



# Genetic analyses of hoof lesions in Canadian Holsteins using an alternative contemporary group

Francesca Malchiodi<sup>1\*</sup>, A. Koeck<sup>1</sup>, N. Chapinal<sup>2</sup>, M. Sargolzaei<sup>1,3</sup>,  
A. Fleming<sup>1</sup>, D. F. Kelton<sup>4</sup>, F. S. Schenkel<sup>1</sup> and F. Miglior<sup>1,5</sup>

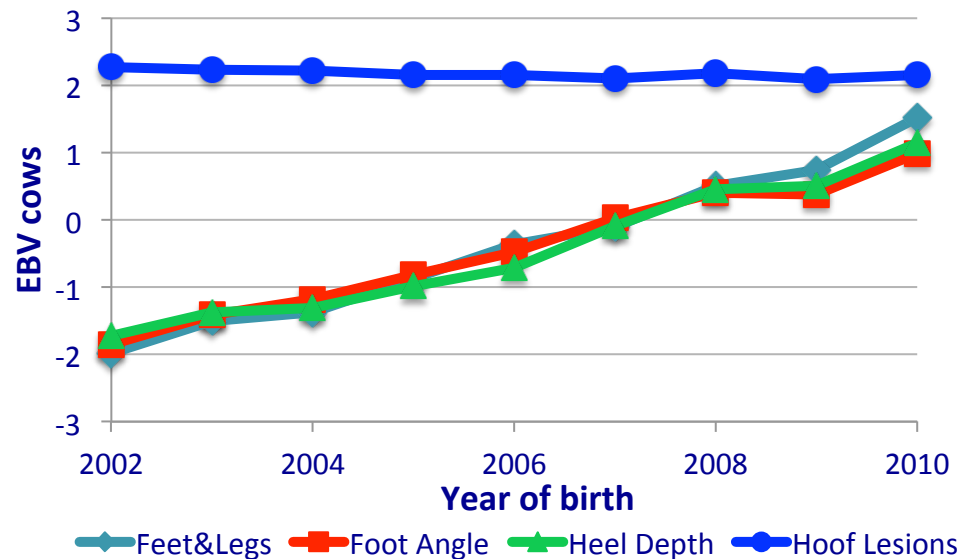
<sup>1</sup>CGIL, University of Guelph; <sup>2</sup>Animal Welfare Group, University of British Columbia, Vancouver; <sup>3</sup>Semex Alliance, Guelph; <sup>4</sup>Pop Med, Veterinary College, University of Guelph; <sup>5</sup>Canadian Dairy Network, Guelph, Ontario

# Hoof Lesions

- Lameness considered number one health issue by Canadian dairy producers
- Prevalence of 40 to 70% of cows with at least one hoof lesion – North America and Europe
- Hoof lesions compromise the welfare of animals
- Economic loss, costs associated:
  - with treatment of lesions
  - with decreased cow performance

# Hoof Lesions and Type Traits

- Historically, selection for feet and leg type traits has not resulted in any decrease of hoof lesions



- Low correlations have been estimated among hoof lesions and feet and leg type traits

# Objectives

- The project aims to initiate a routine data flow for genetic evaluation of hoof health
- To estimate genetic parameters for hoof lesions in Canadian Holsteins using an alternative contemporary group

# Data

- Provincial projects:  
Ontario, British Columbia, Alberta
- June 2009 to October 2012
- 23 hoof trimmers
- Hoof supervisor<sup>®</sup> system  
(KS Dairy Consulting, Dresser, Wisconsin)
- 75,559 records from 53,654 cows in 365 herds
- First record of each lactation



# Data Analysis

- Lesions analyzed: digital and interdigital dermatitis, sole and toe ulcer, sole hemorrhage, white line disease, and inter-digital hyperplasia
- Binary (0 – 1)
  - 0: no lesion
  - 1: presence of a lesion

# Contemporary Groups

**GROUP 1:** only cows presented at least one time to the trimmer during the course of lactation for a given herd

**OR**

**GROUP 2:** all cows in a given herd that were presented or not to the hoof trimmer during the lactation

# Data Analysis - Model

Linear animal model DMU (Madsen and Jensen, 2008):

$$Y = \mu + \text{HERD} + \text{TRIMMER} + \text{PARITY} + \text{STAGE} + a + pe + e$$

HERD: herd-date of hoof trimming (1 to 3,086)

