Considerations in using quantitative measurements of milking speed for genetic evaluations for all dairy breeds in the USA

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Council on Dairy Cattle Breeding Milking Speed Task Force

Scope of Task Force

- Evaluate the economic importance of providing milk speed evaluations
- Review the existing data types and develop a clear definition of the trait to be adopted by CDCB and member sectors
- Assess the status of milking speed data availability and access within the DRP/DRPCs
- Identify the steps needed to develop a milking speed data pipeline into the National Cooperator Database
- Suggest quality standards for milking speed data
- Provide a full implementation plan, defining roles and responsibilities, costs, timeline, and deliverables

Existing Evaluations for Milking Speed

- **Interbull-participating countries (N = 14) include milking speed in their "workability" evaluations**
  - Australia, Canada, Denmark/Sweden/Finland, France, Germany/Austria/Luxembourg, Great Britain, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Slovenia, and Switzerland

- **Nearly all phenotypes collected during first parity only and sometimes from a single classification**
- **If milk flow rates were available, classification data were discarded**

From April 2022 MACE “Workability” Report

LAPPENDIX I. Sire standard deviations for milking speed in diagonal and genetic correlations below diagonal

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HOL msp

	CAN	CHE	DEU	DFS	FRA	NLD	AUS	GBR	SVN	NZL	ITA	JPN	ESP	CZE	POL
CAN	7.59														
CHE	0.93	12.40													
DEU	0.89	0.96	12.55												
DFS	0.94	0.95	0.95	14.41											
FRA	0.95	0.98	0.94	0.96	1.07										
NLD	0.95	0.98	0.94	0.97	0.98	5.12									
AUS	0.83	0.84	0.79	0.81	0.85	0.84	0.25								
GBR	0.76	0.77	0.76	0.77	0.80	0.78	0.75	0.20							
SVN	0.71	0.81	0.84	0.80	0.79	0.81	0.70	0.73	23.26						
NZL	0.87	0.88	0.81	0.83	0.88	0.87	0.89	0.73	0.68	0.33					
ITA	0.76	0.83	0.81	0.83	0.84	0.84	0.71	0.61	0.75	0.72	5.61				
JPN	0.96	0.93	0.88	0.93	0.97	0.96	0.86	0.80	0.75	0.85	0.82	2.16			
ESP	0.94	0.93	0.90	0.93	0.95	0.95	0.82	0.75	0.75	0.83	0.80	0.94	13.60		
CZE	0.88	0.91	0.92	0.90	0.89	0.91	0.78	0.68	0.74	0.78	0.75	0.84	0.89	17.73	
POL	0.56	0.57	0.54	0.56	0.56	0.57	0.57	0.54	0.57	0.53	0.48	0.57	0.57	0.57	14.91

