Biosecurity and Zoonotic Disease Risk at Livestock Exhibition Events

Diane Larson, DVM
MPH Candidate
Infectious Diseases/Zoonoses
Field Experience

• Kansas Department of Agriculture, Division of Animal Health (KDAH)
  • Manhattan, Kansas
  • May 2016 – May 2017
• Preceptor: Tarrie Crnic, DVM, MPH
• Focus: Animal and zoonotic disease risk and prevention at livestock exhibition events
Kansas State Fair Biosecurity Plan

• Designed by previous intern in 2015
  • John Lawrence, DVM, MPH

• Includes
  • Animal traceability
  • Controlled animal movement
  • Infectious disease control
  • Public health

• Evidence needed: Exhibitor biosecurity practices and zoonotic disease risk on the fairgrounds
Kansas 4-H Biosecurity Survey
Background

• Recent animal disease outbreaks in the United States have put the spotlight on biosecurity
  • Porcine epidemic diarrhea virus, 2013
  • Highly pathogenic avian influenza, 2015
  • Equine herpesvirus myeloencephalopathy, 2016
• Exhibition events inherently pose a large risk for infectious disease spread among animals
Kansas State Fair (KSF)

• Currently the largest animal exhibition event in Kansas

• 6274 total animal entries (2016)
  • Beef and dairy cattle – 1233
  • Sheep – 1197
  • Dairy and meat goats – 1103
  • Poultry and pigeons – 900
  • Rabbits – 745
  • Swine – 581
  • Horses – 515
Kansas State Fair

• Youth Shows (4-H and FFA)
  • Sheep – 529
  • Swine – 462
  • Beef cattle – 343
  • Meat goats – 202
• 4-H horses – 178 exhibitors
  (horse count not available)
Biosecurity on the Fairgrounds

• No record of what animals are on the fairgrounds
  • No check out process at the end of the show
  • Stalling records only for equine events, no entries
• Barns are turned over multiple times during the fair
• KDAH wanted to know the biosecurity practices that exhibitors use at exhibition events
  • Help understand the potential impact a disease outbreak could have at an event
  • Educate youth about the importance of biosecurity in protecting animal health
Kansas 4-H Biosecurity Survey

• KDAH partnered with the KSRE 4-H Office
• Survey of families enrolled in 4-H animal projects during 2015-2016

• Objectives
  • Understand current biosecurity knowledge and practices of youth exhibitors
  • Provide recommendations to KSRE on where to focus future education and outreach efforts
Methods

- Formsite – online survey builder
- Survey sent to approximately 3900 families
  - November 15 – 30, 2016
  - Asked for one submission per household
  - Multiple submissions not allowed
  - Anonymous entries (no IP addresses stored)
## Survey Results

937 responses – 24% response rate

### Exhibitions where 4-H families showed their animals in 2016

<table>
<thead>
<tr>
<th>Show(s)</th>
<th>Number of Families</th>
<th>Overall Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>County fair only</td>
<td>542</td>
<td>67.2%</td>
</tr>
<tr>
<td>County fair + KSF + KJLS</td>
<td>119</td>
<td>14.7%</td>
</tr>
<tr>
<td>County fair + KSF</td>
<td>90</td>
<td>11.2%</td>
</tr>
<tr>
<td>County fair + KJLS</td>
<td>43</td>
<td>5.3%</td>
</tr>
<tr>
<td>Kansas State Fair (KSF) only</td>
<td>6</td>
<td>0.7%</td>
</tr>
<tr>
<td>A different exhibition</td>
<td>4</td>
<td>0.5%</td>
</tr>
<tr>
<td>KSF + KJLS</td>
<td>2</td>
<td>0.2%</td>
</tr>
<tr>
<td>Kansas Junior Livestock Show (KJLS) only</td>
<td>1</td>
<td>0.1%</td>
</tr>
</tbody>
</table>
The fate of exhibition animals at the end of county fairs in Kansas in 2016†

