Sow Mortality: Biological Priorities and Productivity

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"Epidemiologists predict where the carpet is going to wear out… in front of the door"

UNIVERSITY OF MINNESOTA
Driven to Discover®

Mathematician's Answer

- "Is it A or B?"
- "Yes"

Mathematician's Answer

if you ask someone a question, and he gives you an entirely accurate answer that is of no practical use whatsoever, he has just given you a Mathematician's Answer

What risk factor should sows avoid to avoid death?

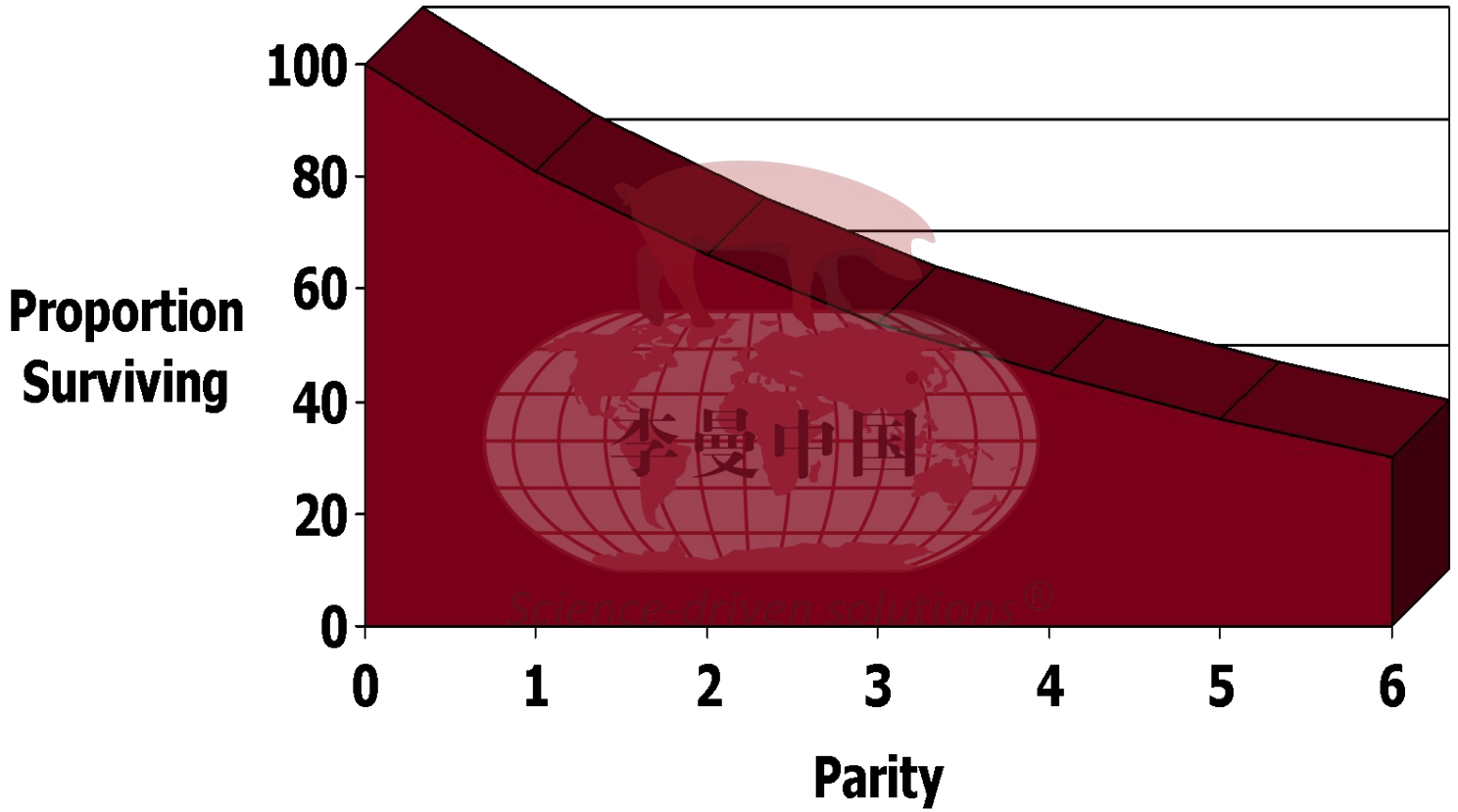
- Pregnancy

- What one thing should sows do to avoid culling?
  - Get pregnant

Challenges

- Mortality vs longevity
- Biology vs history
- Multifactorial causes vs simple causation
- Prospective vs retrospective analysis
- Denominator manipulation
- Herd vs individual priorities
- Resource allocation by the sow
- Analytic models

Sow Attrition



Is mortality a good dependent variable?

