



Biosecurity and Zoonotic Disease Risk at Livestock Exhibition Events

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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)

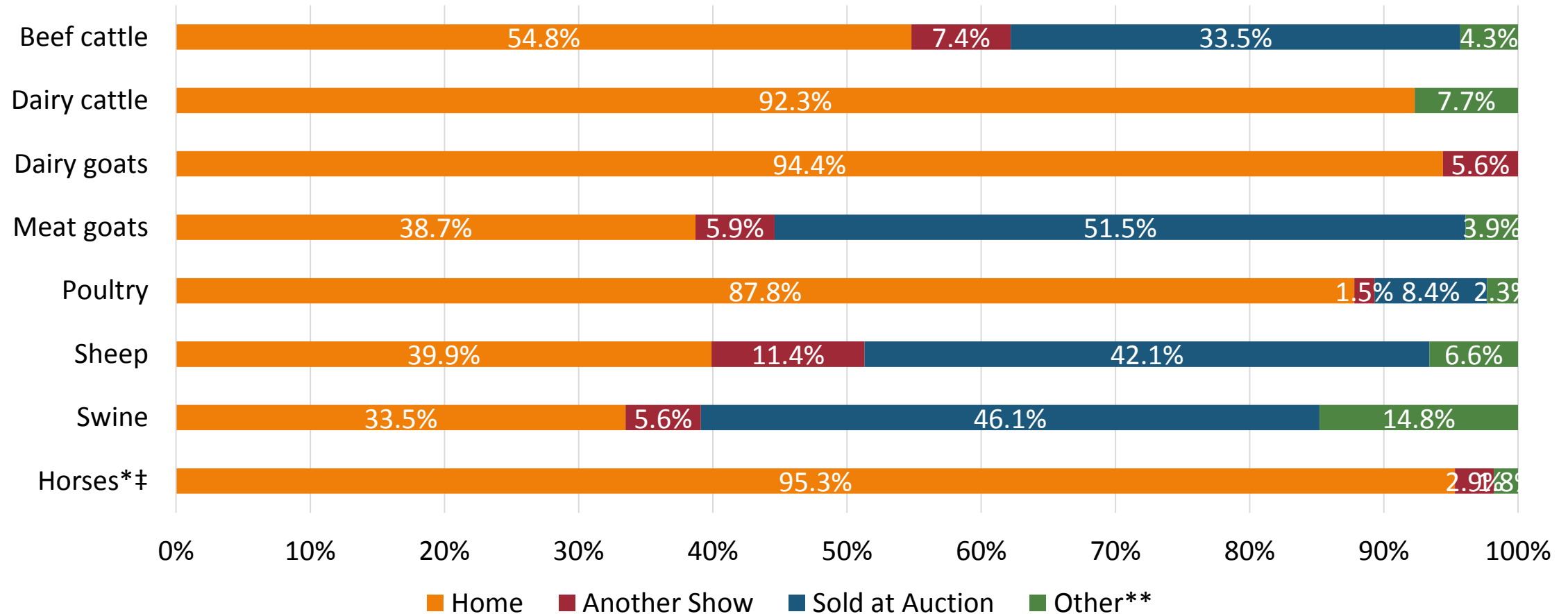
Survey Results

937 responses – 24% response rate

Exhibitions where 4-H families showed their animals in 2016

Show(s)	Number of Families	Overall Percentage
County fair only	542	67.2%
County fair + KSF + KJLS	119	14.7%
County fair + KSF	90	11.2%
County fair + KJLS	43	5.3%
Kansas State Fair (KSF) only	6	0.7%
A different exhibition	4	0.5%
KSF + KJLS	2	0.2%
Kansas Junior Livestock Show (KJLS) only	1	0.1%

The fate of exhibition animals at the end of county fairs in Kansas in 2016[†]



