Veterinary Services

Risk Assessment of exporting brucellosis infected breeding cattle from the Designated Surveillance Areas

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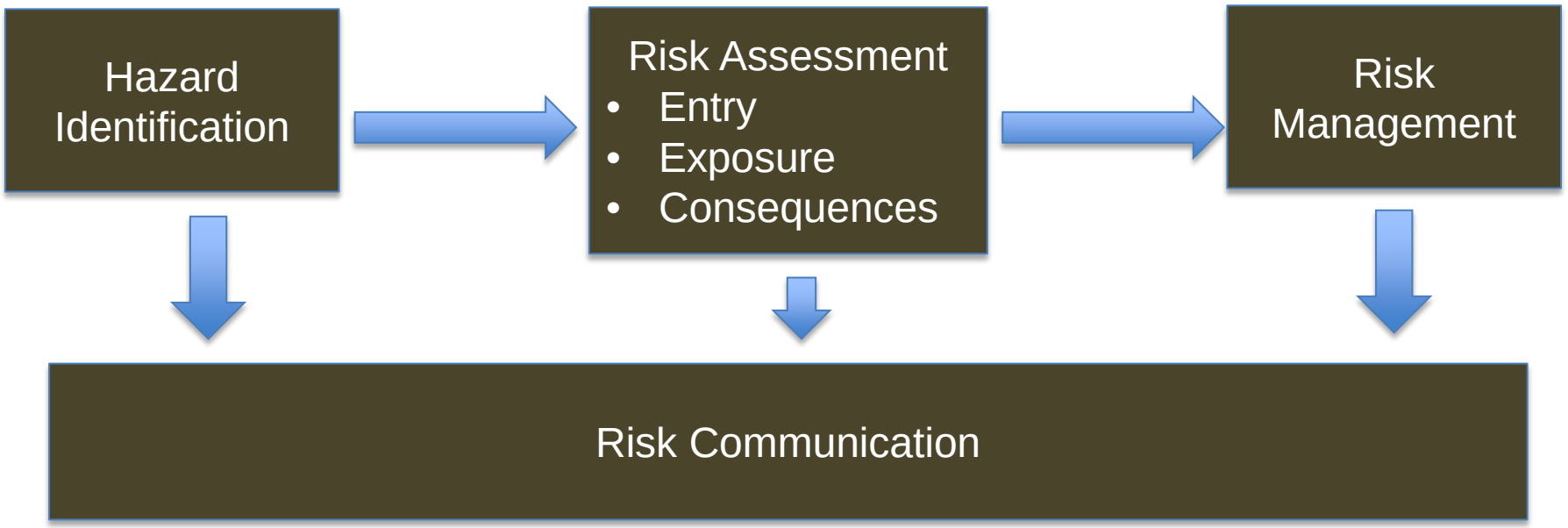
Background

- The interim rule 75 FR 81090 requires States with a known wildlife reservoir to develop a brucellosis management plan to prevent the spread of brucellosis outside of these geographic areas
- State rule in Texas (2013) requiring post-entry monitoring and testing of DSA-origin breeding cattle, regardless of DSA testing
- ID, MT, and WY requested a risk assessment from VS

The Risk Analysis Process



USDA United States Department of Agriculture

The Risk Analysis Process

- What could go wrong

- Pathways of introduction
- How likely is the event
- What are the consequences

- What are the mitigations
- What is the cost of mitigations, relative to consequences

Hazard Identification

Risk Assessment
- Entry
- Exposure
- Consequences

Risk Management

Risk Communication

Transparency
- Stakeholder input
- Convey results
- Risk ≠ probability of event
- Risk = probability of event in context of risk management and consequences

Hazard ID

Brucella abortus infected and undetected breeding cattle leaving the DSAs of Idaho, Montana, and Wyoming

- Focus is on interstate introductions
- 22 affected herds 2002-2013 within current DSA boundaries
  - 18 direct link to infection from wildlife
  - 4 linked to cattle traces from affected herds with most likely wildlife source

Risk Management

What is the benefit *vs.* cost of post-entry tests by receiving states?

- **Benefit** = avoiding introduction of *B. abortus,* weighted by the probability of exposure and effectiveness of the destination mitigation
- **Cost** = paying for post-entry testing and monitoring
- Livestock and trade issue: **economic objective**

Risk Assessment: Entry

What is the probability of a DSA herd having infected cattle (apparent herd prevalence)?