- Binary
- Considers all mortality equivalent
- Does not consider prior states
- Has been replaced in human policy studies

“Get thee to a nunnery”

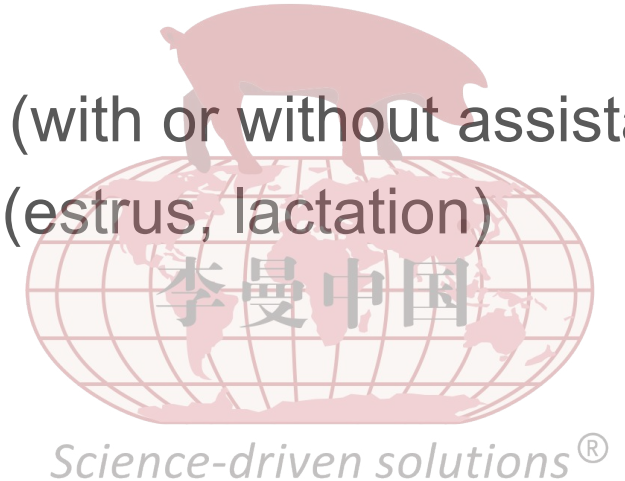
Four Biological **F**unctions to **F**lourish

- **F**eed – take in adequate nutrition
- **F**ight – compete and adapt in difficult conditions (disease, heat etc)
- **F**light – avoid difficult adverse conditions
- **R**eproduction – replacement

- Breeding reprioritizes functions
  - Eating vs lactation
  - Condition vs estrus
  - Robustness vs FCR

Why did the sow die?

- Because it wasn't culled
- Because it farrowed
- Because it couldn't cope (with or without assistance)
- Because it took life risks (estrus, lactation)



- Unpredictable
- Predictable
  - Retained (correctly or in error)
  - Culled (correctly or in error)

Successful removals

- At planned productive age (7th parity?)
- Without predictive productivity failure
- Without welfare concerns
- At full sale value
- At weaning
- With a replacement ready
  - Less than 10% in most herds
  - Most sows leave with DALP's

Longevity

- How about disability adjusted life parities (DALP's)
  - Combines mortality and culling
  - Assumes culling represents disabilities
  - Problem: disabilities rarely recorded except for reproductive
  - Weightings based on predicted impact:
    - Needs economic model
    - Problem: economics not at individual level, but at space level
    - Economics embedded in opportunity costs

"to give everyone the chance to live a healthy, productive life"

IHME Celebrating 10 years of measuring what matters
Institute for Health Metrics and Evaluation

- DALY: Disability Adjusted Life Year
- GBD: Global Burden of Disease
- YLL: Years Life Lost
- HALE: Health Adjusted Life Expectancy