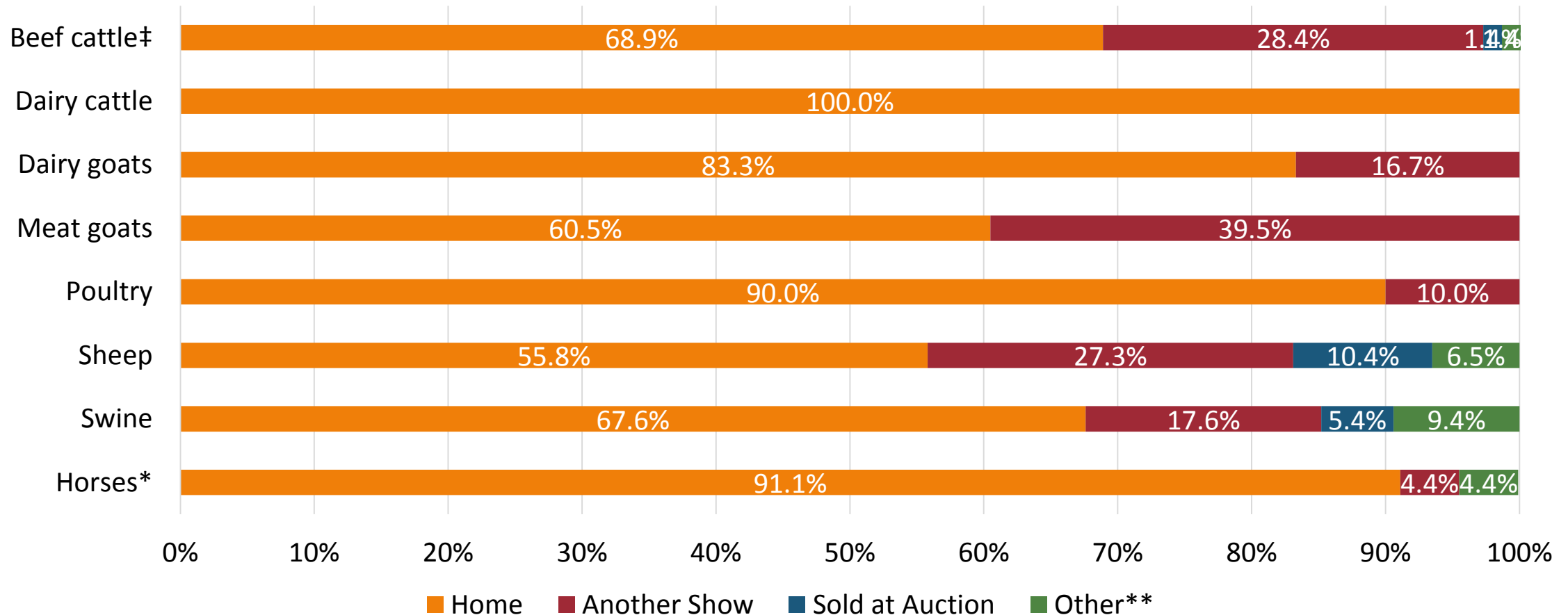
[†]1836 responses

**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[†]



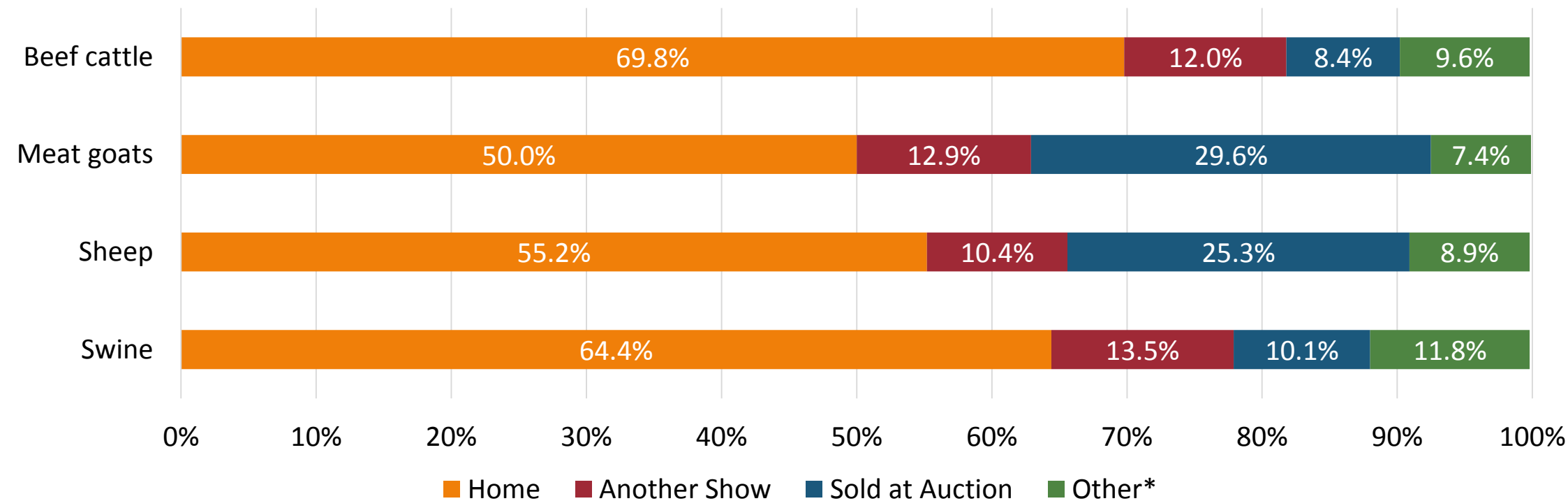
[†]333 responses

**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).

‡Sold at auction: 1.4%; other: 1.4%

The fate of exhibition animals at the end of the Kansas Junior Livestock Show in 2016[†]



[†]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

Species	County Fairs	Kansas State Fair	Kansas Junior Livestock Show
FMD susceptible*	713 families	224 families	165 families
AI susceptible**	125	11	Not applicable
EHV-1 susceptible***	164	45	Not applicable