TRIMMER: hoof trimmer (1 to 23)

PARITY: parity at trimming (1 to 7<sup>+</sup>)

STAGE: stage of lactation at trimming (1 to 16)

a: random additive genetic animal effect

(GROUP 1: 1 to 196,879 ; GROUP 2: 1 to 230,367)

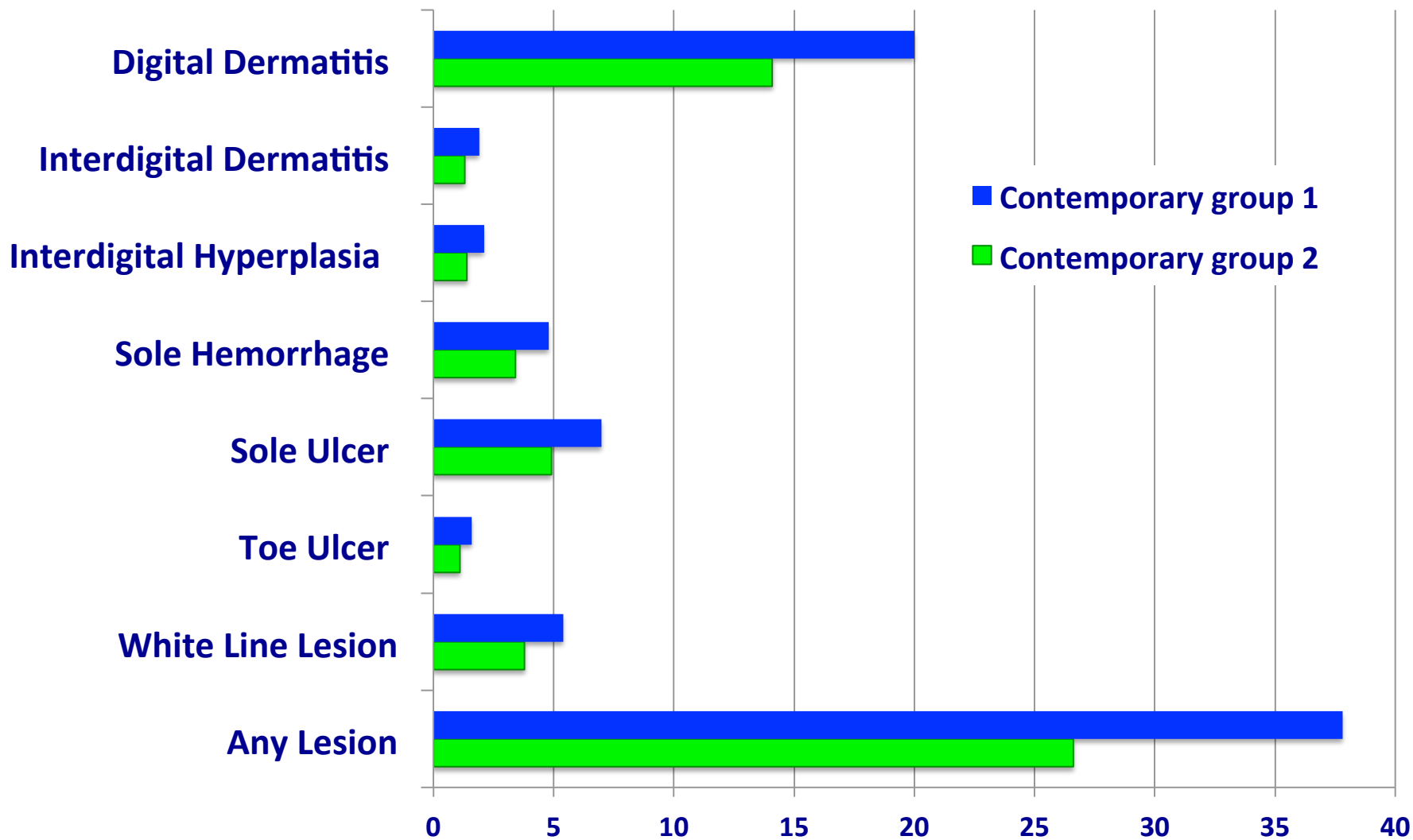
pe: random permanent environmental effect

