

Systematic Reviews in Animal Husbandry

Lessons for Translation

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- Food and companion animals
 - Animal health
 - Animal welfare
 - Food safety
 - Public Health

Co-author statement



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- European Food Safety Authority
- National Pork Board
- Iowa Health Livestock Initiative
- None from pharma/biological companies



- Common issues
- Comparisons not in literature
- Agency initiated questions



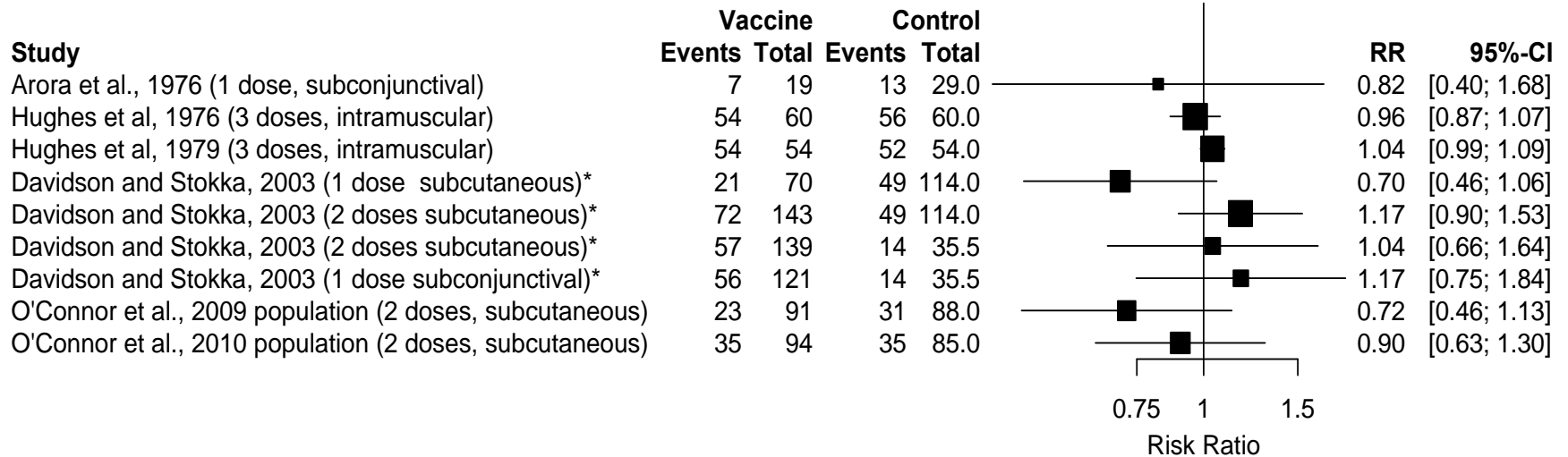
- Common issues
- Comparisons not in literature
- Mandate questions



