

Genetics of increased importance of health traits

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ESTINTORE

CHRISTE





Porta Borsari
Basilica San Lorenzo
Arco del Gavi
Castelvecchio
Chiesa SS. Apostoli
Basilica San Zeno

DOLBY
WATCHING JEWELRY

42

40

38

Health traits

- CDCB dairy: March 26: added resistance to diarrhea, resistance to respiratory problems to 6 existing health traits
- Pig Company X: Desired evaluation for > 10 health traits
- Why extra health traits
 - Recessive genes?
 - More problems? Deteriorating disease resistance?
 - Better recording?

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Special Topics



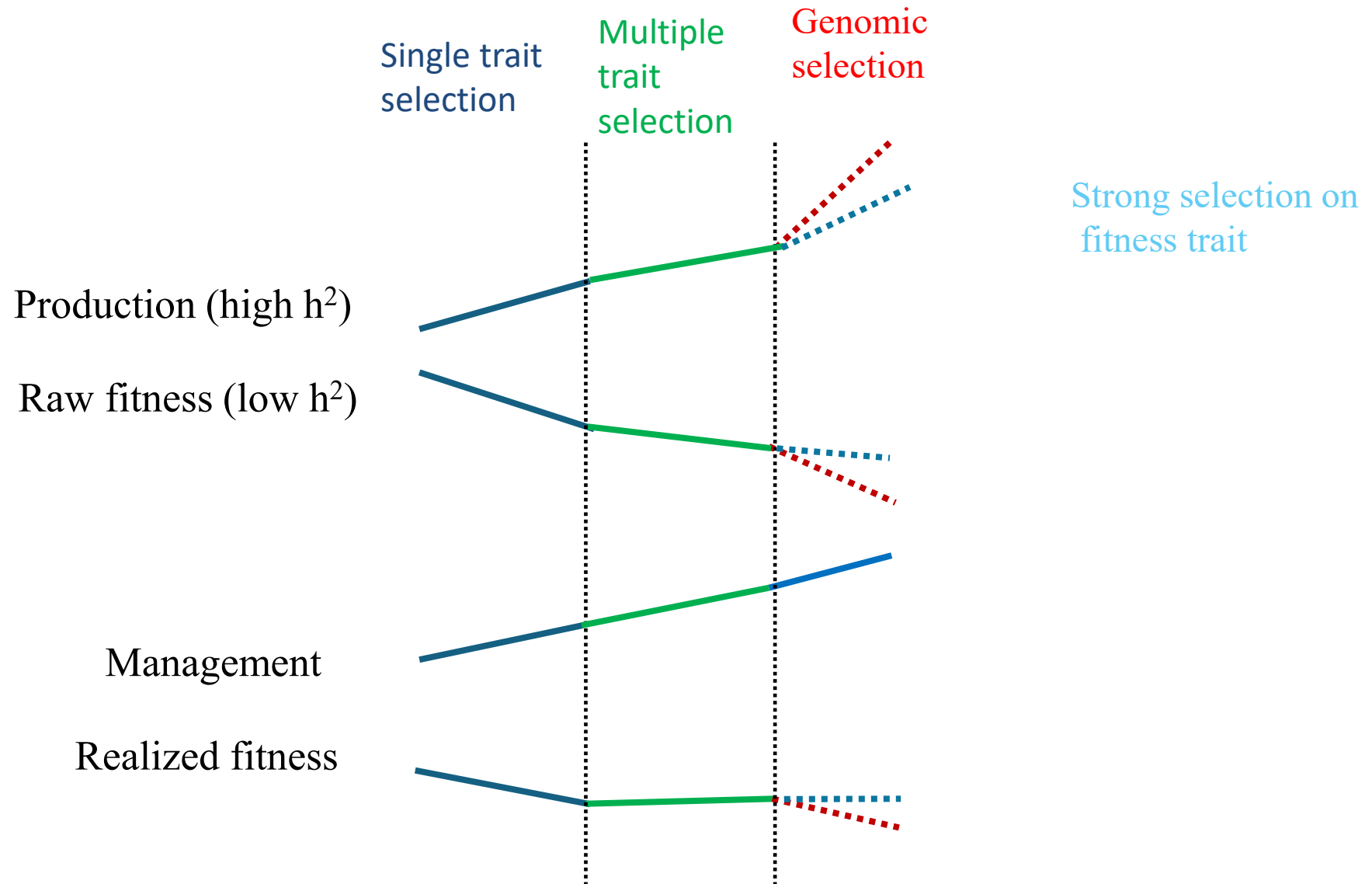
Potential negative effects of genomic selection