(GROUP 1: 1 to 53,654 ; GROUP 2: 1 to 70,394)

e: random error term



# Prevalence of hoof lesions by contemporary group



# Heritability of hoof lesions

Traits	Contemporary Group 1 Heritability (SE)	Contemporary Group 2 Heritability (SE)
Digital Dermatitis	<b>0.067</b> (0.007)	<b>0.053</b> (0.005)
Interdigital Dermatitis	<b>0.015</b> (0.003)	<b>0.011</b> (0.002)
Interdigital Hyperplasia	<b>0.036</b> (0.005)	<b>0.025</b> (0.004)
Sole Hemorrhage	<b>0.017</b> (0.003)	<b>0.012</b> (0.002)
Sole Ulcer	<b>0.038</b> (0.006)	<b>0.031</b> (0.004)
Toe Ulcer	0.006 (0.002)	0.004 (0.001)
White Line Lesions	<b>0.017</b> (0.002)	<b>0.012</b> (0.002)
At Least one Lesion	<b>0.065</b> (0.007)	<b>0.048</b> (0.005)

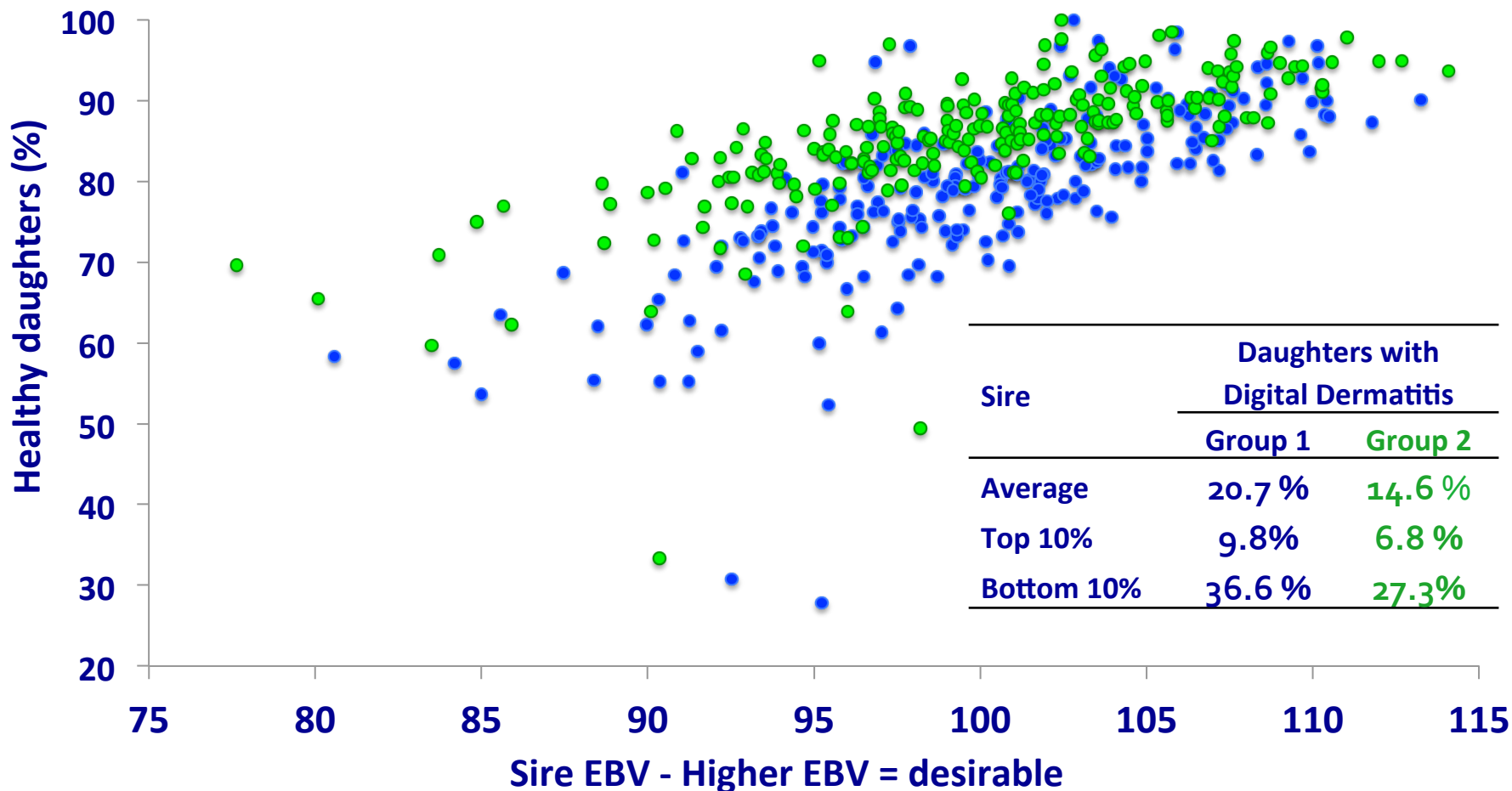
# Genetic correlations between hoof lesions