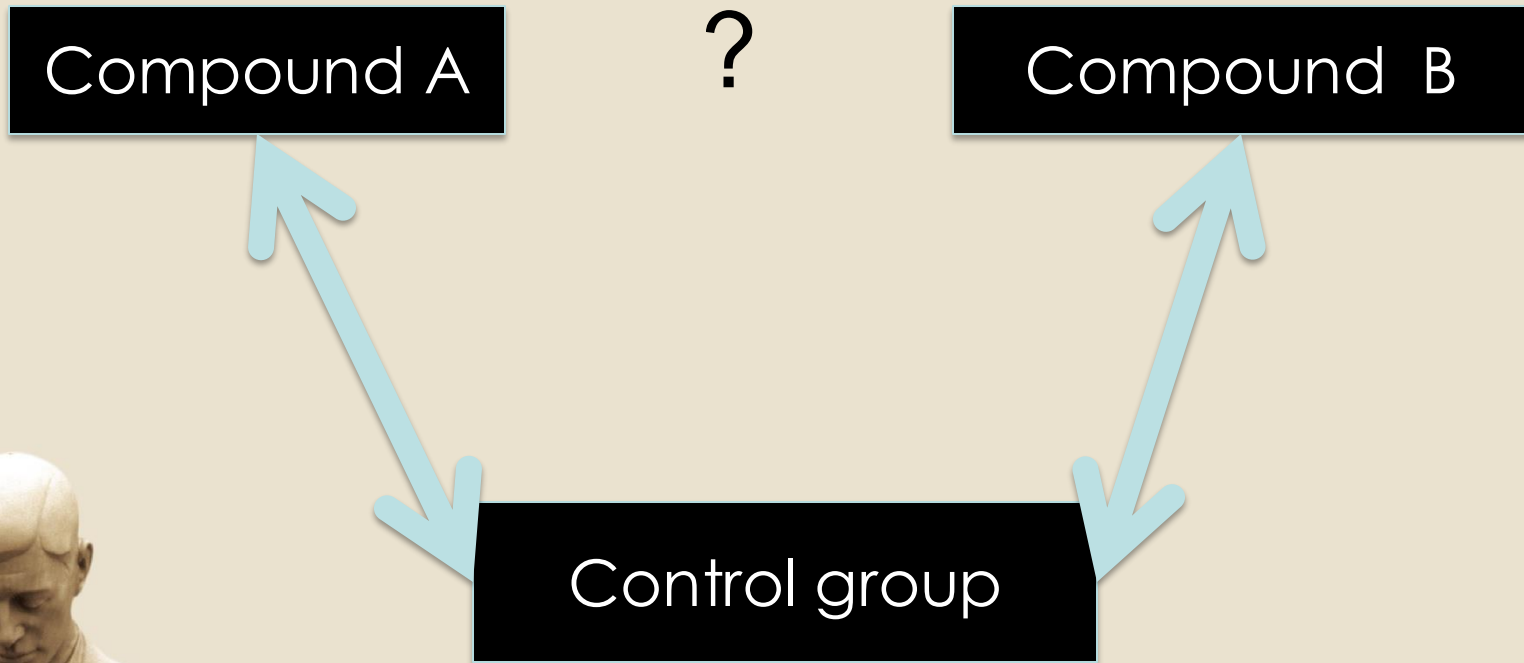
- Univariable SR & MA
 - One outcome
 - One comparison



Pair-wise meta-analysis



Indirect comparisons



- John is 15 cm taller than Mary
- Mary is 5 cm taller than Richard.

- How much taller is John than Richard?



- Univariable SR & MA
 - One outcome
 - One comparison
- Multivariable SR & MA
 - One outcome
 - Multiple comparisons



- Multiple-treatments meta-analysis, or network meta-analysis
- Allows integration of data from
 - **direct comparisons**
 - **indirect comparisons**



- The underlying model (Dias et al., 2010a; Higgins and Whitehead, 1996) for discrete outcomes :

$$\theta_{jk} = \begin{cases} \mu_{jb'} \\ \mu_{jb} + \delta_{jbk'} \end{cases}$$

