

Bacterial Causes of Small Ruminant Abortion: A systematic Review and Meta-Analysis

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RESEARCH
PROGRAM ON
Livestock



Introduction

- Abortion in sheep and goat cause significant wastage and financial losses worldwide, affect productivity (lambs/kids)
- Infectious agents are the most common causes
- Common bacterial causes
 - *Chlamydia abortus*
 - *Brucella spp.*
 - *Coxiella burnetii*
 - *Campylobacter spp.*
 - *Listeria spp.*
 - *Leptospira spp.*

Most causes are zoonotic, thus are a public health risk, with high risk of exposure for farmers

Objective

Improve understanding of relative importance of bacterial abortion causes

- To conduct a comprehensive literature search
- To perform systematic review and meta-analysis of reports which identify bacterial agents from abortion cases in small ruminants



Methodology

Literature search strategy

- Review protocol based on PRISMA guideline
- Search in PubMed and Google Scholar databases
- Keywords:(list of hazards) and (animal species) and (Abortion).
- Titles and abstracts were screened by two independent reviewers.
- Duplicates were identified and removed



Inclusion criteria

- Study conducted on small ruminants
- Samples collected from aborted ewes and doe (not sero-survey in healthy population!)
- Observational studies
- Published in English and after 2000
- The presence of the following data
 - a. location (country) of study
 - b. type and number of sample examined
 - c. pathogen detection technique
 - d. type of pathogen identified and
 - e. number of positive samples for each pathogen in each animal species



Data extraction

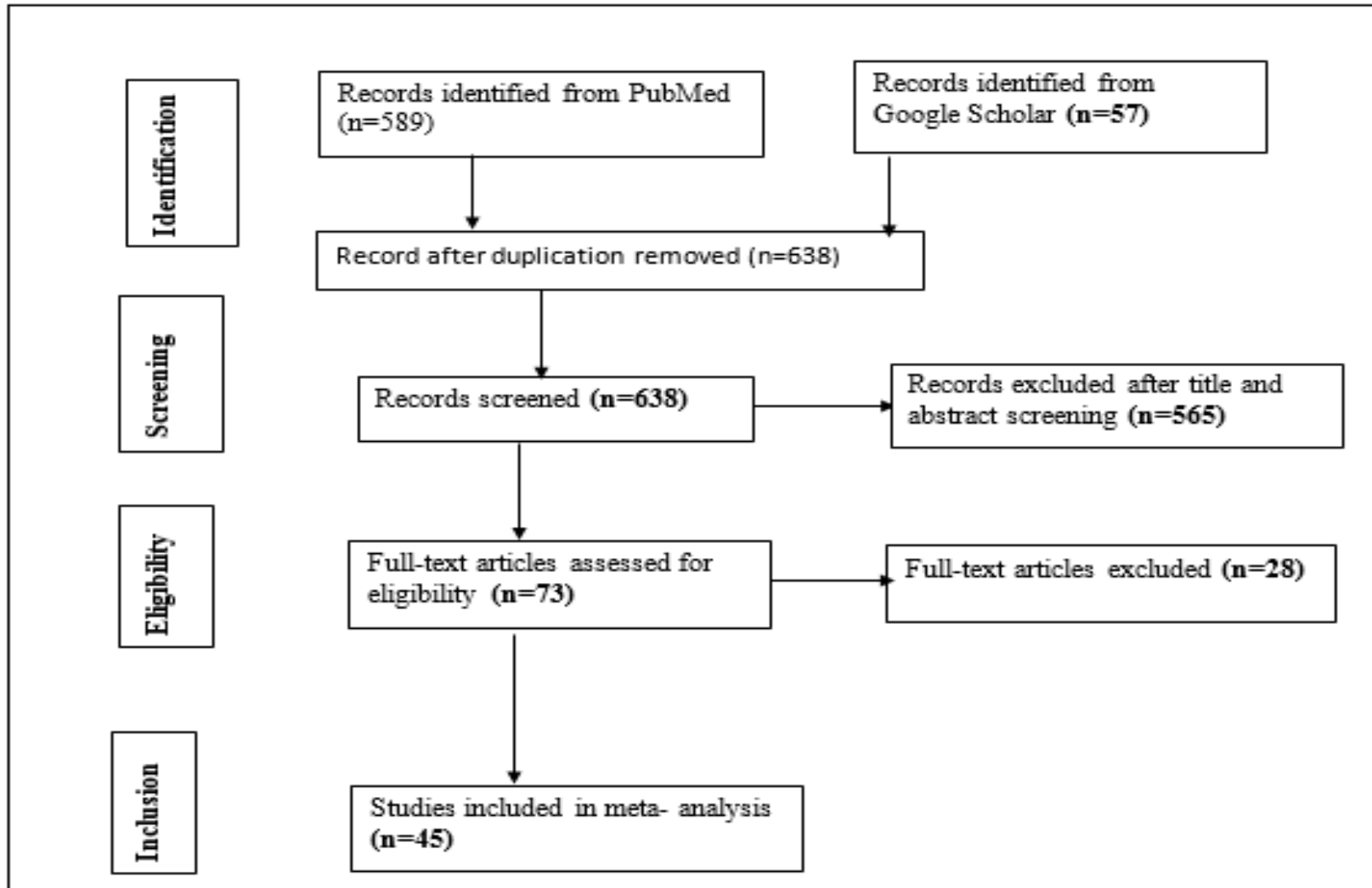
- Using data extraction template:
 - ✓ first author
 - ✓ year of publication
 - ✓ year of study
 - ✓ location(country)
 - ✓ number positive
 - ✓ number negative
 - ✓ continent
 - ✓ study design
 - ✓ bacteria species
 - ✓ animal species
 - ✓ test method
 - ✓ type of sample
 - ✓ number of abortion cases