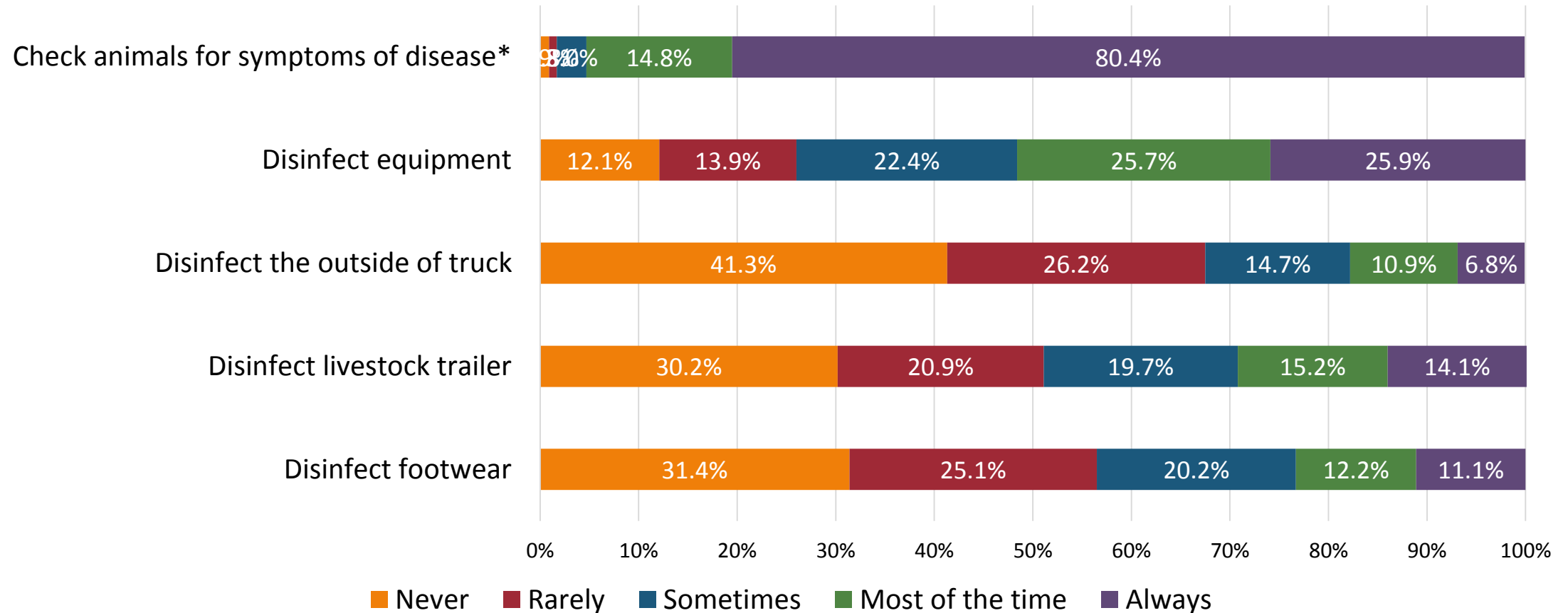
*Cattle, sheep, goats, and swine

**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.

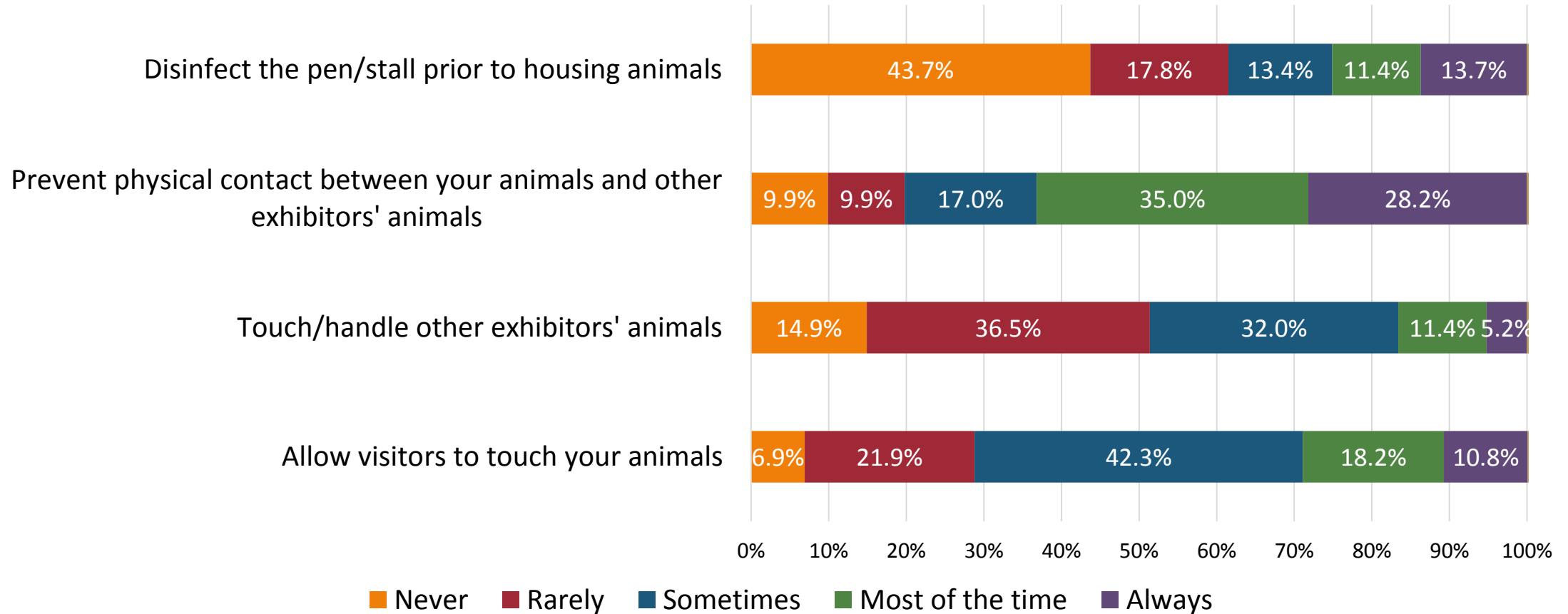
Biosecurity measures taken by exhibitors before an exhibition event[†]



