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Validation of genomic predictions for a lifetime merit selection index for the US dairy industry

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Take Home Point:

- DWP\$ gPTA of Holstein heifers predicted significant differences in observed lifetime profit



Introduction

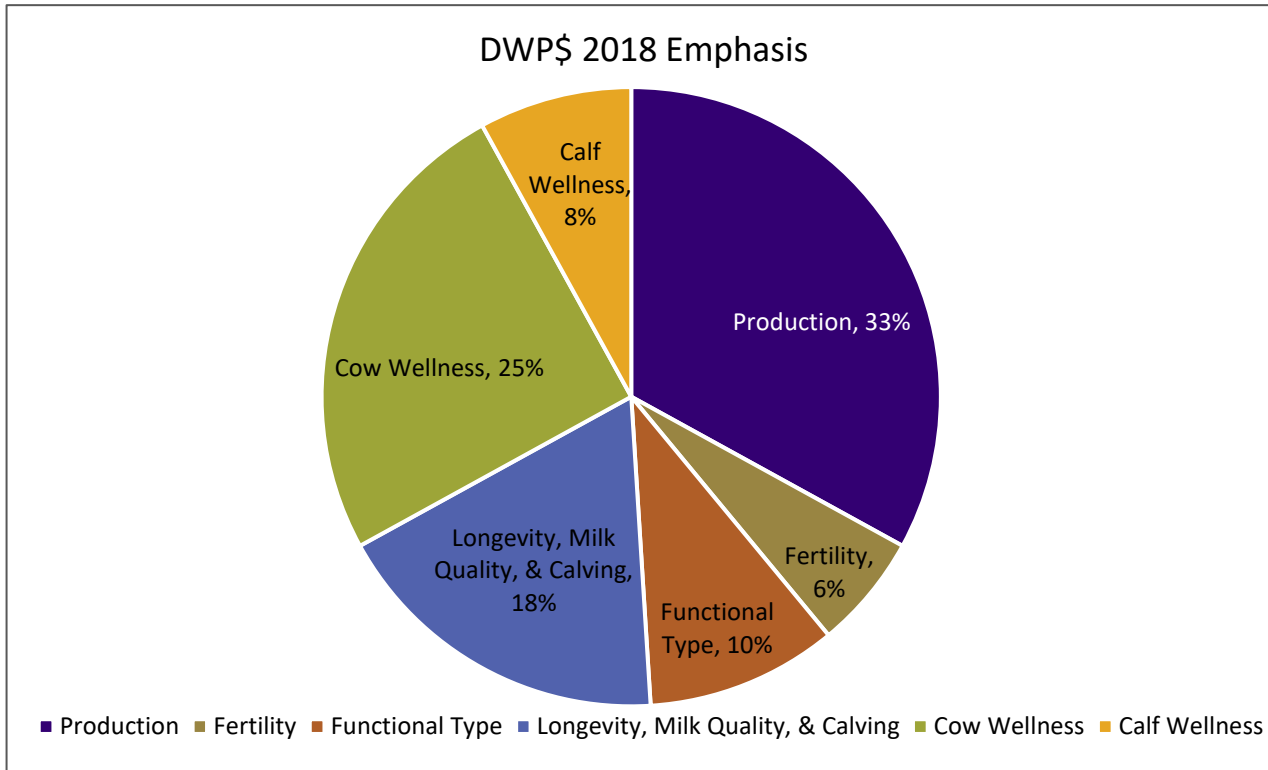
- **Selection indices are a critical component of many breeding programs**
- **Most common purpose of a selection index is to predict an animal's genetic potential for total economic merit (Shook, 2006)**
- **Need to determine if selection indices predict differences in animal profitability in real-world settings**

Objective



- **Objective of this study was to evaluate the ability of a selection index to predict observed lifetime profit in US Holstein animals**
- **Secondary objective was to evaluate the association between a selection index and observed phenotypes that contribute to lifetime profit**
- **The selection index being evaluated was Dairy Wellness Profit Index[®] (DWP\$[®])**