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Hypothetical trend changes in 3 stages of genetic selection



Response of unrecorded trait b on selected trait a

$$\begin{bmatrix} \Delta u_a \\ \Delta u_b \end{bmatrix} = \overset{\text{Expected gain}}{i_a} \overset{\text{Selection intensity}}{acc_a} \begin{bmatrix} 1 & \\ & corr_{ab} \end{bmatrix} \begin{bmatrix} \sigma_a \\ \sigma_b \end{bmatrix}$$

Accuracy of EBV

Antagonistic genetic correlations between production and some health traits (from AI)

- Mastitis: 0.13-0.38
- Metabolic disorders: 0.11 -0.47
- Lameness: 0.38
- Fertility: 0.20-0.48

Health traits		
Composite	Independent	M305, kg (SE)
ALL		0.149 (0.125)
REPR		-0.078 (0.126)
	METR	0.087 (0.148)
	EM	0.290 (0.151)*
	RETP	-0.191 (0.144)
	ABOR	0.707 (0.146)*
UDDE		0.245 (0.123)*
	MAST1	0.176 (0.124)
	MAST2	0.532 (0.127)*
DIGS		0.186 (0.155)
	DIAR	0.189 (0.160)
	ENTR	0.554 (0.201)*
	DYSP	-0.205 (0.270)
	ANTF	0.02 (0.229)
METB		-0.054 (0.133)
	KETO	-0.171 (0.133)
	DSAB	-0.460 (0.199)*
	MFEV	0.011 (0.132)
UCCF		0.061 (0.161)