<table>
<thead>
<tr>
<th>Animal Type</th>
<th>Home</th>
<th>Another Show</th>
<th>Sold at Auction</th>
<th>Other**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cattle</td>
<td>54.8%</td>
<td>7.4%</td>
<td>33.5%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>92.3%</td>
<td></td>
<td>7.7%</td>
<td></td>
</tr>
<tr>
<td>Dairy goats</td>
<td>94.4%</td>
<td></td>
<td>5.6%</td>
<td></td>
</tr>
<tr>
<td>Meat goats</td>
<td>38.7%</td>
<td>5.9%</td>
<td>51.5%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Poultry</td>
<td>87.8%</td>
<td></td>
<td>1.5% 8.4% 2.3%</td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>39.9%</td>
<td>11.4%</td>
<td>42.1%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Swine</td>
<td>33.5%</td>
<td>5.6%</td>
<td>46.1%</td>
<td>14.8%</td>
</tr>
<tr>
<td>Horses*‡</td>
<td>95.3%</td>
<td></td>
<td></td>
<td>2.9%</td>
</tr>
</tbody>
</table>

†1836 responses

*Sold at auction was not an option to select for horses
‡Another show: 2.9%; other: 1.8%
**Responses given for other included: custom feeding for own consumption; butcher or slaughterhouse; meat locker; private sale; sold back to breeder; and boarding facilities (horses).
The fate of exhibition animals at the end of the Kansas State Fair in 2016†

<table>
<thead>
<tr>
<th>Animal</th>
<th>Home</th>
<th>Another Show</th>
<th>Sold at Auction</th>
<th>Other**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef cattle‡</td>
<td>68.9%</td>
<td>28.4%</td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td>Dairy cattle</td>
<td>100.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy goats</td>
<td>83.3%</td>
<td>16.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meat goats</td>
<td>60.5%</td>
<td>39.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td>90.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep</td>
<td>55.8%</td>
<td>27.3%</td>
<td>10.4%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Swine</td>
<td>67.6%</td>
<td>17.6%</td>
<td>5.4%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Horses*</td>
<td>91.1%</td>
<td></td>
<td></td>
<td>4.4%</td>
</tr>
</tbody>
</table>

†333 responses
*Sold at auction* was not an option to select for horses
**Responses given for other included: butcher or slaughterhouse; meat locker; a breeder; and training and boarding facilities (horses).
The fate of exhibition animals at the end of the Kansas Junior Livestock Show in 2016†

![Bar chart showing the fate of different types of animals.](chart)

- **Beef cattle**: 69.8% Home, 12.0% Another Show, 8.4% Sold at Auction, 9.6% Other*
- **Meat goats**: 50.0% Home, 12.9% Another Show, 29.6% Sold at Auction, 7.4% Other*
- **Sheep**: 55.2% Home, 10.4% Another Show, 25.3% Sold at Auction, 8.9% Other*
- **Swine**: 64.4% Home, 13.5% Another Show, 10.1% Sold at Auction, 11.8% Other*

†263 responses

**Responses given for other included: private sale; butcher or slaughterhouse; and meat locker.**
Families that showed susceptible species at each exhibition in 2016

<table>
<thead>
<tr>
<th>Species</th>
<th>County Fairs</th>
<th>Kansas State Fair</th>
<th>Kansas Junior Livestock Show</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMD susceptible*</td>
<td>713 families</td>
<td>224 families</td>
<td>165 families</td>
</tr>
<tr>
<td>Al susceptible**</td>
<td>125</td>
<td>11</td>
<td>Not applicable</td>
</tr>
<tr>
<td>EHV-1 susceptible***</td>
<td>164</td>
<td>45</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

* Cattle, sheep, goats, and swine
** Chickens, turkeys, and ducks
*** Horses and donkeys

These numbers demonstrate the impact and extent of the potential spread a disease outbreak could have at one of these exhibitions in Kansas.
## Biosecurity measures taken by exhibitors before an exhibition event†