## *Contemporary Group 2*

Traits	ID	IH	SH	SU	TU	White Line
Digital Dermatitis (DD)	0.54	0.60				-0.23
Interdigital Dermatitis (ID)		0.61				-0.26
Interdigital Hyperplasia (IH)						
Sole Hemorrhage (SH)				0.83		0.54
Sole Ulcer (SU)					0.60	0.79
Toe Ulcer (TU)						0.54

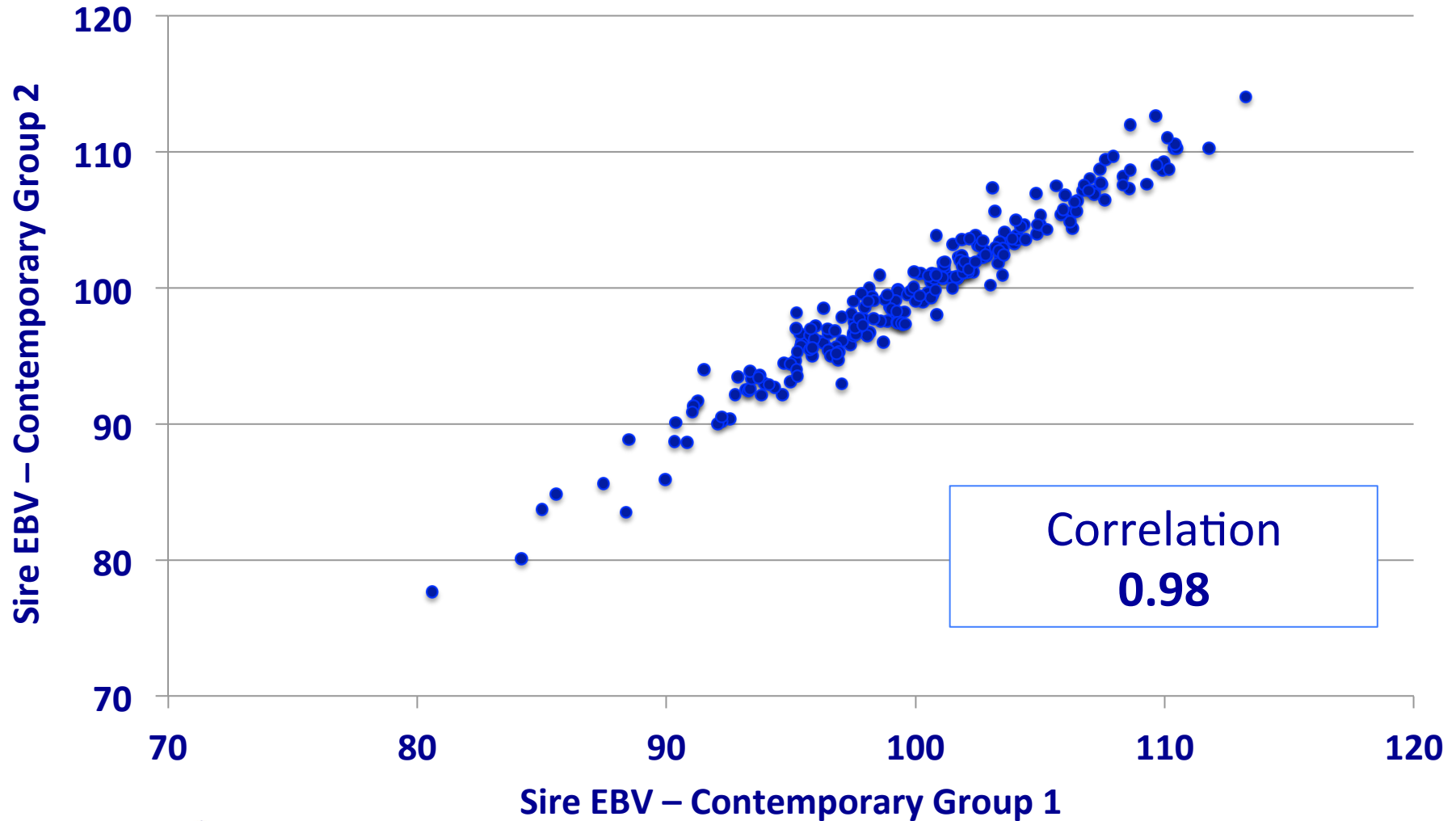