Dairy Wellness Profit Index (DWP\$)



Materials & Methods: Phenotypic Data



Herds and animals:

- **Five large US dairy herds were included based upon the following criteria:**
 - Had at least 200 genomic tested Holstein females born in 2011
 - Recorded health events for at least 3 of the 6 health events
 - Recorded milk, fat, and protein production on a per-animal basis
 - Recorded breeding and calving data
 - Recorded when an animal left the herd
- **To be enrolled an individual animal needed to meet the following criteria:**
 - Born in 2011
 - Genomic tested prior to December 2012
 - Entered the lactating herd as a first lactation animal
- **2,185 animals included in the study**

Materials & Methods: Economic Evaluation

- **Lifetime Profit = production income over feed cost + calf value + salvage value – heifer raising costs – breeding costs – disease costs – genomic cost – other daily costs**
- **Lifetime Profit was adjusted to account for the time value of money using a present value calculation**
 - Discounted using a 10.5% interested rate
 - Discounted to birth

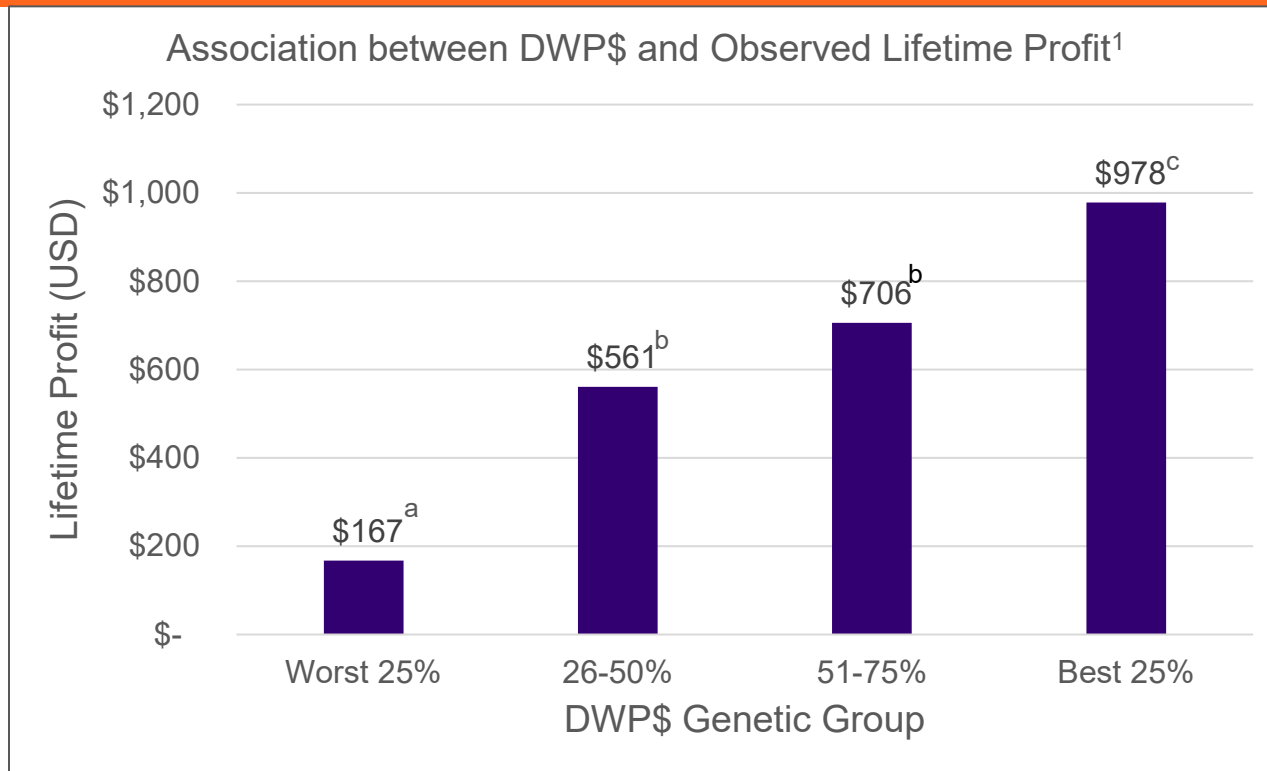
Materials & Methods: Evaluation of Genetic Merit