<table>
<thead>
<tr>
<th>Measure</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Most of the time</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check animals for symptoms of disease*</td>
<td>39.9%</td>
<td>14.8%</td>
<td>80.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disinfect equipment</td>
<td>12.1%</td>
<td>13.9%</td>
<td>22.4%</td>
<td>25.7%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Disinfect the outside of truck</td>
<td>41.3%</td>
<td></td>
<td>26.2%</td>
<td>14.7%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Disinfect livestock trailer</td>
<td>30.2%</td>
<td>20.9%</td>
<td>19.7%</td>
<td>15.2%</td>
<td>14.1%</td>
</tr>
<tr>
<td>Disinfect footwear</td>
<td>31.4%</td>
<td>25.1%</td>
<td>20.2%</td>
<td>12.2%</td>
<td>11.1%</td>
</tr>
</tbody>
</table>

†752 – 761 responses per question

*Never: 0.9%; rarely: 0.8%; sometimes: 3.0%
<table>
<thead>
<tr>
<th>Biosecurity measures taken by exhibitors while at an exhibition event†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfect the pen/stall prior to housing animals</td>
</tr>
<tr>
<td>Prevent physical contact between your animals and other</td>
</tr>
<tr>
<td>exhibitors' animals</td>
</tr>
<tr>
<td>Touch/handle other exhibitors' animals</td>
</tr>
<tr>
<td>Allow visitors to touch your animals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
</tr>
<tr>
<td>43.7%</td>
</tr>
<tr>
<td>9.9%</td>
</tr>
<tr>
<td>14.9%</td>
</tr>
<tr>
<td>6.9%</td>
</tr>
</tbody>
</table>

†743 – 747 responses per question
Sharing Equipment

- 330 families (44%) reported that they do share equipment at exhibition events
- 421 families (56%) said they do not share equipment

How often families who share equipment disinfect shared equipment before using it with their animal(s)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>100 (30.5%)</td>
<td></td>
</tr>
<tr>
<td>Rarely</td>
<td>99 (30.2%)</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>82 (25%)</td>
<td></td>
</tr>
<tr>
<td>Most of the time</td>
<td>27 (8.2%)</td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>20 (6.1%)</td>
<td></td>
</tr>
</tbody>
</table>
Biosecurity measures taken by exhibitors after an exhibition event†

- **Wash the clothes you wore at the event**: 95.0% Always, 0% Never
- **Disinfect equipment**: 23.5% Always, 15.7% Never
- **Disinfect outside of truck**: 9.1% Always, 44.4% Never
- **Disinfect livestock trailer**: 15.9% Always, 33.4% Never
- **Disinfect footwear**: 14.2% Always, 32.9% Never

†730 – 736 responses per question
*Never: 0.5%; rarely: 0.1%; sometimes: 0.8%; most of the time: 3.5%
Length of quarantine of exhibition animals after returning home from an exhibition

<table>
<thead>
<tr>
<th>Length of Quarantine</th>
<th>1 – 7 days</th>
<th>8 – 14 days</th>
<th>15 – 21 days</th>
<th>&gt;21 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not quarantine</td>
<td>513 (69.6%)*</td>
<td>89 (12.1%)</td>
<td>67 (9.1%)</td>
<td>12 (1.6%)</td>
</tr>
<tr>
<td>1 – 7 days</td>
<td>89 (12.1%)</td>
<td>67 (9.1%)</td>
<td>12 (1.6%)</td>
<td>56 (7.6%)</td>
</tr>
<tr>
<td>8 – 14 days</td>
<td>67 (9.1%)</td>
<td>12 (1.6%)</td>
<td>56 (7.6%)</td>
<td>513 (69.6%)*</td>
</tr>
<tr>
<td>15 – 21 days</td>
<td>12 (1.6%)</td>
<td>56 (7.6%)</td>
<td>513 (69.6%)*</td>
<td>89 (12.1%)</td>
</tr>
<tr>
<td>&gt;21 days</td>
<td>56 (7.6%)</td>
<td>513 (69.6%)*</td>
<td>89 (12.1%)</td>
<td>67 (9.1%)</td>
</tr>
</tbody>
</table>

