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Correlation of Caecal *Campylobacter* Enumeration Results with On-farm Biosecurity Scores in Irish Broilers

EURL –*Campylobacter* Workshop 2023

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Datasets for analysis



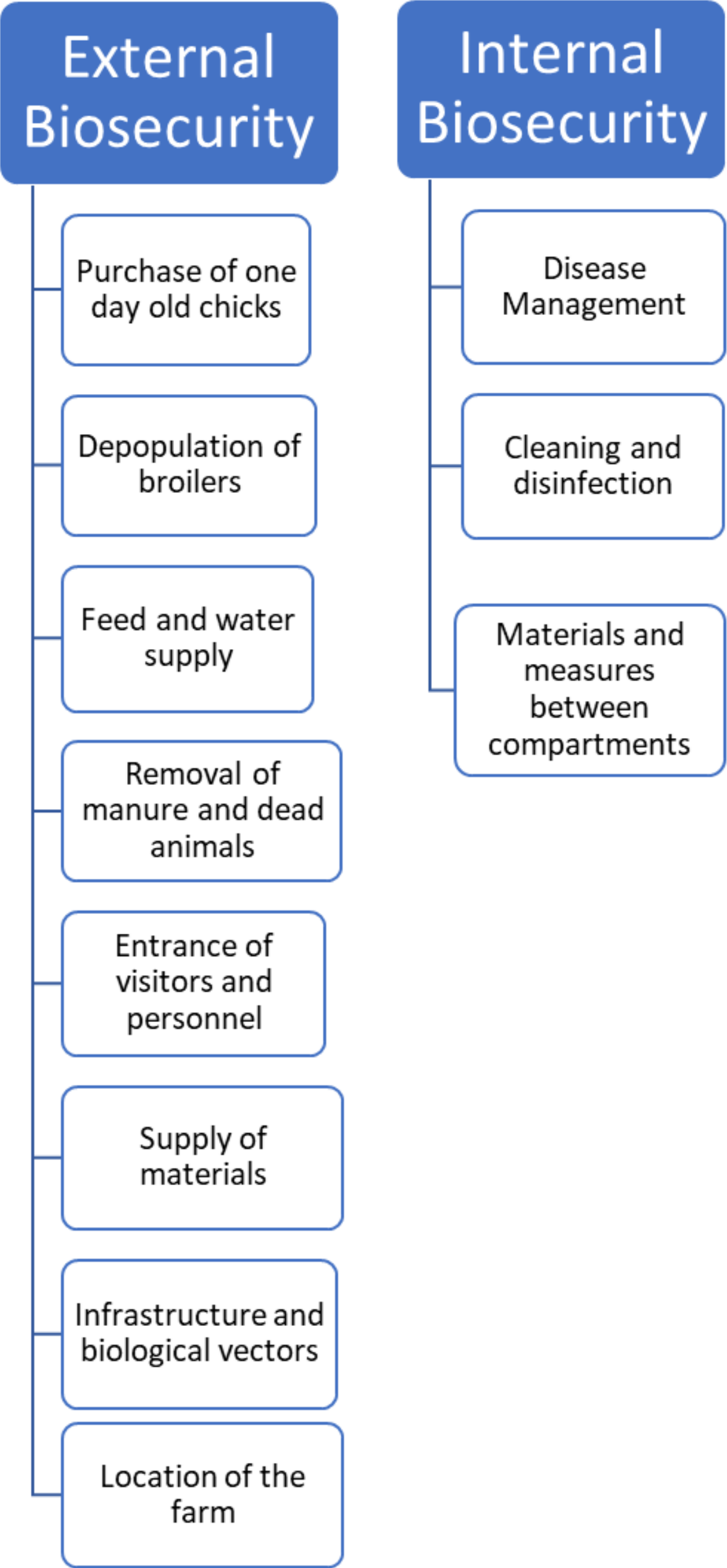
- Campylobacter Stakeholders' Group formed in Ireland in 2015
 - Agreement between Department of Agriculture, Food and the Marine (DAFM) and all Irish broiler processors to carry out caecal sample enumeration testing for all pre-thin broiler batches slaughtered
 - ⑩ Started in February 2019, dataset of 2019 – 2022 results
- Biocheck UGent – risk-based scoring system for quantifying on-farm biosecurity
 - One free annual assessment per farm is available to Irish broiler and layer farmers
 - 2019 – 2022 dataset