Literature Review

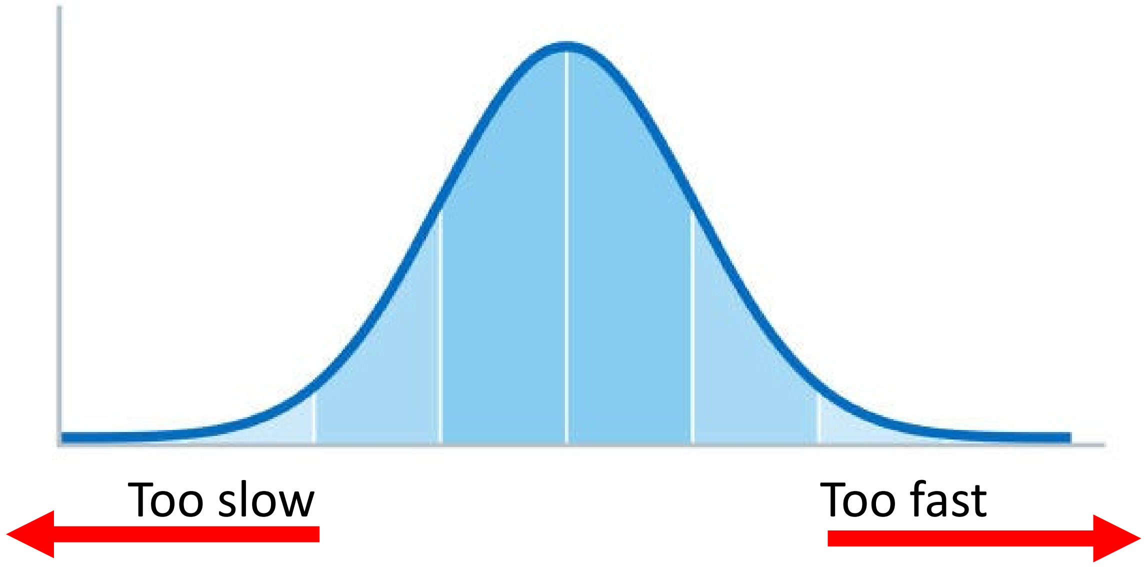
Regarding quantitative milking speed

- Heritabilities range from 0.02 – 0.42 depending on the trait definition
- Repeatabilities range from 0.40 – 0.54
- Conflicting evidence of variation in milking speed across lactations
- Favorable correlations between milking speed and milk yield
- Unclear relationship between udder health and milking speed

Trait Definitions
Milking Duration
Milking Speed
Ascending Time
Average Milk Flow
Maximum Milk Flow
Plateau Time
Descending Time

Literature Review

Milking Speed is an intermediate-optimum trait



- How does milking speed change by stage in lactation?
- How many times should a cow be sampled to get an accurate phenotype?
- How would producers use milking speed data?
- Can conventional and AMS herds be evaluated together?

Data Types & Availability

- **Format 6 includes milking "speed", but there have only been 21 records submitted to the NCD since 2006**

Milking Speed

A cow with faster than average milking speed (7) on a 9-point scale

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MSPD20031004A00907-
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A cow that took 10 minutes and 30 seconds of actual time to milk out

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MSPD20031004AT1030-
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Milking duration