*153 families (20.8%) said they do not quarantine because they do not have other non-4-H animals on their property
Identified Knowledge Gaps

• Lack of general understanding of disease transmission and biosecurity principles
• The importance of quarantining exhibition animals upon returning home from events
• The benefits to avoiding sharing equipment with other exhibitors
• The importance of disinfection in preventing disease spread
Survey Limitations

• <30% response rate
  • Single mode survey
  • Survey distributed around Thanksgiving
  • Uncomfortable with online format or government survey?
• 4-H is only a portion of youth exhibitors in Kansas
  • FFA
  • Open classes
• Unable to collect data by county
Recommendations for KSRE

• Education about all major exhibition species
  • Cattle, sheep, goats, swine, poultry, horses, and rabbits
• Disease transmission
  • Foundational knowledge for understanding biosecurity principles
• Relationship with a veterinarian
  • 76.8% of families reported working with one; 23.1% reported knowing one they could use
  • Continue to emphasize importance of this
Recommendations for KSRE

• Quarantining exhibition animals upon returning home
  • 21 days is ideal
  • Monitor daily for clinical signs of disease
  • Use separate clothing and equipment
• “What happens at the fair, stays at the fair”
  • Do not bring home extra feed and bedding
  • Clean and disinfect all tools and equipment that are brought home
Kansas State Fair
Observational Study
Kansas State Fair

- Largest attended event in Kansas
  - Hutchinson, Kansas
  - September 9 – 17, 2016
  - 359,808 fairgoers in 2016
  - Current record is 369,322 (2015)
- 113 year history
- Major purpose – celebrate and promote the animal agriculture industry in Kansas
Animal Contact Exhibits

• Many documented outbreaks of zoonotic diseases due to animal contact events in the United States
  • 450,000 annual cases of enteric diseases
• Seven states have laws requiring hand hygiene stations at animal contact exhibits
  • Kansas is not one of them

• No documented zoonotic disease outbreaks at the Kansas State Fair to-date
KSF Observational Study

Objectives

• Demonstrate evidence of zoonotic disease risk in the animal exhibits
• Provide the fair with zoonotic disease risk mitigation strategies
  • Support traditions of the event
  • Protect public health while not discouraging attendance
  • Tailor strategies to their current facilities
Methods

Facility Assessment

• Hand hygiene stations
• Educational signage
  • Zoonotic disease risk
  • Hand hygiene
• Concession stands
• Trashcans
• Major visitor entrances/exits to the exhibits
Methods

Observational Study

• Monitored visitor behavior for 30 minutes inside each animal exhibit over the first nine days of the fair – only when there were animals and/or visitors present in the exhibit
Methods

• Visitor Behavior
  • Hand hygiene
    • Walked by a hand hygiene station on their way out of an exhibit or on their way to a concession stand inside an exhibit
  • High-risk behaviors
    • Eating and/or drinking; using pacifiers or teething toys; touching animals; touching animal enclosure with hands or face; hand-to-face behaviors; sitting on ground; and stepping in manure

• Visitor-owned fomites
## Results: Facility Assessment

### Number of hand hygiene stations present in each animal exhibit

<table>
<thead>
<tr>
<th>Animal Exhibit</th>
<th>Number of hand sanitizing stations</th>
<th>Number of handwashing stations*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthing Center</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Dairy Tie Barn</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Expo Center</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Expo II</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Horse Barn</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Livestock Annex</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Petting Zoo</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Prairie Pavilion</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Rabbit and Poultry Barn</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Sheep, Swine, and Goat Barn</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*Does not include restrooms*
Hand hygiene station maintenance in the animal exhibits throughout the duration of the fair

