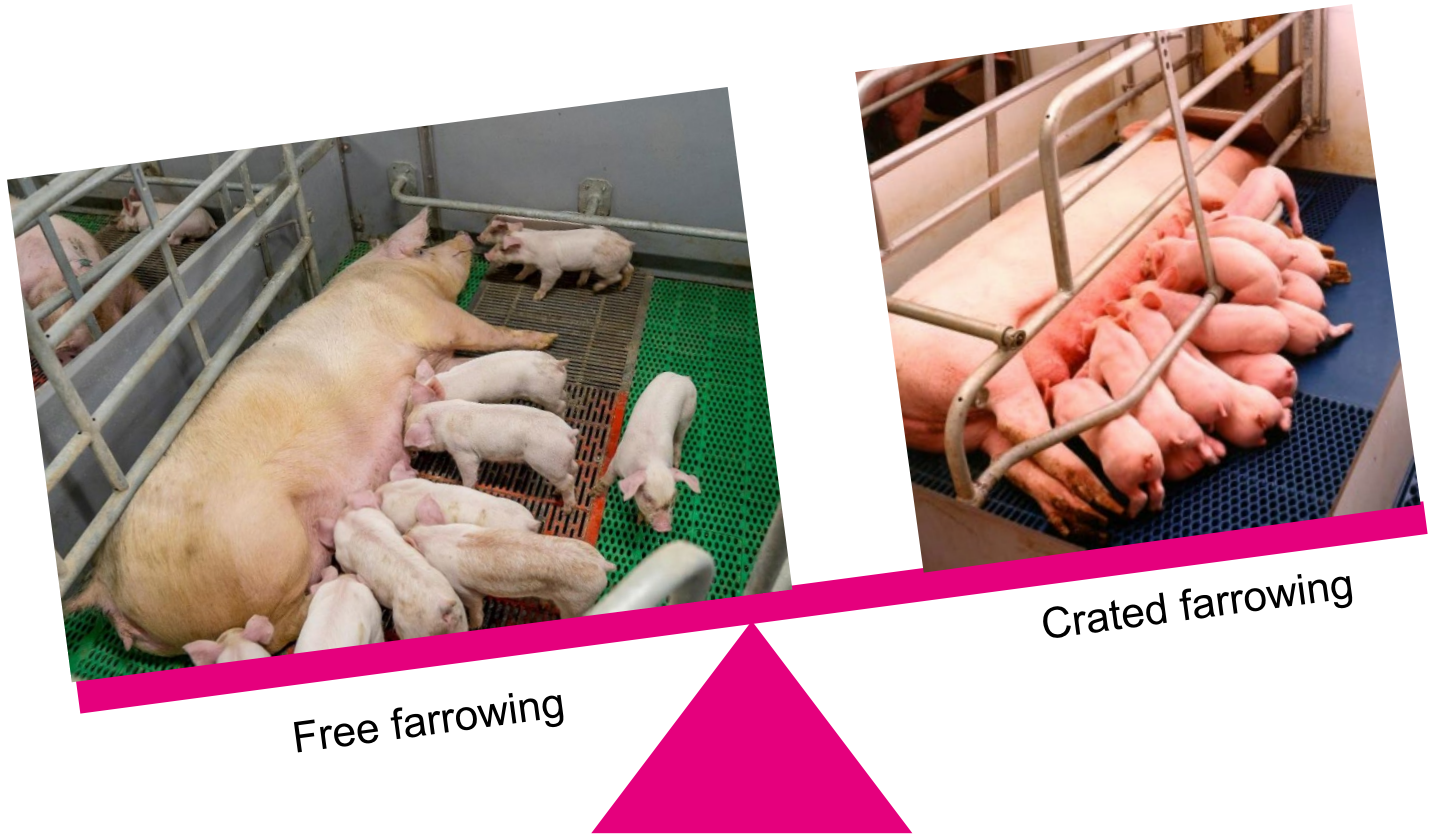
Background

- ✚ Enhanced welfare
- ✚ Nesting behavior
- ✚ Shortened farrowing duration
- ✚ Improved locomotion (and longevity)

- ▬ Increased pre-weaning mortality



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How is farrowing crates / free farrowing legislation world wide?