- **Limited archival data in herd management software**

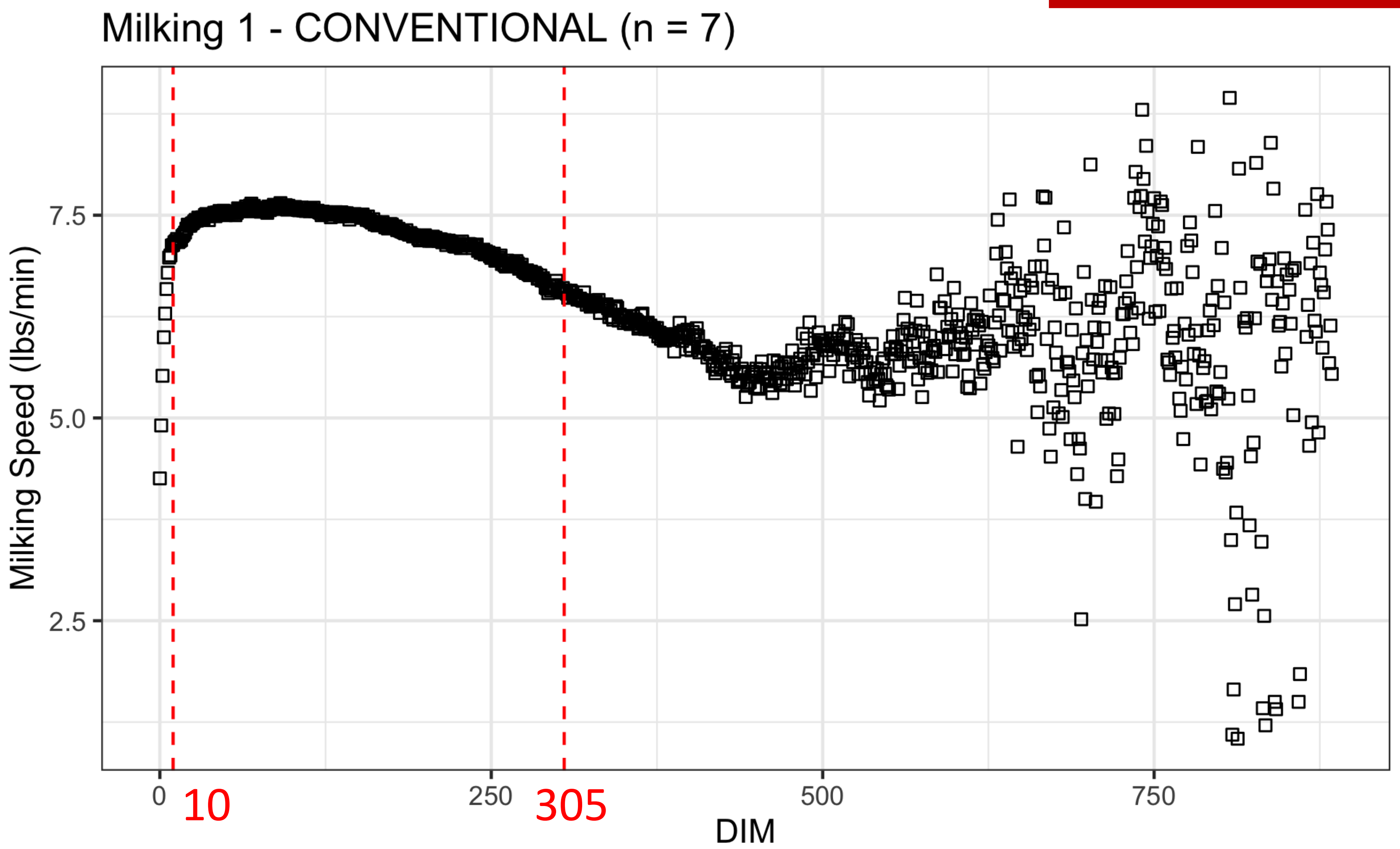
Trait Definition & Quality Standards

Milking Speed = lbs/min

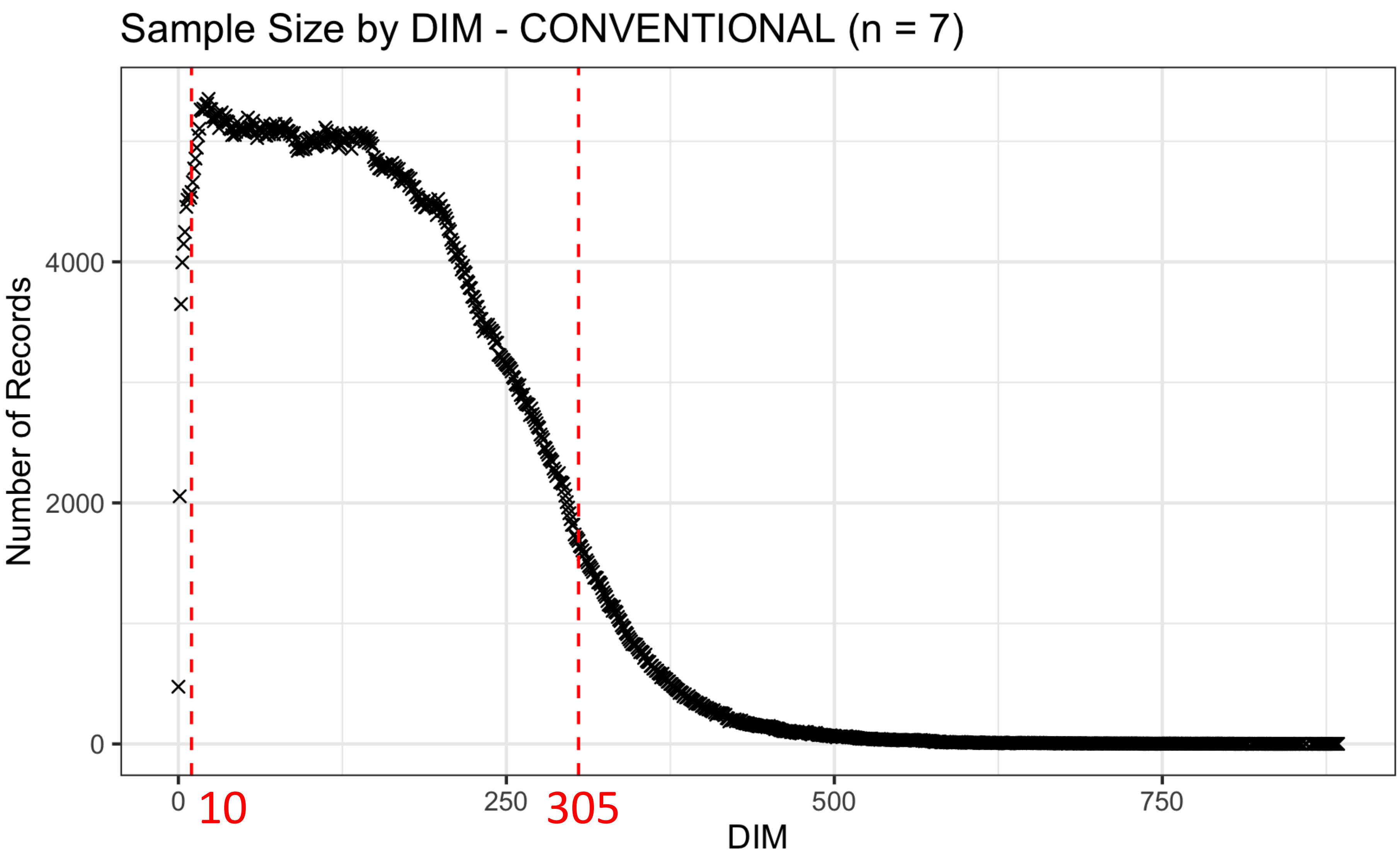
Quality Control Edits	
Data Sparsity	Holstein Only
	Last 150 d Only
	> 10 records per cow
Recording errors	15 min > DURATION > 0 min
	60 lbs > WEIGHT > 0 lbs
	15 lbs/min > SPEED > 0 lbs/min
Biological phenomena	10 > DIM > 305

Conventional Herds (n = 7)

