Reducing Vulnerability to Animal Disease: Strategies, Economic Consequences and Resilience

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National Center for Foreign Animal and Zoonotic Disease Defense

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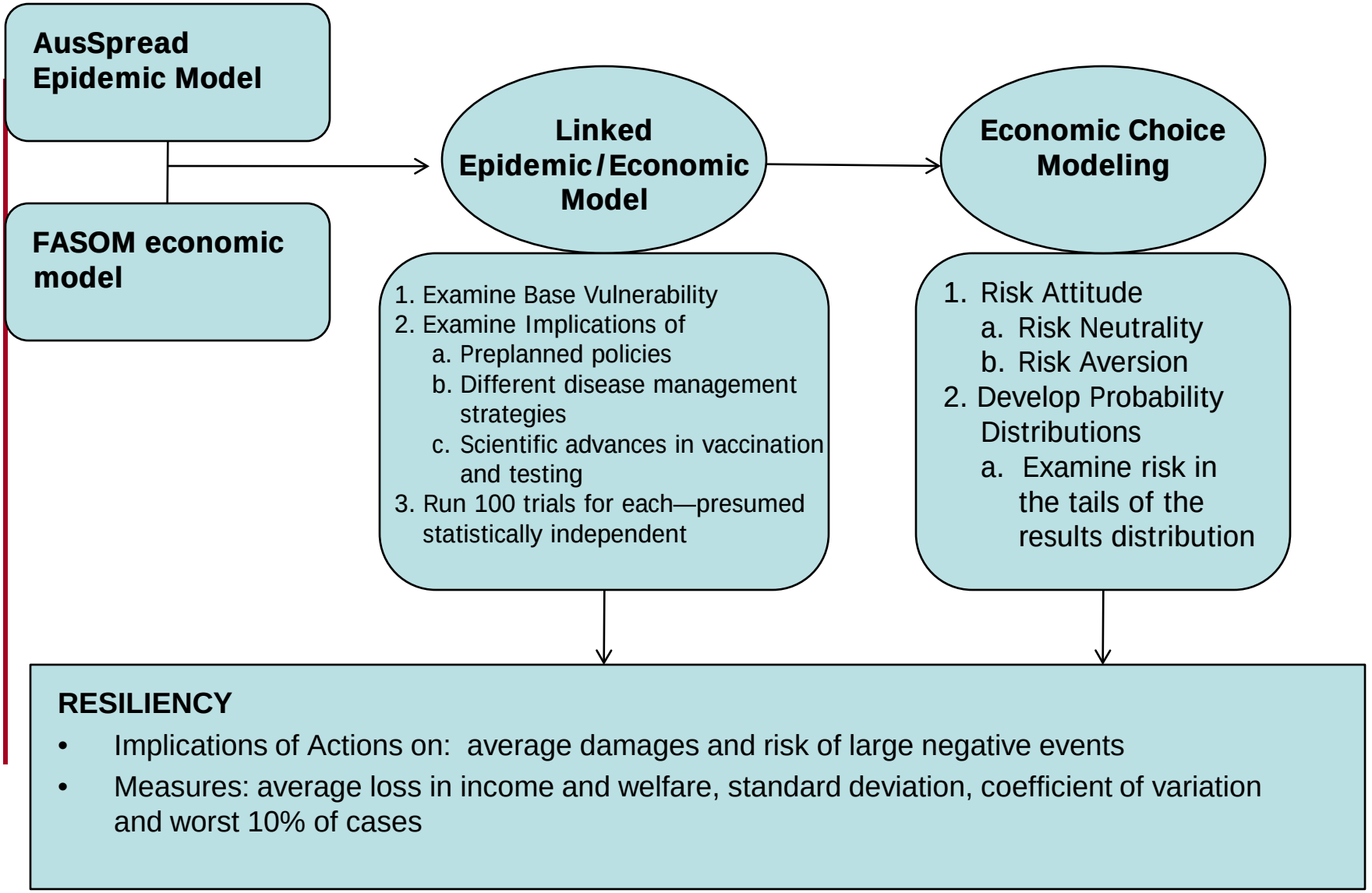
Method



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A Priori Investments vs. *Ex Post* Strategies

A Priori Investments

- Carcass Disposal
- Feed Provision
- Compensation
- Scientific Developments
  - Vaccination
  - Detection
- Traceability

Ex Post Strategies

- Detection
- Surveillance
- Vaccination
- Labor
- Zoning

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When is one risky outcome preferred to another?

