

MILKING SPEED:

Genetic & Genomic Evaluations, Data Flow, & Next Steps

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EVALUATIONS FOR MSPD

- 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 quantitative milk flow rates were available, classification data were discarded

DEVELOPING MSPD EVALS IN USA

- OBJ. 1:** Assemble a high-resolution dataset pertinent to MS representing different dairy breeds, equipment manufacturers, parlor types, and milking management strategies
- OBJ. 2:** Characterize MS for herds grouped by equipment manufacturer and parlor type and assess the impact of additional system effects on the phenotype
- OBJ. 3:** Characterize any biological effects that impact MS, especially concerning udder health
- OBJ. 4:** Standardize MS trait definition and estimate heritability to determine its suitability for selection

AVAILABLE DATA

Demographics



~300 herds
~250,000 cows
~320,000 lactations
~50 million observations

31 States
6+ Breeds
11 OEMs

DeLaval	80
GEA	75
Lely	47
Boumatic	46
AfiMilk	45
SCR	13
DairyMaster	10
AIC Waikato	5
AMS Galaxy	3
Jantec	2
Universal	2

OBJ 1: ASSEMBLE DATA

Example: Data Cleaning

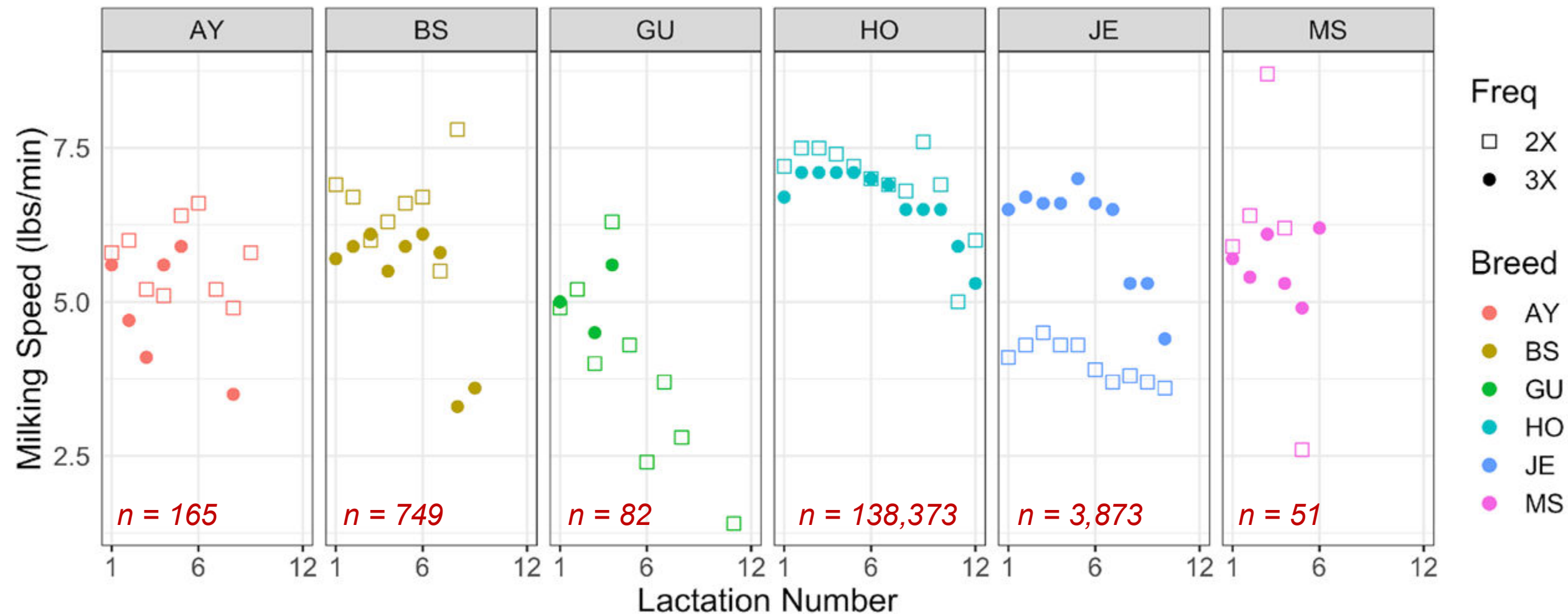
Summary stats on data											
		N	Minimum	Q1	Median	Mean	Q3	Maximum	StDev		
Milking Duration										0 or missing	greater than 15
	M1time	38877488	0	3.6	4.4	5.425	5.4	1440	30.1	3254587	85677
	M2time	38611378	0	3.5	4.3	5.772	5.2	1440	39.791	3493311	89253
	M3time	29804057	-1435.5	3.5	4.2	6.17	5.1	-1435.5	46.83	12223012	61510

