



Epidemiology of Bovine Brucellosis in China and Risk Analysis of Regional Introduction in Hubei Province

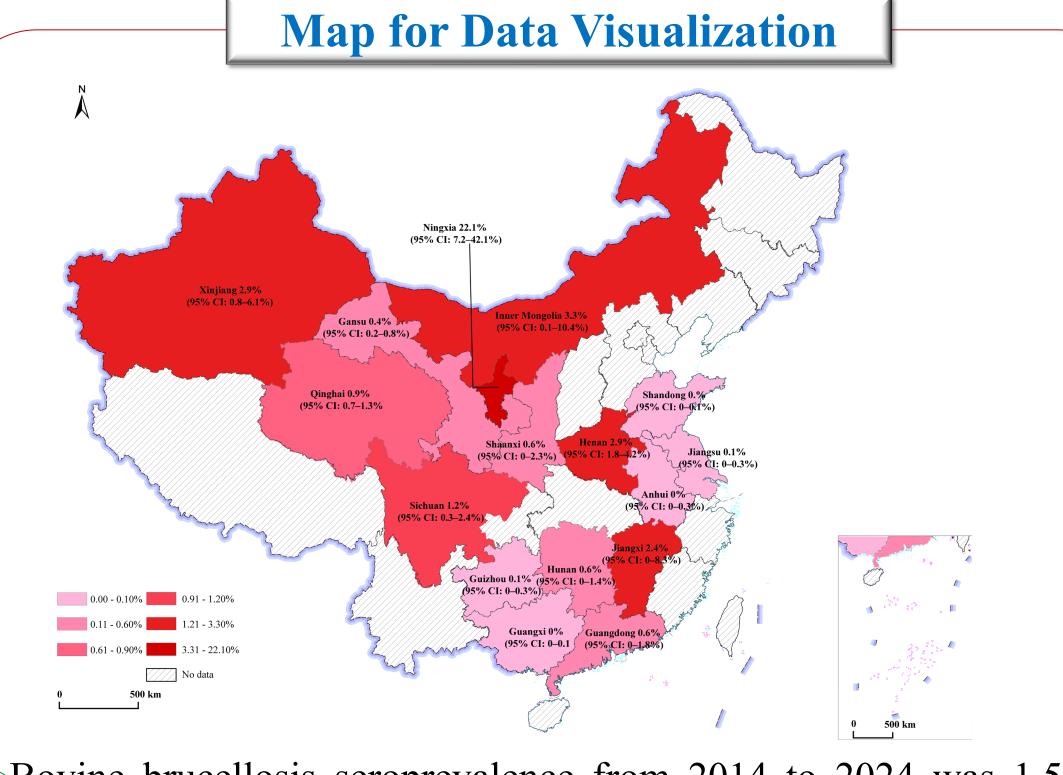
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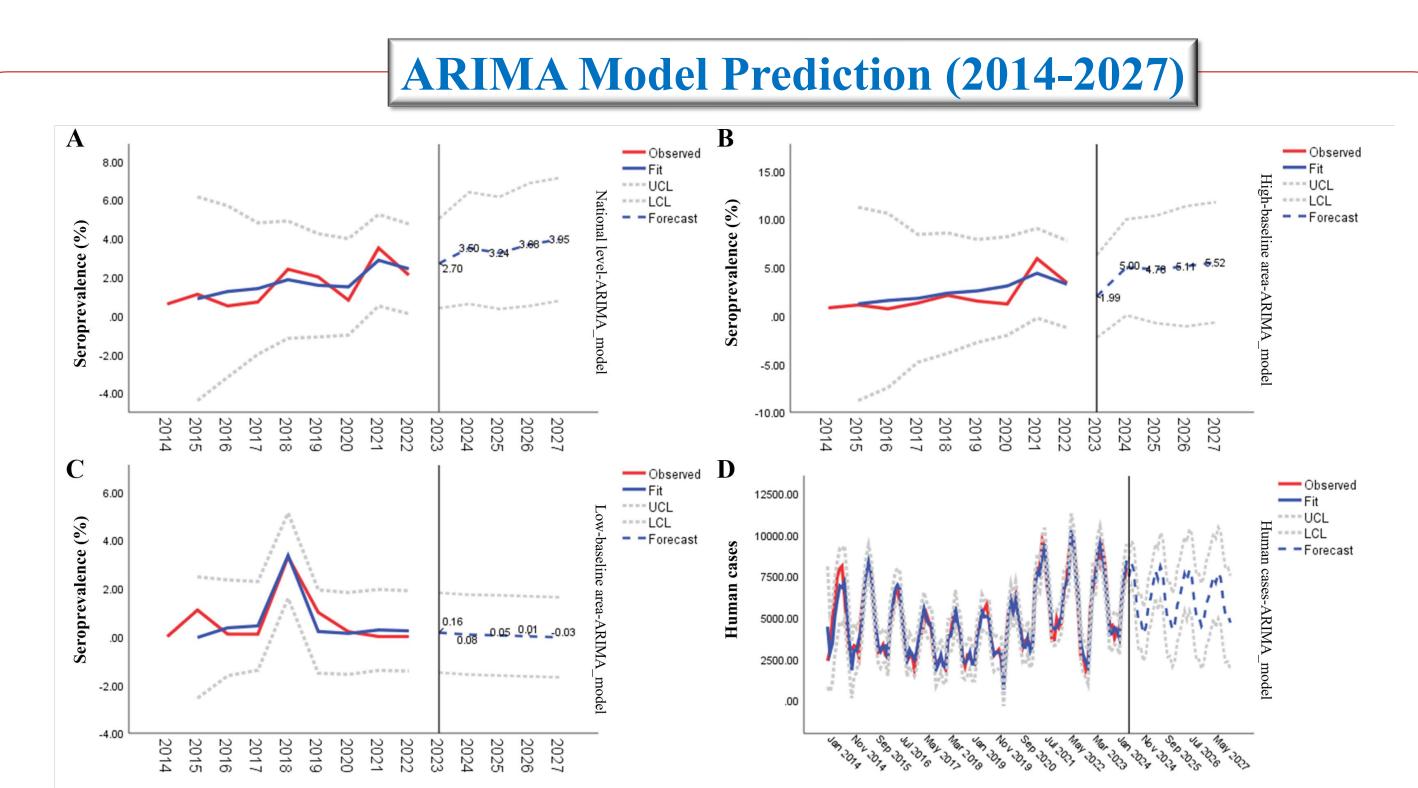
Background