Global Burden of Disease

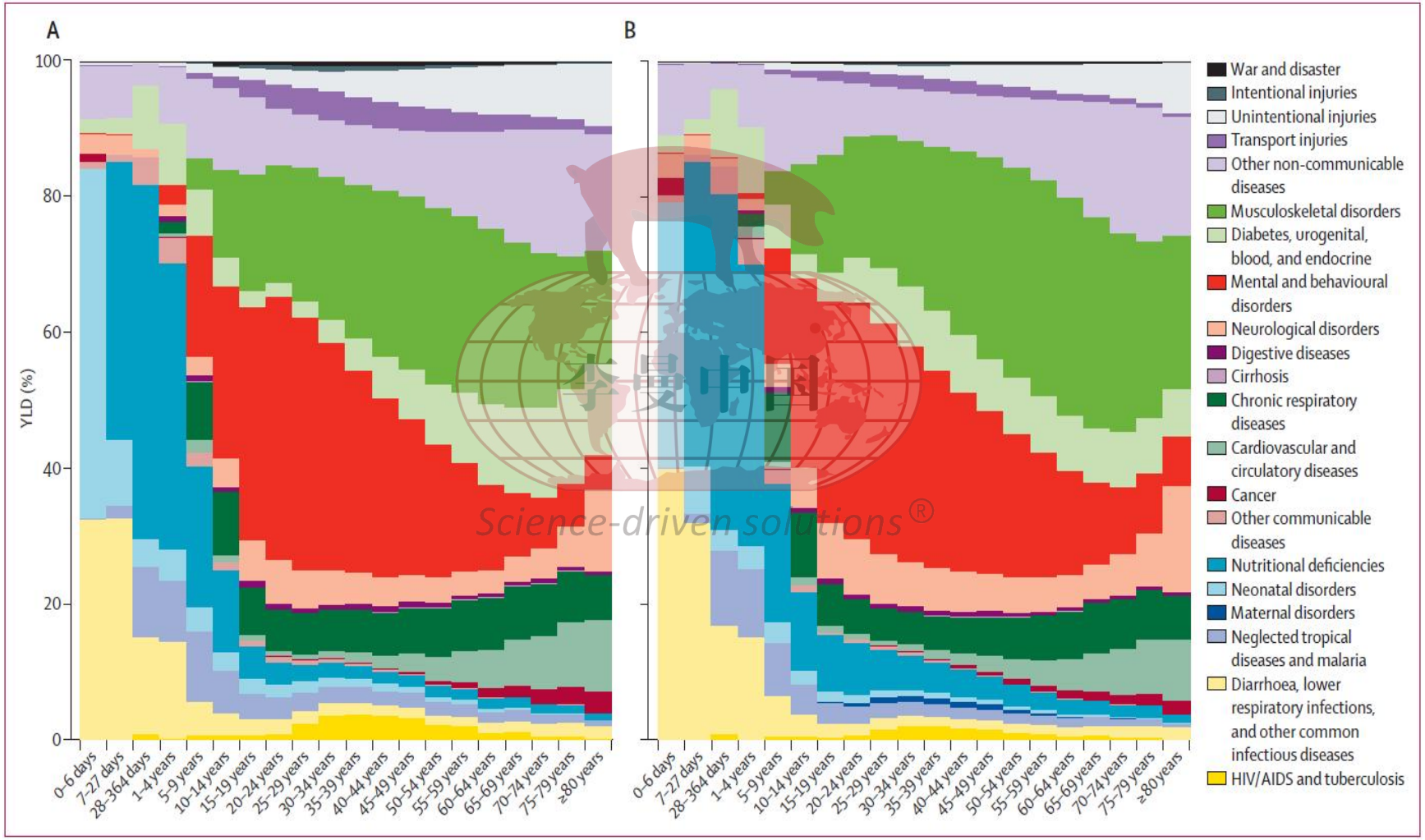


Figure 2: Percentage of years lived with disability (YLDs) in 2010, by cause and age
(A) In male individuals. (B) In female individuals. An interactive version of this figure is available online at http://healthmetricsandevaluation.org/gbd/visualizations/regional.

Disability Adjusted Life Year

“One DALY can be thought of as one lost year of "healthy" life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability.”