Data analysis

- Descriptive analysis
- Fitting a random effects model
- Meta-regression
- Inter-study heterogeneity – χ^2 statistic (Cochrane's Q-test)-
p-value.
- Degrees of heterogeneity among studies(I^2), ranges from 0% to 100%—
 - 0% to 40%: might not be important;
 - 30% to 60%: moderate heterogeneity
 - 50% to 90%: may represent substantial heterogeneity
 - 75% to 100%: considerable heterogeneity.

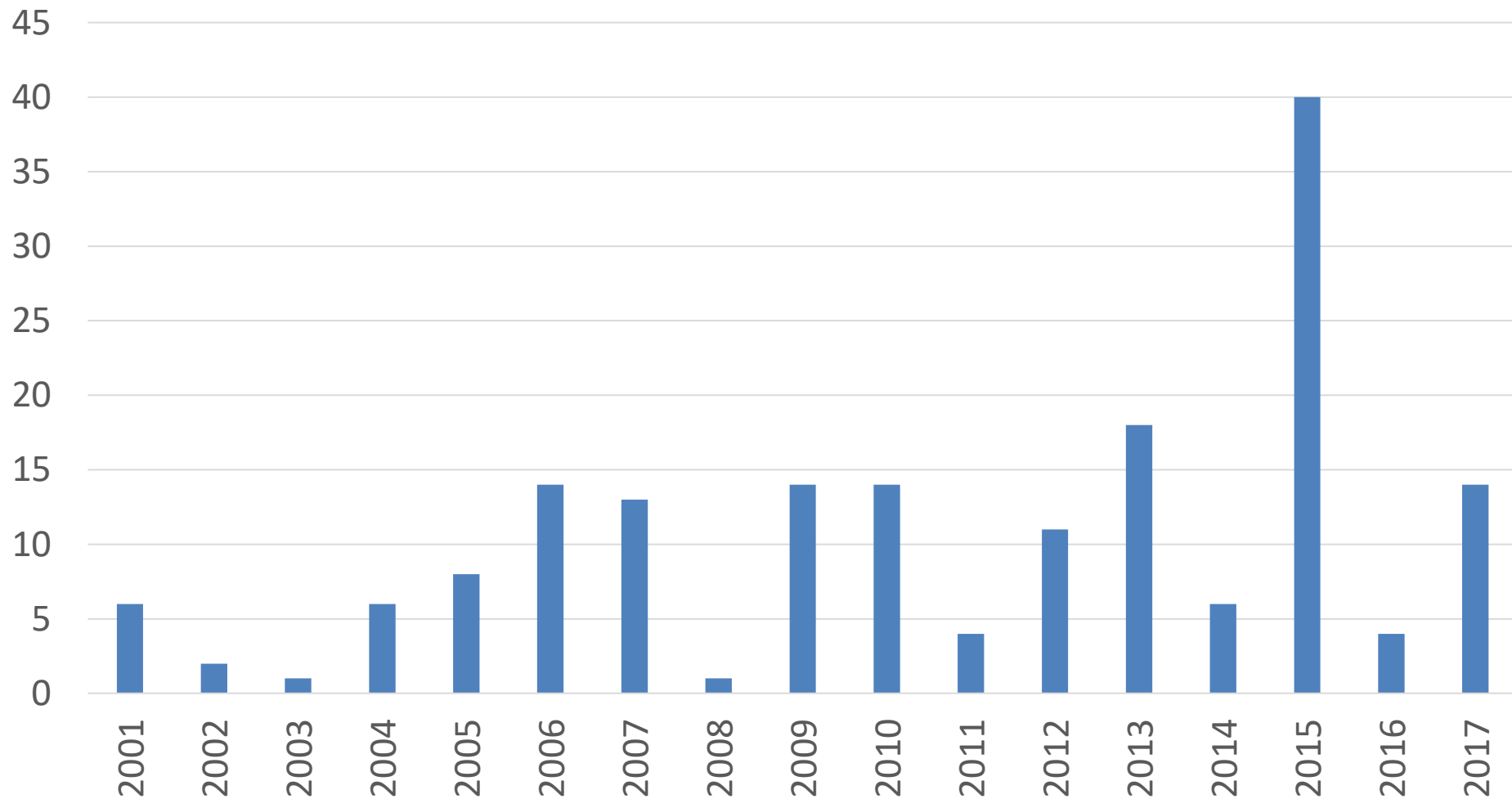
Results