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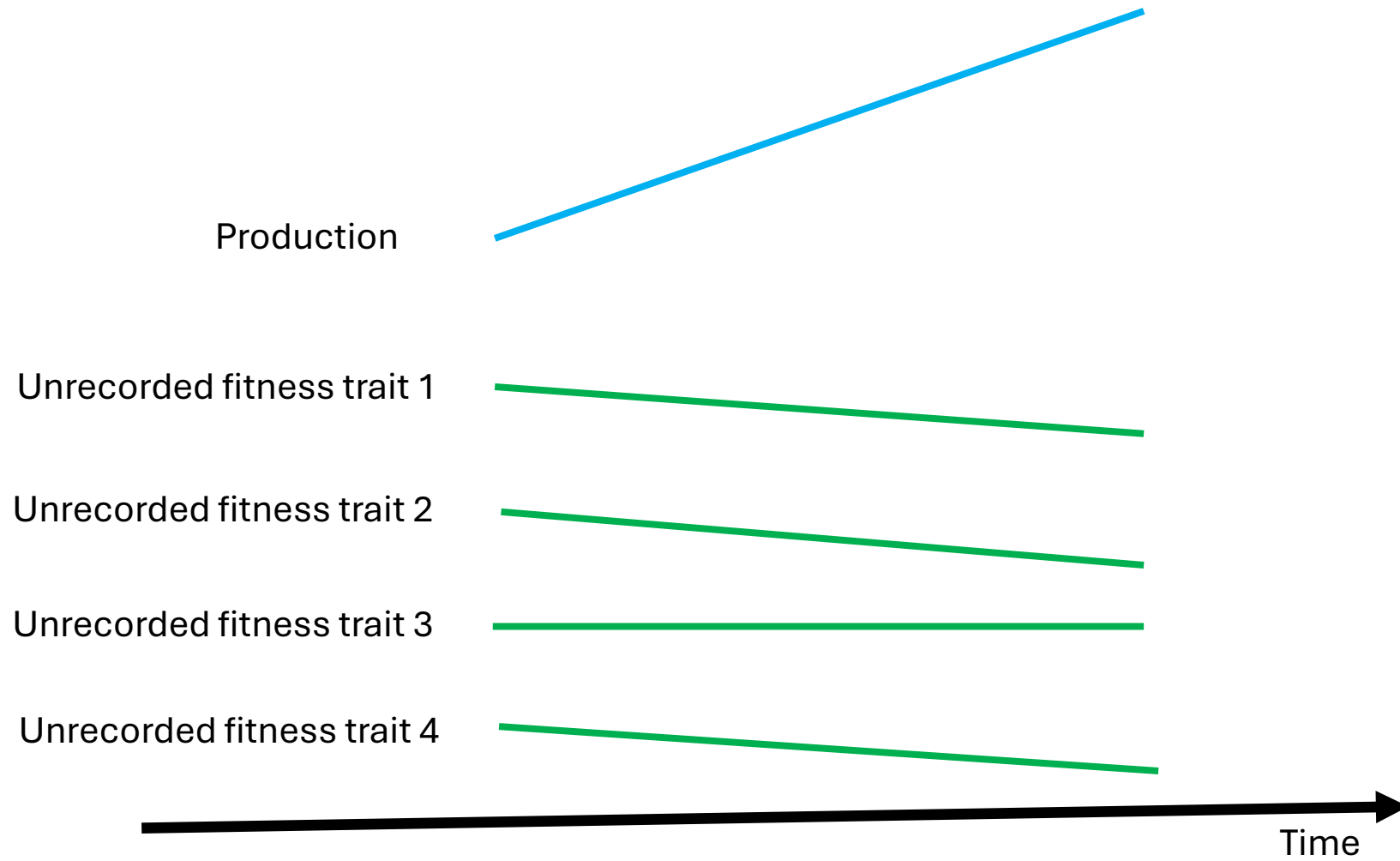
Genetic parameters for health traits and their association with fertility and milk production in Chinese Holsteins

Junxing Zhang¹ | Liyun Han^{1,2,3} | Hailiang Zhang² | Honghong Hu¹ | Hui Sheng¹ | Tongtong Yang² | Yi Zhang² | Wan Wen⁴ | Liqin Ma⁴ | Yun Ma¹ | Yachun Wang²