<table>
<thead>
<tr>
<th>Animal Exhibit</th>
<th>% of days hand hygiene stations fully stocked*</th>
<th>Number of times visitors were unable to clean hands*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthing Center</td>
<td>55.6% (5/9)</td>
<td>20</td>
</tr>
<tr>
<td>Dairy Tie Barn</td>
<td>100% (1/1)</td>
<td>0</td>
</tr>
<tr>
<td>Expo Center</td>
<td>88.9% (8/9)</td>
<td>13</td>
</tr>
<tr>
<td>Livestock Annex</td>
<td>75% (3/4)</td>
<td>1</td>
</tr>
<tr>
<td>Petting Zoo</td>
<td>55.6% (5/9)</td>
<td>45</td>
</tr>
<tr>
<td>Prairie Pavilion</td>
<td>71.4% (5/7)</td>
<td>0</td>
</tr>
<tr>
<td>Rabbit and Poultry Barn</td>
<td>77.8% (7/9)</td>
<td>1</td>
</tr>
<tr>
<td>Sheep, Swine, and Goat Barn</td>
<td>100% (6/6)</td>
<td>0</td>
</tr>
</tbody>
</table>

*During the observation periods
## Hand hygiene and zoonotic disease risk signs in each animal exhibit

<table>
<thead>
<tr>
<th>Animal Exhibit</th>
<th>Hand hygiene signs (number present)*</th>
<th>Zoonotic disease risk signs (number present)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthing Center</td>
<td>yes (9)</td>
<td>no</td>
</tr>
<tr>
<td>Dairy Tie Barn</td>
<td>yes (10)</td>
<td>no</td>
</tr>
<tr>
<td>Expo Center</td>
<td>yes (14)</td>
<td>no</td>
</tr>
<tr>
<td>Expo II</td>
<td>yes (1)</td>
<td>no</td>
</tr>
<tr>
<td>Horse Barn</td>
<td>yes (3)</td>
<td>no</td>
</tr>
<tr>
<td>Livestock Annex</td>
<td>yes (4)</td>
<td>no</td>
</tr>
<tr>
<td>Petting Zoo</td>
<td>yes (7)</td>
<td>yes (1)</td>
</tr>
<tr>
<td>Prairie Pavilion</td>
<td>yes (23)</td>
<td>no</td>
</tr>
<tr>
<td>Rabbits and Poultry Barn</td>
<td>yes (19)</td>
<td>yes (7)</td>
</tr>
<tr>
<td>Sheep, Swine, and Goat Barn</td>
<td>yes (11)</td>
<td>no</td>
</tr>
</tbody>
</table>

*Includes the signs present on the hand sanitizer stations.
Hand Hygiene Signs

Because we care about your health,
please wash your hands after any animal
activity or animal contact.

Porque nosotros queremos cuidar su
salud, por favor lavese las manos
después de cualquier actividad o
contacto con los animales

ALWAYS WASH HANDS:
- After touching animals or their living areas
- After leaving the animal area
- After taking off dirty clothes or shoes
- After going to the bathroom
- Before preparing foods, eating or drinking
Zoonotic Disease Risk Signs

Reduce Your Risk
- Wash your hands after touching the animals or their environment.
- No hand-to-mouth contact, such as eating, smoking or nailbiting.
- Use special caution if you are pregnant, elderly, have children under 5 or have an existing health condition.

WARNING
When entering a potential risk area, avoid hand-mouth activities. Contact with animals may possibly cause diarrhea, hemorrhagic colitis, renal failure, and death. Small children, pregnant women, elderly, and the immune deficient are the most susceptible.

Protect Yourself and Your Family from Germs
- Wash your hands thoroughly with soap and water right after touching live poultry or anything in the area where they live and eat.
- Adults should supervise hand washing for young children.

DOs:
- Wash your hands thoroughly with soap and water.
- Keep your hands clean when handling food or eating.