Flow diagram of the selection of eligible studies

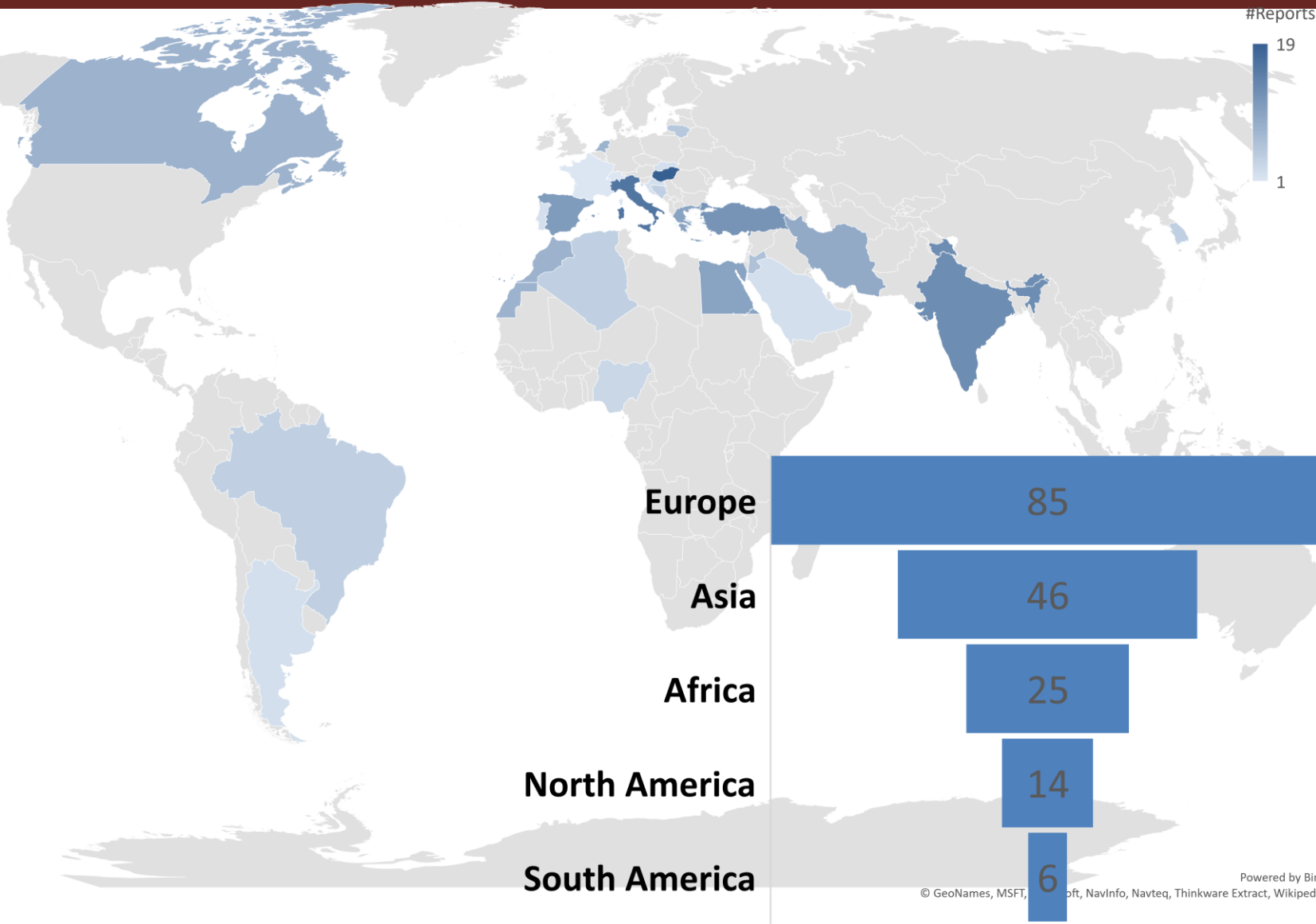


→ Resulted in 176 animal level reports, representing 33,066 animals

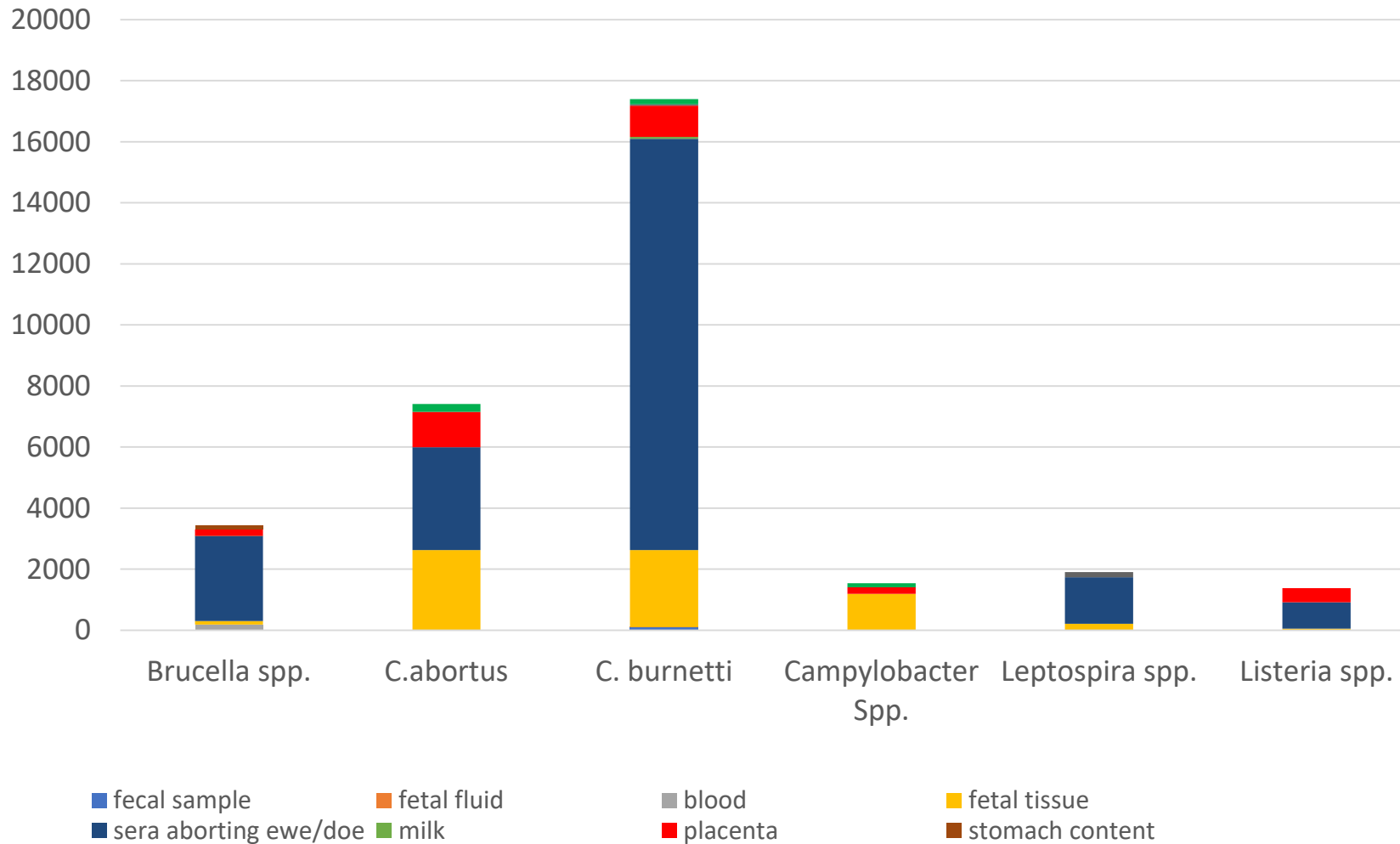
Publication year of the included studies