OBJ 1: ASSEMBLE DATA

Example: Data Cleaning

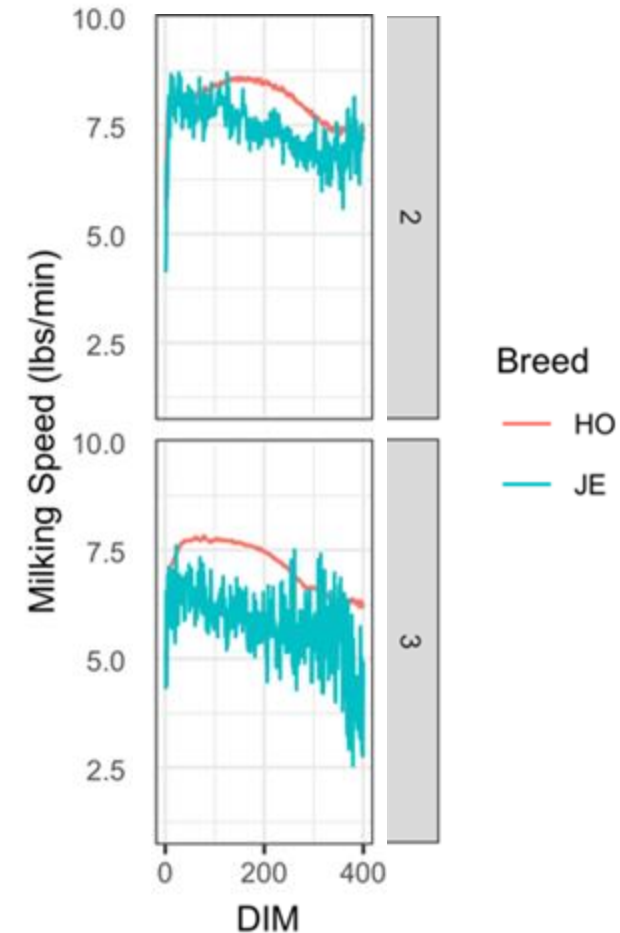
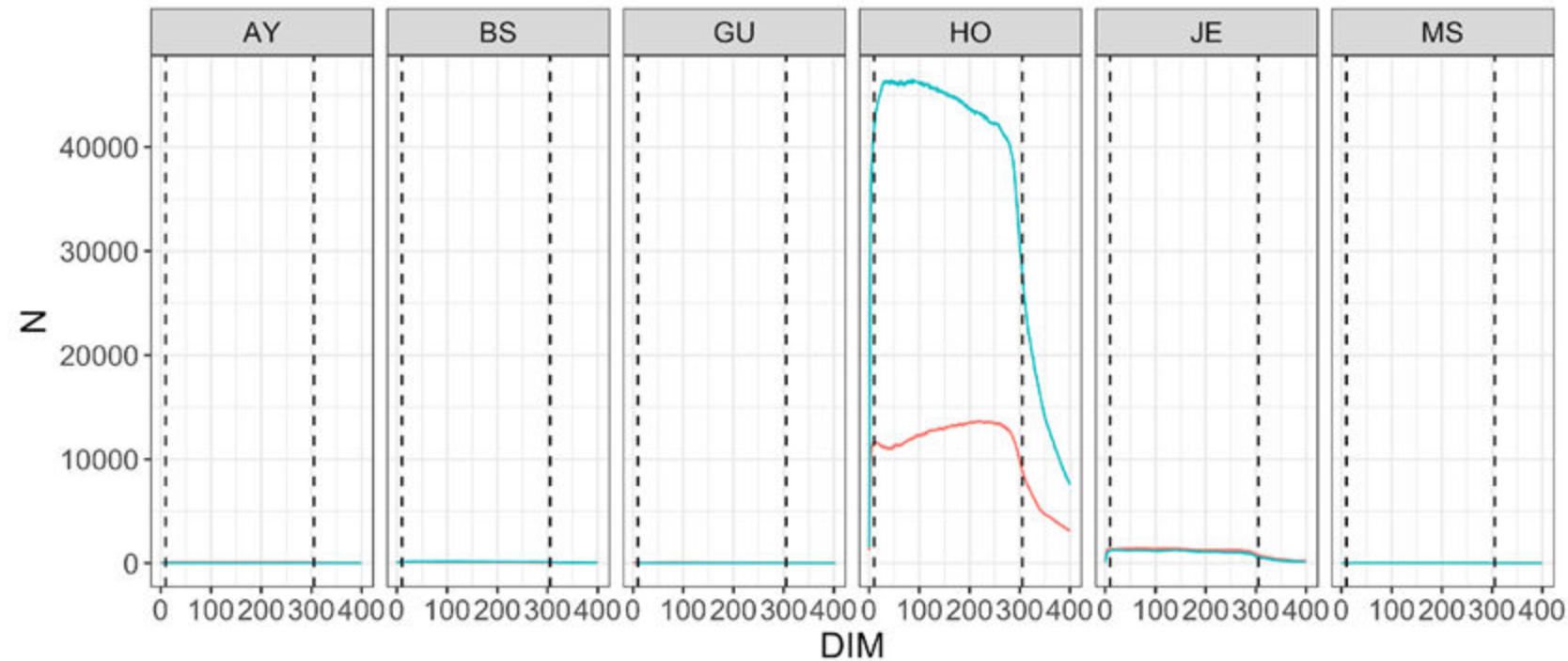
	AY		BS		GU		HO		JE		MS	
	2X	3X	2X	3X	2X	3X	2X	3X	2X	3X	2X	3X
Initial Records	28,412	1,632	67,850	93,193	20,233	495	6,154,246	21,772,400	633,289	599,840	2,119	5,334
After 1/1/2022	28,412	1,597	62,282	92,829	17,604	495	5,852,454	21,224,965	527,501	521,253	2,119	5,334
0 < duration < 15	25,374	994	45,509	57,621	12,130	398	5,138,997	15,803,428	475,668	392,451	1,354	3,661
0 < milk < 80	25,223	993	45,177	57,349	12,126	398	4,778,714	15,665,401	474,852	392,130	1,348	3,659
1 < MSPD < 15	24,646	956	39,324	56,806	10,972	389	4,611,960	15,422,775	463,138	378,765	1,333	3,613
>10 obs per cow	24,621	953	39,193	56,603	10,939	389	4,606,970	15,407,922	461,910	377,735	1,333	3,585
% reduction in data	13.3%	41.6%	42.2%	39.3%	45.9%	21.4%	25.1%	29.2%	27.1%	37.0%	37.1%	32.8%