Breakeven risk aversion

$$\int_{-\infty}^{+\infty} -e^{-rx}(F(x)-G(x)) = 0$$

- Find a breakeven risk aversion parameter. Define the bounds on the risk aversion parameter as:
  - Lower– 0
    - meaning only consider risk neutral and risk averse individuals
  - Upper– Z/2*σ

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Early vs. Late Detection

- Risk neutral decision makers prefer
  - Late detection: large feedlot, small feedlot, and backyard index herds
  - Early detection: large grazing operation index herds
- Risk averse decision makers
  - Late detection: large feedlot index herds.
  - Mixed:
    - Late detection: low risk aversion in small feedlots and backyard index herds
    - switches to early detection as risk aversion increases
  - Early detection: large grazing operations index herds .

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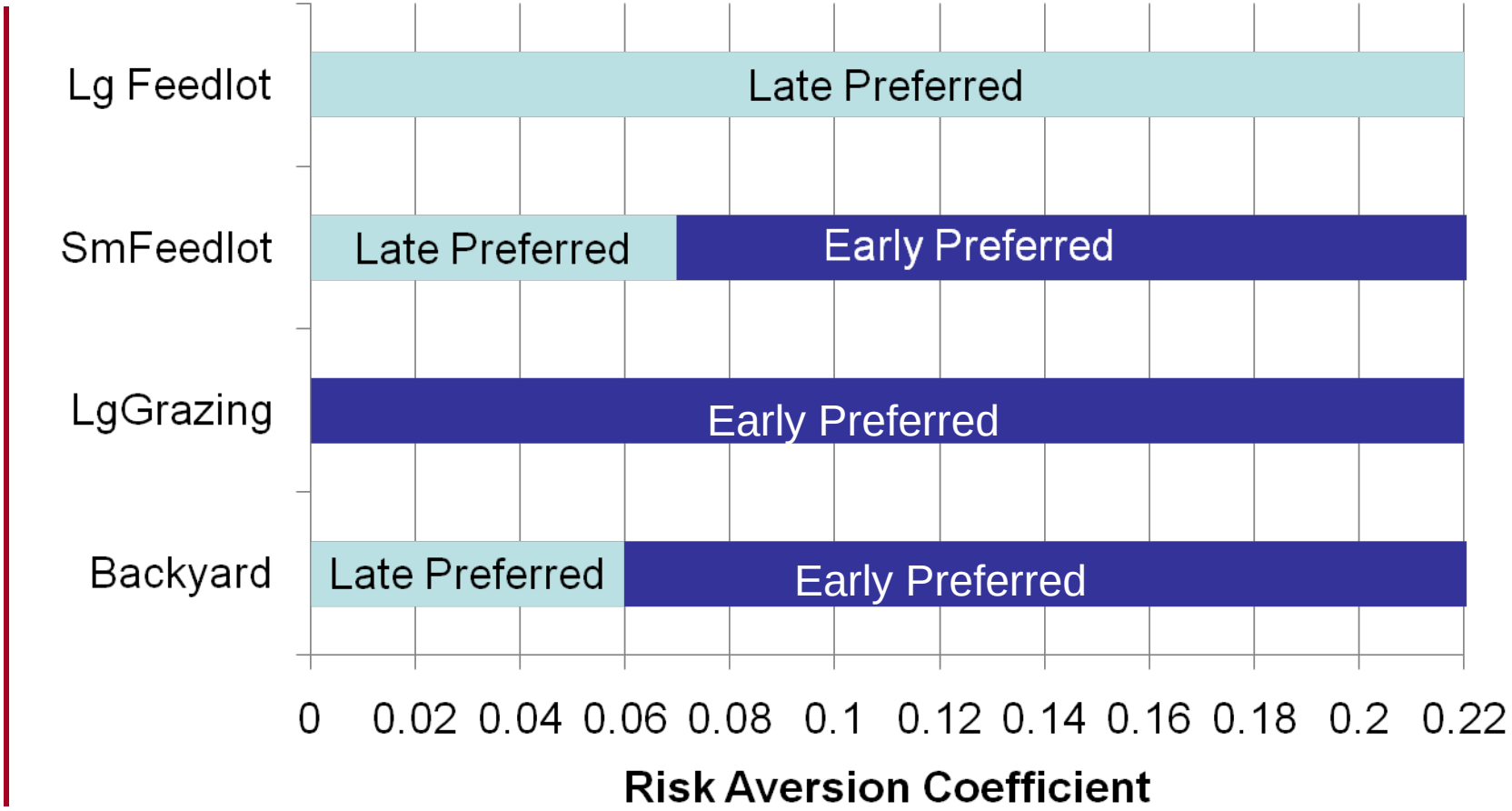
Early vs. Late Detection



