



World Organisation
for Animal Health
Founded in 1924

中华人民共和国农业农村部

Ministry of Agriculture and Rural Affairs of the People's Republic of China

Key features of animal brucellosis – implications on control and elimination

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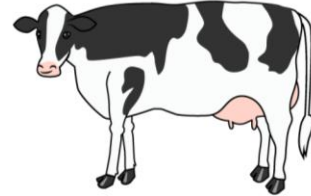


Brucellosis -One of the most widely spread zoonosis in the world-

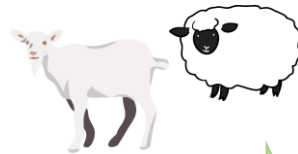
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Gram negative bacteria

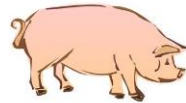
Brucella abortus



Brucella melitensis



Brucella suis



Brucella canis



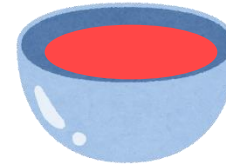
Animal brucellosis

Significant economic loss such as abortion and 20% reduction in milk yield

Transmission in animals

Oral transmission through aborted materials, vertical transmission, milk

Untreated dairy products
Direct contact (farmers, vets)
Aerosol (slaughterhouse, laboratory)



Human brucellosis

Undulant fever
Fatigue
Arthritis

500 thousand human cases each year
WHO 'forgotten' neglected zoonosis
Advised to control with zoonotic TB





Conventional brucellosis and zoonotic TB control

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Farm



- Understanding epidemiology
- Test and slaughter
- Mass vaccination



Milk plant



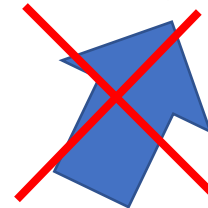
- Pasteurization



Consumers



- Approval of marketing only pasteurized and packaged milk
- Ban of direct sales of non-pasteurized milk from farms