$$k = b; b = A, B, C, \dots$$

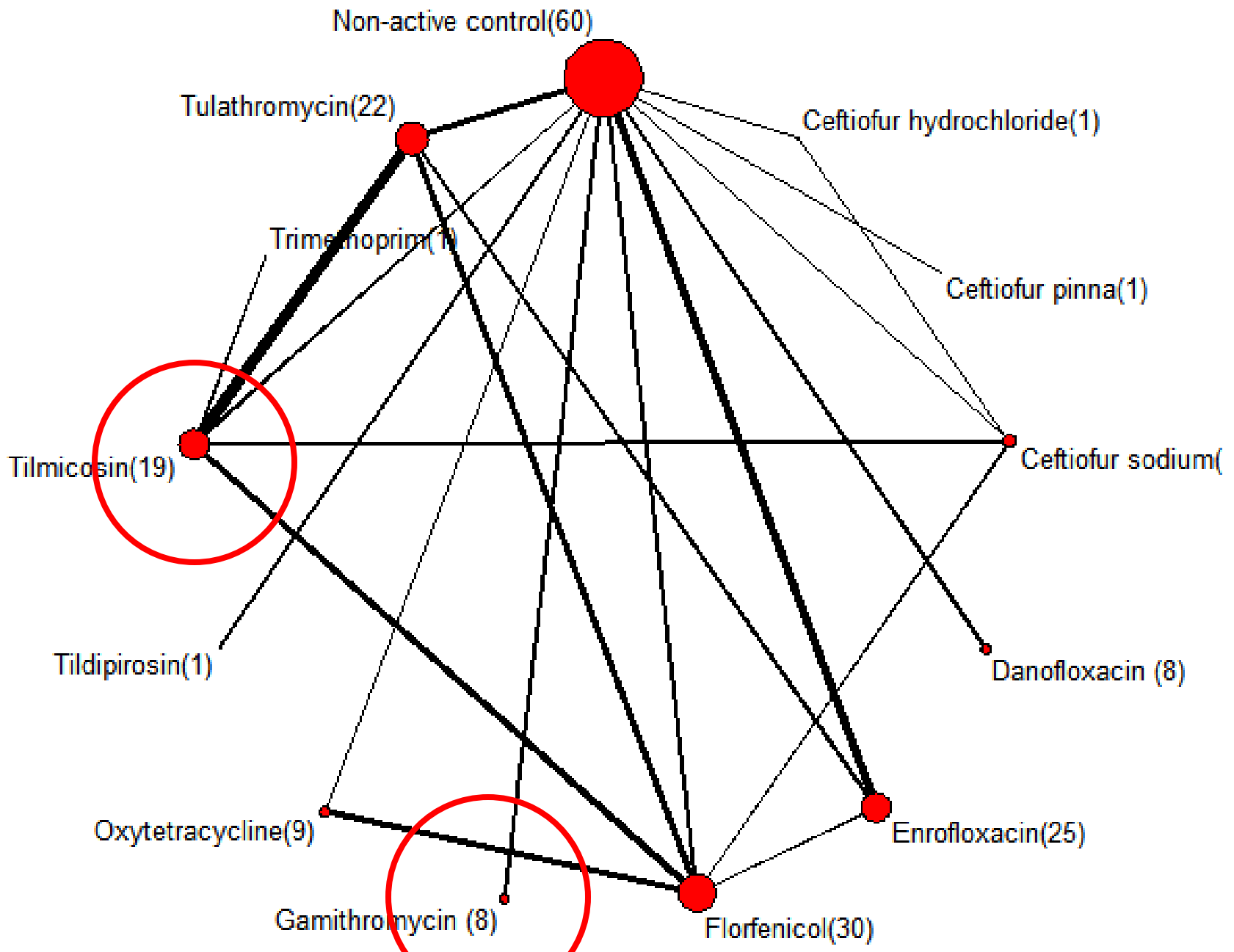
$$k < b; b = A, B, C, \dots$$

θ_{jk} is the logit (p_{jk}) ,

p_{jk} is the probability of the event in trial j under treatment k

μ_{jb} is the log odds of the baseline treatment b in trial j

$\delta_{jbk'}$ is the trial specific effect of treatment k relative to the baseline treatment b in trial j .