Entry pathways to estimate source herd infection rate and prevalence:

- Elk
- Purchased cattle

Pathways not evaluated:

- Bison: intensive management, no known transmission events
- Commuter grazing herd: timing of spring-summer entry overlaps with <5% of elk abortion events

Risk Assessment: Entry

What is the probability of a DSA herd having infected cattle (apparent herd prevalence)?

Entry pathways to estimate source herd infection rate:

- Elk
- Purchased cattle

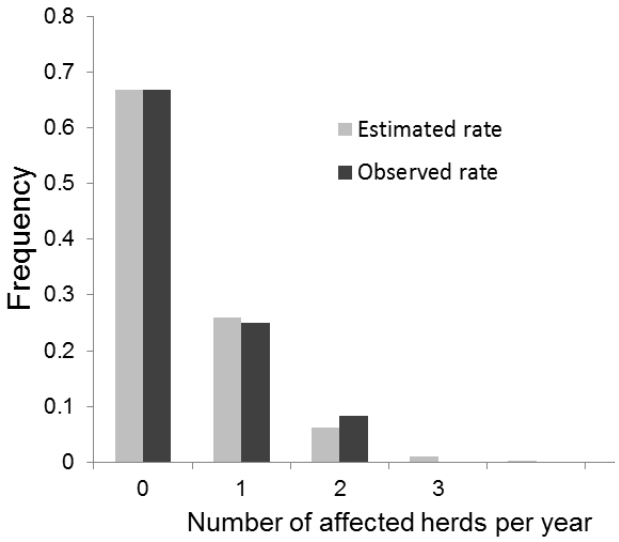
Data: apparent herd prevalence and within-herd prevalence at detection 2002-2013.

Reflects interface ecology that has resulted in observed infection

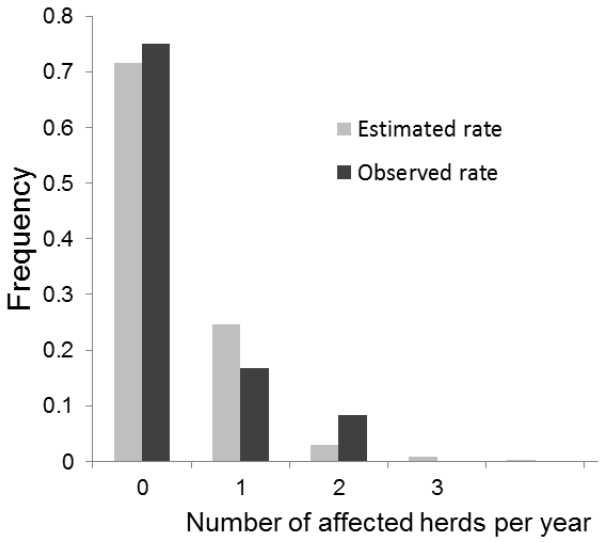
Assumption: Conditions that have resulted in observed infection events are constant
Entry is limited to within current DSA boundaries

Risk Assessment: Entry

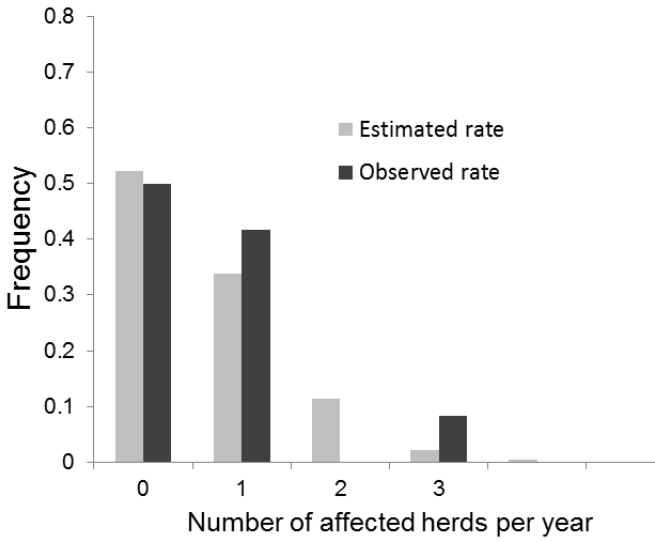
Data: Apparent Herd Prevalence, 2002-2013