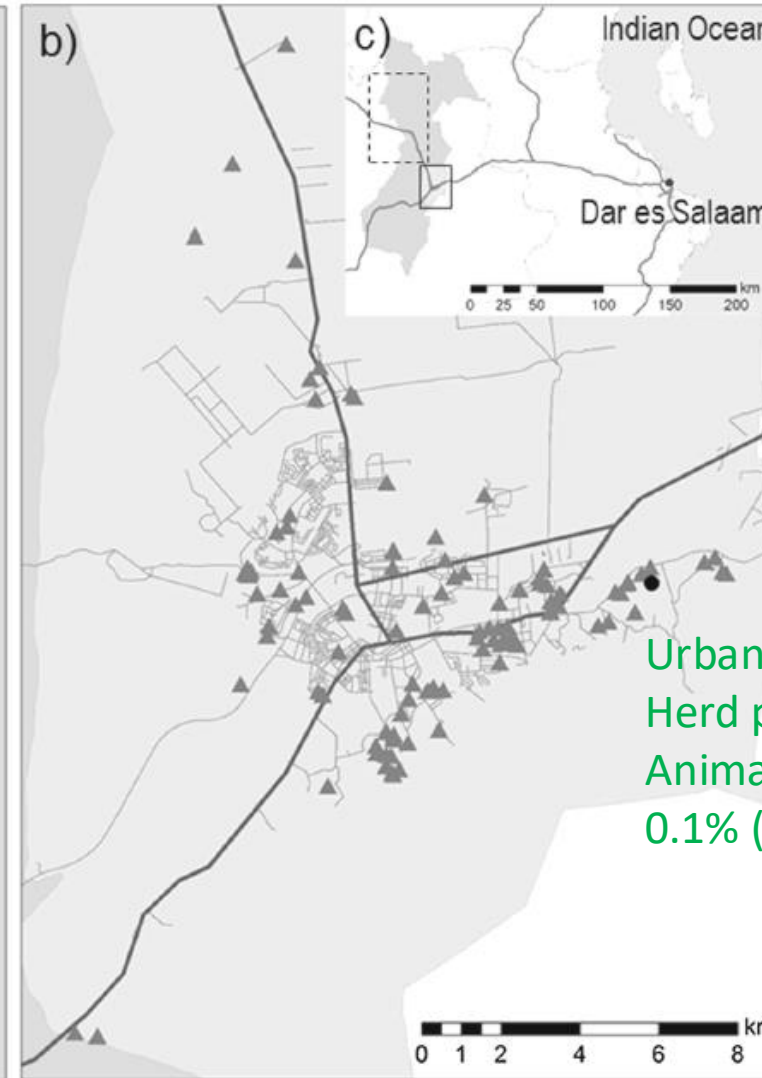
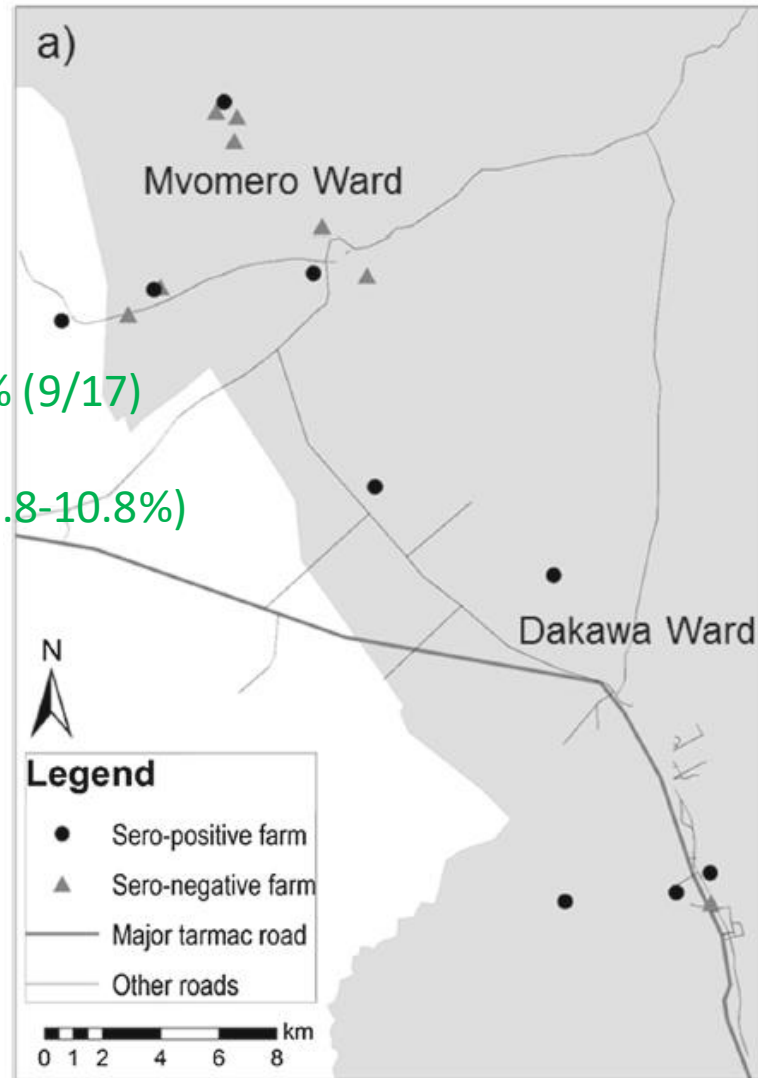
Limited funding in state veterinary and public health services
Dominance of informal value chains



Brucellosis is an ecologically sensitive disease - Grazing -

4

Agro-pastoral areas
Herd prevalence: 52.9% (9/17)
Animal prevalence:
7.4% (28/673, 95%CI: 4.8-10.8%)



Republic of Tanzania

Urban areas of Morogoro
Herd prevalence: 0.9% (1/106)
Animal prevalence:
0.1% (1/667, 95%CI: 0-0.4%)



Silent infection before first parity (Rose Bengal and cELISA) and constant exposure by grazing