Tulathromycin	Gamithromycin	Risk Ratio
9%	17.7%	0.51

RR predicted by the model indirect = 0.49

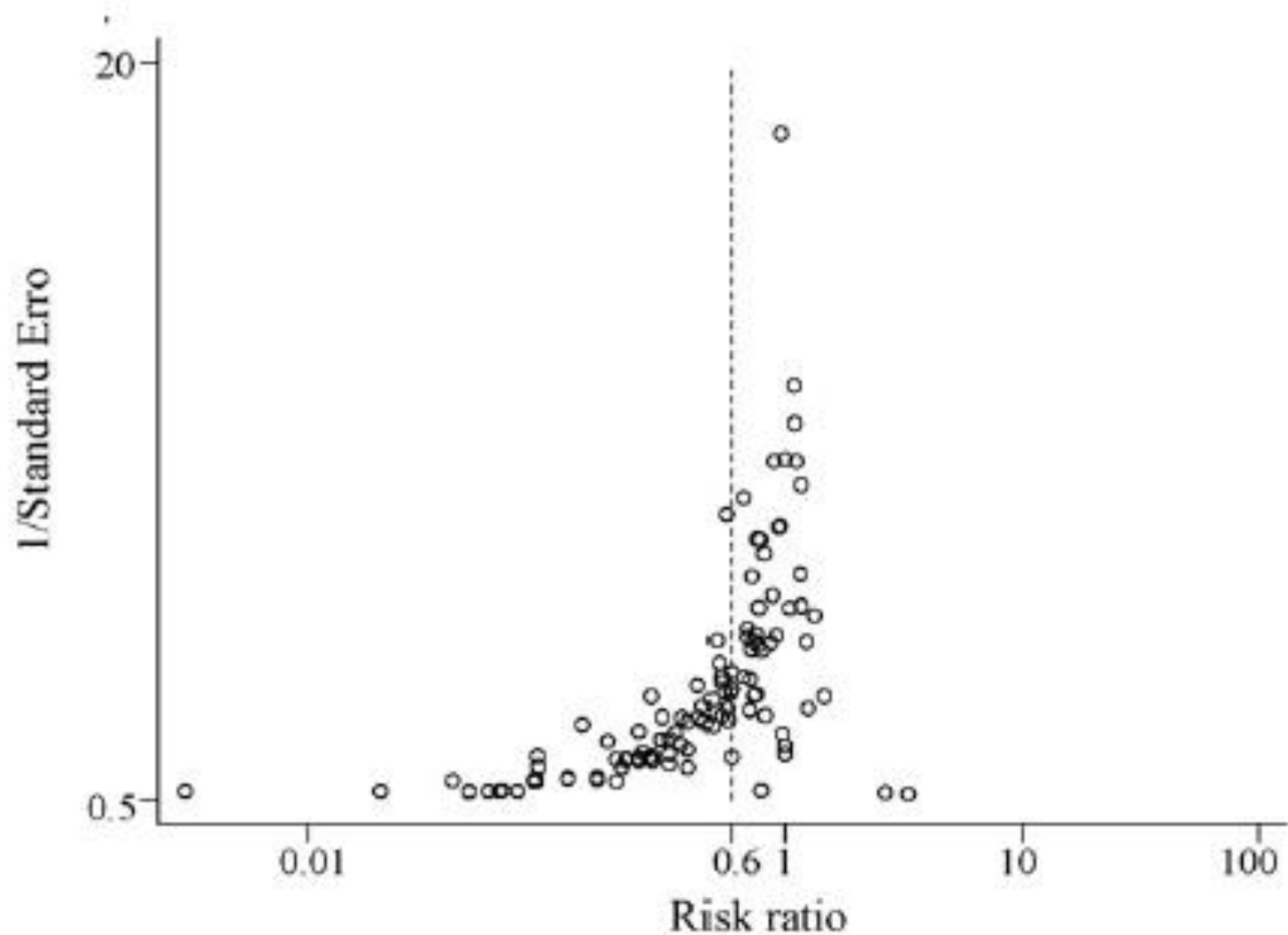
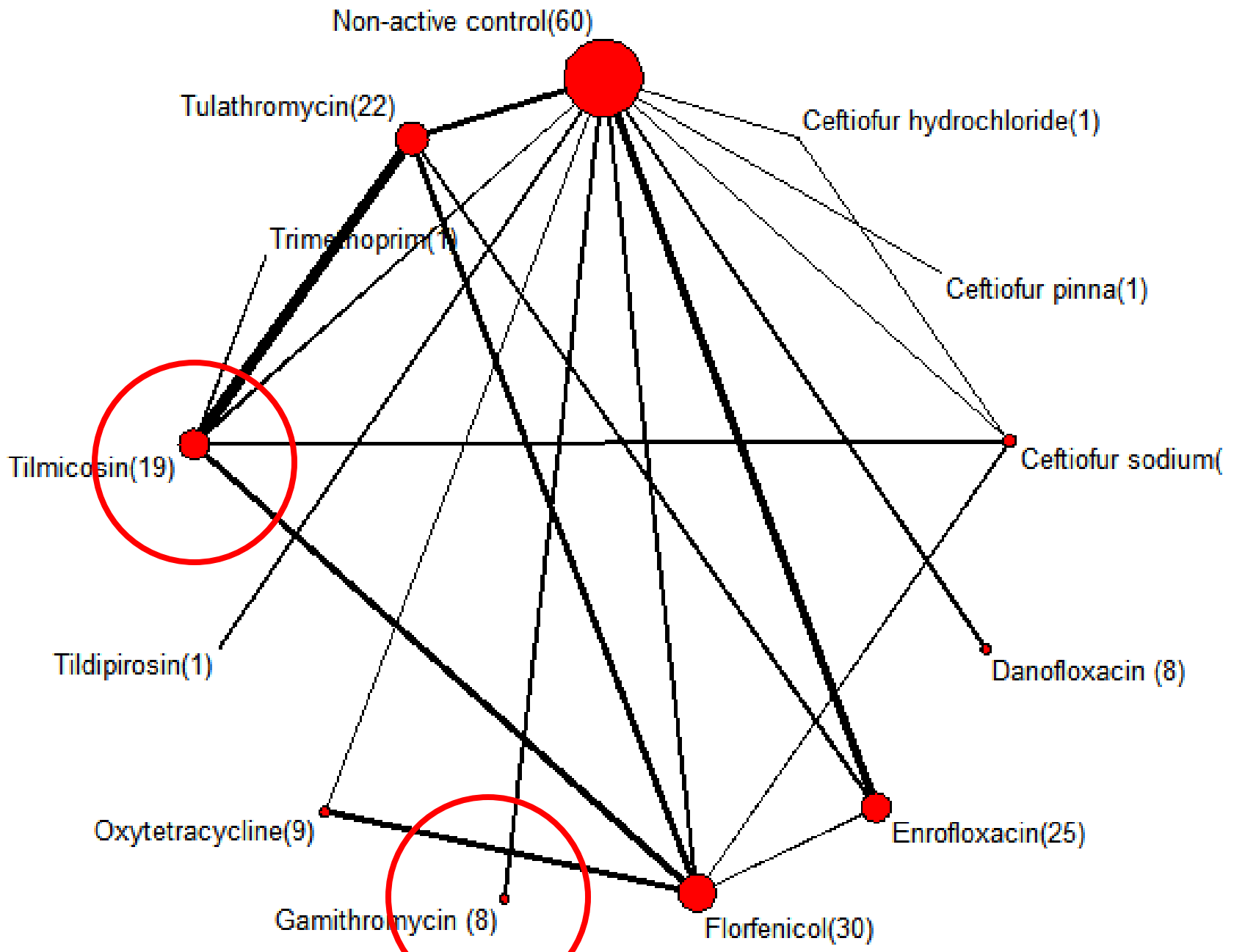
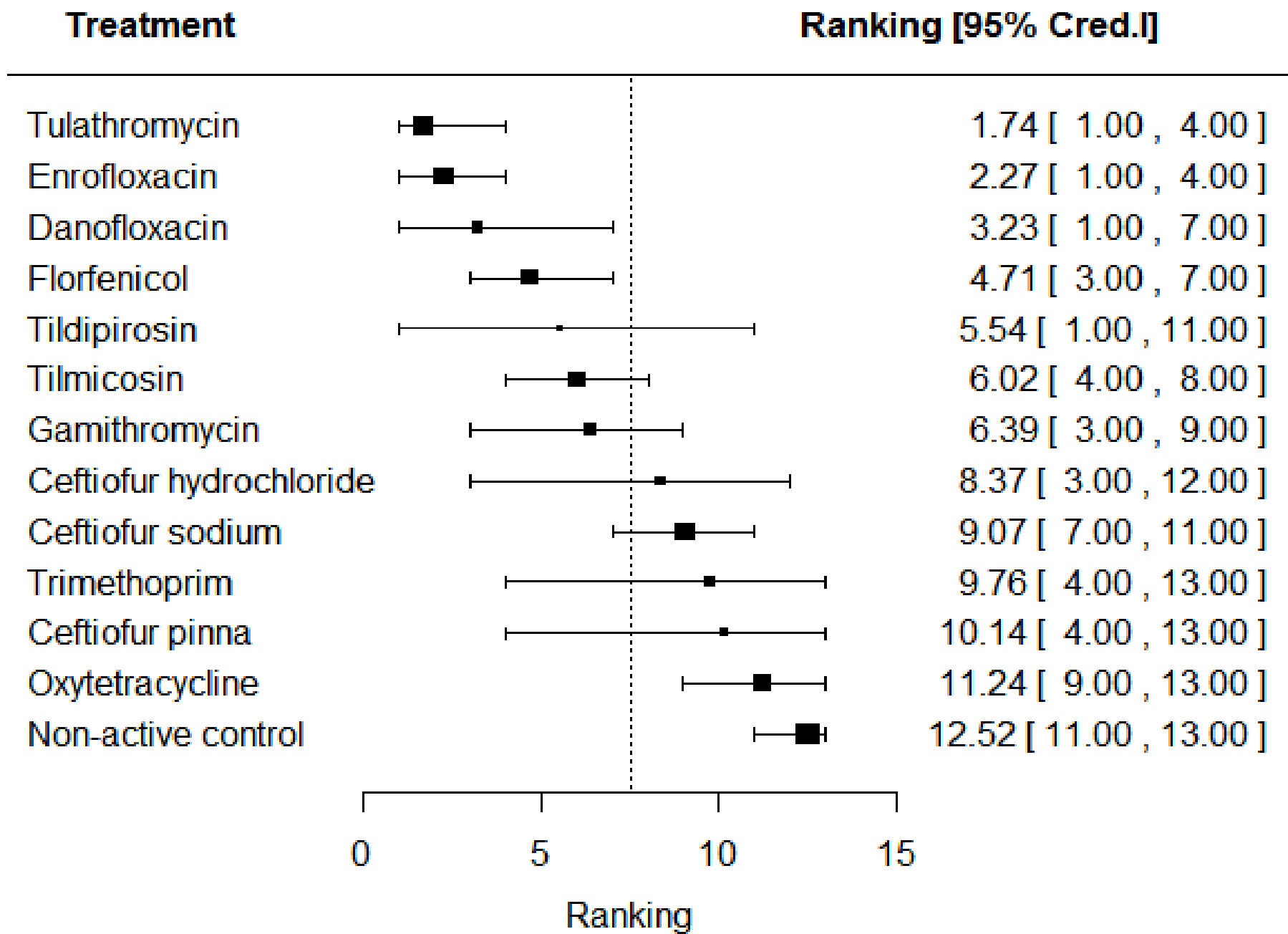