- ◆ Brucellosis remains a significant zoonotic threat in China, affecting both animal and human health despite ongoing control efforts. Effective management is challenged by the disease's complex epidemiology and its economic and public health impacts.
- Comprehensive data on brucellosis prevalence, including differences across cattle breeds, production types, and the disease's temporal and spatial patterns, are crucial for designing targeted prevention and control strategies in China.
- ◆ Key points in the cattle trade chain in a county of Hubei have been identified and quantitatively assessed.

Results and Discussion -



▶Bovine brucellosis seroprevalence from 2014 to 2024 was 1.5% (95% CI: 0.6-2.6%), higher in dairy cattle (3.1%) than in beef cattle (1.3%). This poses public health risks, as rising animal infections can increase human cases, emphasizing the need for coordinated veterinary and public health surveillance.



A: bovine brucellosis seroprevalence at national level. B: bovine brucellosis seroprevalence in high-baseline area, C: bovine brucellosis seroprevalence in low-baseline area. D: Human brucellosis cases in China. The ARIMA model forecasts an increase in bovine brucellosis from 2.70% to 3.95%, with human cases fluctuating between 2,500 and 12,500 annually from 2024 to 2027.

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Mapping and Quantifying Risks 95% Beef Cattle Healthy Cattle **Tested Positive** From Brucellosis-High-**►** Value chain mapping Brucellosis Prevalence Areas Quarantine Outside the Study Area Animal Broker (Import at the Origin identifies key risk Via Cattle Vithin the Study Area Infected Cattle Brokers Trading Platforms Broker [*P*_(Cb)] **Tested Positive** points and pathways Farmers perform From Brucellosis-Low esting with test strip Prevalence Areas False Negative Quarantine Contract Farms **Pathways** Introduction of Quota a Cattle into **Healthy Cattle** the Region Unknown Source > Scenario Tree Model Tested Positive From Brucellosis-High-Brucellosis Prevalence Areas Quarantine quantifies the at the Origin False Negative Via Trading Infected Cattle likelihood of disease Platforms Fresh Meat Market Frozen Meat Market From Brucellosis-Lowintroduction Quarantine Prevalence Areas Consumer Self-breeding and rearing Healthy Cattle Other Province Flow of cattle and related animal products Risk Management Formulation Distribution Graph Risk Assessment Name Interpretation **PTotalRisk** -7.13E-07 4.39E-05 1.46E-05 P_{Risk1} $P_{(Cb)}*P_{(Ahi)}*P_{(B+H)}*P_{(Qtp)}*P_{(Qf)}$ Inputs Ranked by Effect on Output Mean refine our $P_{(Cb)}*P_{(Ahi)}*P_{(B+H)}*(1-$ -3.46E-06 3.97E-04 6.89E-05 P_{Risk2} understanding by P(B+H) $P_{(Qcb)}$)* $P_{(Ss)}$ * $P_{(sf)}$ 0.020985 .0075706 $P_{(Cb)}*P_{(Ahi)}*P_{(B+H)}*(1-P_{(Qcb)})*(1-P_{(B+H)})$ addressing P(Ahi) 0.013972 0.014560 2.22E-02 1.11E-02 P_{Risk3} Sensitivity P(Ss) 0.013952 0.014536 uncertainties in risk $P_{(Cb)}*P_{(Ali)}*P_{(B+L)}*P_{(Qcb)}*P_{(Qf)}$ P_{Risk4} 1.24E-11 5.52E-07 9.85E-08 Analysis P(Ali) 0.013973 0.014555 factors $P_{(Cb)}* P_{(Ali)}* P_{(B+L)}* (1-$ 2.44E-11 4.16E-06 4.68E-07 1-P(Sf) 0.014049 0.014542 P_{Risk5} Probability of brucellosis $P_{(Qcb)}$)* $P_{(Ss)}$ * $P_{(sf)}$ Input High introduction through different P(B+L) 0.014045 0.014511 $P_{(Cb)}*P_{(Ali)}*P_{(B+L)}*(1-P_{(Qcb)})$ 2.95E-04 7.55E-05 P_{Risk6} Input Low 0.014085 0.014470 > Sensitivity analysis $P_{(Tp)}^*P_{(Ahi)}^*P_{(B+H)}^*P_{(Qtp)}^*P_{(Qf)}$ -8.13E-07 | 4.63E-05 | 1.50E-05 0.014126 0.014451 P_{Risk7} P(Qcb) 0.014115 0.014417 N (Tp) prioritizes factors $P_{(Tp)}*P_{(Ahi)}*P_{(B+H)}*(1-P_{(Qtp)})$ -1.83E-04 8.15E-03 2.96E-03 P_{Risk8} 0.014113 0.014405 P(Qtp) such as regional $P_{(Tp)}{}^*P_{(Ali)}{}^*P_{(B+L)}{}^*P_{(Qtp)}{}^*P_{(Qf)}$ 1.16E-11 | 5.63E-07 | 1.01E-07 P_{Risk9} 1-P(Qf) 0.014243 0.014373 prevalence and testing Baseline = 0.014271 $P_{(Tp)} * P_{(Ali)} * P_{(B+L)} * (1-P_{(Qtp)})$ 2.16E-09 8.84E-05 2.01E-05 P_{Risk10} rates, guiding targeted Probability that any single feeder $P_{TotalRisk} = \frac{\sum P_{Risk}}{1 - \sum P_{Out}}$ 3.04E-02 1.43E-02 cattle introduced into the study area interventions tests positive with brucellosis Probability of introducing at least 1-(1-P_{TotalRisk}) Unifrom(Inported) -5.08E+01 | 1.00E+00 | 9.95E-01 one brucellosis-positive animal through imported cattle each year

-Conclusion

- ◆Comprehensive Framework: This study integrates meta-analysis, value chain investigation, and quantitative risk assessment to create a comprehensive approach for brucellosis control.
- •Key Risk Identification: The methods pinpoint critical risk points in the cattle trade, allowing targeted interventions at vulnerable stages of the value chain.
- ◆Data-Driven Strategy: By quantifying disease introduction risks and prioritizing control measures, the framework provides a solid basis for preventing brucellosis spread in both cattle and humans.