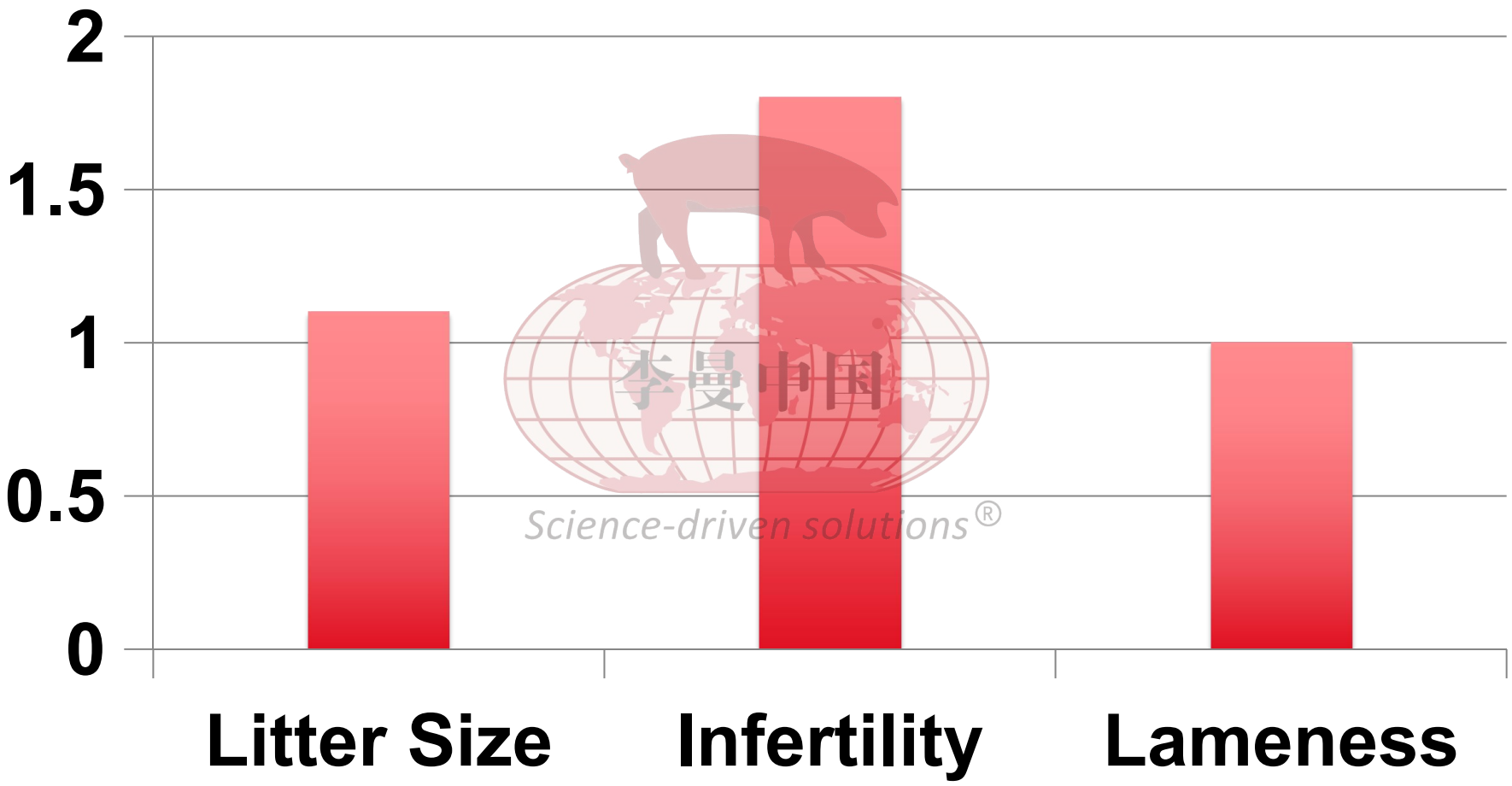
DALYs

i) for epidemiological surveillance of the total disease burden (number of DALYs)