[†]752 – 761 responses per question

*Never: 0.9%; rarely: 0.8%; sometimes: 3.0%

Biosecurity measures taken by exhibitors while at an exhibition event[†]



[†]743 – 747 responses per question

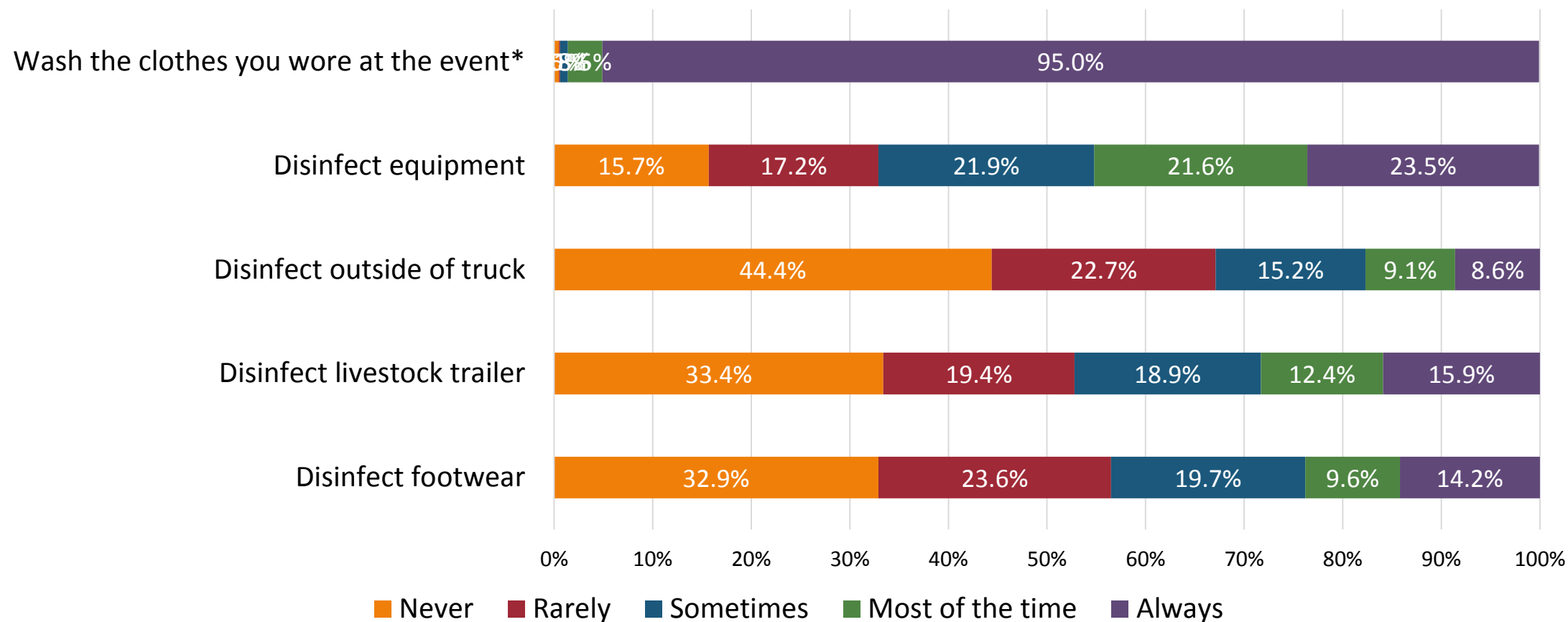
Sharing Equipment

- 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)

Never	Rarely	Sometimes	Most of the time	Always
100 (30.5%)	99 (30.2%)	82 (25%)	27 (8.2%)	20 (6.1%)

Biosecurity measures taken by exhibitors after an exhibition event[†]



[†]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

Do not quarantine	1 – 7 days	8 – 14 days	15 – 21 days	>21 days
513 (69.6%)*	89 (12.1%)	67 (9.1%)	12 (1.6%)	56 (7.6%)

*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

Animal Exhibit	Number of hand sanitizing stations	Number of handwashing stations*
Birthing Center	2	1
Dairy Tie Barn	2	0
Expo Center	2	0
Expo II	0	0
Horse Barn	0	0
Livestock Annex	2	0
Petting Zoo	3	0
Prairie Pavilion	5	0
Rabbit and Poultry Barn	3	0
Sheep, Swine, and Goat Barn	2	0

*Does not include restrooms

Hand hygiene station maintenance in the animal exhibits throughout the duration of the fair

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

*During the observation periods

Hand hygiene and zoonotic disease risk signs in each animal exhibit

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

*Includes the signs present on the hand sanitizer stations.