Idaho



Montana

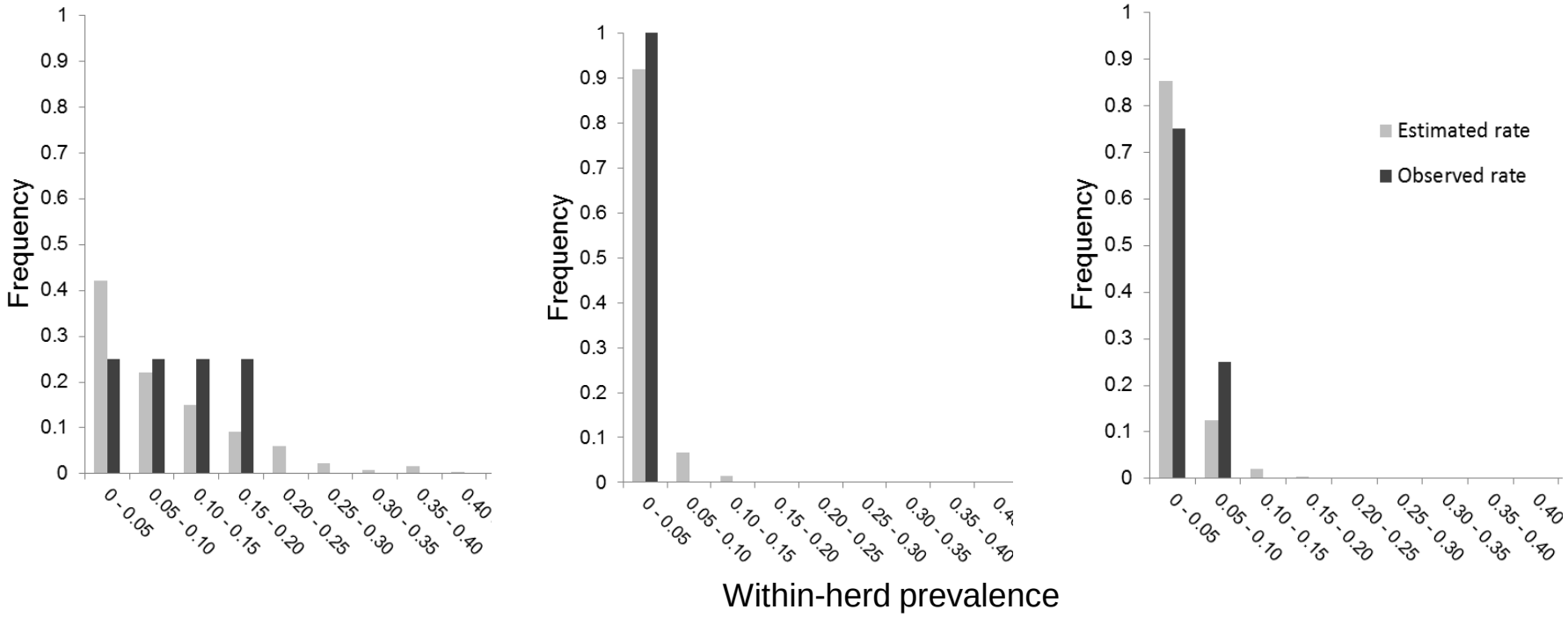


Wyoming

No statistical difference in apparent herd prevalence among states

Risk Assessment: Entry

Data: Within-Herd Prevalence, 2002-2013



Idaho Montana Wyoming

No statistical difference in within herd prevalence among states

Risk Assessment: Exposure

What is the probability of infected breeding cattle leaving the DSAs, undetected?

Exposure pathways:

- Breeding animals destined for breeding herds
- Feeding animals: test-eligible (sexually intact) removed from feeding chains post-movement (~4% NAHMS Feedlot)

Risk Assessment: Exposure

What is the probability of infected breeding cattle leaving the DSAs, undetected?

Data:

- **State brand inspection data** – number, size, and composition of shipments; number of DSA herds
- **NAHMs cow-calf survey** – supplement state shipment data, where necessary
- **DSA reviews** – number of DSA herds, testing regulations and compliance
- **Epidemiological reports** – apparent herd prevalence and within-herd prevalence