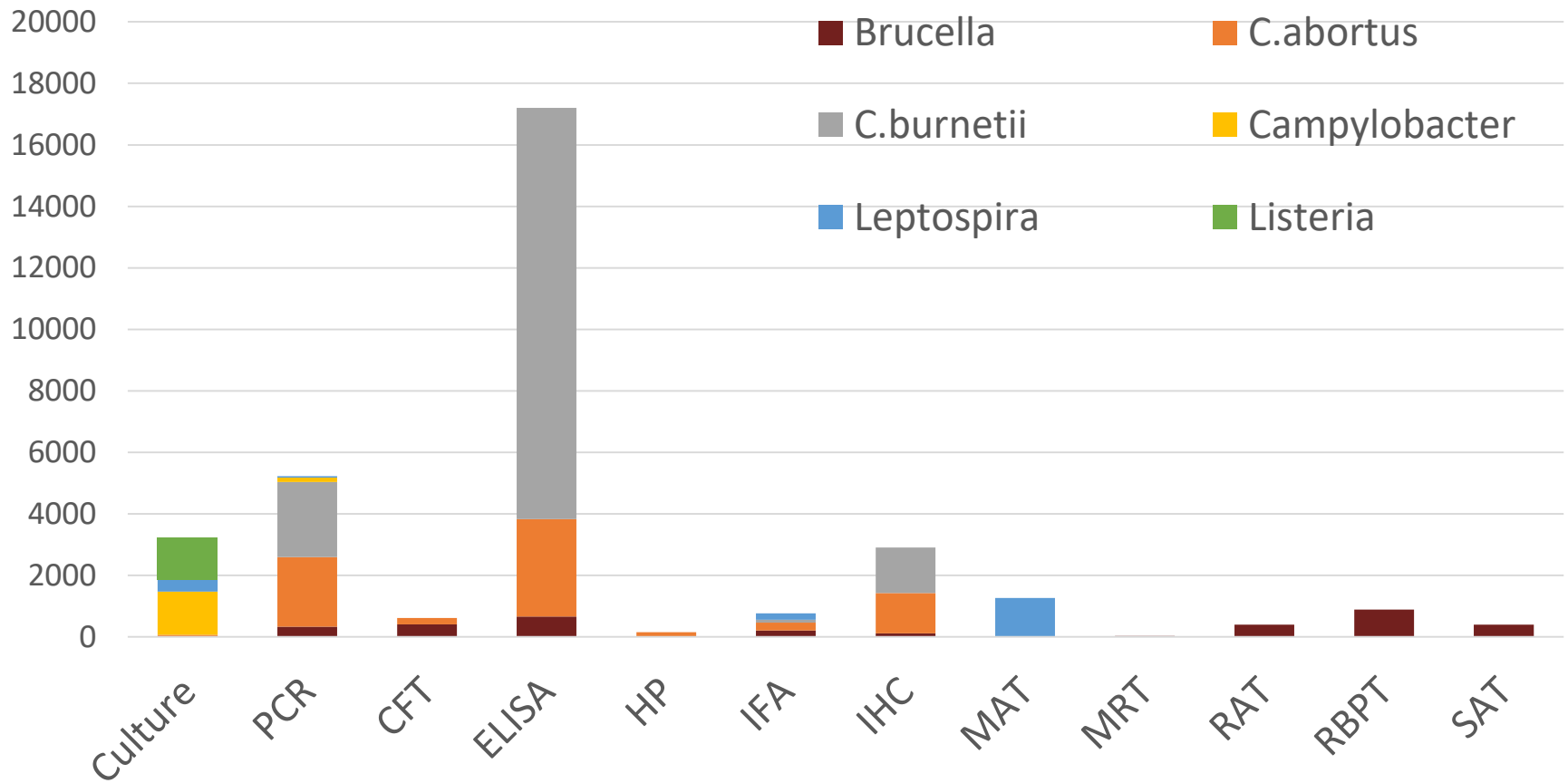
Origin of included studies



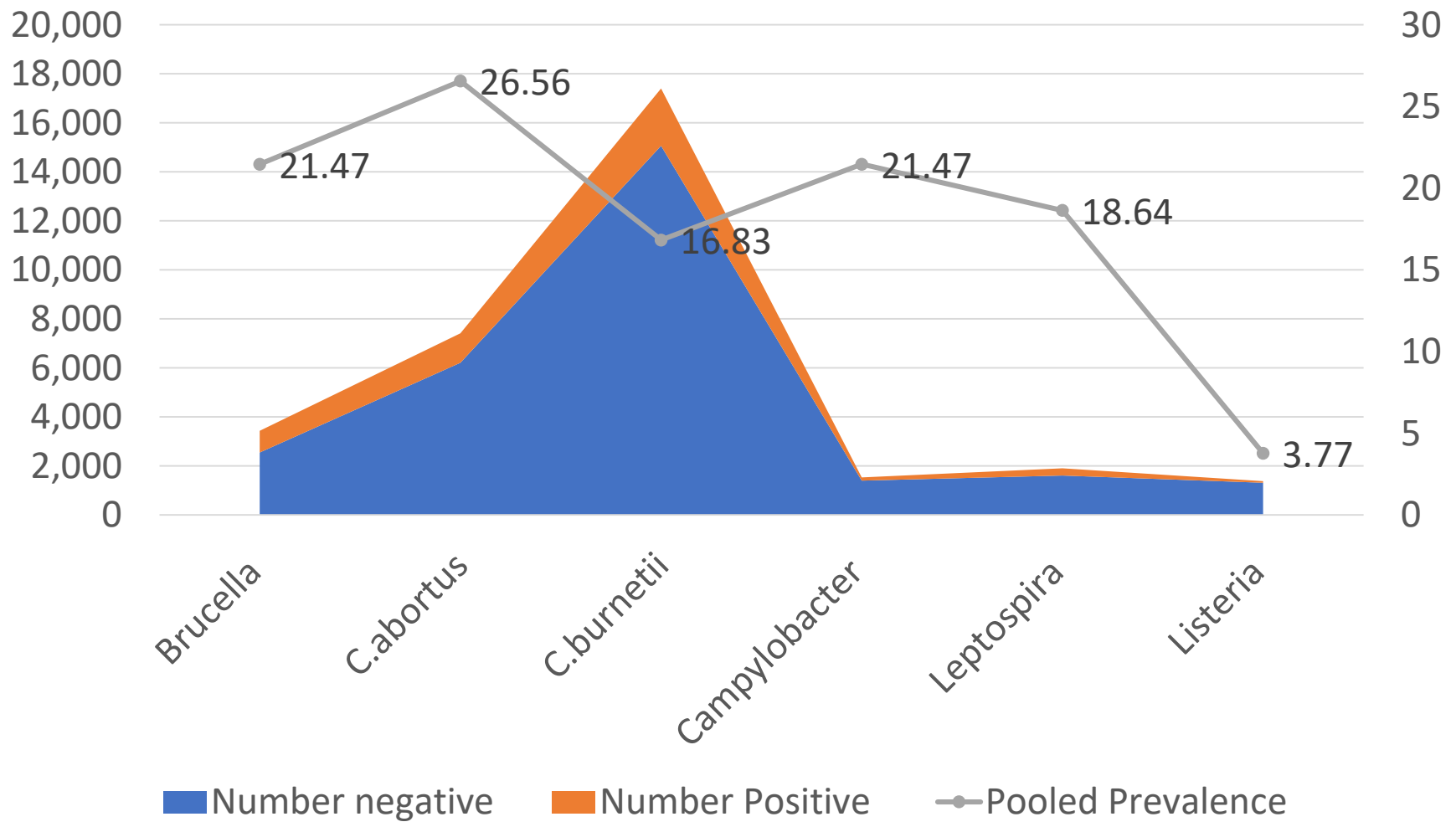
Type of samples used



Diagnostic tests used



Proportion of SR abortion cases with bacterial causes

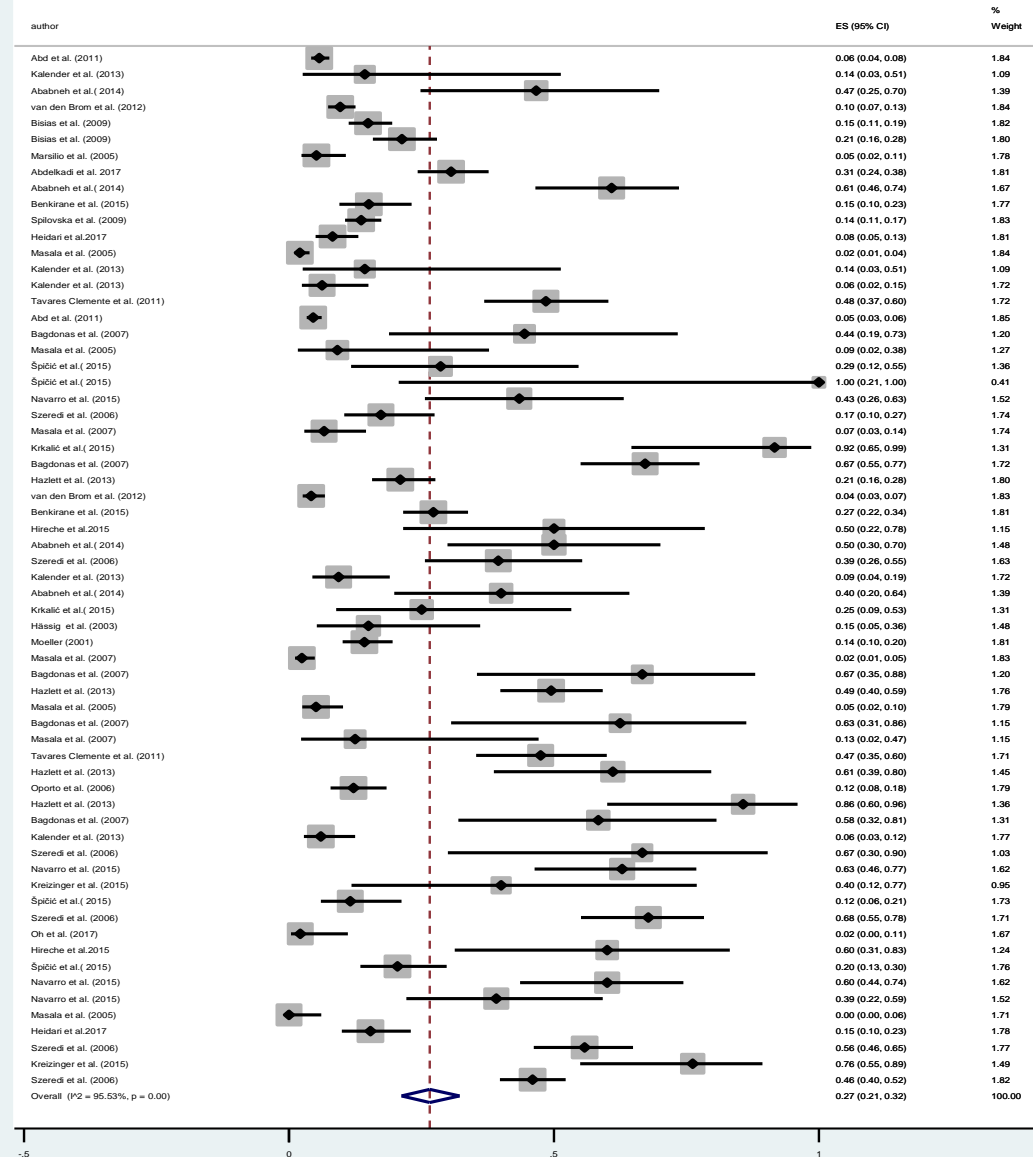


Proportion of *C. abortus* in SR abortion cases