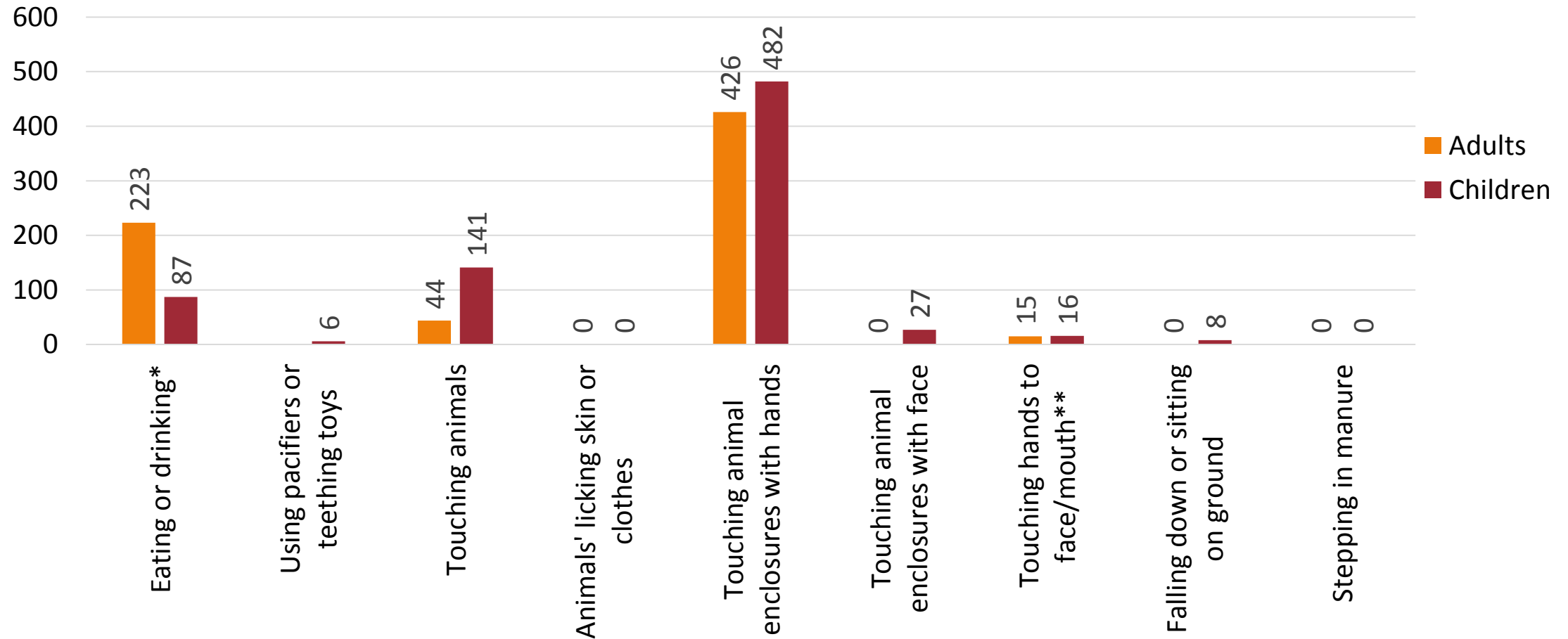
Hand Hygiene Signs



Zoonotic Disease Risk Signs



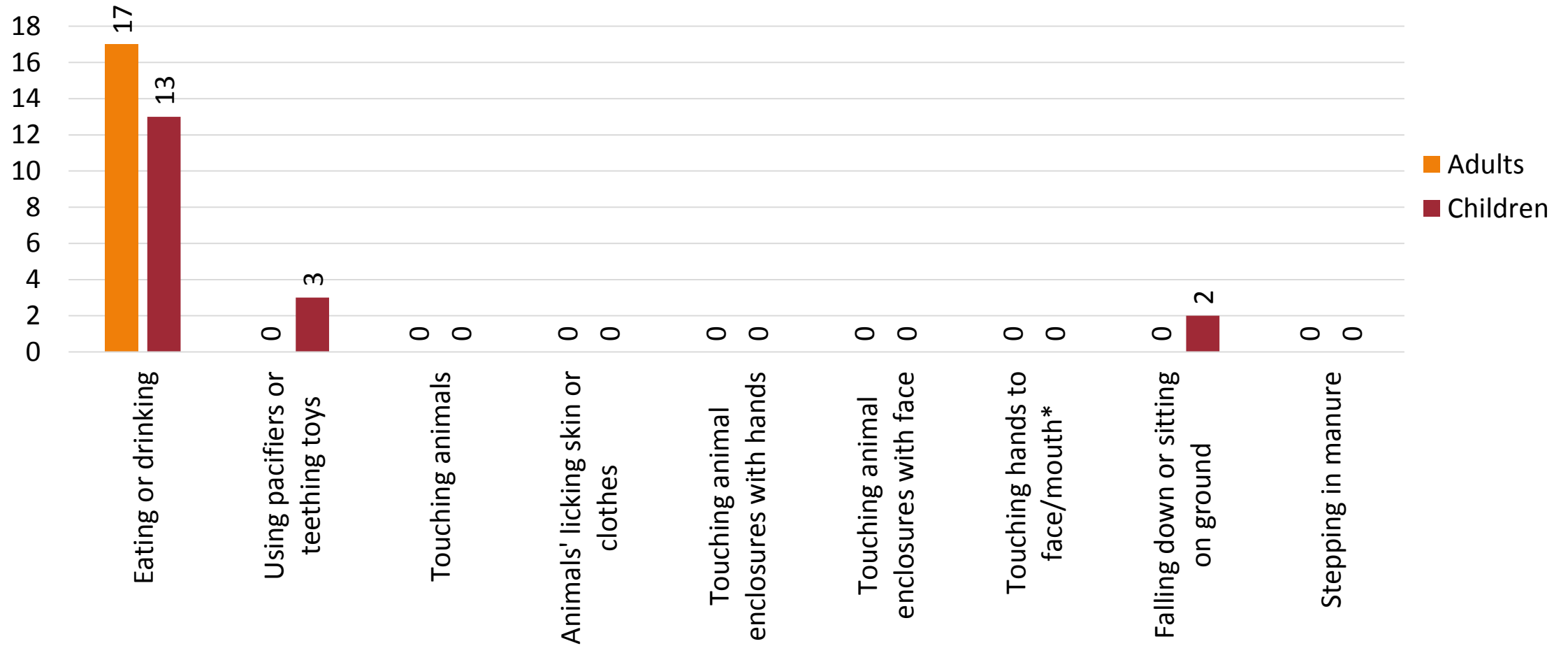
Total number of high-risk behaviors observed being performed by visitors