Fig. 3 Funnel plot describing the distribution of study risk ratio compared to inverse of the standard error of risk ratio.



Tulathromycin	Gamithromycin	Risk Ratio
9%	17.7%	0.51

RR predicted by the model indirect = 0.49



Probability of being the worst treatment

Treatment	Mean
Ceftiofur sodium	0
Danofloxacin	0
Enrofloxacin	0
Florfenicol	0
Gamithromycin	0
Tilmicosin	0
Tulathromycin	0
Tildipirosin	0.0024
Ceftiofur hydrochloride	0.02
Oxytetracycline	0.07
Trimethoprim sulfur	0.12
Ceftiofur (pinna)	0.17
No Active Control	0.60

- Applications
- Deciding or convincing a panel to candidate agents to further invest in
- Compare multiple interventions in husbandry of laboratory animals



- Common issues
- Comparisons not in literature
- Agency initiated questions



- Univariable SR & MA
 - One outcome
 - One comparison
- Multivariable SR & MA
 - One outcome
 - Multiple comparisons
- Multivariate/variable SR & MA
 - Multiple outcomes
 - Multiple comparisons



- What is the impact of sheep production on sheep welfare?
- What is the sensitivity and specificity of indicators of unconsciousness at slaughter?
- What stunning protocols are most effective for rabbits?
- What is the most welfare appropriate housing for laying hens?



- What is the impact of experimentation on lab animal welfare?
- What is the sensitivity and specificity of indicators of successful gas euthanasia of laboratory animals ?
- What stunning protocols are most effective for rabbits?
- What is the most welfare appropriate housing for laboratory animals?



- Systematic review of peoples health
- **Health** is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.



- Systematic review of animal welfare
- **Animal welfare** is the well-being of **animals**. The standards of "good" **animal welfare** vary considerably between different contexts. These standards are under constant review and are debated, created and revised by **animal welfare** groups, legislators and academics worldwide.



- What is the most welfare appropriate housing for laying hens?
- Population – Laying hens
- Exposure-housing
- Comparison-
- Outcome-



Define the components

Exposures-what are they?

- What it is about the setting that can vary and affect
- Scoping review to identify aspects of the intervention / exposure
- Expert elicitation



Define the components

Exposures-what are they?

- Hens- genotype, purpose, climate, environment, enrichment, stocking density
- Laboratory animals-species, genotype, purpose, housing, density



Define the components

Exposures-which can be changed

- Hens- Genotype, purpose, climate, environment, enrichment, stocking density, flooring
- Laboratory animals-purpose, housing, density



Define the components

Outcomes-What are they?

- Try to avoid metrics without sampling distributions
- Joy, Pain, Anger, Frustration, Pleasure



Define the components

Outcomes-What are they?

- Do select outcomes with sampling distributions
- Animal-based metrics-
 - Behavioral states % of time lying
 - Behavioral events- count of biting,
 - Biochemical- cortisol, beta-endorphins
 - Physiological- heart rate



Define the components

Outcomes-What are they?

- Try to avoid metrics where the direction is not known
- If piglets are in pain will they lie down more because they are in pain or will they lie down less because they are in pain?



Define the components

Outcomes-What are they?