Forest plot on proportion of *C. abortus* in aborted small ruminants

Chi², P = 0.00

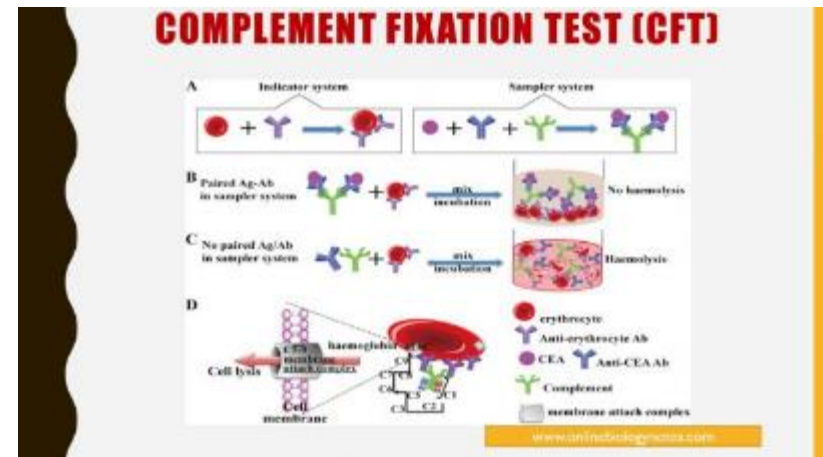
Degrees of heterogeneity (I²) = 95.53%



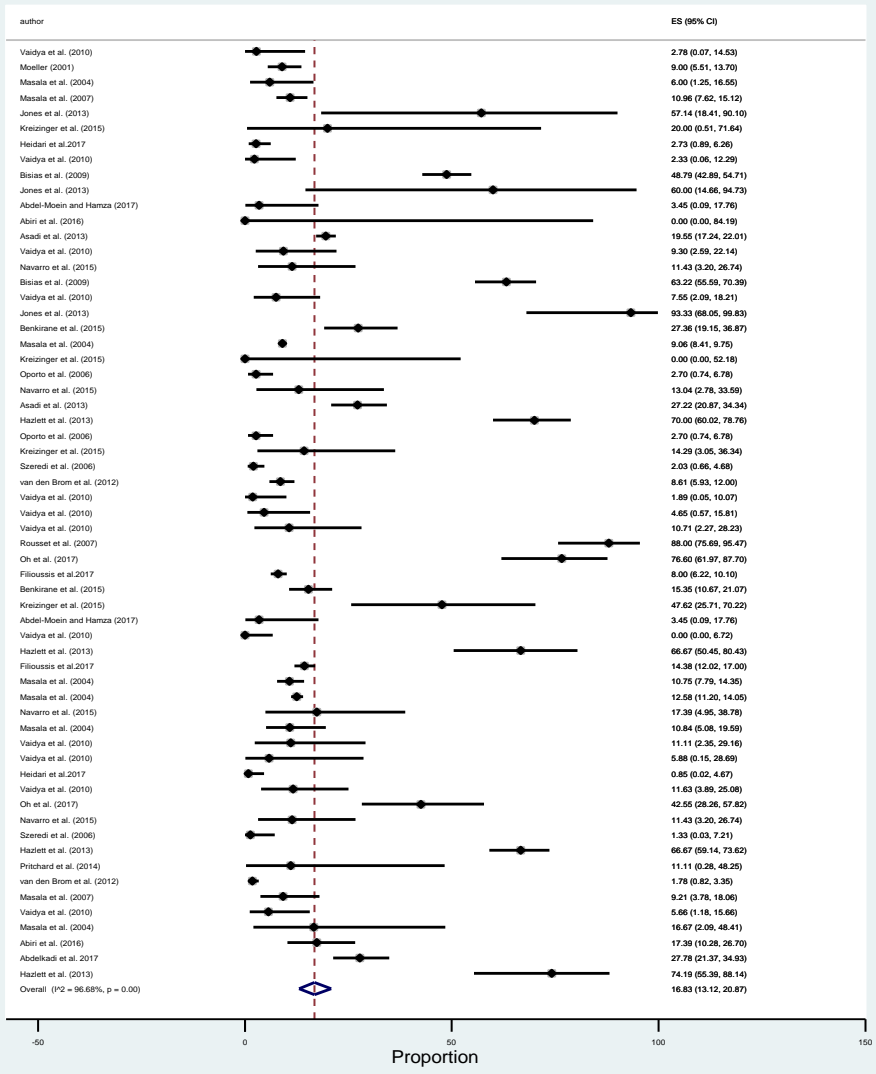
C. abortus

Role of animal species, continent, sample type and diagnostic test:

- No significant difference between sheep and goat
- Differences between continents: range from 14.51% (Asia) to 42.29% (North America), $P=0.54$
- Most positives were detected in placenta samples ($p=0.04$)
- Highest proportion of positives with CFT