in the Birthing Center over nine days of observation



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

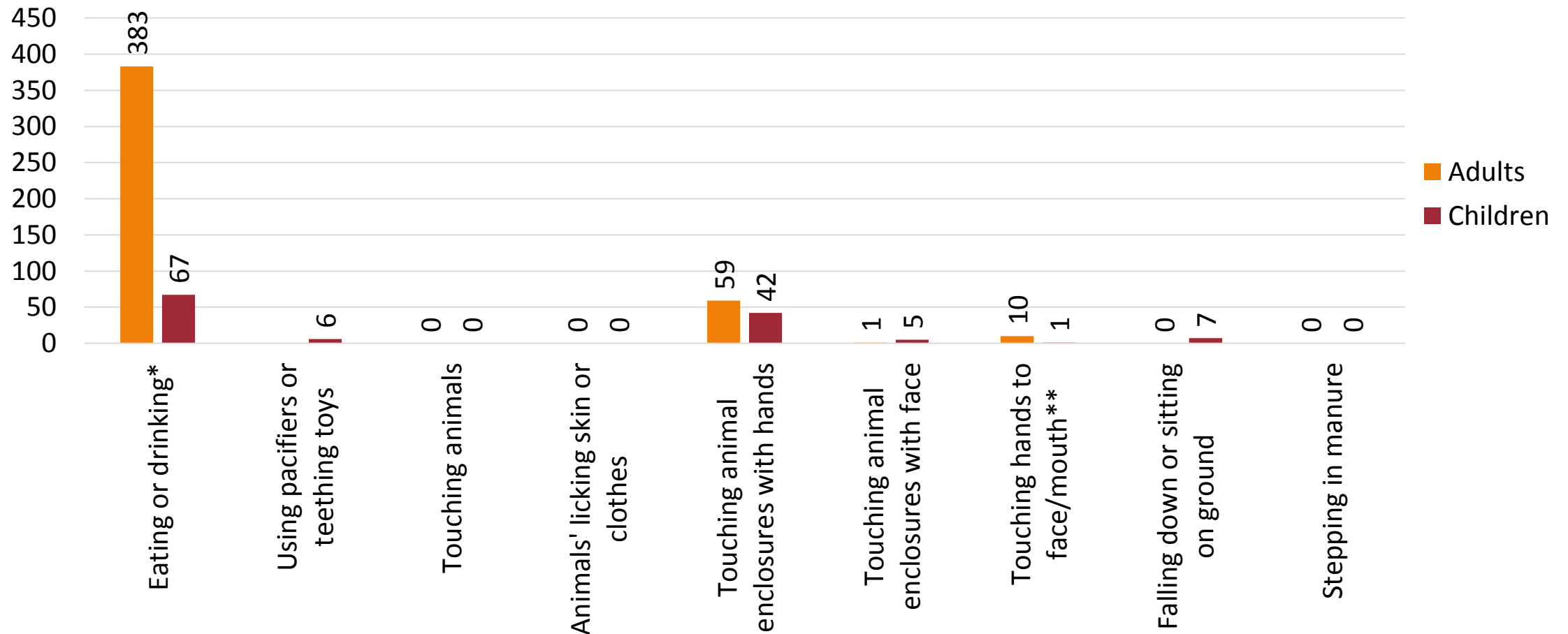
**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