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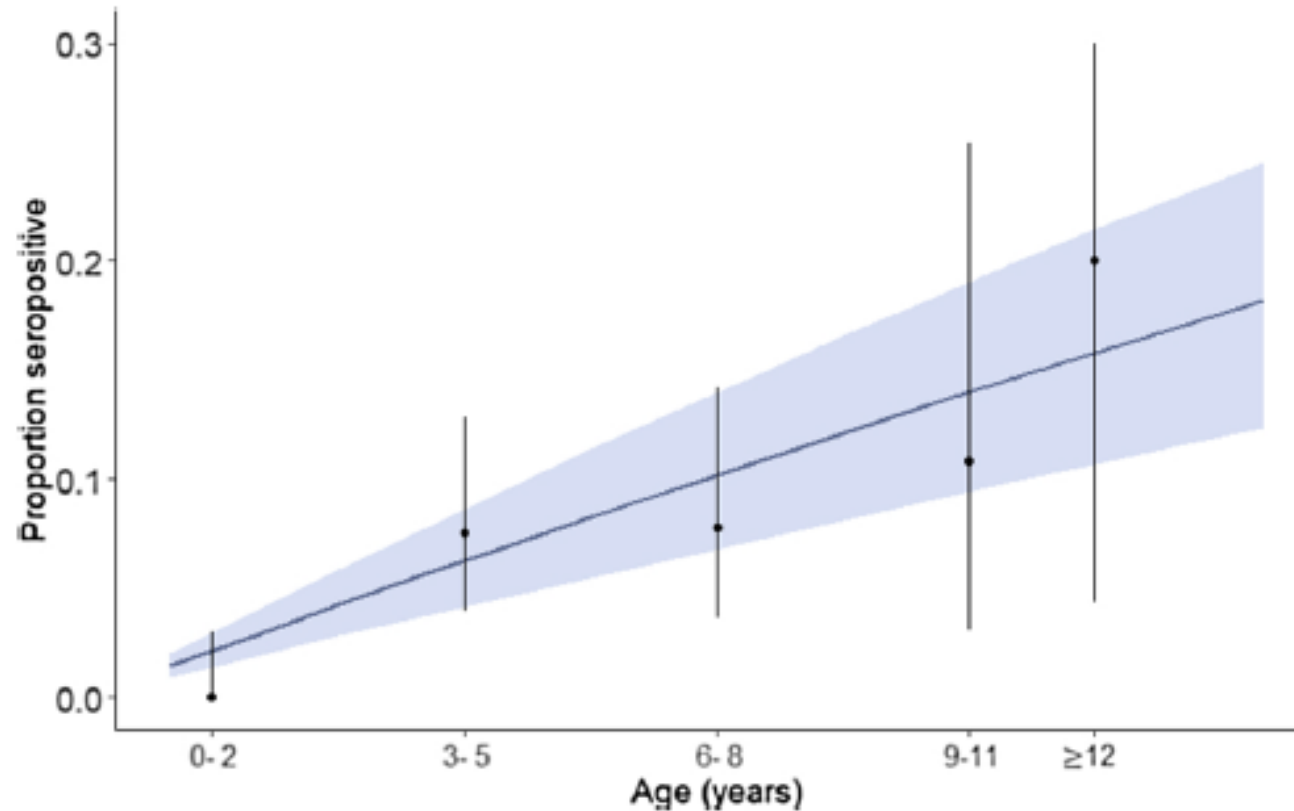


Fig. 6. Observed age-specific sero-prevalence (points) and 95 % confidence interval (vertical lines) and age-specific sero-prevalence (curve solid line) and 95 % credible interval (blue area) estimated using based on the constant FOI model.

Ukita and Makita et al. (2021) PVM 194, 105425



Basic reproduction number (R_0)