Datasets for analysis



- Caecal enumeration testing carried out by private laboratories contracted by poultry processors
 - Training days at the NRL
 - Harmonisation of caecal testing methods – standardised dilutions: 10^{-2} – 10^{-6}
 - 1000 cfu/g = lowest positive result
- Animal Health Ireland co-ordinates Biocheck Programme
 - Trains private veterinary practitioners (PVP) to carry out Biocheck biosecurity assessments on-farm
 - Farmers receive breakdown of external and internal biosecurity scores, and an overall score

Biocheck UGent Subcategories



Biocheck survey – 79 questions

- 51/79 relate to external biosecurity
- 28/79 relate to internal biosecurity

Questions are weighted differently

- External and Internal Scores are calculated as a weighted average of the corresponding subcategory scores
- A total biosecurity score is calculated as a weighted average of internal and external biosecurity scores. This is calculated from 70% external and 30% internal scores.

Higher score = better biosecurity practices

Analysis



- Only data from farms that had both a Biocheck score and caecal enumeration results in a given year could be analysed
- 6,252 batches from 296 farms (~66% broiler farms) were analysed for 2019-2022 (530 farm visits)
- For caecal *Campylobacter* enumeration results, four measures were selected, 2 at farm level and 2 at batch level:
 - Positive or negative result for each batch
 - Percentage of positive batches in a farm per year (i.e., likelihood of a farm having a positive batch)
 - Cfu/g result for each batch
 - Highest cfu/g value for each farm in a given year
- Seasonality of *Campylobacter* caecal enumeration results controlled for

Regression Analysis Results



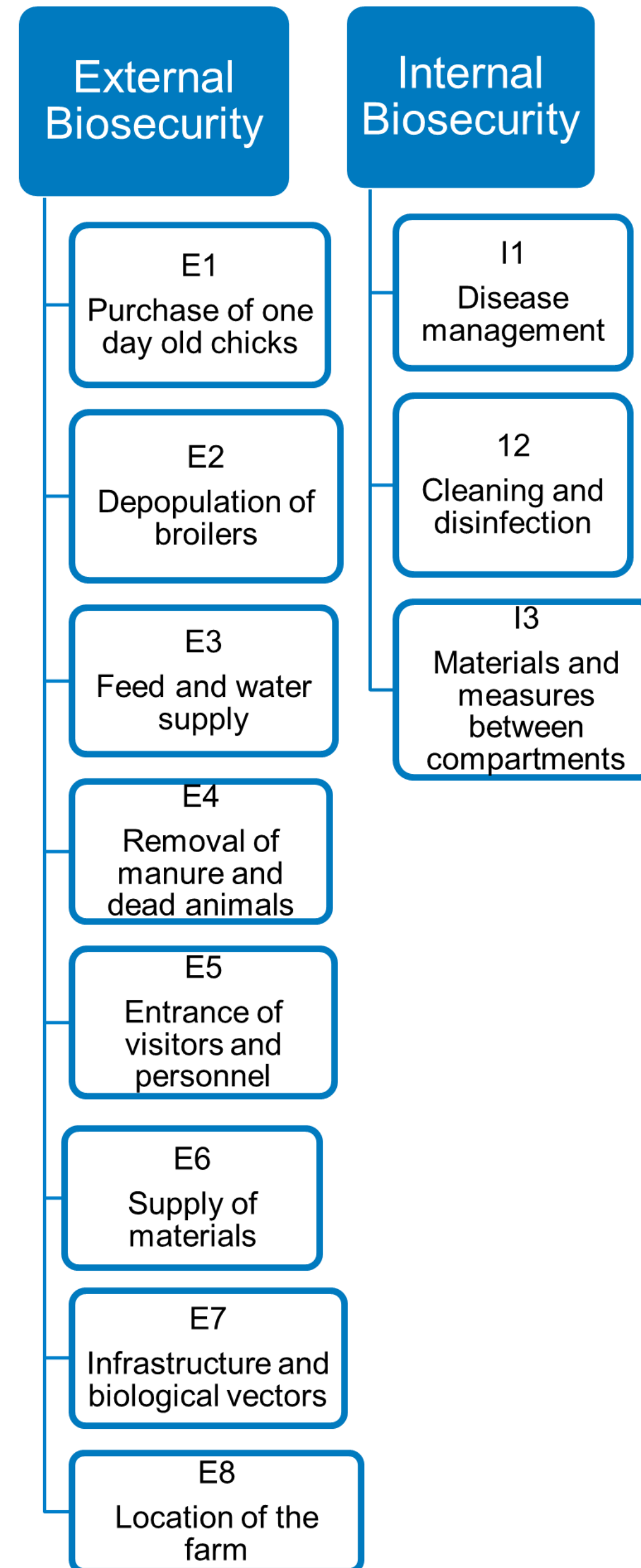
Mixed-effects ordinal and binary logistic regressions were used to assess the relationship between biosecurity scores and the two *Campylobacter* measures