Total number of high-risk behaviors observed being performed by visitors in the Dairy Tie Barn over one day of observation



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

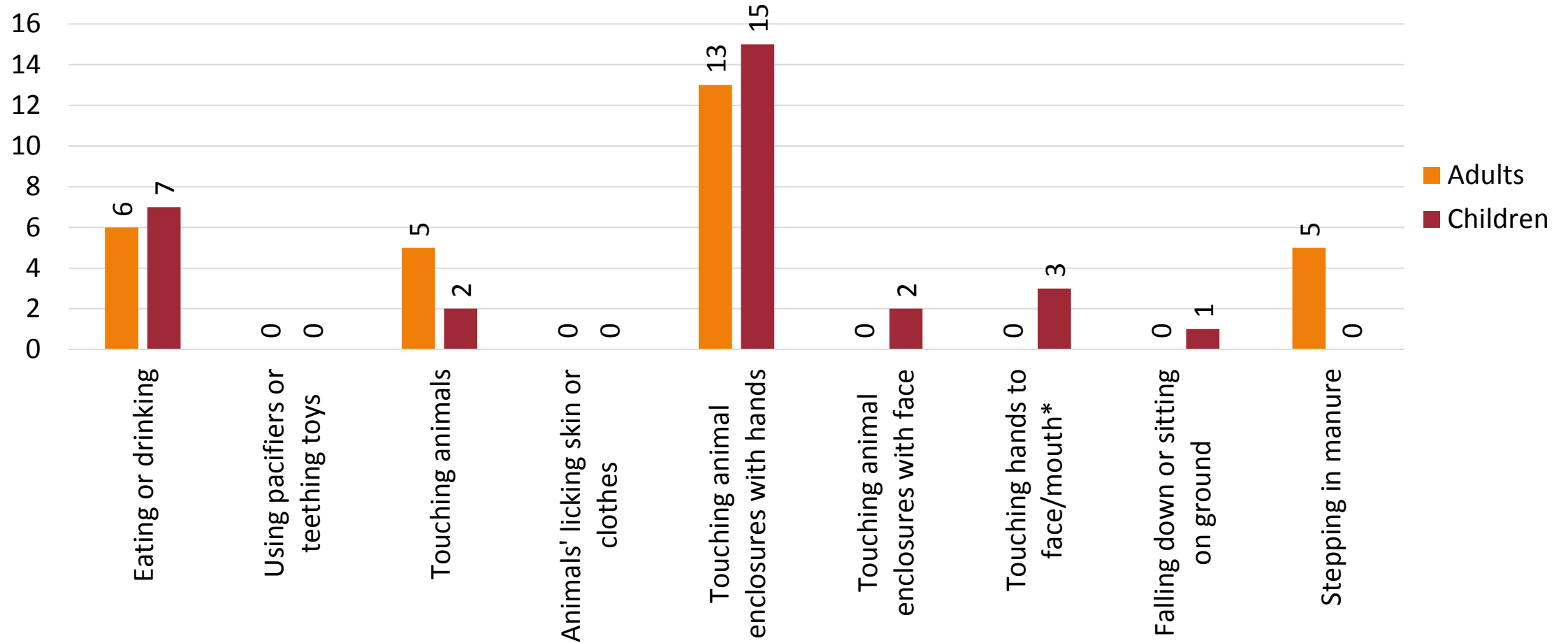
Total number of high-risk behaviors observed being performed by visitors in the Expo Center over nine days of observation