6

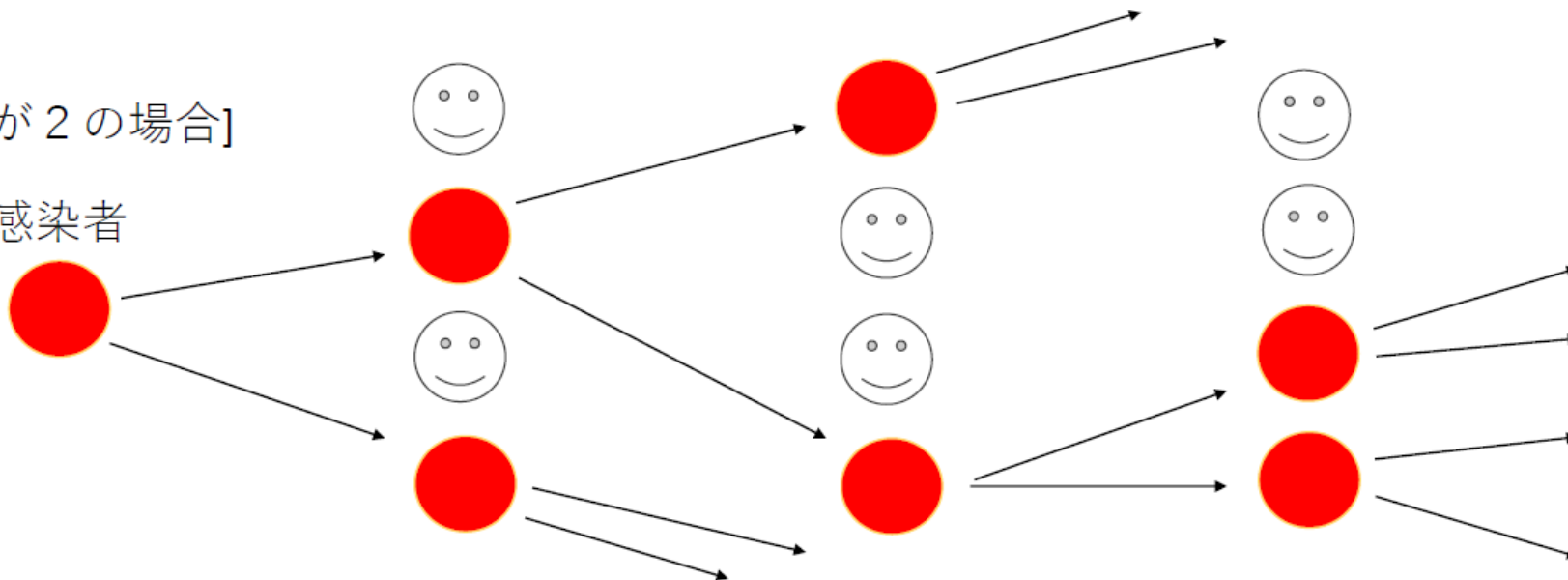
- The average number of secondary infectious persons resulting from an infectious person following their introduction to a totally susceptible population
 - $R_0 < 1$ Infections die out
 - $R_0 = 1$ Infections are maintained (endemic)
 - $R_0 > 1$ Infections take off

$$i(t) = \int_0^{\infty} A(\tau) i(t - \tau) d\tau$$

$$R_0 = \int_0^{\infty} A(\tau) d\tau$$

[R_0 が2の場合]

感染者





R_0 suggests an endemic nature

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The average life expectancy of a cow ($1/\mu$) is

$$1/\mu = \sum_{x=0}^{\infty} l_x \quad (4)$$

where l_x represents the survival rate by age (x), calculated as the number of animals at each age divided by the number of animals at age 0. For

$$\log L(R_0) = \sum_{i=0}^n \log(\exp(-a_i \mu (R_0 - 1))) + \sum_{i=0}^m \log(1 - \exp(-b_i \mu (R_0 - 1))) \quad (5)$$

where n ($= 645$) is the number of susceptible animals (sero-negative) of age a_1, \dots, a_n , and m ($= 28$) is the number of sero-positive animals (ages b_1, \dots, b_m) for all farms (Keeling and Rohani, 2008). This estimation was

Overall in 17 farms

$$R_0 = 1.07$$

In 10 infected farms

$$R_0 = 1.10$$

Ukita and Makita et al. (2021) PVM 194, 105425



Introduction of an infected animal to a susceptible herd results in higher prevalence