With help from ChatGTP:

Mandating free farrowing

- Norway
- Sweden
- Switzerland
- Austria *

Plan to phase out farrowing crates before 2035

- Germany
- Denmark

Increased pressure and plan for phasing out

- The Netherlands
- United Kingdom
- USA (state dependent)
- Canada
- Australia
- New Zealand

Not a pressure or focus on free farrowing

- China
- South America

Consumer demand and retailer policies are increasingly influencing producers to adopt free farrowing systems, even in the absence of legislation

How to define good mothering ability?

- Breeding value for mothering ability:
  - Survival of piglets during lactation

- Selection for piglet survival (based on EBVs) is partly from crated systems

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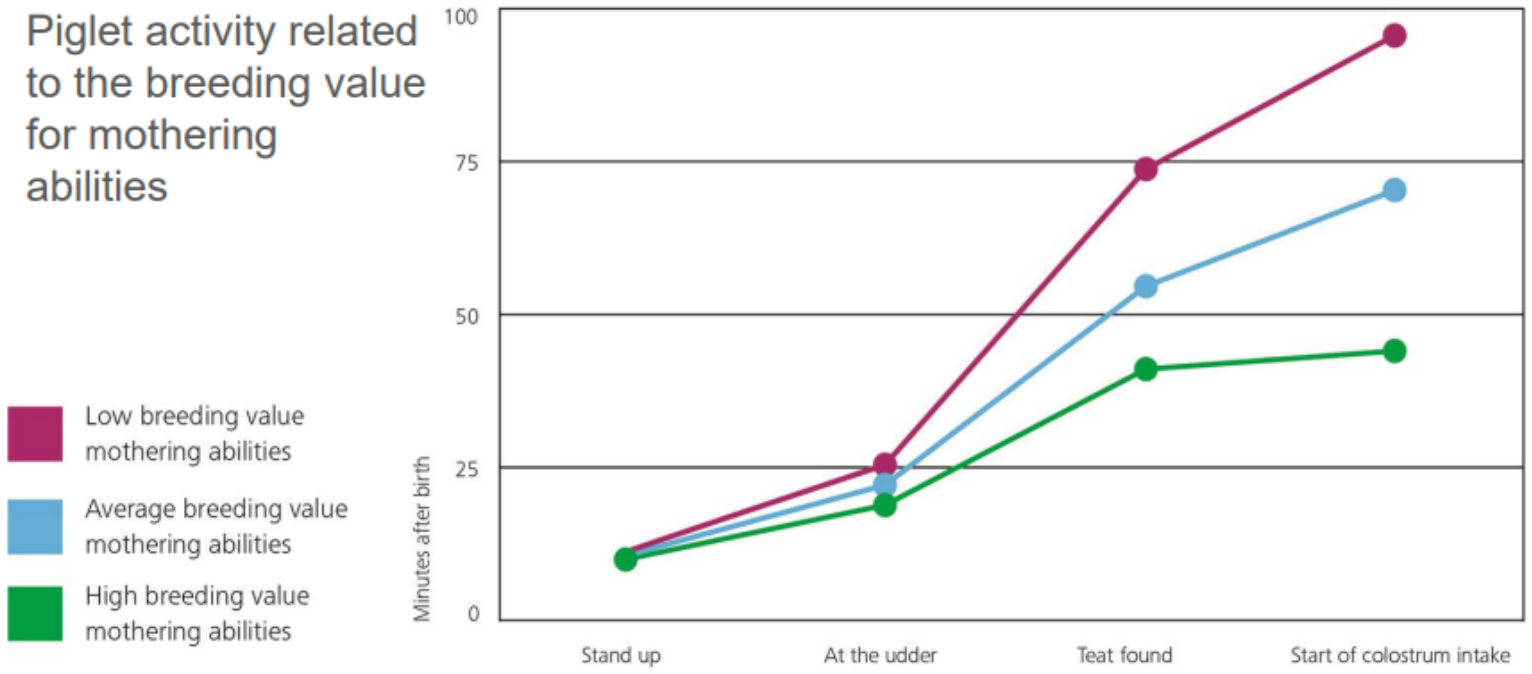
Good mothering ability help the piglet for life

Piglet activity related to the breeding value for mothering abilities



Data from PhD thesis of Jascha Leenhouwers, Topigs Norsvin

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Final goals of this research work is to…

Improve mother and piglet welfare !

Meet the future legislation !

Improving mothering ability – realizing that a good mother is more than keeping our piglets alive!