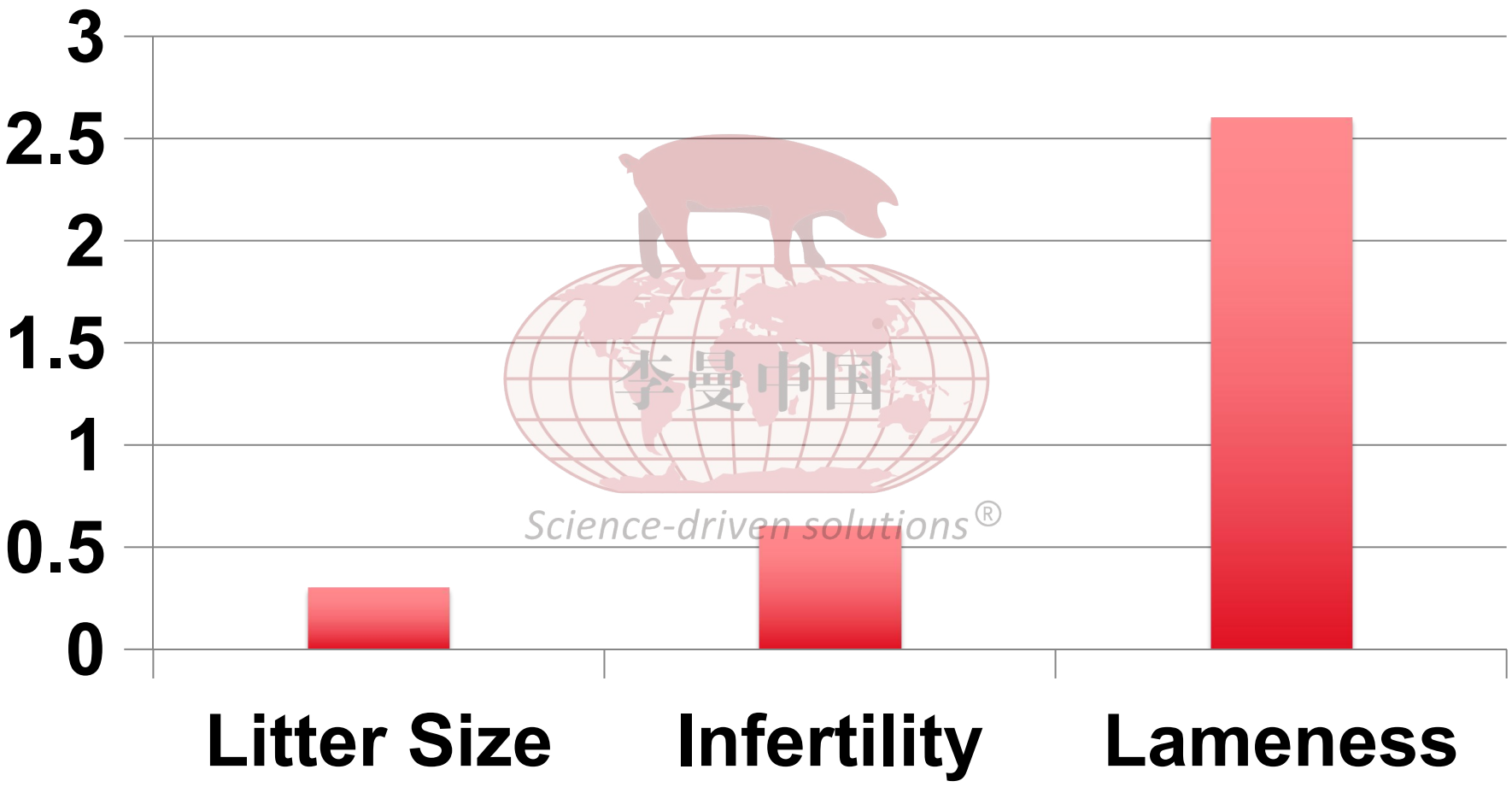
ii) to measure cost- effectiveness of interventions (cost per avoided DALY)

iii) to decide what should be included in a country's 'core services' (the package of essential health care services). Within a fixed budget, it has been suggested that only the most cost-effective interventions should be included (cost per avoided DALY) .