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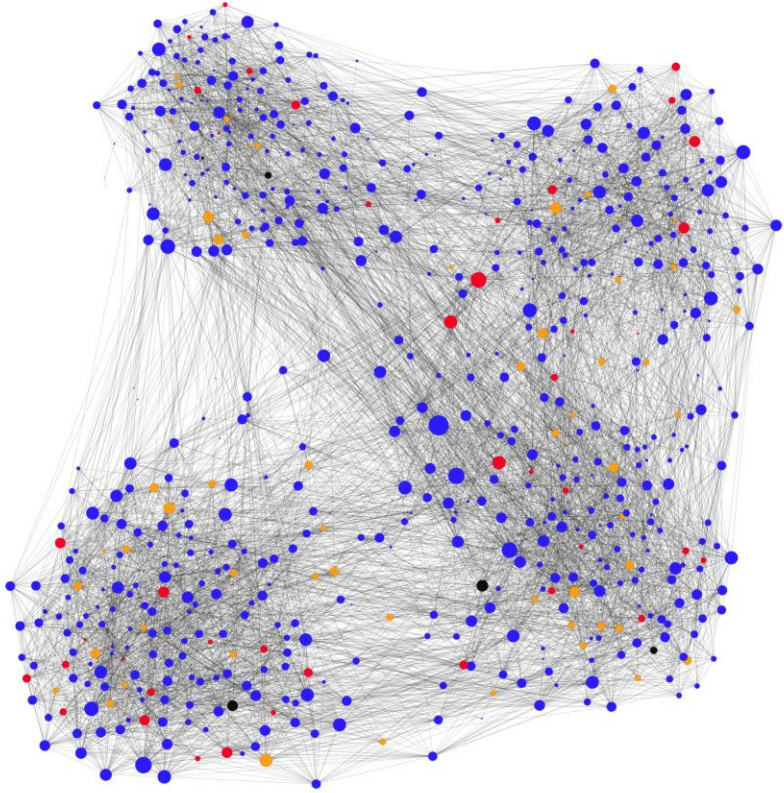


Table 4

Final multivariable model for brucellosis within-herd prevalence, with potential confounders.

| Variable | Estimate | Standard error | <i>p</i> -value |
|--|----------|----------------|-----------------|
| Intercept | −6.72 | 1.10 | <0.01 |
| Direct purchase of cattle from other farms | 3.18 | 1.11 | 0.01 |
| Owner visits animal markets | 1.85 | 0.63 | 0.01 |
| Maasai tribe | −0.66 | 0.62 | 0.31 |
| Herd size | −0.001 | 0.002 | 0.83 |