Our approach to reach the goals

- Automatic on-site behavior observations are needed:
  - Behavior that leads to less crushing (communication sow/piglet, movements, presenting udder, etc)
  - Sow towards care taker
  - Nesting behavior
  - Time from birth to teat found
  - Farrowing duration

- Some movements of a sow are more risky than others, besides increased levels of posture changes could lead to increased preweaning mortality
- Continuous/automatic conformation score would help (e.g. leg and feet)

….the questions we want to answer

- **Is it possible to automatically collect these data from video footage using ML models?**
- Free farrowing makes mothering ability more visible due to more variation in piglet survival between sows → opportunity for more genetic progress?
- Direct video observations on behavior

  → more accurate breeding values for mothering ability?

  → new phenotypes in breeding goal (not current available)?

- **Will benefit both free farrowing and traditional (crated) systems?**

Build to prepare for the future

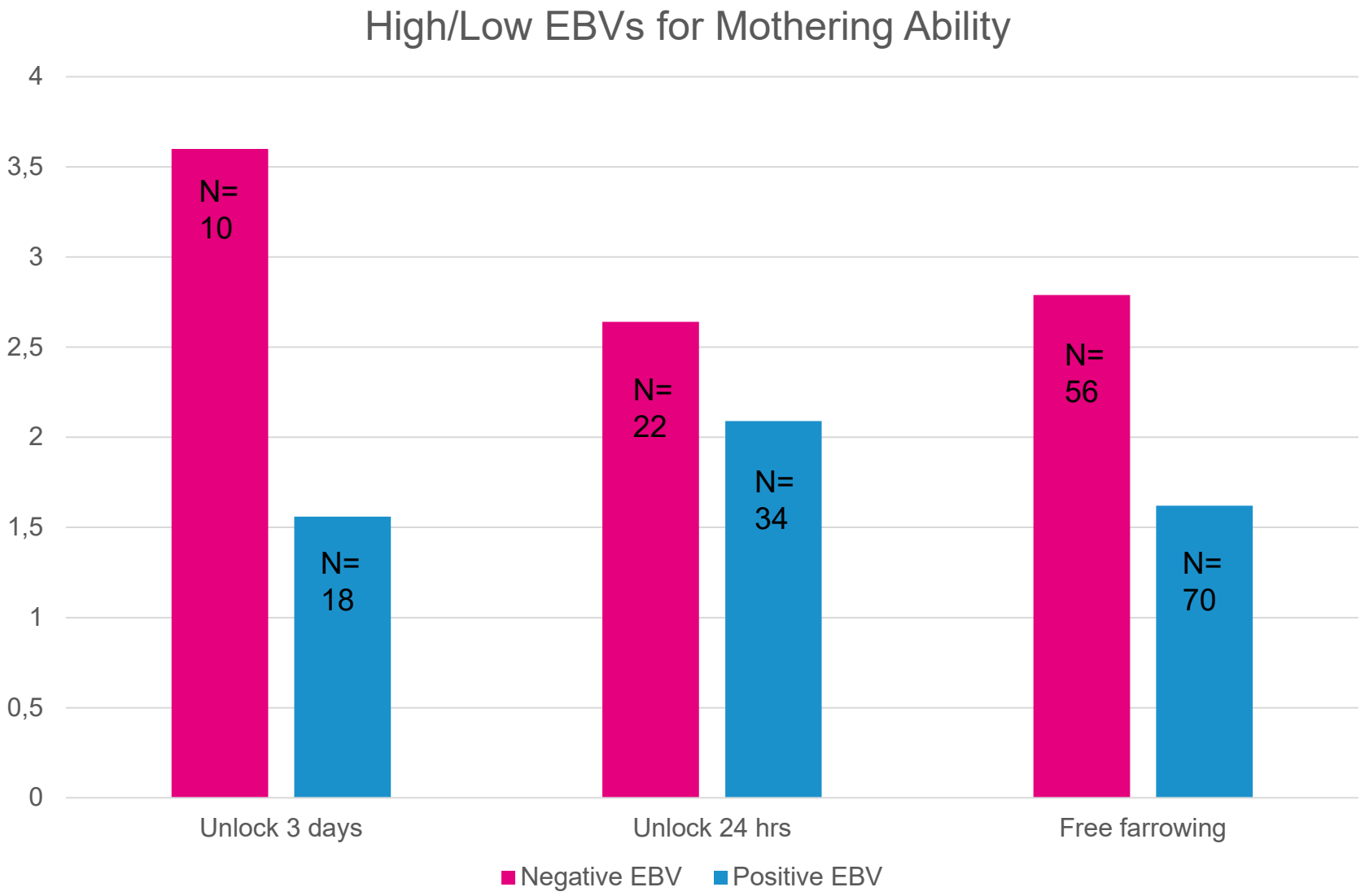
Innova Canada

- 1600 nucleus sow farm in Canada
- Free farrowing and free lactation
- 360 free farrowing pens of ProDromi
  - 2.85m x 2.80m = 7.98m2