Retrospective DALP's



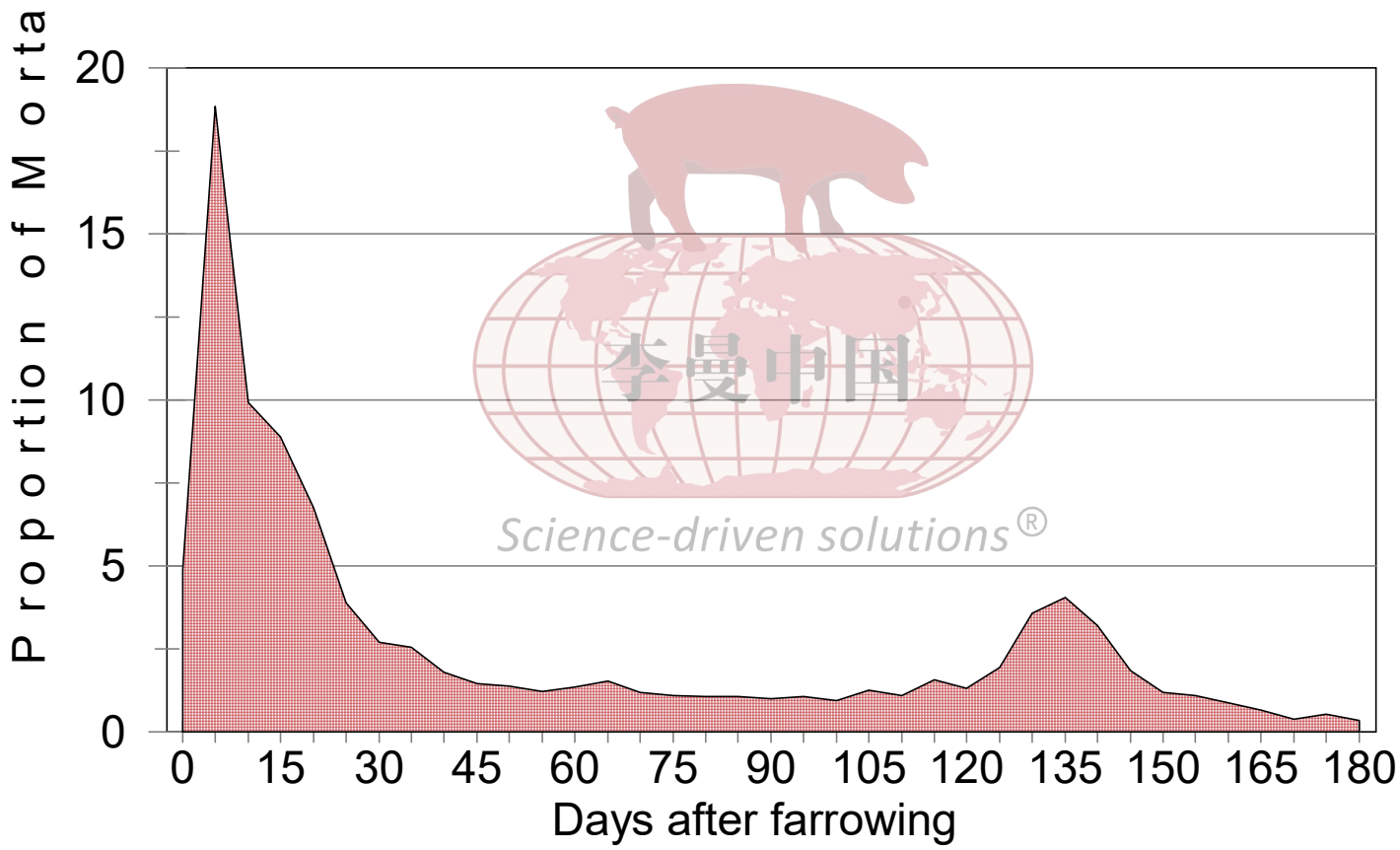
Prospective DALP's



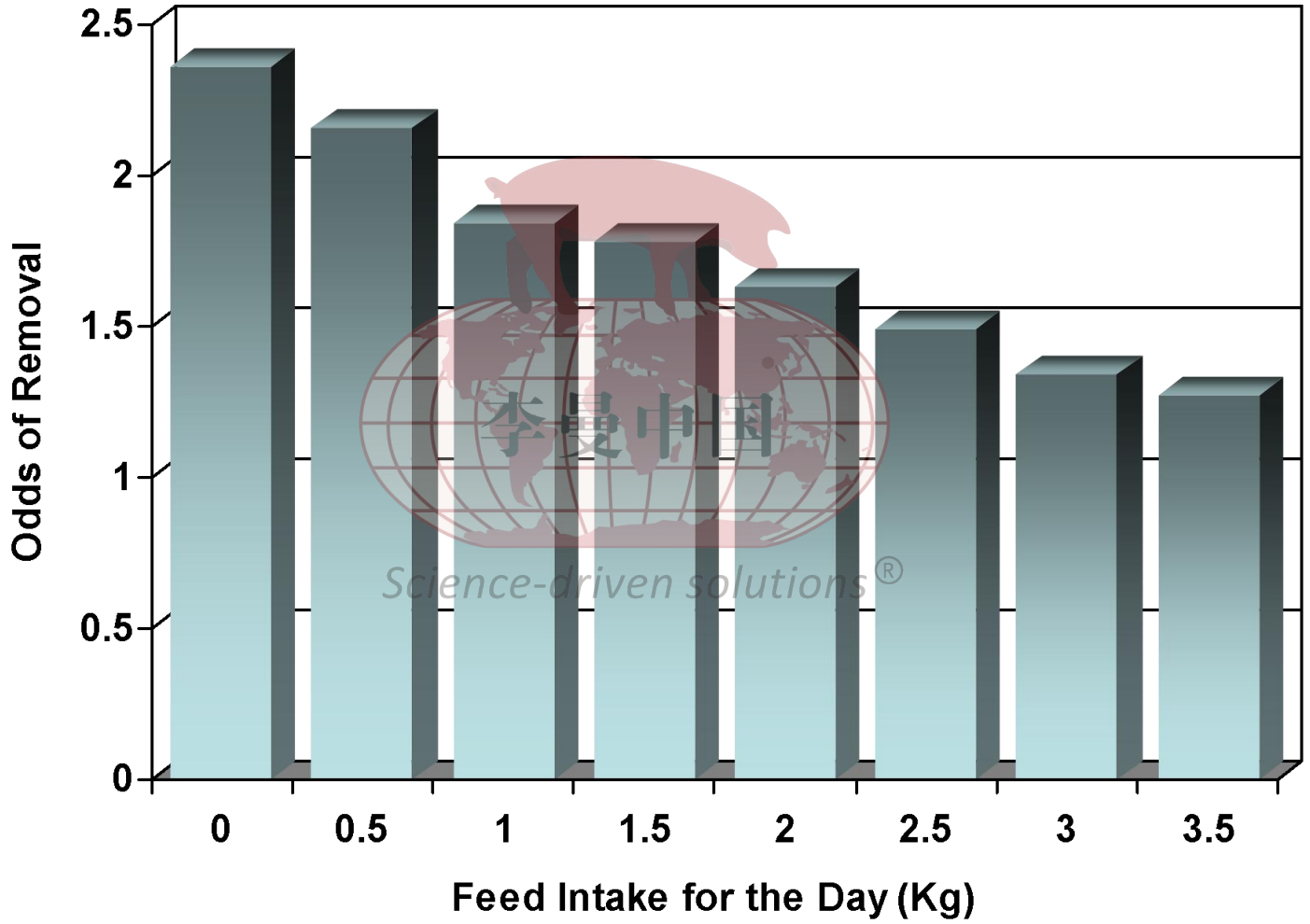
Farrowing Crates

- Approximately 2.8% of sows die before leaving the farrowing crate
- Approximately 63% of the total mortality is in the periparturient period
- The risk of mortality is approximately seven times higher

Risk post farrowing



Odds of Removal vs One Day's LFI



Herd productivity effects

- Weaned per sow per year related to mortality rate
  - -0.4 per 1% annual mortality, r=.36
- A significant portion of farrowing rate
- Significant amount of clustering within weeks

Predictors of breeding group mortality rates *within herd*