- **Animals were genotyped by Zoetis Genetics Laboratory and received CDCB genetic evaluation predictions**
- **CDCB predictions from December 2012 official release were included in DWP\$ calculation**
- **Cow and calf wellness predictions were generated from phenotypic data available on December 31, 2012**
- **This was done to ensure an animal's own performance data was not contributing to the genetic evaluations**

Materials & Methods: Statistical Analysis

- **DWP\$ predictions generated with the 2018 formulation were used to rank animals within herd and assign them to quartiles**
- **Data analyzed using PROC Mixed in SAS**
 - Fixed effect of genetic group
 - Random effect of herd

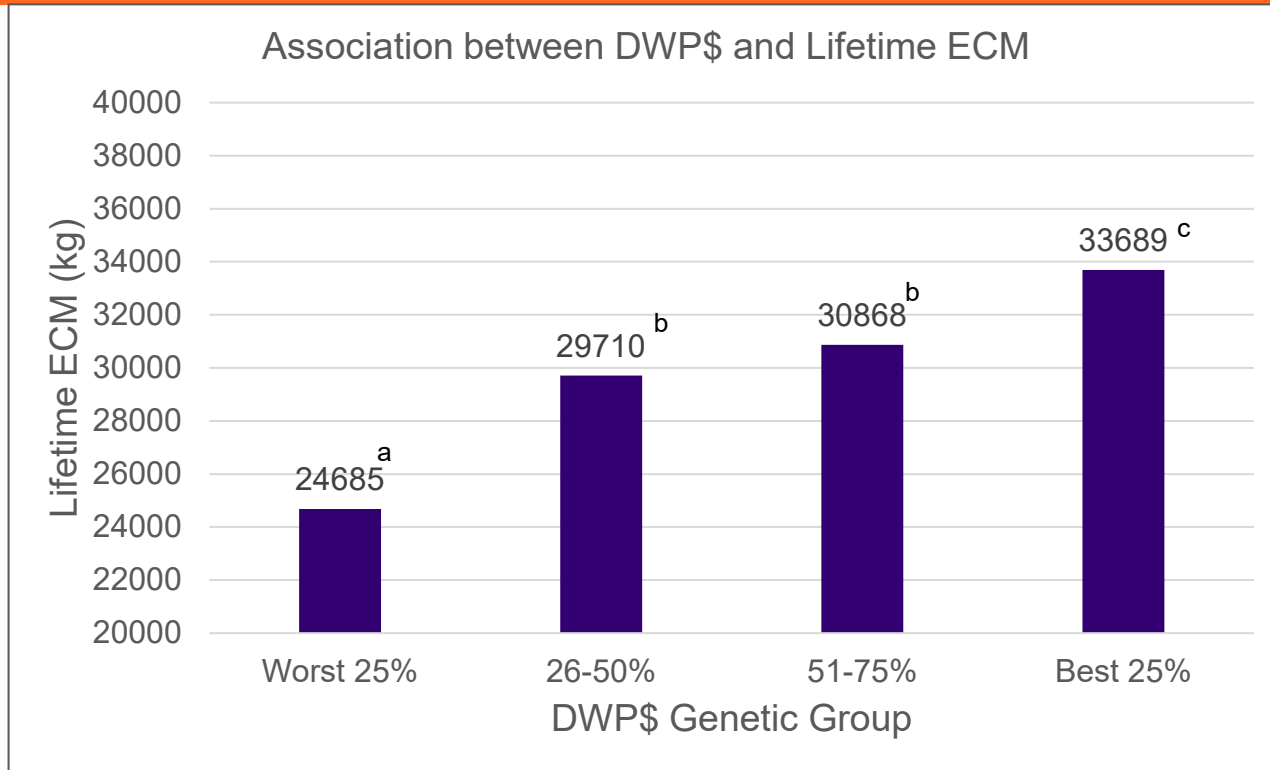
Results: Lifetime Profit



^{a-c} Marginal means with different superscripts differ ($P < 0.01$), SEM = 297

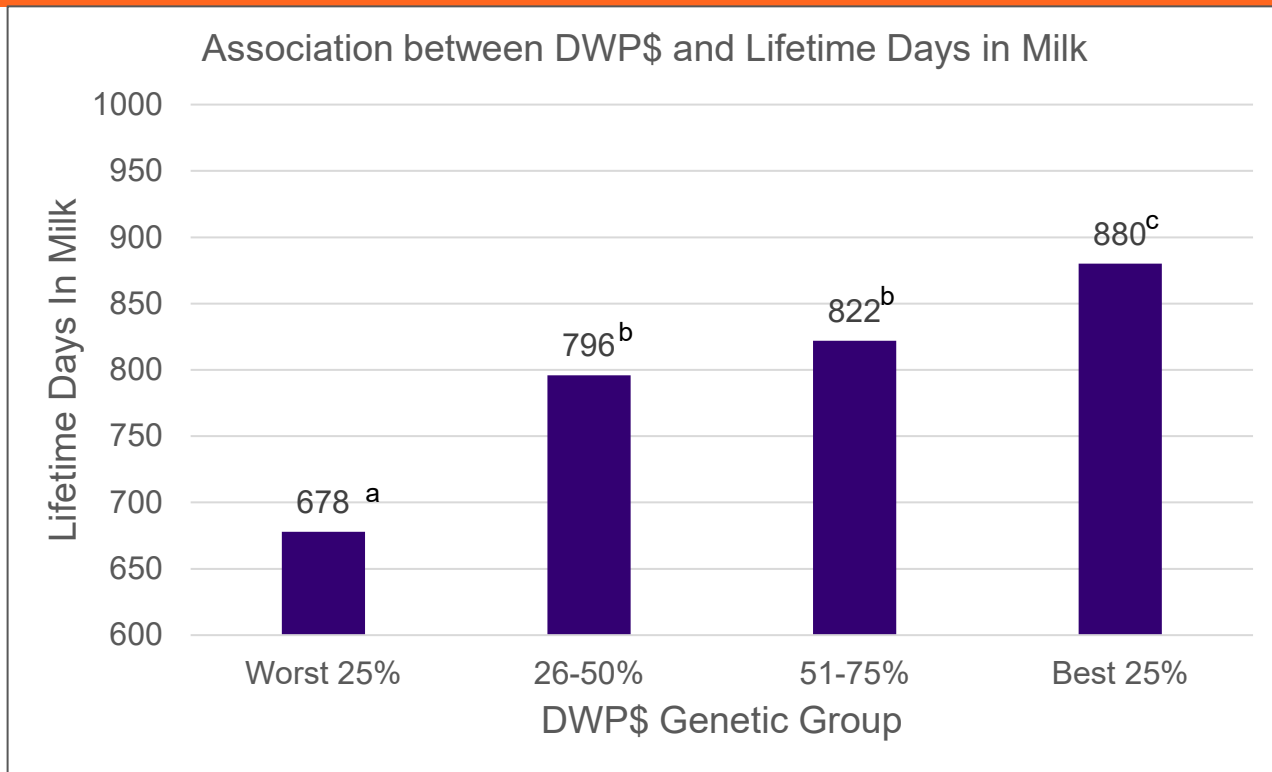
¹All incomes and expenses were discounted to birth using a 10.5% rate of interest