Proportion of *C. burnetii* in SR abortion case



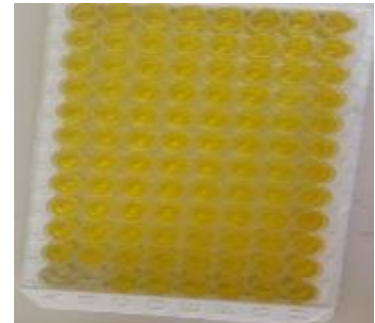
Chi², P = 0.00
I² = 96.68%

Forest plot of proportion of *C. burnetii* in aborted small ruminants

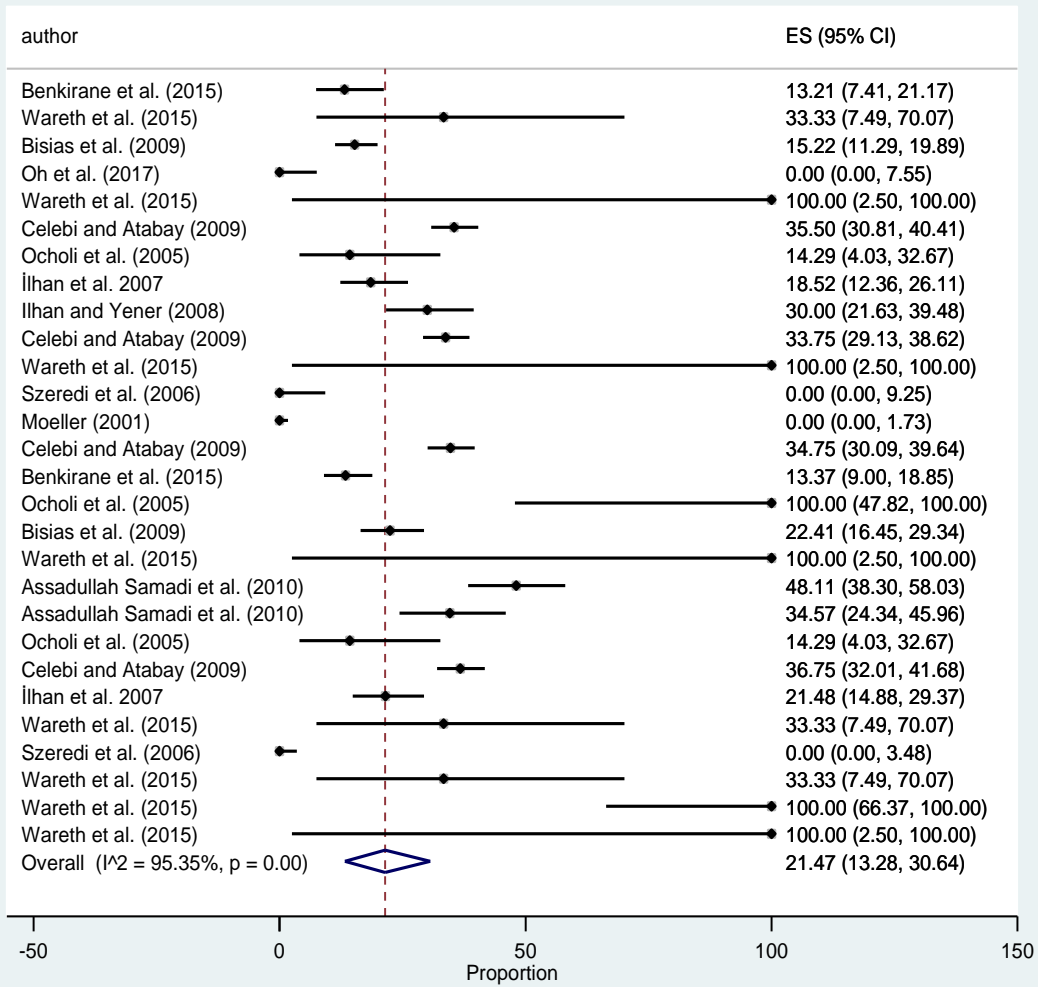
C. burnetii

Role of animal species, continent, sample type and diagnostic test:

- Higher proportion was detected from goat(22.22%) than sheep(13.10%), $p=0.08$
- Differences between continents: range from 9.93% (Asia) to 55.91%(North America), $p=0.00$
- Most positives was detected in feta fluid samples ($p=0.46$).
- Highest proportion of positives with ELISA($P=0.24$)



Proportion of Brucella spp. in SR abortion case



Q- Chi², P = 0.00

I² = 95.35%

T² = 0.17

Forest plot on proportion of *Brucella spp.* in aborted small ruminant

Brucella spp.

Role of animal species, continent, sample type and diagnostic test:

- Higher proportion was detected from sheep(23.48%), than goat (17.33%) $p=0.063$
- Differences between continents: range from 0.0 (North America) to 39.84(Africa), $p=0.00$
- Most positives detected in milk samples ($p=0.1$).
- Highest proportion of positives with PCR ($P=0.01$)



Conclusions

- Similar causes across continents, but with different importance and roles they play
- No or limited data found on socio-economic impact caused by these agents
- Overall few studies, especially for LMICs, even though reproductive performance in these countries is lower
- Surveillance and routine diagnostic data not widely accessible, and thus not included in the review
- Further research needed on the role of major pathogens that cause abortion in small ruminants

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