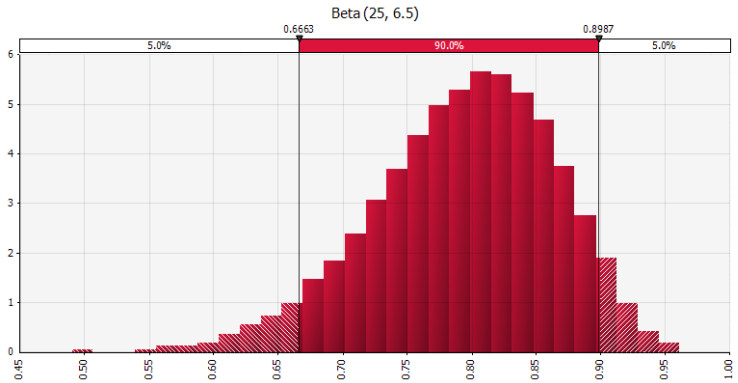
Risk Assessment: Exposure

What is the probability of infected breeding cattle leaving the DSAs, undetected?

Data:

- State brand inspection data
- NAHMs cow-calf survey
- DSA reviews
- Epi reports

Affected Herd prev → Within-herd prev → Out-shipments → Diagnostic testing



Sensitivity of:
RAP → FPA → CF
Test in series

Risk Assessment: Exposure

What is the probability of infected breeding cattle leaving the DSAs, undetected?

Data:

- State brand inspection data
- NAHMs cow-calf survey
- DSA reviews
- Epi reports

Affected Herd prev → Within-herd prev → Out-shipments → Diagnostic testing

Output:

rate of shipments leaving DSAs undetected with infected breeding cattle

Risk Assessment: Exposure

What is the probability of infected breeding cattle leaving the DSAs, **undetected**?

Full Testing per DSA plans: 100% testing of test-eligible animals
All breeding shipments, ~40% of feeding shipments

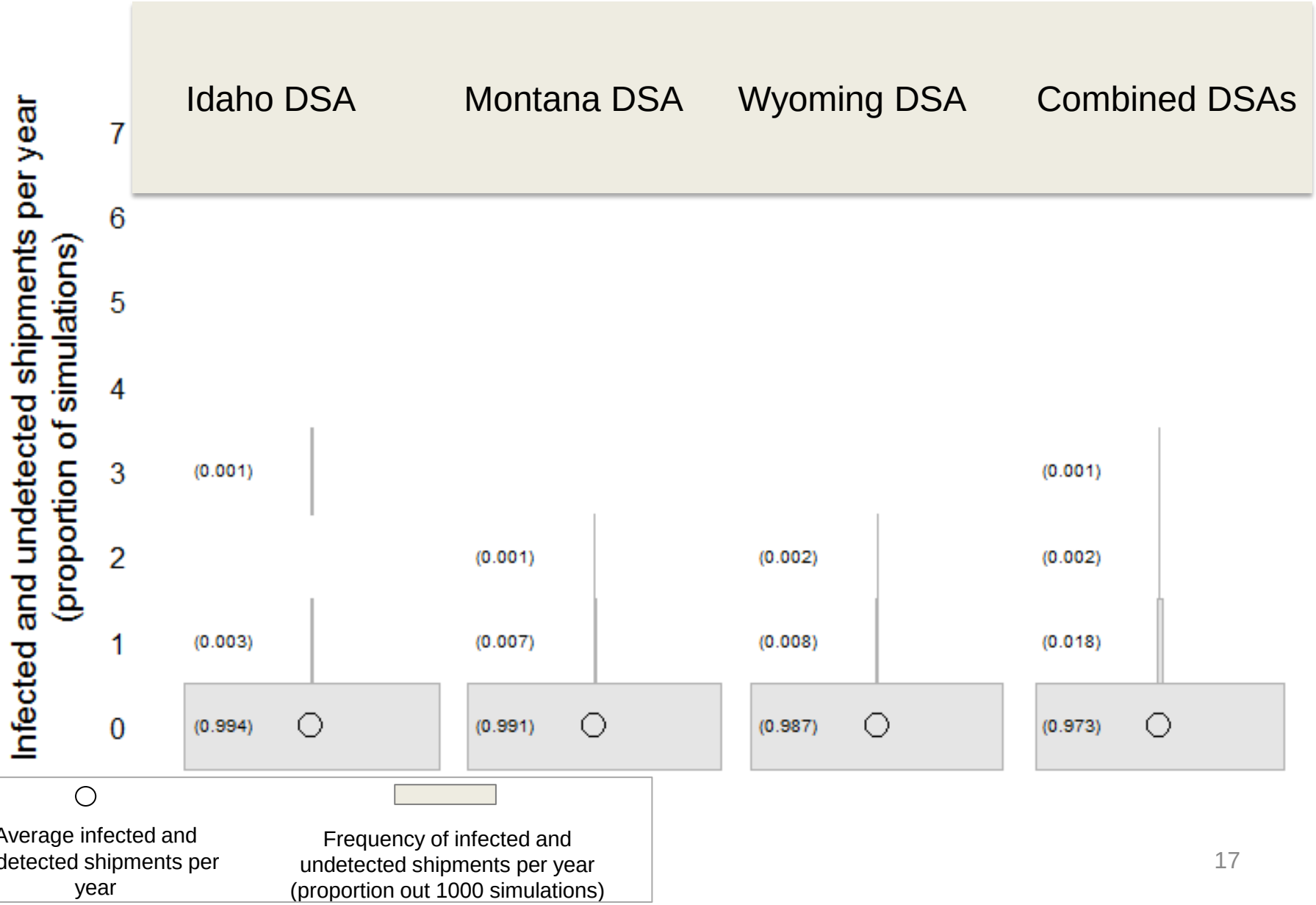
Assumption: Compliance with movement testing regulations is at (or very close to) 100%