Ukita and Makita et al. (2021) PVM 194, 105425

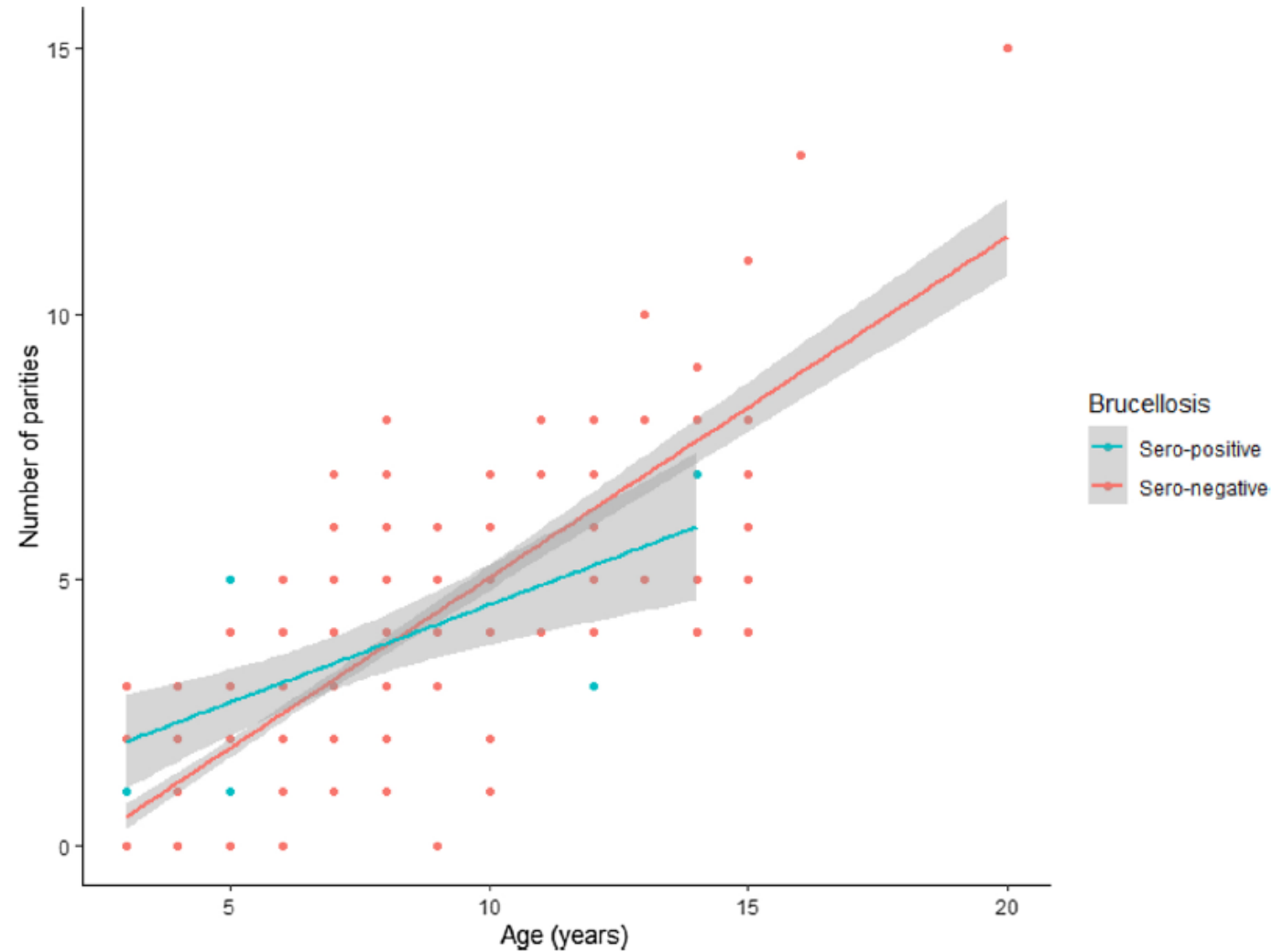


Fig. 3. Analysis of covariance comparing the relationships between age and the number of parities: between *Brucella* sero-positive and sero-negative cows showing degraded reproduction performance by infection with brucellosis (difference of slopes = -0.27, se = 0.10, $p = 0.01$).



Risk-based control planning may consider target groups

-An example from the dry zone of Sri Lanka-

Table 3

Logistic regression analysis results and odds ratio of farmer and herd level factors on *Brucella* sero-positivity.

| Variable | Category | Coefficient | SE | Z | P > Z | OR (95% CI) |
|---------------------|------------------|-------------|-------|-------|---------|---------------------|
| <i>Farmer level</i> | | | | | | |
| Ethnicity | 1: Muslim | 1.808 | 0.732 | 2.47 | 0.014** | 7.25 (2.35 – 22.28) |
| | 0: Sinhala/Tamil | | | | | |
| Living subsidy | 1: Yes | 1.449 | 0.688 | 2.11 | 0.035** | 3.75 (1.43 – 10.0) |
| | 0: No | | | | | |
| Education | 1: No formal | 0.526 | 1.023 | 0.51 | 0.607 | 3.44 (0.63 – 18.78) |
| | 0: Formal | | | | | |
| <i>Herd level</i> | | | | | | |
| Grazing practice | 1: Free | 1.391 | 0.725 | 1.92 | 0.055* | 5.62 (1.7–18.61) |
| | 0: Restricted | | | | | |
| Brought-in | 1: Yes | 1.232 | 0.662 | 1.86 | 0.063* | 3.06 (1.15 – 8.13) |
| | 2: No | –0.181 | 0.741 | –0.25 | 0.806 | 2.44 (0.83 – 7.18) |
| Insemination | 1: AI | 0.648 | 0.705 | 0.92 | 0.358 | 2.79 (0.81 – 7.18) |
| | 0: NS | –5.071 | 0.863 | –5.87 | 0.000 | |
| Abortions history | 1: Yes | | | | | |
| | 0: No | | | | | |
| cons | | | | | | |

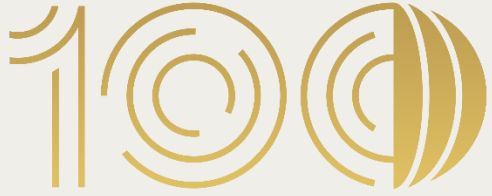
** p < 0.05, and * p < 0.10; OR=Odds ratio; CI=Confidence interval.

Kothalawala, Makita, Kubota, and Kono et al. (2017) PVM 147, 117-123



- Mass or risk-based approach?
 - Vaccination will mask infected animals
 - Diagnosis for quarantine
 - Vaccination to prevent abortion (targeting calves)
 - Target group
- Economic consideration
 - High initial cost with high return (stumping out)?
 - Sensitize economic and public health burden
 - Less costly design
 - Public-private partnership
 - Community-based approach
- Education
 - Change risky behavior through One Health and education





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Thank you!

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