7 days after index vs 14

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Enhanced vs. Regular Surveillance

- Risk neutral decision makers prefer
  - Regular Surveillance: small feedlot and large grazing index herds
  - Enhanced Surveillance: large feedlot and backyard operation index herds
- Risk averse decision makers
  - Regular Surveillance: large grazing index herds.
  - Mixed:
    - Regular surveillance: low risk aversion in small feedlots, high risk aversion in backyard operations
    - Enhanced surveillance: high risk aversion for small feedlots and low risk aversion for backyard operations
  - Enhanced Surveillance: large feedlot index herds .

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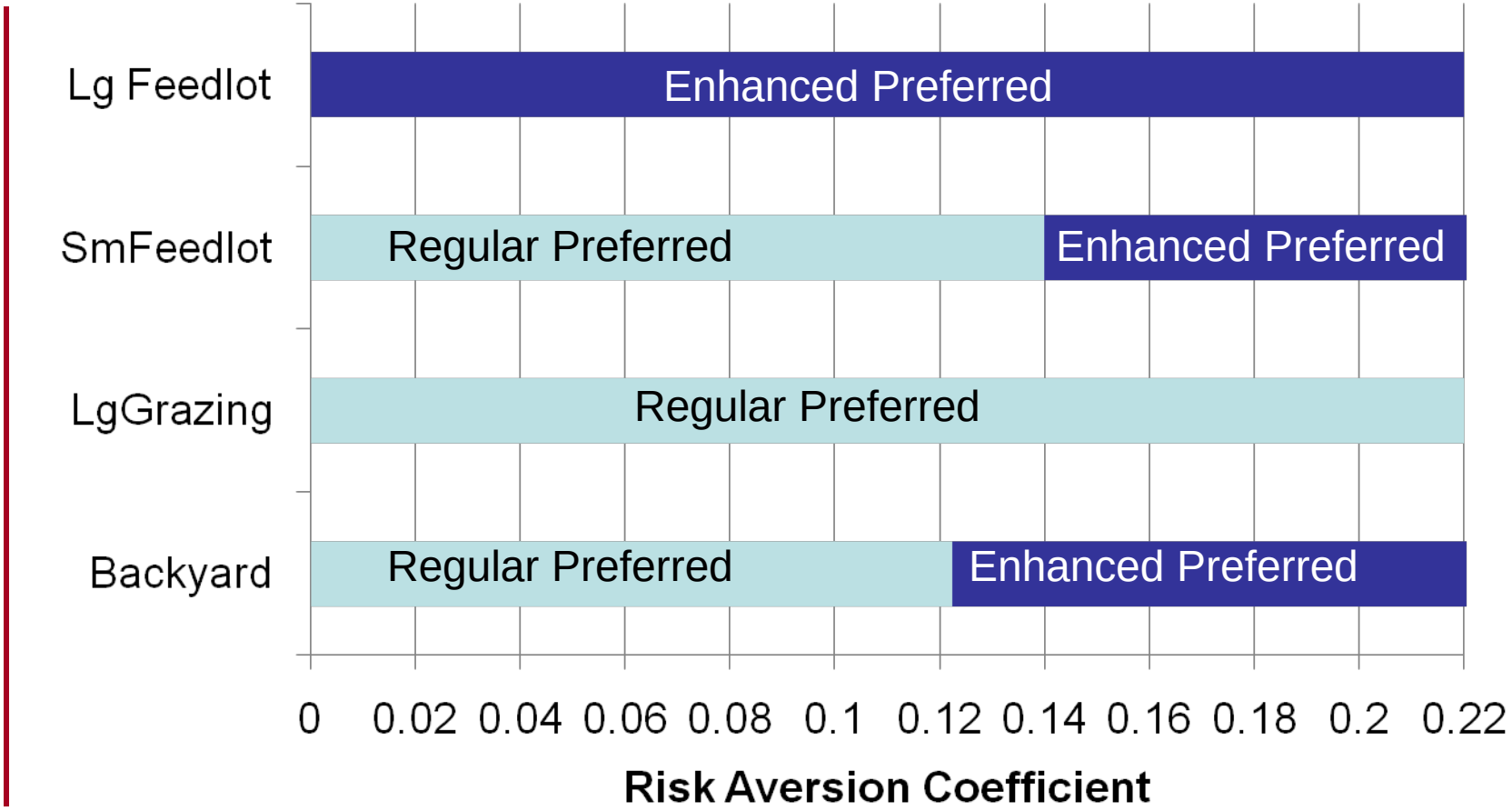
Enhanced vs. Regular Surveillance