Results: Lifetime Energy Corrected Milk (ECM)



^{a-c} Marginal means with different superscripts differ ($P < 0.01$), SEM = 2,436

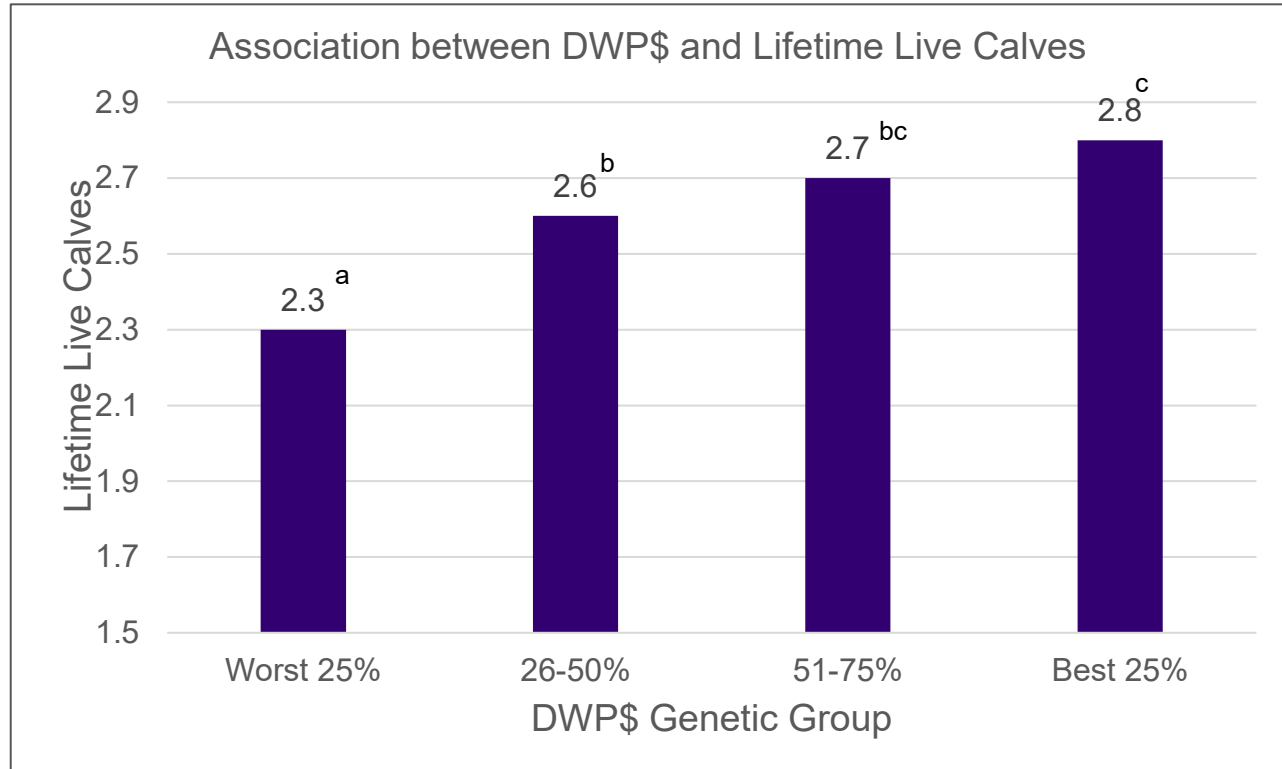
Results: Lifetime Days in Milk



^{a-c} Marginal means with different superscripts differ ($P < 0.01$), SEM = 47

Results: Lifetime Live Calves

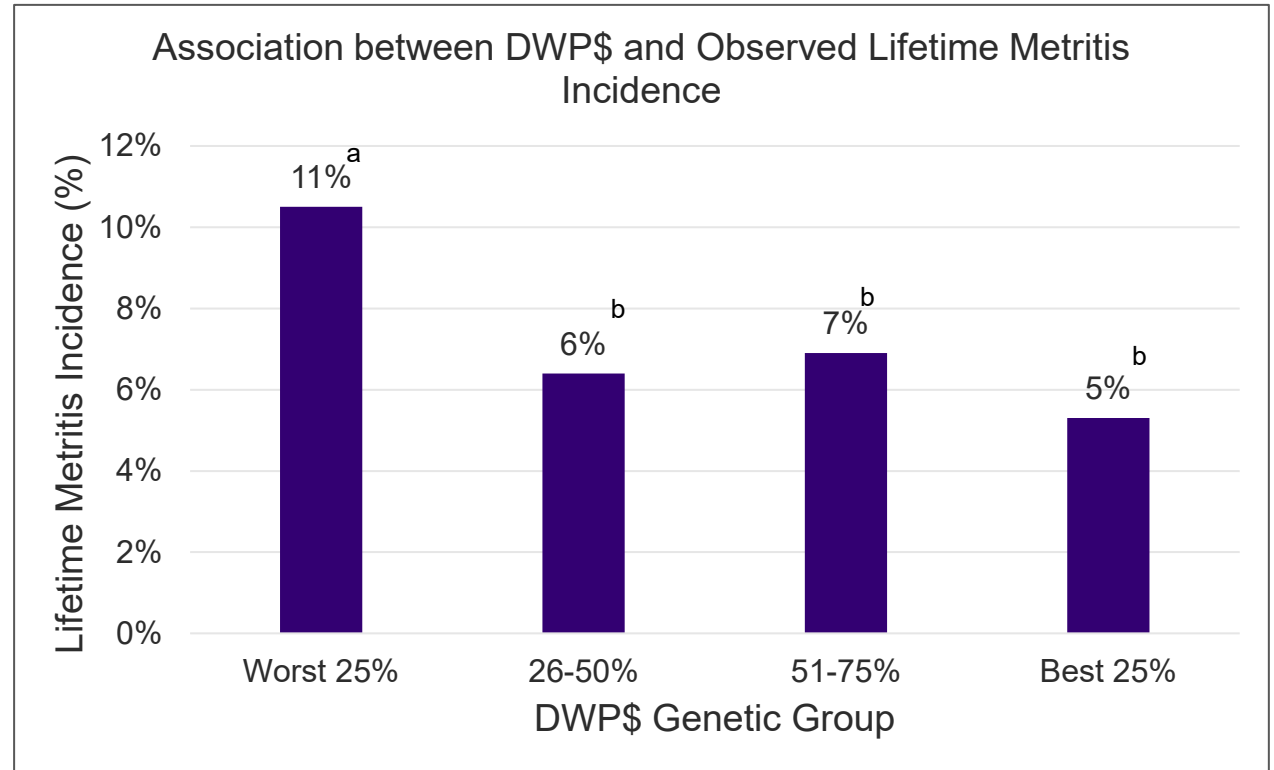
- On 1000 cow dairy the Best 25% would generate 75 more calves over their lifetime



^{a-c} Marginal means with different superscripts differ ($P < 0.01$), SEM = 1.5 

Results: Lifetime Metritis Incidence

- **Best 25% DWP\$**
group had **55% less**
metritis than the
worst 25%



Conclusion



- **DWP\$ gPTA of Holstein heifers predicted significant differences in observed lifetime profit**
- **DWP\$ gPTA predictions were associated with significant differences in observed lifetime energy corrected milk, days in milk, live calves born, and metritis incidence**
- **DWP\$ gPTA predictions for young calves can be used to effectively predict potential future lifetime profitability**
- **DWP\$ predictions are a useful tool for dairy producers interested in using genetics as a method to improve their overall herd profitability**

Thank you

- **Dr. Fernando Di Croce**
- **Dr. Dan Weigel**
- **Dr. Jason Osterstock**
- **Dr. Dave Galligan (University of Pennsylvania)**

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