- Avoid metrics that are the reciprocal of each other



Dumfries and Edinburgh cow 'pedometer' study wins Ig Nobel prize



The study looked at the time between cows standing up and sitting down

A paper analysing whether the length of time a cow stands up affects the likelihood of it lying down has won an international science award.

The research was carried out at Scotland's Rural College (SRUC) farms in Dumfries and Edinburgh.

It won an Ig Nobel award - a light-hearted version of the Nobel prizes.

Related Stories

['Beer goggle' study wins Ig Nobel](#)

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Define the components

Outcomes-What are they?

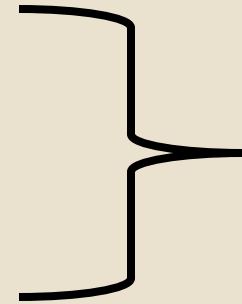
- Avoid metrics that are the reciprocal of each other
- If piglets in pain **do** lie down more they will also be necessity stand-up less.



Define the components

Outcomes-Which ones matter?

- Welfare –
- Grouping outcomes that are proxies for the same thing
 - Keel bone fractures
 - Keel bone deformities
 - Keel bone lesions
 - Foot lesions
 - Perch usage
 - Weight loss
 - Egg production



Define the components

Outcomes-Which ones matter?

- Welfare –
- Remove distal outcomes along the same pathway
 - Orthopedic lesions
 - Perch usage
 - Weight loss
 - Egg production



Define the components

Outcomes-Which ones matter?

- Welfare –
- Vote for prioritization
 - Orthopedic lesions
 - Perch usage



- What is the most welfare appropriate housing for laying hens?
- Population – Laying hens
- Exposures-perches height, shape, cage height, material
- Outcome- orthopedic problems of keel bone, perch use



Outcomes

- Perch height
- Perch material
- Perch shape
- Cage height

Exposures

- Orthopedics
- Perch use



- Other issues
- Clustering – animals live in populations – responses are correlated
- Housing is rarely randomized
- Most studies are observational



- Final issue
- It is now widely accepted that good welfare is not simply the absence of negative experiences, but rather is primarily the presence of positive experiences such as pleasure.





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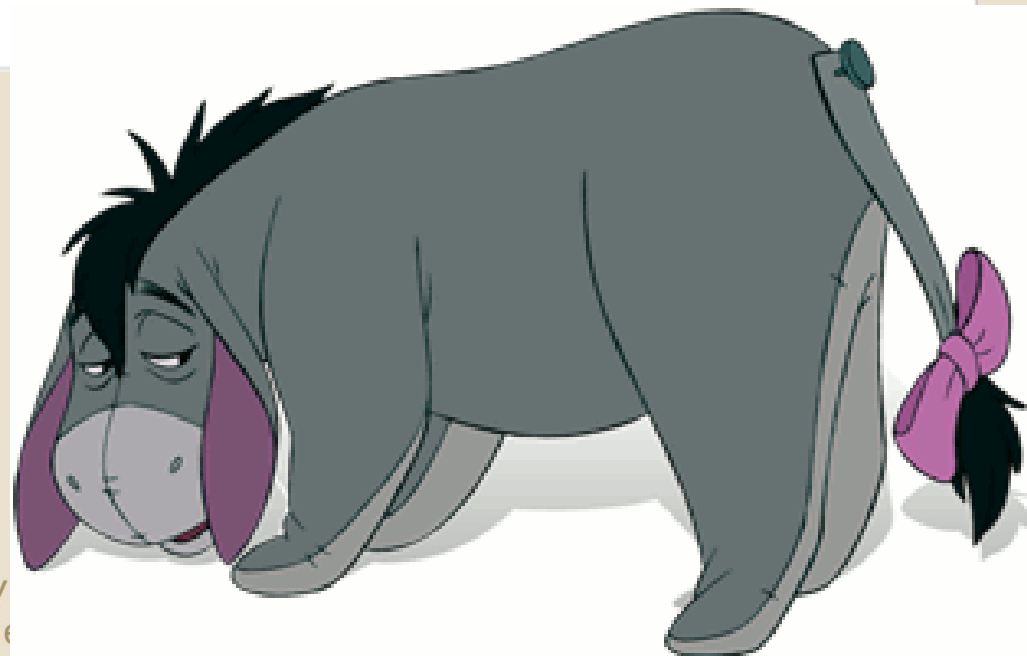
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