4 times a week vs 2 times

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Regular vs. Rapid Availability of Vaccinate

- Risk neutral decision makers prefer
  - Regular Availability: large feedlot, small feedlot, large grazing and backyard index herds
- Risk averse decision makers
  - Regular Availability: large grazing index herds
  - Mixed:
    - Regular Availability: low risk aversion in large feedlots, small feedlots, and backyard index herds
    - Rapid Availability: as risk aversion increases, rapid availability is preferred.

7 day vs no lag

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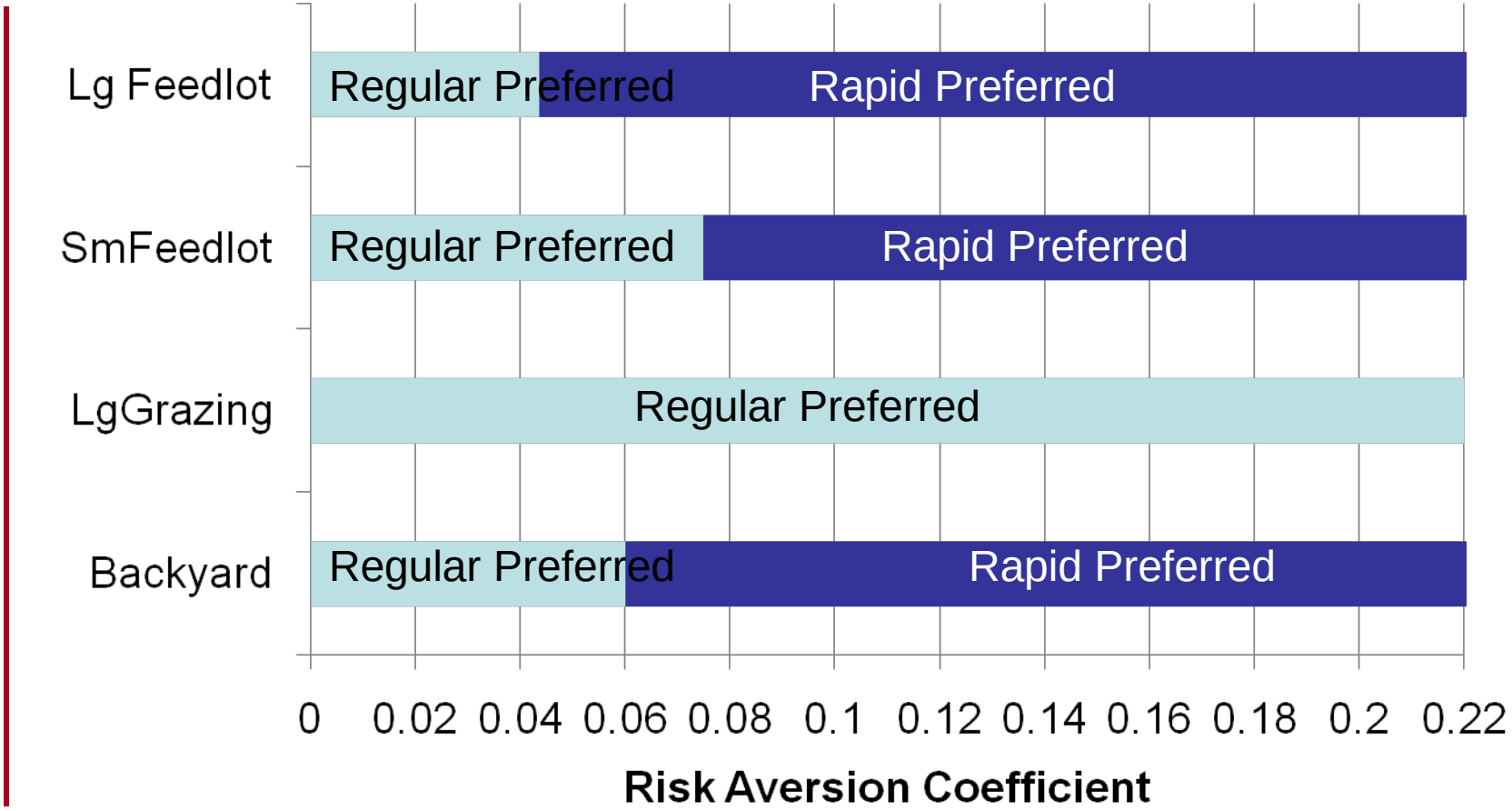
Regular vs. Rapid Availability of Vaccine