- Average parity farrowed sows
  - +0.9% per parity
- Gilt pool size at weaning
  - -0.3% per 1% of herd inventory
- Number of sows farrowed
  - +.04% per 1% of herd inventory

Odds Ratios: the gambling

- Comparison of one state of a sow to the other
- Eg a sow that has returned twice vs a replacement
- What are the odds of the replacement lowering mortality compared to the sow?
- Often in the range of 1.2 to 1
  - Vs a lame sow of 4:1

Culling classification

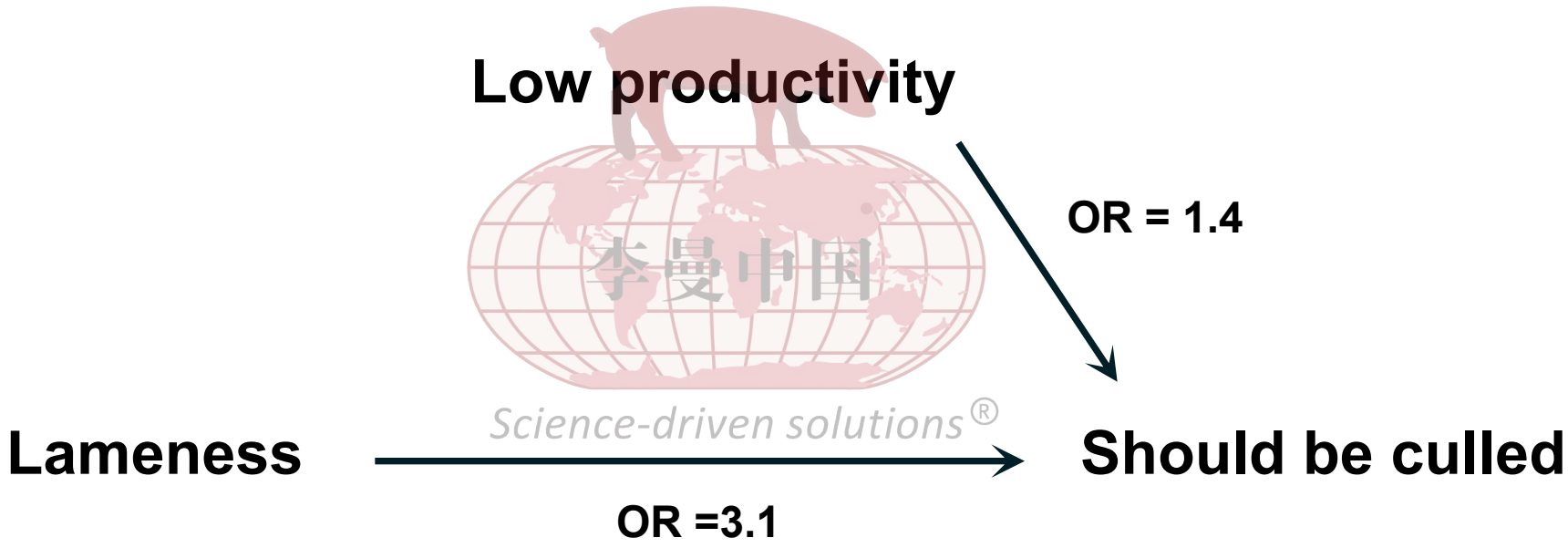
	Predicted Final Models	
Prior	Not cull	Cull
	0.24	0.65
Misclassification rate	0.44	
	0.10	**0.70**
Posterior		
Misclassification rate	**0.40**	