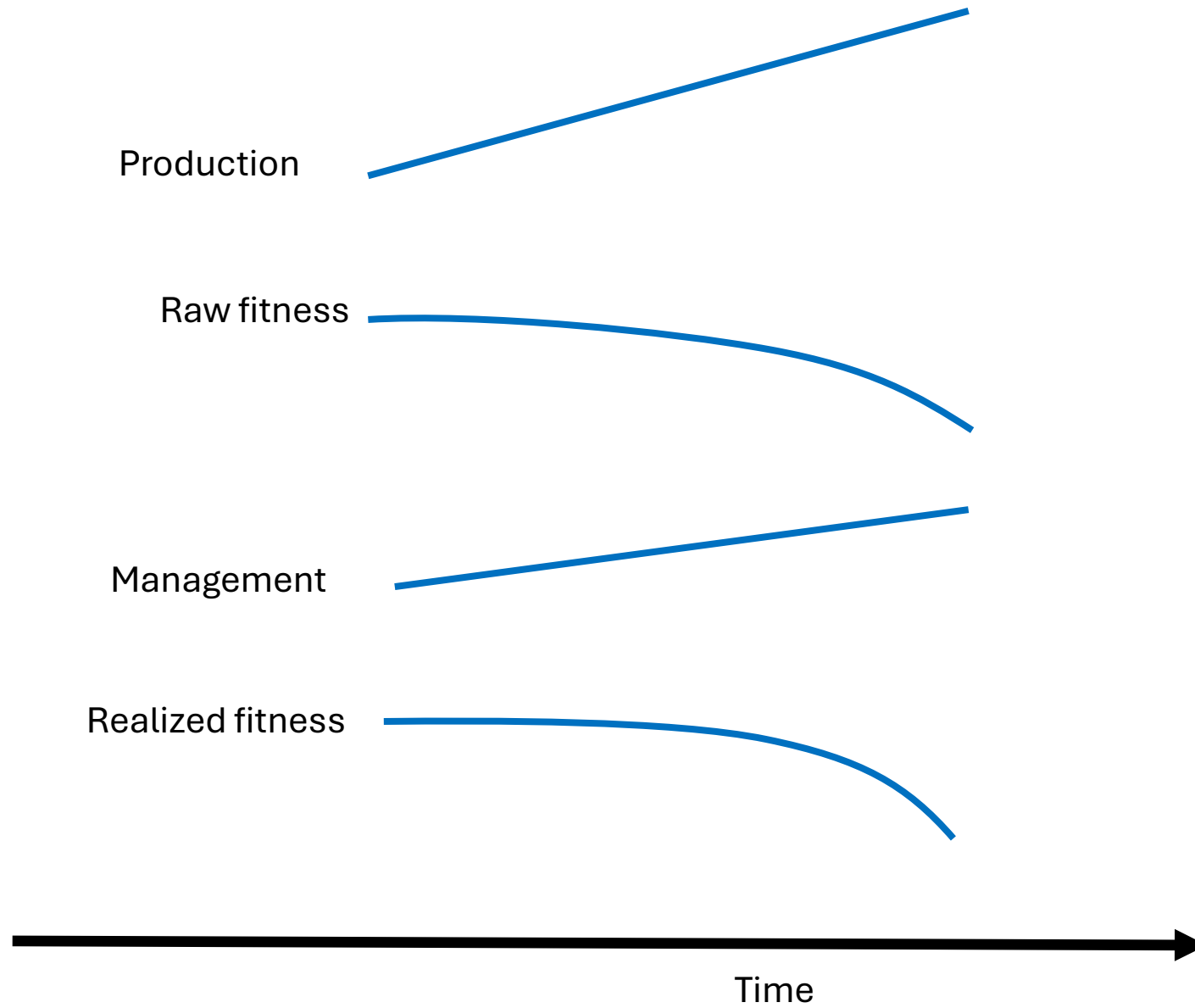
Unrecorded and unrealized secondary traits

- Not considered important now
- Becoming important in the future
- Antagonistic to production