Use of cameras for behavioral observations

- 40 cameras installed at Innova Canada
  - Top-down view
  - Recording 24/7
- Approximately 18,500 frames annotated
  - 6 sow postures segmented
  - Around 80,000 bounding boxes of piglets
- YOLOv8 models trained to predict sow and piglet

Preweaning mortality



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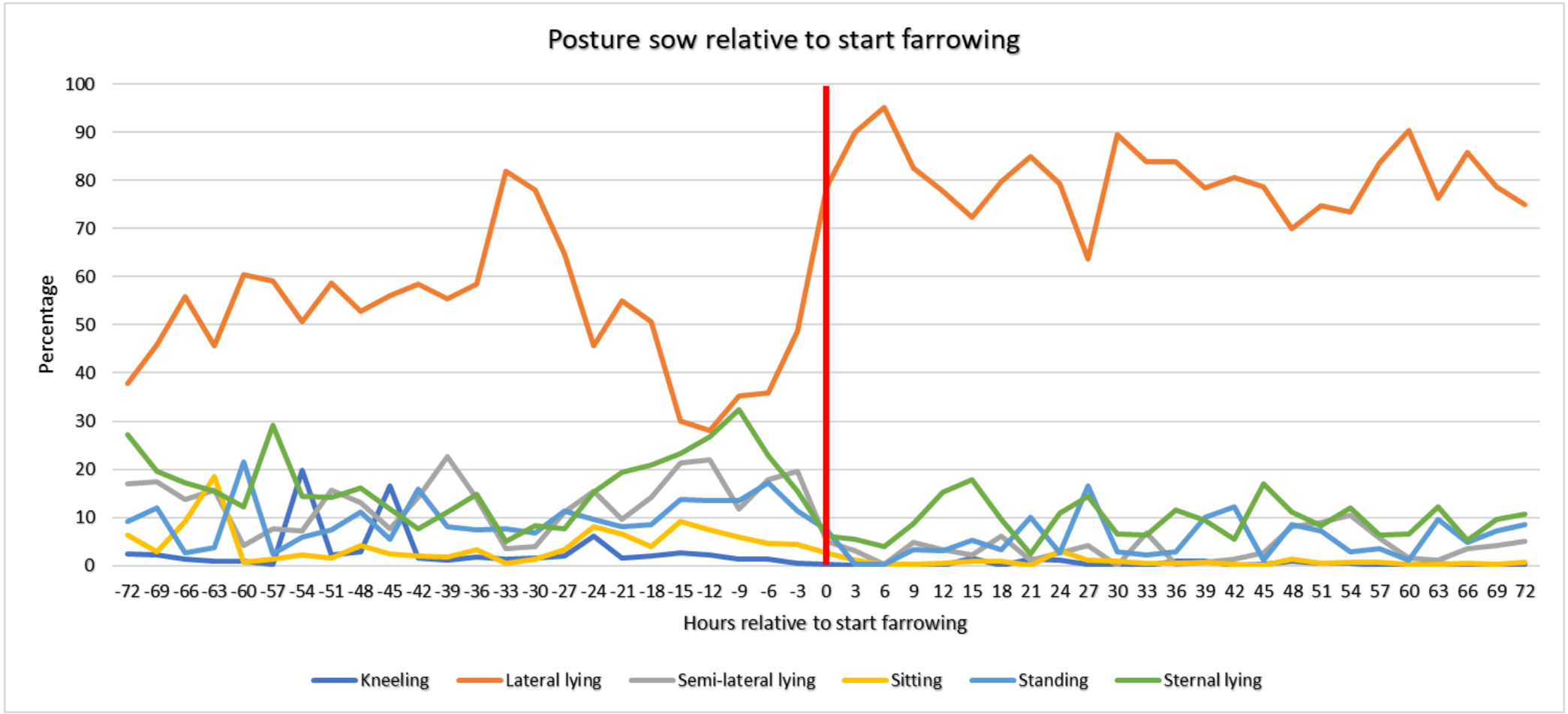
Results – initial data set