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Outlier Analysis

- Large Feedlots
  - Average national welfare loss in the worst 10% of outcomes is reduced by early detection, but not enhanced surveillance or rapid vaccine availability
- Small Feedlots
  - Average national welfare loss in the worst 10% of outcomes is reduced by early detection, enhanced surveillance and rapid vaccine availability

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Outlier Analysis

- Large Grazing
  - Average national welfare loss in the worst 10% of outcomes is made worse by early detection, enhanced surveillance or rapid vaccine availability
- Backyard
  - Average national welfare loss in the worst 10% of outcomes is reduced by early detection and rapid vaccine availability, but not by enhanced surveillance

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New Vaccines

- Vaccination
  - Manage an outbreak
  - Gain additional time for carcass disposal
  - May reduce risk of large events
  - Not a good strategy for reducing average loss, but for avoiding risk.
- Biological Innovations in Vaccination
  - Production in the US (7 days to 4-5)
  - Protective immunity (48-96 hrs to 36-72)
  - Differentiable Vaccine: DIVA – “vaccinate to live”.
- Ring and targeted vaccination

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New Vaccines

- Vaccinate to Live
  - Saves about $3 million in total disease mitigation costs
  - Includes welfare slaughter
  - 50% reduction in the value of the meat
- Vaccinate to Die
  - Animals vaccinated are slaughtered and the carcass is disposed of with others
- Benefits derived from a vaccinate to live strategy, even with a reduced carcass value

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Feed Provision

- Welfare Slaughter
  - About 36% of slaughter in the UK was welfare slaughter.
  - This implies it is worthwhile to pre-arrange for feed contingencies in the High Plains
- In the High Plains the provision of feed to prevent welfare slaughter is always preferred across all index herd types and risk aversion coefficients.

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Summary

- Early detection is a good overall strategy that is particularly useful in reducing risk if the index herd is a large beef grazing operation.
- Enhanced surveillance is particularly useful in large feedlot index herds
- Vaccination, though expensive, is useful for reducing the risk for feedlot and backyard index herds
- In particular, the ability to differentiate between vaccinated and recovered would be beneficial
- It would be worthwhile for operators at risk of welfare slaughter to pre-arrange for feed to be brought in should the area go under quarantine.
- Large scale carcass disposal should be planned ahead of time to prevent backlogs

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Future Research

- Innovations in testing technology
- Expanded trade restriction/ zoning work
- Run tracing on multiple index herd types
- Relative distribution of welfare effects across multiple groups and regions
- Effects of more complex outbreaks

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Questions

For more information on some of the topics discussed today:

- Jin, Y., W. Huang and B.A. McCarl. 2005. “Economics of Homeland Security: Carcass Disposal and the Design of Animal Disease Defense” Selected paper presented at the Annual Meeting of American Agricultural Economics Association, Providence Rhode Island, July, 2005.

- Elbakidze L., “Economic Benefits of Animal Tracing in the Cattle Production Sector ” *Journal of Agricultural and Resource Economics*, 32, 1, (April 2007):169-180.

- Elbakidze L. and B.A. McCarl, “Animal Disease Pre Event Preparedness versus Post Event Response: When is it Economic to Protect?” *Journal of Agricultural and Applied Economics.* 38, 2, (August 2006):327-336