DON'Ts:
- Don't touch live poultry or the environment where they are kept.
- Don't let children under 5 years of age, elderly persons, or people with weak immune systems handle or eat live poultry, eggs, or contact droppings.
- Don't let live poultry or their droppings enter the house in the presence of food or eatable surfaces.
- Don't let live poultry or their droppings touch your mouth, eyes, or nose.
- Don't swim or drink water from areas where live poultry or their droppings have been.
Total number of high-risk behaviors observed being performed by visitors in the Birthing Center over nine days of observation

*One notable observation was children eating ice cream cones while touching the few-day-old chicks.

**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.
Total number of high-risk behaviors observed being performed by visitors in the Dairy Tie Barn over one day of observation

<table>
<thead>
<tr>
<th>Behavior Description</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating or drinking</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Using pacifiers or teething toys</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Touching animals</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Animals’ licking skin or clothes</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Touching animal enclosures with hands</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Touching animal enclosures with face</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Touching hands to face/mouth*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Falling down or sitting on ground</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Stepping in manure</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Behaviors include biting nails, rubbing eyes, sucking thumb, etc.
Total number of high-risk behaviors observed being performed by visitors in the Expo Center over nine days of observation

*“The Feed Bunk” concession stand is located inside this exhibit.

**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.
Total number of high-risk behaviors observed being performed by visitors in Expo II over one day of observation

*Behaviors include biting nails, rubbing eyes, sucking thumb, etc.
Total number of high-risk behaviors observed being performed by visitors in the Livestock Annex over four days of observation

*Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

**This is likely a gross underestimate. There were shavings in the walkways during the goat shows and manure and straw on the walkways during the Watusi and Longhorn display.
Total number of high-risk behaviors observed being performed by visitors in the Petting Zoo over nine days of observation

*Feeding the animals either with their hands or the shovels provided by the Petting Zoo.
**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.
Total number of high-risk behaviors observed being performed by visitors in the Prairie Pavilion over seven days of observation

- Eating or drinking: 459
- Using pacifiers or teething toys: 127
- Touching animals: 0
- Animals’ licking skin or clothes: 0
- Touching animal enclosures with hands: 4
- Touching animal enclosures with face**: 0
- Touching hands to face/mouth: 8
- Falling down or sitting on ground: 1
- Stepping in manure**: 82

*The “Cattleman’s Café” concession stand is located inside this exhibit.

**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

***This is likely a gross underestimate. The walkways were covered in manure from cattle moving to the wash rack and show ring.
Total number of high-risk behaviors observed being performed by visitors in the Rabbit and Poultry Barn over nine days of observation

*Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

**This is likely a gross underestimate. The walkways were often covered in litter and shavings from the bird cages.
Total number of high-risk behaviors observed being performed by visitors in the Sheep, Swine, and Goat Barn over nine days of observation

*Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

**This is likely a gross underestimate. The walkways were often covered in shavings from the animal pens.
Total number of visitor-owned fomites observed in each animal exhibit during the observation period

<table>
<thead>
<tr>
<th>Animal Exhibit</th>
<th>Strollers and Wagons</th>
<th>Walkers and Canes</th>
<th>Wheelchairs and Scooters</th>
<th>Total Dogs (Service Dogs)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birthing Center</td>
<td>171</td>
<td>16</td>
<td>44</td>
<td>0</td>
</tr>
<tr>
<td>Dairy Tie Barn</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Expo Center</td>
<td>95</td>
<td>20</td>
<td>37</td>
<td>4 (3)</td>
</tr>
<tr>
<td>Expo II</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Livestock Annex</td>
<td>52</td>
<td>2</td>
<td>4</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Petting Zoo**</td>
<td>16</td>
<td>4</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Prairie Pavilion</td>
<td>107</td>
<td>8</td>
<td>33</td>
<td>10 (5)</td>
</tr>
<tr>
<td>Rabbits and Poultry Barn</td>
<td>134</td>
<td>14</td>
<td>63</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Sheep, Swine, and Goat Barn</td>
<td>89</td>
<td>10</td>
<td>18</td>
<td>3 (2)</td>
</tr>
</tbody>
</table>

*These were the presumed to be service dogs. There was no definite way to determine if they were true service dogs or not.