- Successful development of a computer vision algorithm to detect sows from camera footage
- Identified some specific sow behaviors and postures
- Recording animal location and distance walked (sow and piglets)

	Instances	Precision
Lateral lying	295	1,000
Semi-lateral lying	267	0,983
Sternal lying	314	0,969
Standing	353	0,969
Sitting	293	0,986
Kneeling	327	0,984
Piglet	7815	0,983



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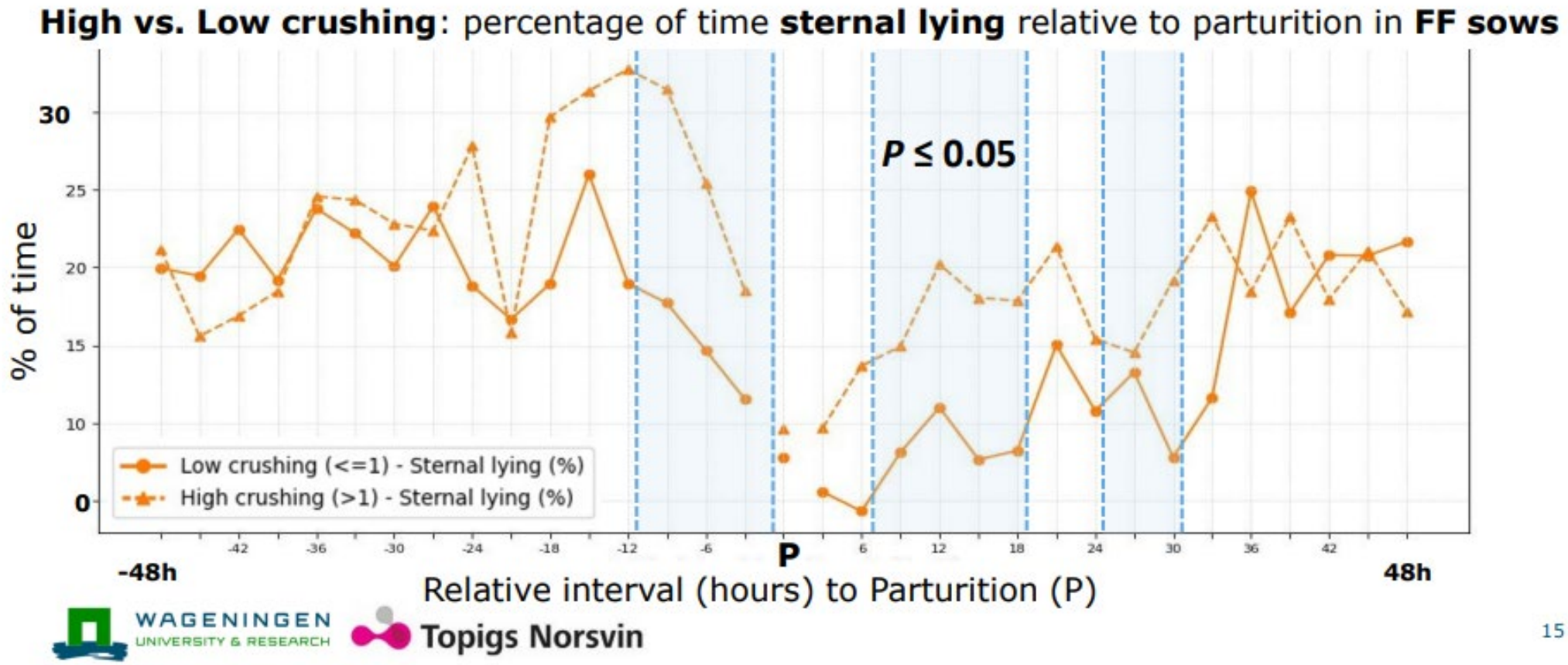
Chiara Lipori, PhD Student WUR/Topigs Norsvin:

«Significant differences in postures/behavior between high/low EBV for mothering ability»



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Future work

- Apply models to videos of sows around farrowing to create phenotypes
- Identify differences between sows
  - What makes a sow a good mother?

It is key to translate detections into relevant phenotypes

Acknowledgement

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Thanks!

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PROGRESS IN PIGS

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