Risk Assessment: Exposure

State	Estimated number of breeding shipments per year	Average exposure per year [99% IQR]	Years per 1 average exposure	Average exposure per 1000 shipments
Idaho	~250	**0.006** [0-0]	**167**	**0.024**
Montana	~1000	**0.009** [0-0]	**111**	**0.009**
Wyoming	~850	**0.012** [0-1]	**83**	**0.014**
Combined DSAs	~2100	**0.027** [0-1]	**37**	**0.013**

Assumptions: Exposure per state is independent
Entry conditions are constant

Risk Assessment: Exposure



Risk Mitigation

How much does post-entry testing and monitoring reduce exposure?

Average exposure per year		
	Exposure assessment	**With post-entry mitigations**
Idaho	0.006	<0.001 - 0.002
Montana	0.009	<0.001 – 0.003
Wyoming	0.012	<0.001 – 0.004
Full testing per DSA plan	0.027	0.001 – 0.010

Risk Estimation & Consequences

How much would an outbreak have to cost to equal $$ spent on post-movement testing?

Exposure rate x Post-entry detection x Outbreak cost

Entry and exposure assessment

Diagnostic sensitivity

Unknown

$$\frac{benefits\ (outbreak\ costs\ avoided)}{cost\ of\ maintaining\ post\ entry\ testsing} = 1$$

Accounting based on TAHC rules

Serological testing with pre- and post-calving health monitoring

Risk Estimation & Consequences

How much would an outbreak have to cost to equal $$ spent on post-movement testing?

Exposure rate x Post-entry detection x **Outbreak cost**

Break-Even value of mitigation
(not expected consequences)

Entry and exposure assessment

Diagnostic sensitivity

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$$\frac{benefits\ (outbreaks\ costs\ avoided)}{cost\ of\ maintaining\ post\ entry\ testsing} = 1$$

$$\frac{Cost\ of\ maintaining\ post\ entry\ testing}{Exposure\ rate * Post\ entry\ dectection} = benefits\ (outbreaks\ costs\ avoided)$$

Risk Estimation & Consequences

How much would an outbreak have to cost to equal $$ spent on post-movement testing?

Assumption:

- All breeding animals out of DSA are subject to post-movement mitigations
- No destination is more or less likely to receive infection = break-even value is the same for any receiving state

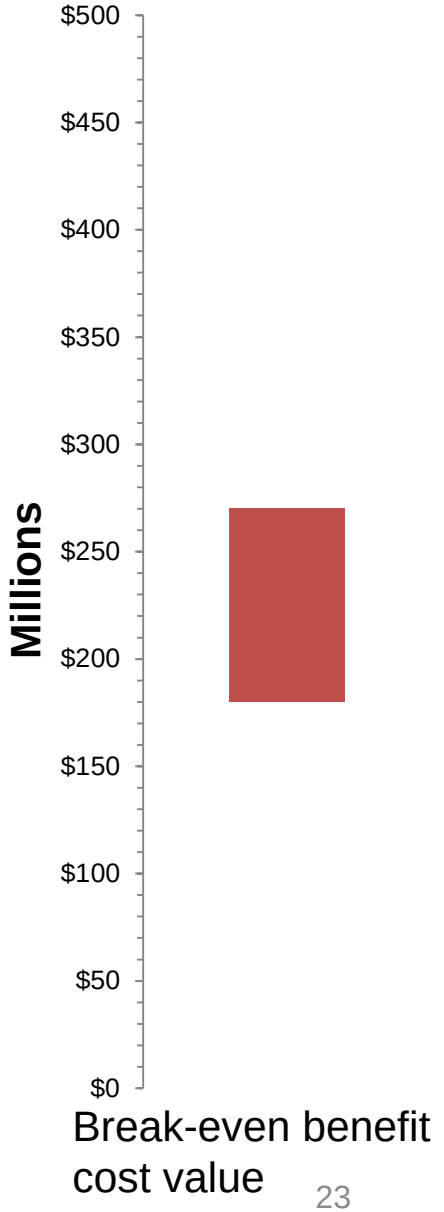
$$\frac{Cost\ of\ maintaining\ post\ entry\ testing}{Exposure\ rate * Post\ entry\ dectection} = benefits$$