BREED, PARITY, FREQUENCY TRENDS



DATA SPARSITY IS A CHALLENGE

Example: BREED



UDDER HEALTH; MILK COMPONENTS

HOLSTEIN

	SCS	FAT %	PROTEIN %
2X	-0.02*	0.10***	0.13***
3X	-0.04***	0.04***	0.06***
AMS	-0.18***	-0.27***	-0.29***

JERSEY

	SCS	FAT %	PROTEIN %
2X	-0.13***	-0.07†	-0.24***
3X	-0.13***	-0.14***	-0.27***
AMS	-0.01	-0.05†	-0.03

- Average MS for all milkings on a test day
- Correlated with SCS, Fat, and Protein on respective test day
- No statistically significant association with clinical mastitis
- Linear correlations may mask trends for extremes (very slow, very fast)

PROPOSED TRAIT

HOLSTEIN (n = 1642 bulls, genetic corr with SCS = 0.37, NM\$ = 0.10)

Total number of lactation records used = 50,406

	PTA				REL			
Trait	Min	Mean	SD	Max	Min	Mean	SD	Max
MSPD	-0.95	0.09	0.31	1.17	50.10	69.07	13.07	98.70
SCS	-0.65	-0.18	0.16	0.67	50.30	95.21	6.88	99.90

- Stage of lactation effects were removed as fixed effects before averaging residuals into lactation records
- Genetic model included milking frequency, parity, OEM, herdyear, genetic groups, permanent environment
- Genomic PTAs were derived from the deregressed pedigree model PTAs. For young HO animals, MSPD predictions averaged 47% REL compared to ~70% for most other traits

ENSURING DATA FLOW

Minimum Required Data Novel to MSPD

Observation date (YYYYMMDD)

Milking Session Time (00:01 – 24:00)

