

Supplementary Material

Table S1. Automatic milk feeder data definitions

	Definition
Start Visit	The time a calf starts a visit to the feeder
End Visit	Timestamp for when the calf exits the feeder after each visit
Actual entitlement	Entitlement at that time (ml)
Visits With Entitlement	The number of visits per day by each calf when an entitlement was due/present.
Visits Without Entitlement	The number of visits to the feeder each day by each calf when an entitlement wasn't due/present.
Feeding Speed	Mean daily feeding rate for each visit to the feeder where the calf is entitled to and consumes milk.
Total Milk	The total amount of milk consumed by each calf for the entirety of the calf's life or time with that machine.

Table S2. Optimal parameters used for each model type and health assessment outcome.

Model Type	WS	WS+RT	WS+RT+T
Random Forest	Mtry = 4 Maxnode = 10 Ntrees = 700	Mtry = 9 Maxnode = 11 Ntrees = 950	Mtry = 10 Maxnode = 9 Ntrees = 550
Elastic Net	Alpha = 0 Lambda = 3.939455	Alpha = 0 Lambda = 1.616245	Alpha = 1 Lambda = 0.0001
Gradient Boosting Machine	n.Trees = 400 Interaction.depth = 5 Shrinkage = 0.05 n.Minobsinnode = 3	n.Trees = 500 Interaction.depth = 3 Shrinkage = 0.005 n.Minobsinnode = 3	n.Trees = 350 Interaction.depth = 7 Shrinkage = 0.005 n.Minobsinnode = 5

Table S3. Descriptive table to show the number of calves that experienced one or more BRD sick classification per health assessment outcome.

	WS	WS+RT	WS+RT+T
Total number of sick calves	61	104	123
No. calves with one sick event	37	51	36
No. calves with two sick events	10	27	32
No. calves with three sick events	11	16	29
No. calves with four sick events	1	7	13
No. calves with five sick events or more	2	3	13

Table S4. Results for random forest and elastic net classification algorithms with all 229 features.

	WS	WS+RT	WS+RT+T
Random Forest			
Accuracy	0.766	0.752	0.724
Precision	0.916	0.962	0.903
Sensitivity	0.458	0.396	0.348
Specificity	0.972	0.989	0.975
F1 Score	0.611	0.562	0.502
Elastic Net			
Accuracy	0.655	0.636	0.670
Precision	0.727	0.611	0.584
Sensitivity	0.222	0.251	0.614
Specificity	0.944	0.892	0.707
F1 Score	0.340	0.356	0.599