**There was a designated stroller park outside the entrance of the petting zoo. The strollers parked there were not included in the count.
Average percentage† and range of adults and children that used hand hygiene stations before exiting the animal exhibit or going to a concession stand* inside the animal exhibit

†Percentages were averaged over the number of days each animal building/exhibit was observed.
*The Expo Center and the Prairie Pavilion each have a concession stand within the building.
Findings

Facilities Assessment

• Inadequate number of hand hygiene stations in the animal exhibits
• Poor maintenance of hand hygiene stations
• Insufficient educational signage
  • Zoonotic disease risk
• Dirty floors and picnic tables
Findings

Observational Study

• Poor hand hygiene compliance
• Large amount of high-risk behaviors observed
  • Eating and drinking – animal exhibits with concession stands
  • Touching animal enclosures
• Many visitor-owned fomites in the animal exhibits
  • Many are necessary for comfortably navigating the fairgrounds
Study Limitations

• Did not collect the volume of data originally desired
  • Volunteers unable to participate
  • Only two days with >1 observer
  • Not every hand hygiene station could be observed
  • Smaller area for observation of high-risk behavior
• Inability to record the number of visitors inside the exhibits during the observation periods
  • Limited to descriptive statistics
Recommendations

Facilities

• Trashcans should be located by every visitor entrance to the animal exhibits
• Floors in the animal exhibits should be kept clean and free of manure and soiled bedding
• Picnic tables in the animal exhibits should be cleaned and sanitized as needed throughout the day
• Non-exhibition dogs should not be allowed on the fairgrounds, except for service dogs covered by the ADA
Recommendations

Facilities

• Meals should not be served in the Prairie Pavilion nor any other animal exhibits
  • Grand Drive dinner
  • Beef appreciation ice cream social
• Until these can be moved, provide hand hygiene stations at the beginning of the food line and have staff encourage hand hygiene
Recommendations

Hand Hygiene Stations

• Washing hands with soap and water is more effective than hand sanitizer in the presence of organic material
• Increase number of stations in each exhibit
• Strategic placement near the animal exhibit exits, concession stands within the exhibits, and the fairground gates
• Improve maintenance throughout the day
Recommendations

Public Education

• Improve educational signage
  • Hand hygiene
  • Zoonotic disease risk – clinical disease/symptoms; high-risk behaviors; and susceptible populations
  • English and Spanish
• KSF website
  • Clean and disinfect strollers, wheelchairs, canes, etc.
Recommendations

Personnel

- Train staff and volunteers about zoonotic disease risk and the importance of hand hygiene
  - Have them encourage visitors to reduce their risk
- Proper Kansas State Fair identification
  - More reliable and influential
Recommendations

Outreach

- Reno County Health Department and Kansas Department of Health and Environment
  - Funding, training, materials, personnel
- 4-H and FFA
MPH Core Competencies

• **Biostatistics** – critically assess statistical analyses in scientific literature; apply descriptive statistical methods to public health studies

• **Environmental Health Sciences** – zoonotic diseases as potential environmental diseases; susceptible populations to specific exposures; disposal of carcasses and dairy products; chemicals for disinfection

• **Epidemiology** – identify ways to prevent zoonotic disease transmission indirectly without eliminating the diseases themselves; identify biases and limitations in scientific studies to assess validity
MPH Core Competencies

• Health Service Administration – public health programs can help reduce the need for individual healthcare services; Hispanic population may be underserved in healthcare

• Social and Behavior Sciences – how the different levels of society affect human behavior; how and why people perceive risk; identify ways to effectively alter fairgoer and exhibitor behavior to reduce health risks of people and animals
Thank you!

- Kansas Division of Animal Health
  - Dr. Tarrie Crnic
  - Drs. Bill Brown and Justin Smith
  - Kendra Frasier
- Kansas State University
  - Dr. Ellyn Mulcahy
  - Drs. Keith Hamilton and Lina Mur
  - Barta Stevenson
Questions?
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