	External Biosecurity	Internal Biosecurity	Total Biosecurity
Positive batch result	Estimate: -0.215 OR: 0.81 (0.74-0.89) p <0.001***	Estimate: -0.245 OR: 0.78 (0.71-0.86) p <0.001***	Estimate: -0.243 OR: 0.78 (0.71-0.86) p <0.001***
Percentage of positive batches per year	Estimate: -0.441 OR: 0.64 (0.64-0.64) p <0.001***	Estimate: -0.404 OR: 0.67 (0.67-0.67) p <0.001***	Estimate: -0.482 OR: 0.62 (0.62-0.62) p <0.001***

*** $p < 0.001$, ** $p < .01$, * $p < .05$, OR = Odds Ratio, (Confidence Interval)

Subcategory analysis

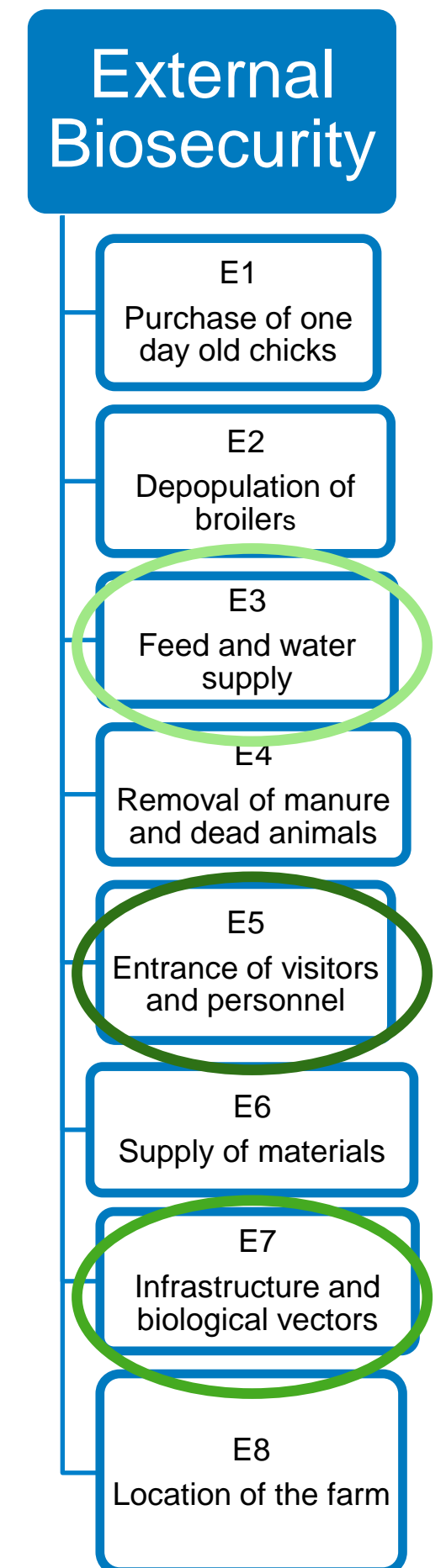
The same regression models were used for this analysis, but with multiple explanatory variables (8 external E1-E8 and 3 internal I1-I3).