Actual Group	Number of observation	Predicted group	
		Cull	Not cull
Cull	n1	a	b
Not cull	n2	c	d

Estimates of sensitivity and specificity of lameness assessment using a latent class model

	Sensitivity	Specificity
Lame	82%	84%
UL	90%	89%
LL	60%	67%

Proposed path model for sow retention



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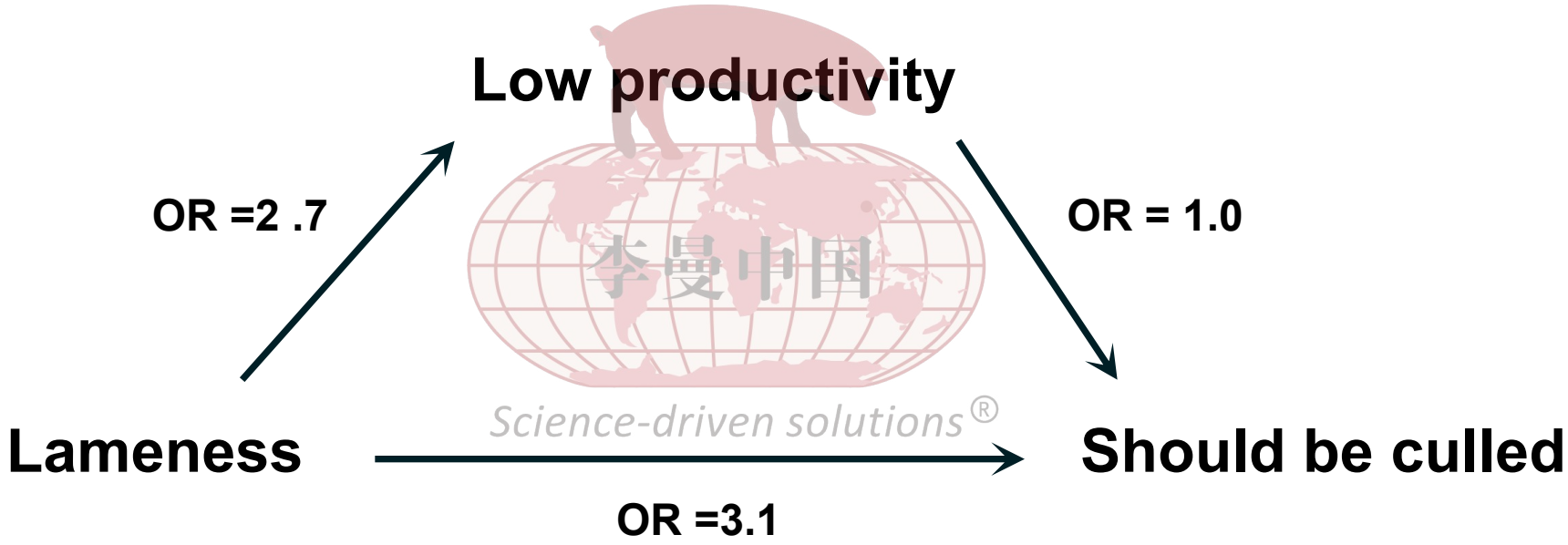

Are there high population attributable fraction (PAF) sow conditions?

- Those diseases whose elimination have a greater outcome than attributed effects
- Chronic are more likely to be underestimated and under-noticed…
- Often compensatory mechanisms exist for chronic diseases
- Is lameness a linchpin disease?


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