Milking Frequency (01X, 02X, 03X, 04X, AMS)

Robotic or Manual Attachment (R or M)

Original Equipment Manufacturer (OEM) Code

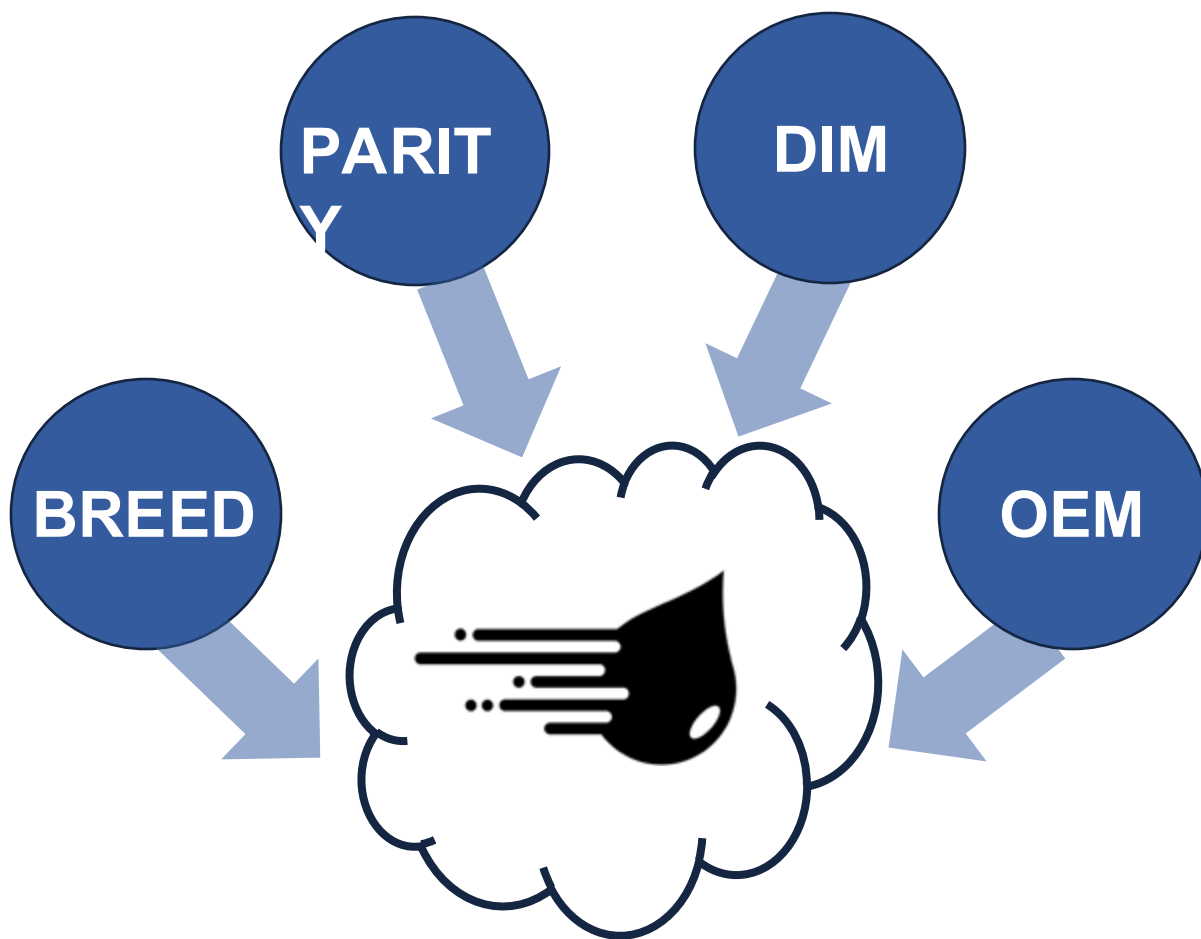
Milk Yield from Individual Milking (lbs * 10)

Milking Duration of Individual Milking (minutes * 10)

Abnormal Flags (Y or N)



**ICAR Device
Reference IDs**



**Many factors influence
quantitative MSPD measurements**

THE BOTTOM LINE

- Methodology has been approved by CDCB Genetic Evaluation Methods (GEM) Committee & endorsed by CDCB Board of Directors
- Routine data flow is a key hurdle; a new Format has been developed in cooperation with DRPC
- Research continues, exploring the use of AMS data