# EBV – Digital Dermatitis

- Contemporary Group 1
- Contemporary Group 2

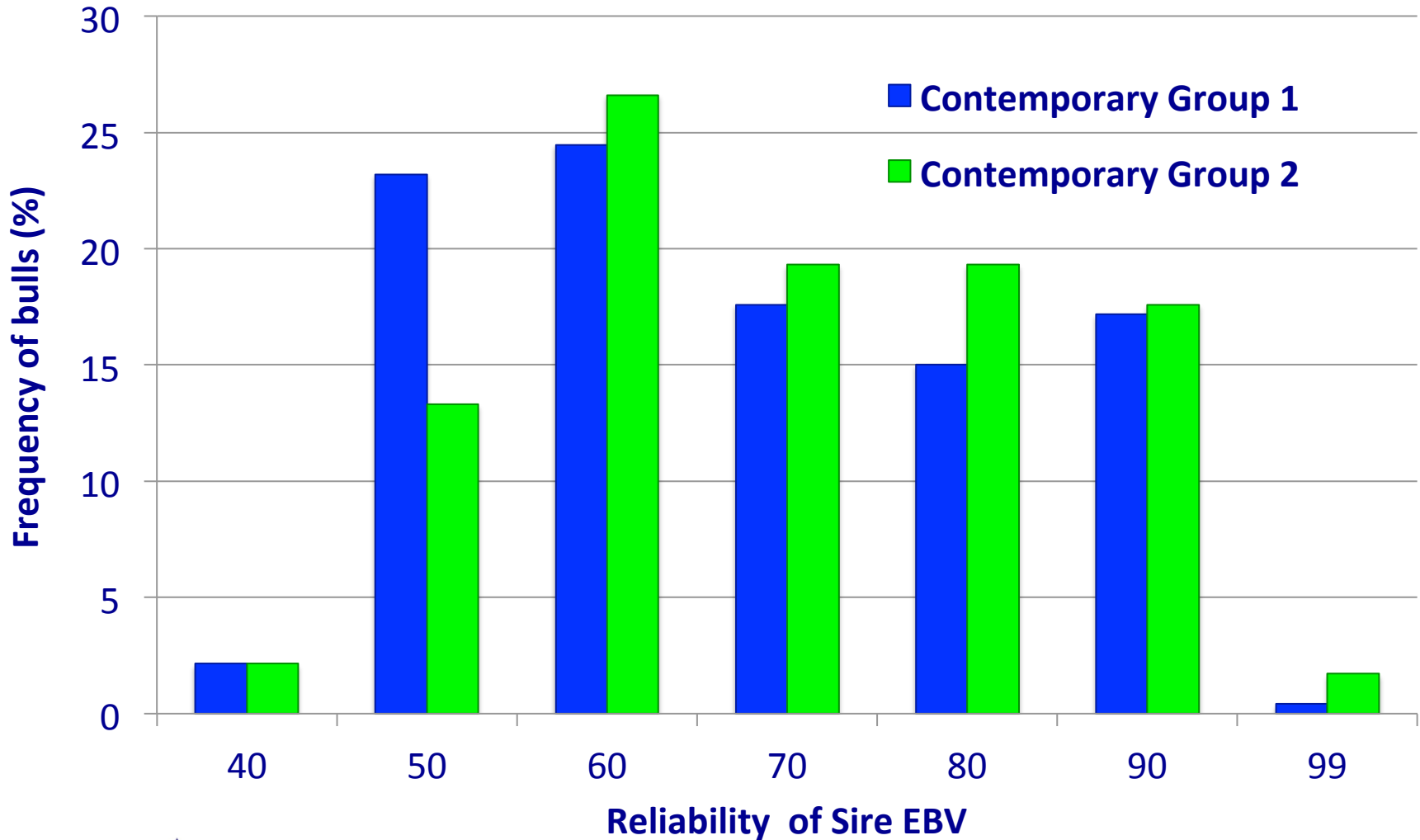


233 Sires ≥ 30 daughters

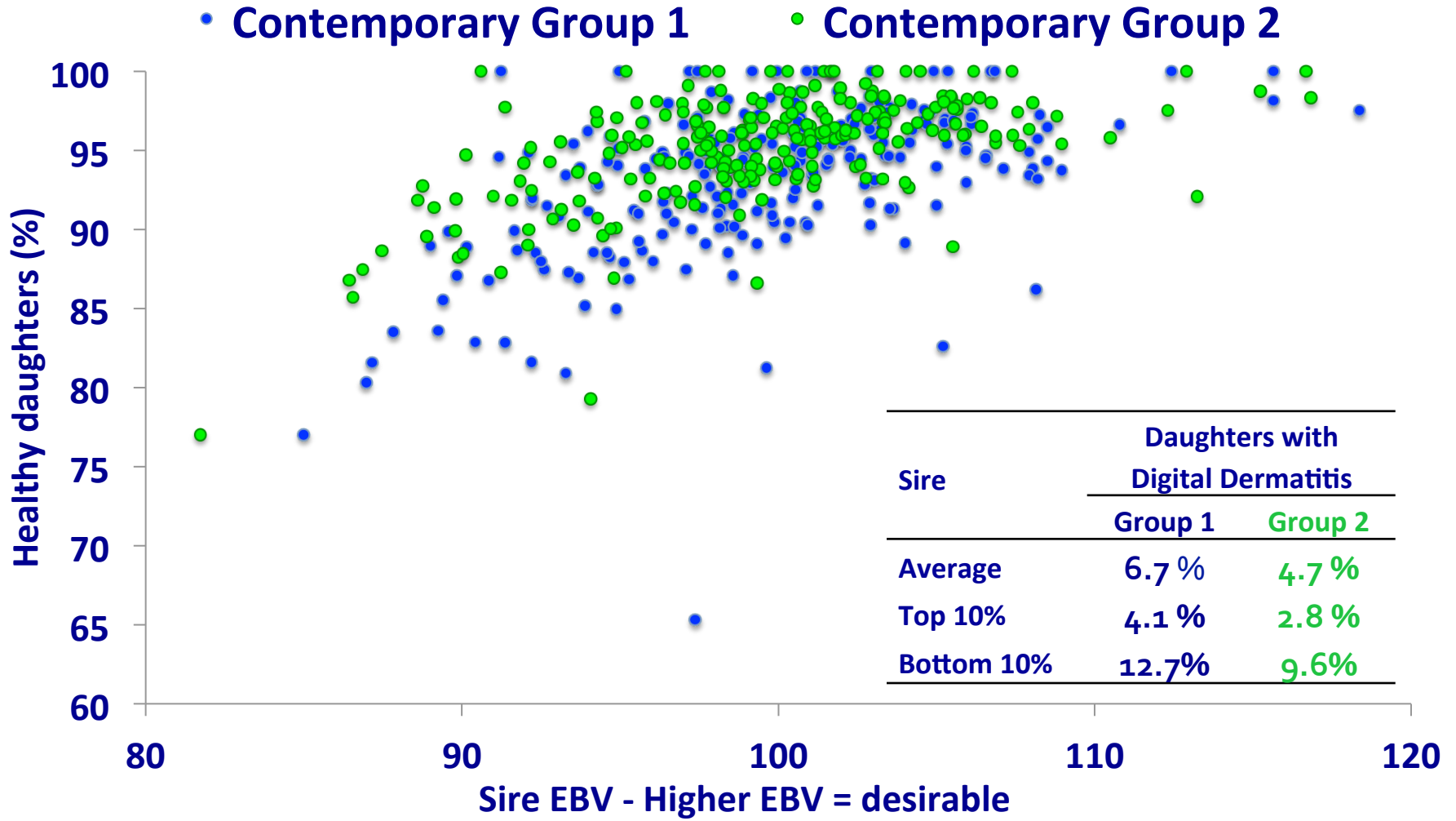
# EBV – Digital Dermatitis



# Reliability distribution – Digital Dermatitis

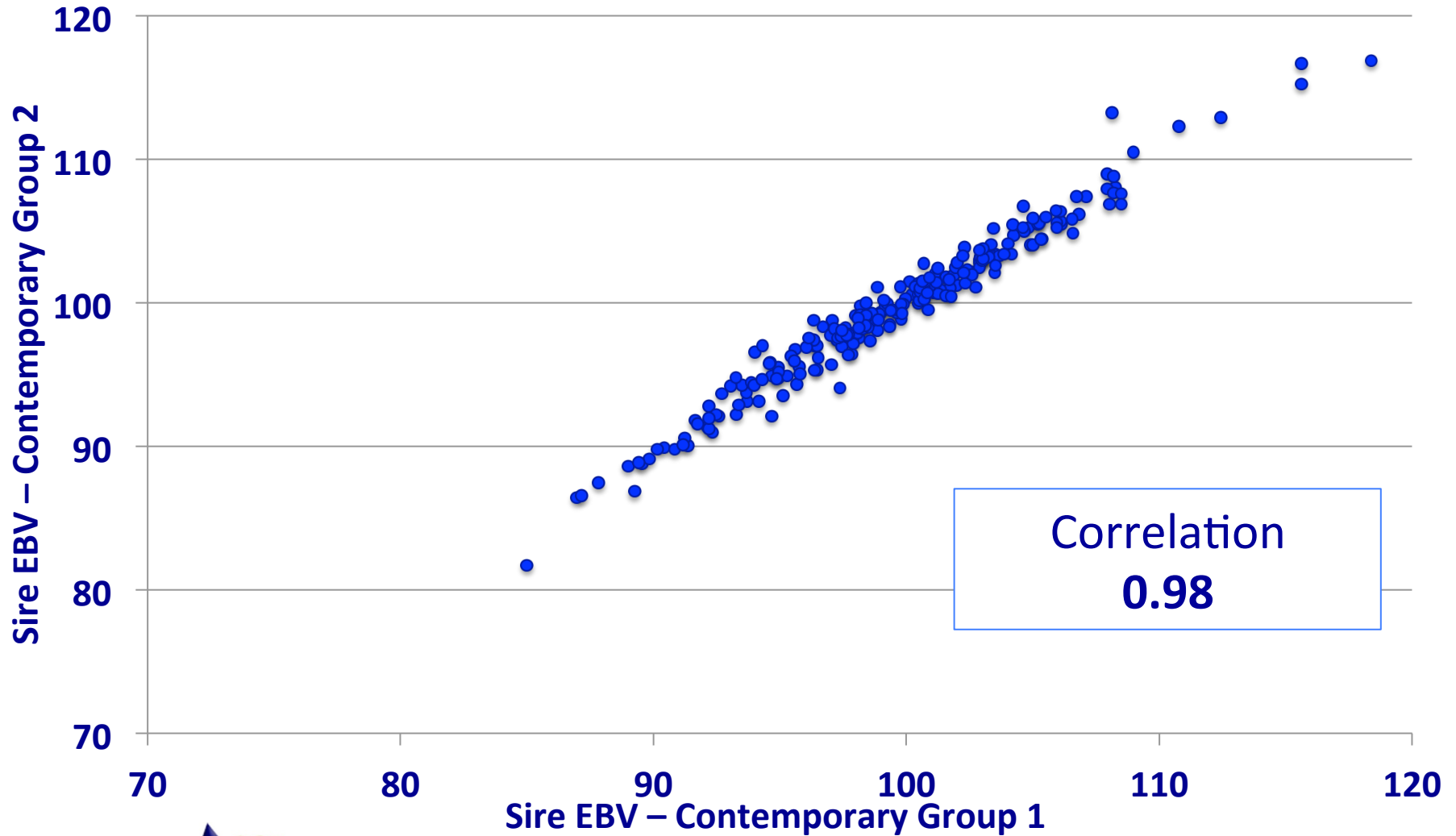


# EBV – Sole Ulcer



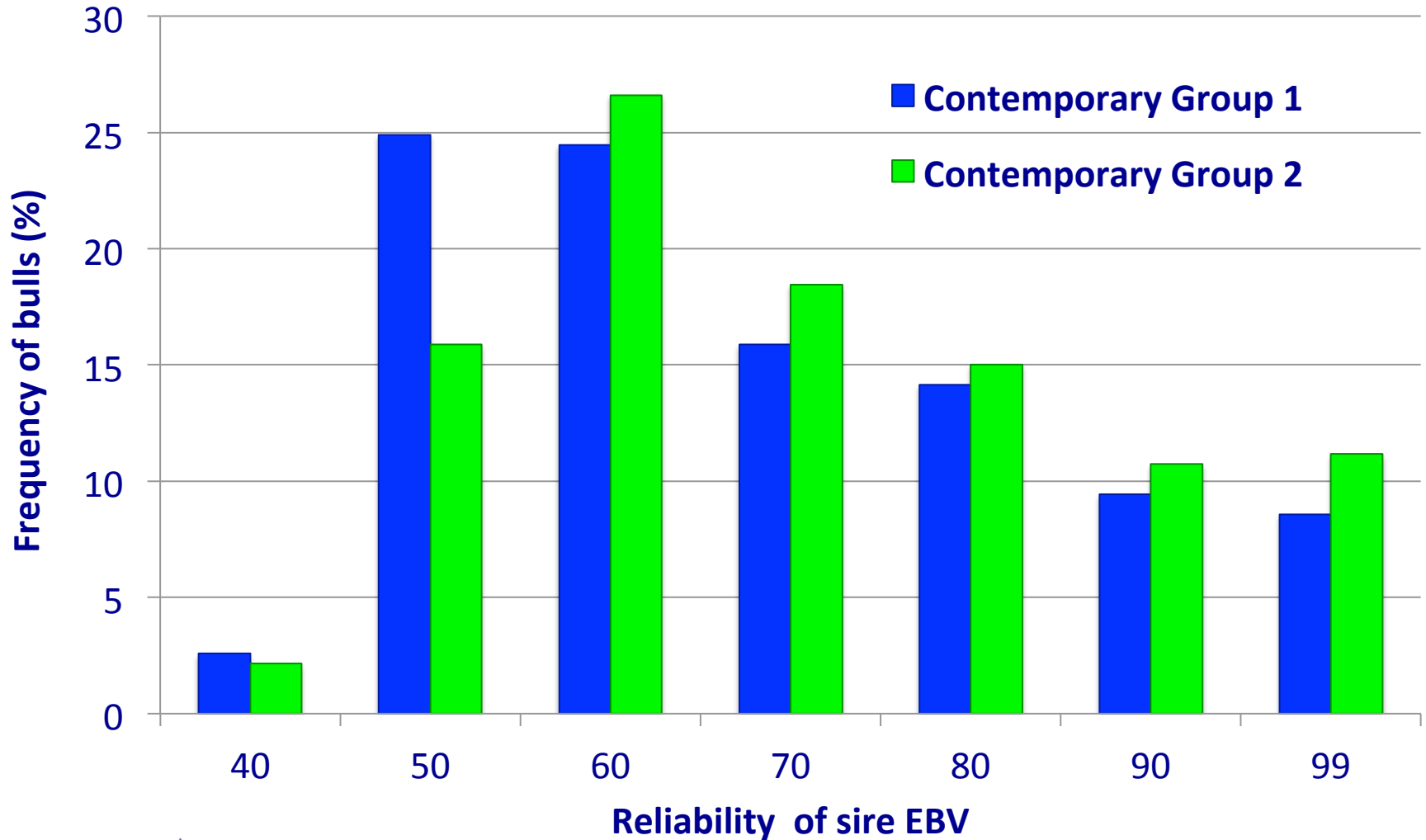
233 Sires ≥ 30 daughters

# EBV – Sole Ulcer





# Reliability distribution – Sole Ulcer



# Summary

- Prevalence of hoof lesions are elevated in Canada
  - genetic selection for hoof health should be incorporated in breeding programs
- Data from hoof trimmers can be used for genetic analyses
- Need to increase volume of data in order to validate preliminary results and to prepare for a national genetic evaluation in the future



# Acknowledgments

- The hoof trimmers who participated in this study
- Dairy Research Cluster Initiative: Dairy Farmers of Canada, Agriculture and Agri-Food Canada, the Canadian Dairy Network and the Canadian Dairy Commission
- Ontario Genomics Institute
- Alberta Milk



Dairy Farmers  
of Canada



Les Producteurs laitiers  
du Canada



Ontario **Genomics** Institute



Agriculture and  
Agri-Food Canada

Agriculture et  
Agroalimentaire Canada



**Canadian Dairy  
Commission**

**Commission  
canadienne du lait**