External biosecurity subcategories



	E1	E2	E3	E4	E5	E6	E7	E8
Positive batch result			*		*		**	
Percentage of positive batches per year					*		*	

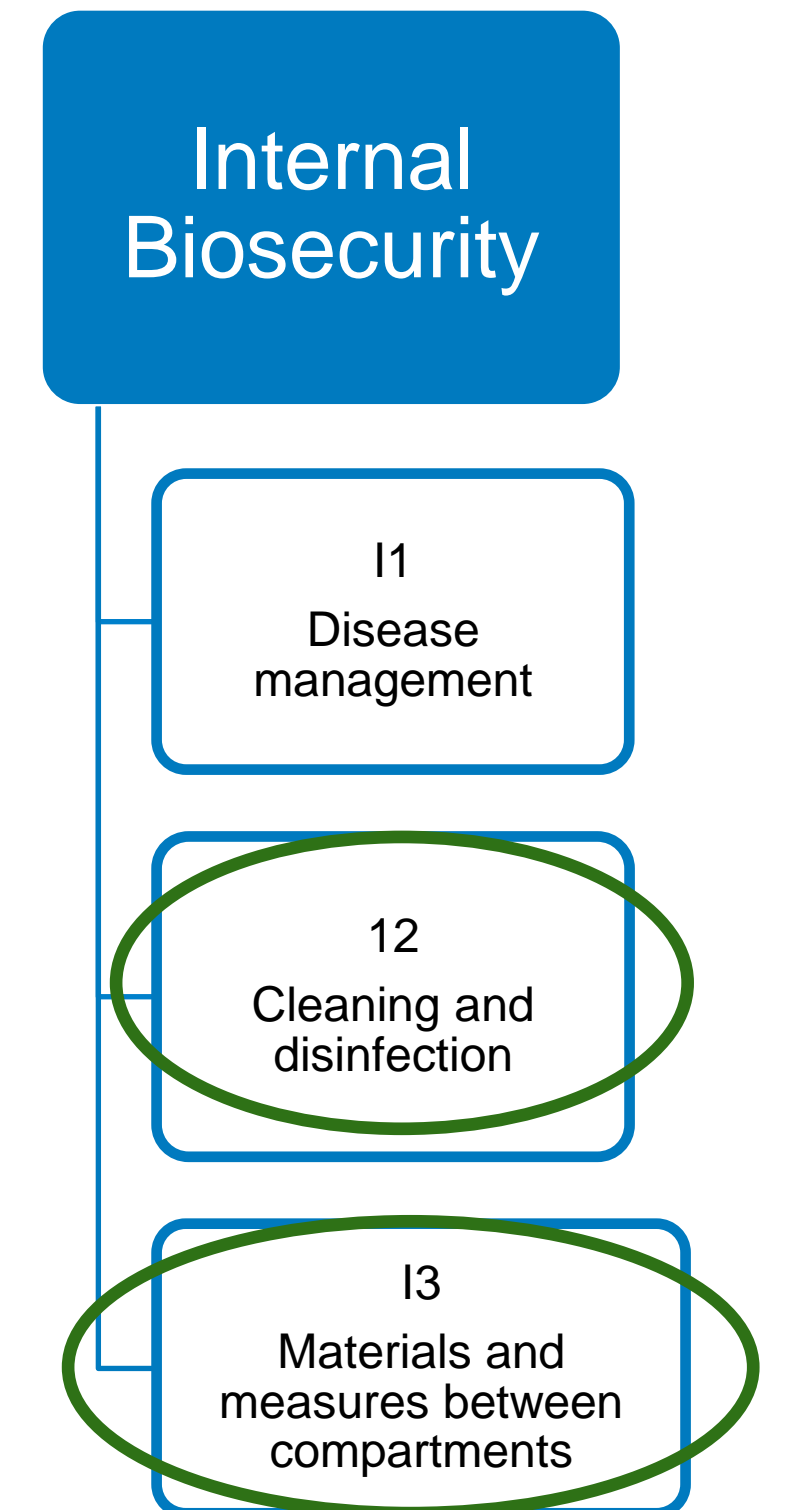


*** $p < 0.001$, ** $p < .01$, * $p < .05$

Internal biosecurity subcategories

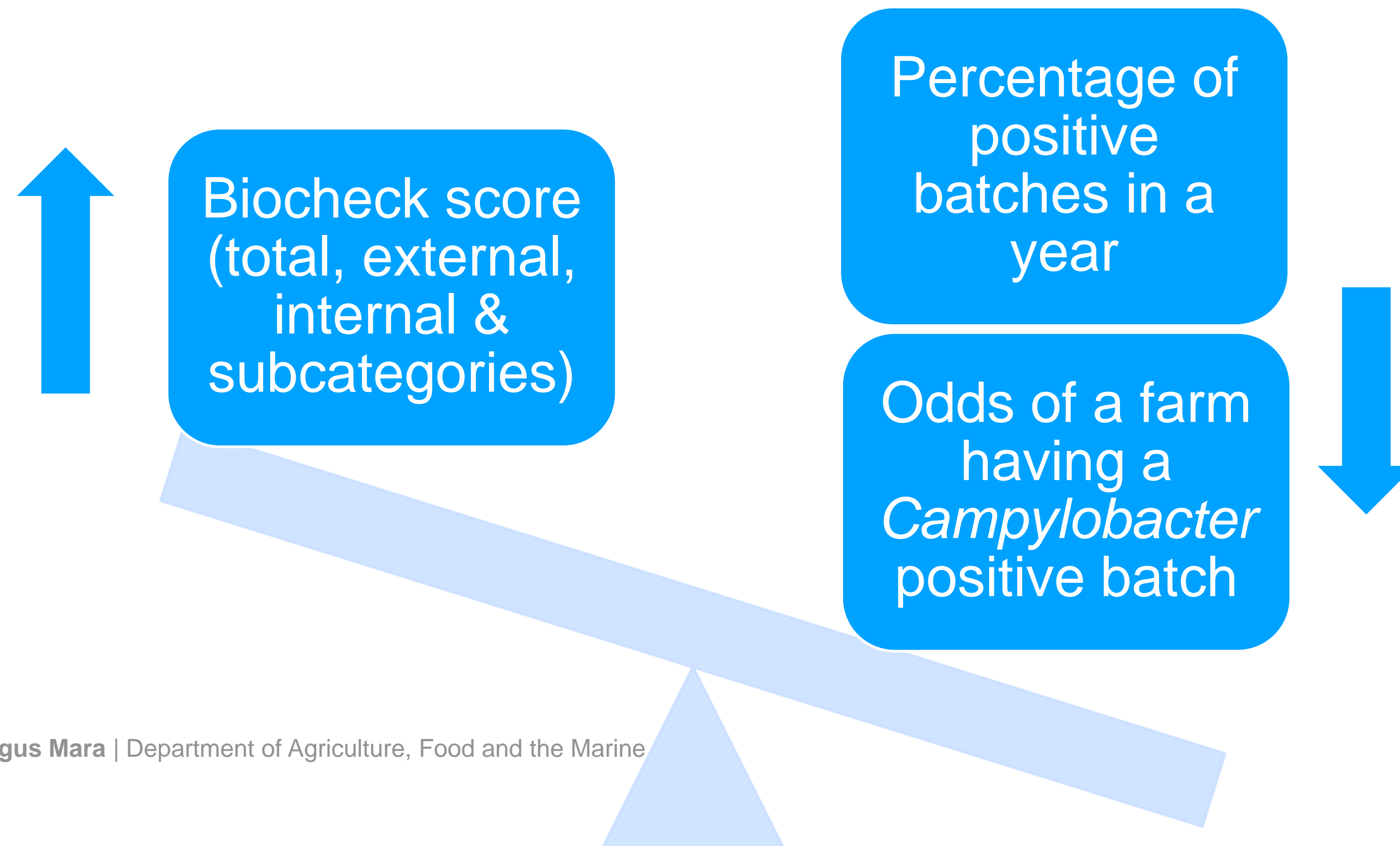


	I1	I2	I3
Positive batch result		*	***
Percentage of positive batches per year		*	***



*** $p < 0.001$, ** $p < .01$, * $p < .05$

Conclusions



Conclusions - Subcategories



Two external (E5 and E7) and two internal (I2 and I3) biosecurity subcategories significantly associated with lower *Campylobacter* positivity rates

- E5 - Entrance of visitors and personnel
- E7 - Infrastructure and biological vectors
- I2 – Cleaning and disinfection
- I3 – Materials and measures between compartments

2 out of 3 biosecurity measures identified by expert panel as most important (Gelaude et al 2014)

Conclusions



- Two independent data sets, collected for different purposes
- Strongly supports role of biosecurity in reducing *Campylobacter* in food chain
- Confirms the value, in practice, of specific biosecurity measures, as identified by expert panel.

Acknowledgements



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- Staff at Campylobacter NRL, Ireland