Milking Speed : Milk Yield
Correlations 0.52 – 0.58

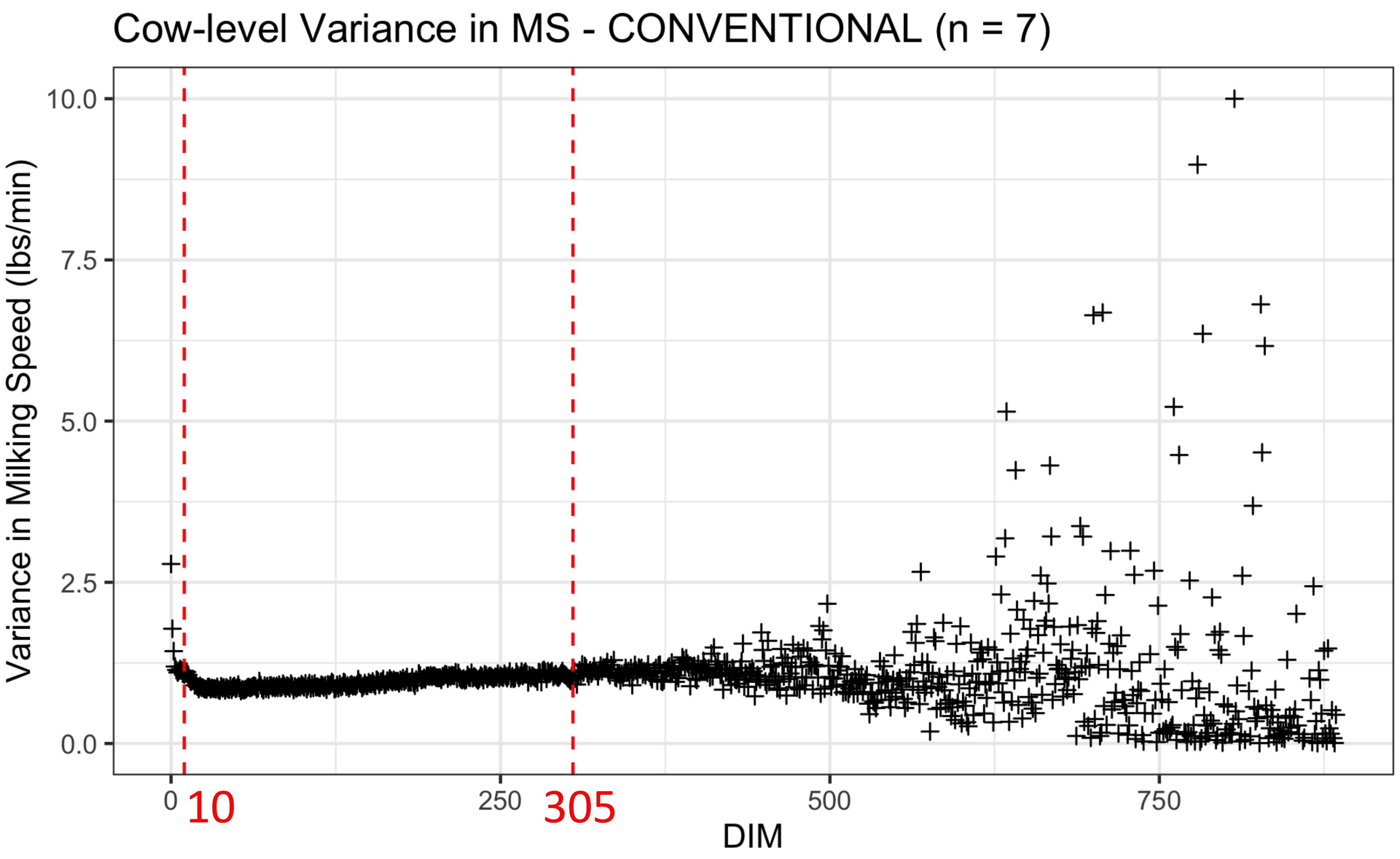


Conventional Herds



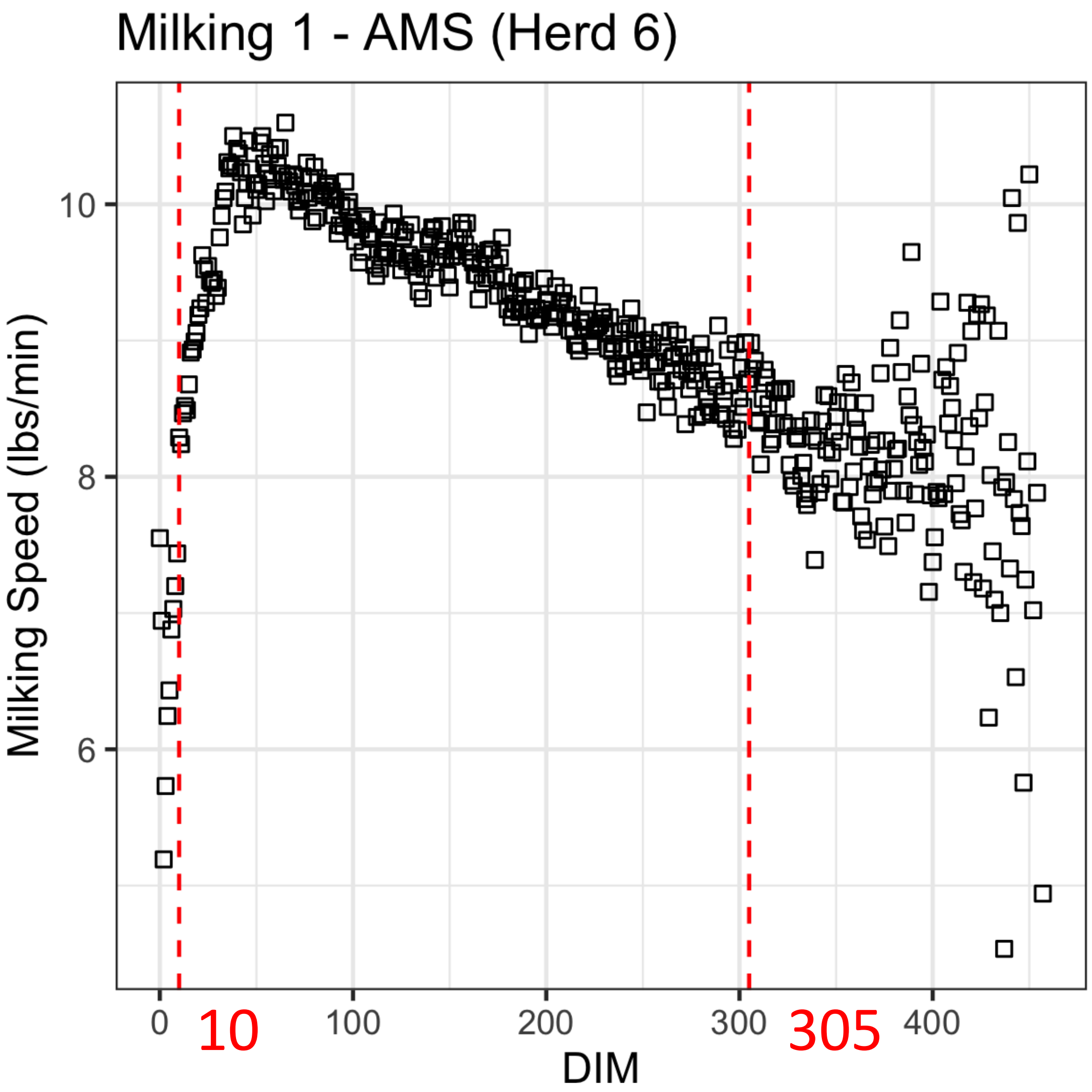
Conventional Herds

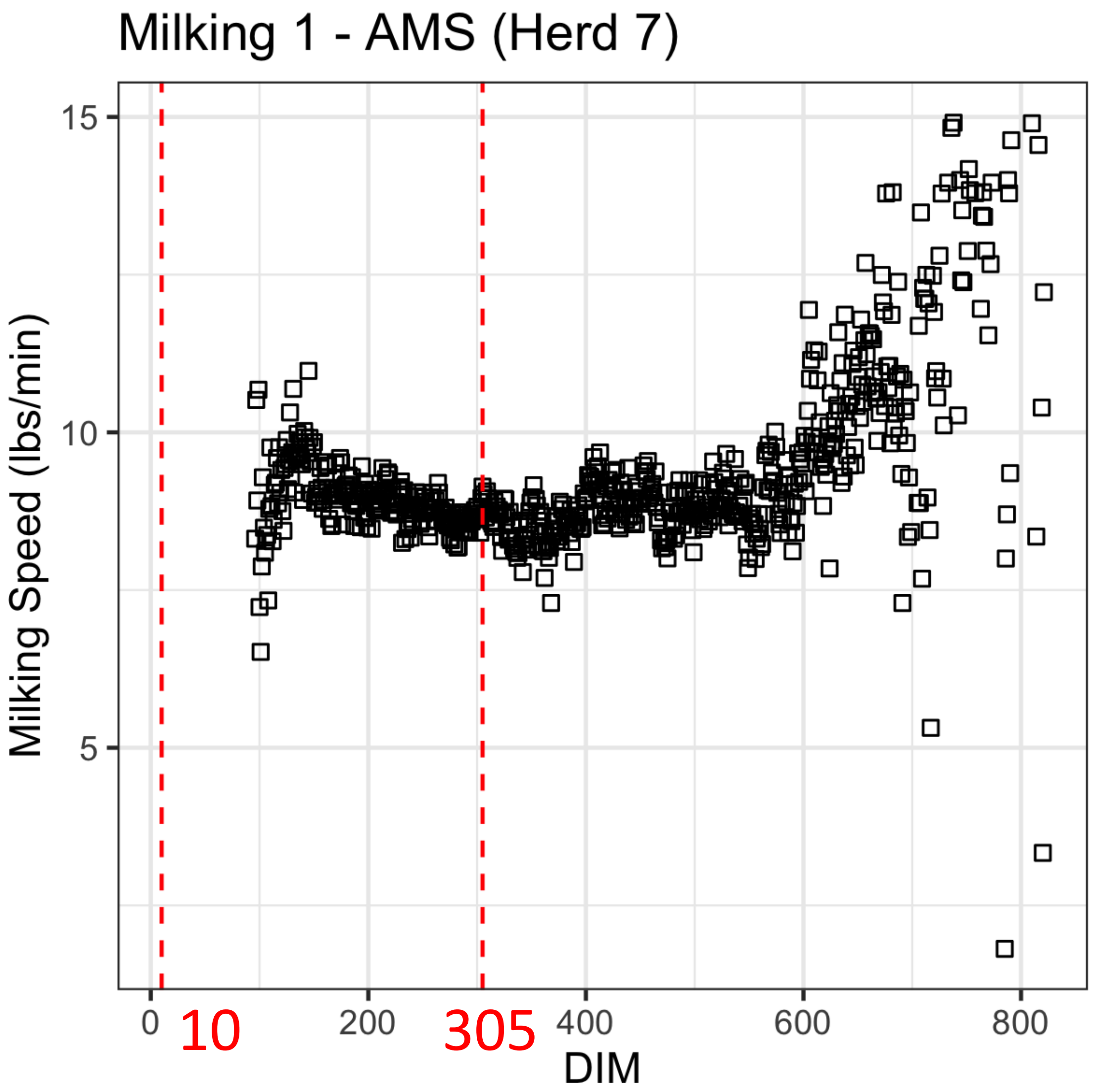
DEN/FIN/SWE: 30 – 240 DIM
NOR: 20-300 DIM



AMS Herds (n = 2)

Milking Speed : Milk Yield Correlation ~0.5 - 0.6





What else do we know?

- AMS cows milk faster than conventional cows
- MS is slightly faster for milkings earlier in the day
- Milking interval is not correlated with milking speed in conventional herds; more investigation is needed regarding AMS herds
- First lactation cows have slower average MS than multiparous cows

What don’t we know?

Other Considerations		
System Effects	Meter manufacturer	Time in parlor
	Automatic take-off	Incomplete udder evac
	Variable pulsation ratios	Automatic ID detection & validation
	Milking frequency	Milking interval
	Individual meter effect	Calibration protocol
Biological Effects	Stage in lactation	Season/Region effects
	Breed	Cow effects
	Parity	

Proposed Research

Obj. 1: Assemble a high-quality dataset pertinent to milking speed and capturing U.S. dairy systems demographics, especially relating to different dairy breeds and milking management

Obj. 2: Develop clear definition for milking speed considering availability of data types, their respective heritabilities, and suitability for selection purposes

Obj. 3: Characterize any biological effects that impact milking speed, especially the relationship of milking speed to udder health

Obj. 4: Quantify the influence of system effects on milking speed, including milking system (conventional v. AMS), meter manufacturer, and milking management factors

Thank you. Questions?

Special thanks to task force members for their efforts

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