Risk Estimation & Consequences

How much would an outbreak have to cost to equal $$ spent on post-movement testing?

$100M's

- $4.6M year^{-1} to test all breeding animals out of DSA
- Testing all DSA breeding animals = 40-60 years



Risk Estimation & Consequences

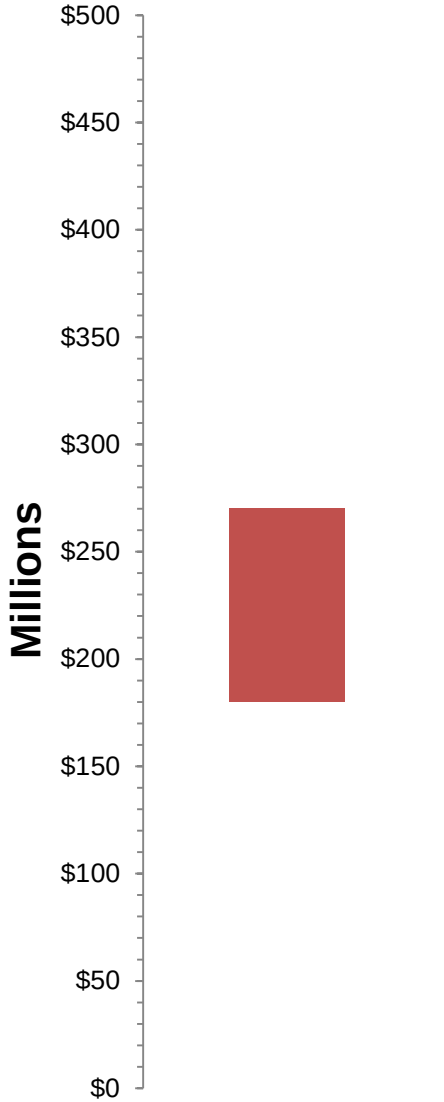
How much would an outbreak have to cost to equal $$ spent on post-movement testing?

Perspective…

- A hypothetically big outbreak (100 affected herds with 100k breeding head subject to GYA DSA-like response and testing) ~**$20-30M** cost[1]
- **1976**: Economic cost of **$120M** (2014 dollars)

  1% nation-wide herd infection rate (2012 NASS ~7000 herds)

  0.7% animal infection rate (2012 NASS ~ 480k head)
- USDA slaughter surveillance goal is 1 in 100k



[1] 2008 MT economic assessment of DSA and Wilson (2011)- UWyo upper estimate of cost to producer of brucellosis in 400 head breeding herd test and slaughter

Information Gaps and Limitations

Entry and Exposure

- Undetected herds or time to detection
- Can't explicitly account for variation owing to vaccination, elk dynamics, herd management, spatial location etc.
  - but we don't need to under the objectives of the RA
- Can't account for risk outside DSA boundaries
- Assumes relatively constant conditions
- Limitations on movement data to
  - Number of herds in DSA?
  - Link shipments to herds?

Consequences

- Epidemiological consequences- prospective modeling
- Impact of reduced national surveillance

Questions?

VS CEAH project team

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Data Collection and Entry

State brand inspection divisions
Colorado State University- Dr. Colleen Webb

Risk Assessment Working group

Colorado Department of Agriculture
Idaho Department of Agriculture
Montana Division of Livestock
South Dakota Animal Industry Board
Texas Animal Health Commission
Wyoming Livestock Board
USDA VS District 5: ADD's, Field Personnel, and Director's office