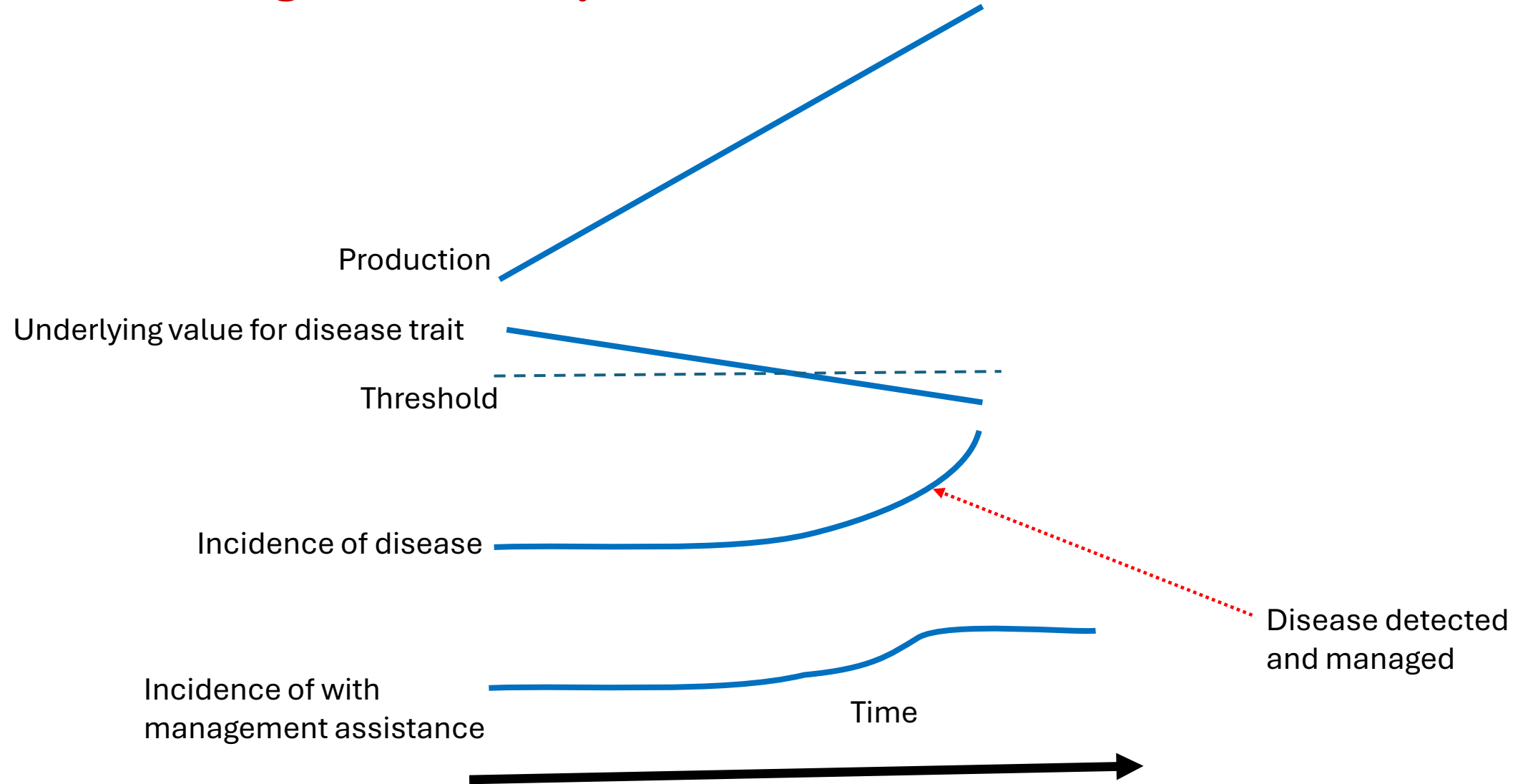
Trend changes for production and hypothetical unselected traits



Trend changes when genetic antagonism intensifies



Trend changes for liability to disease and incidence of disease



Selection index based on multiple trait BLUP

$\hat{\mathbf{u}} = \text{EBV}$ $\mathbf{u} = \text{BV}$ \mathbf{a} – economic weights

$$\begin{aligned} \mathbf{I} &= E(\mathbf{a}'\mathbf{u}|\hat{\mathbf{u}}) = \mathbf{a}'\text{cov}(\mathbf{u}, \hat{\mathbf{u}})\text{var}(\hat{\mathbf{u}})^{-1} \hat{\mathbf{u}} \\ &= \mathbf{a}' \hat{\mathbf{u}} \end{aligned}$$

$\text{cov}(\mathbf{u}, \hat{\mathbf{u}}) = \text{var}(\hat{\mathbf{u}})$ only with multiple trait model BLUP

If EBVs calculated by single trait or cluster of traits, less response for secondary trait (Van Der Werf, 2014)

How to circumvent deterioration of health traits?

- Estimate trend of antagonism
 - Thrigibbsf90 only choice for categorical data? Limited size
 - GPP not yet applicable to categorical data
- Slow down the selection for production to let management catch up
- Use better methods for analysis of categorical data
- Use MT model for all traits, or adjust the index

Calf and piglet mortality

- Calf mortality < 1 yr 5-16% dependent on definition (Santman-Berend et al., 2019)
 - 3.1% < 14d, 4.5% 15-55d, 3.1 56-365d
- Piglet mortality up to 40%, with many post weaning
- Drastic steps to lower mortality by a major pig company
 - Nearly all selection on mortality
 - Losses in gain and feed efficiency
- Feed efficiency and disease resistance

Conclusions

- Sudden increase in incidence of health traits may be due to reaching thresholds in gradual decline of underlying values
- Health traits in an index may need extra weights if EBV not from multiple-trait model