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

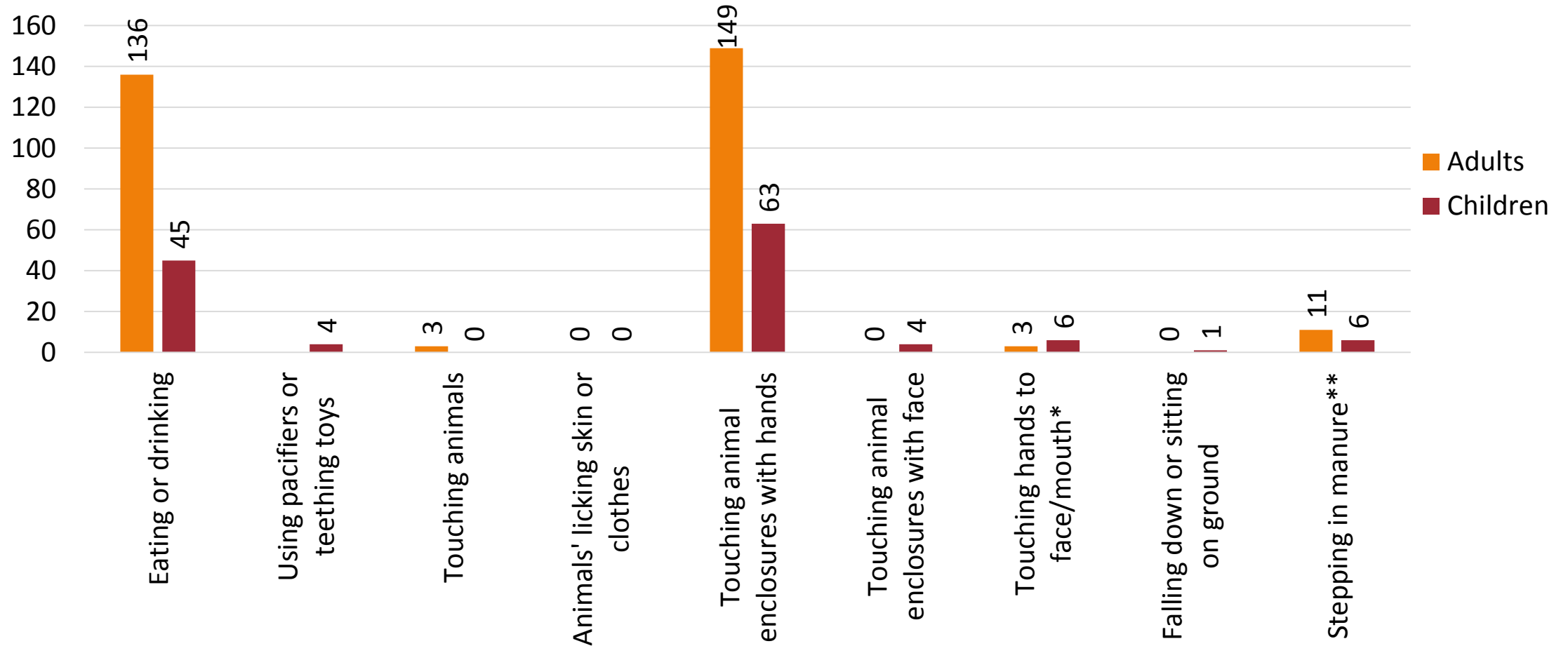
**Behaviors include biting nails, rubbing eyes, sucking thumb, etc.

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.

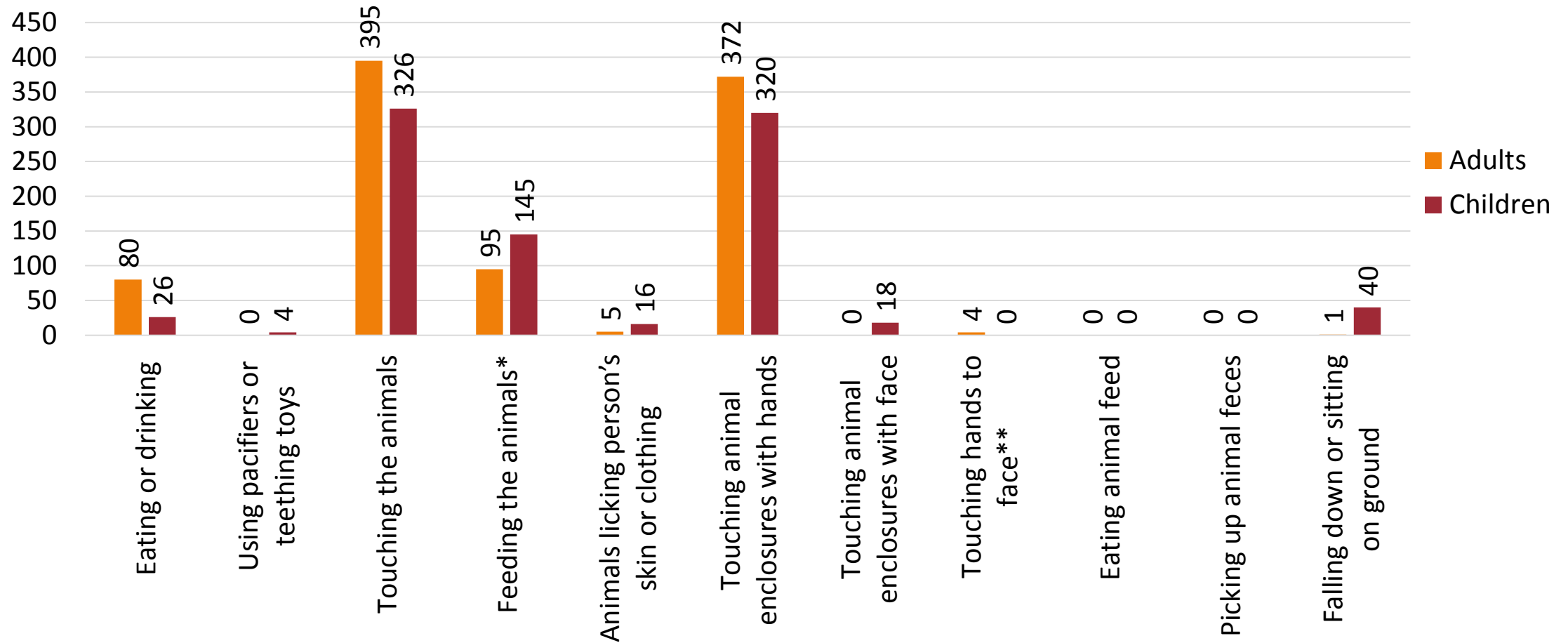
Total number of high-risk behaviors observed being performed by visitors in the Livestock Annex over four days of observation



* 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.

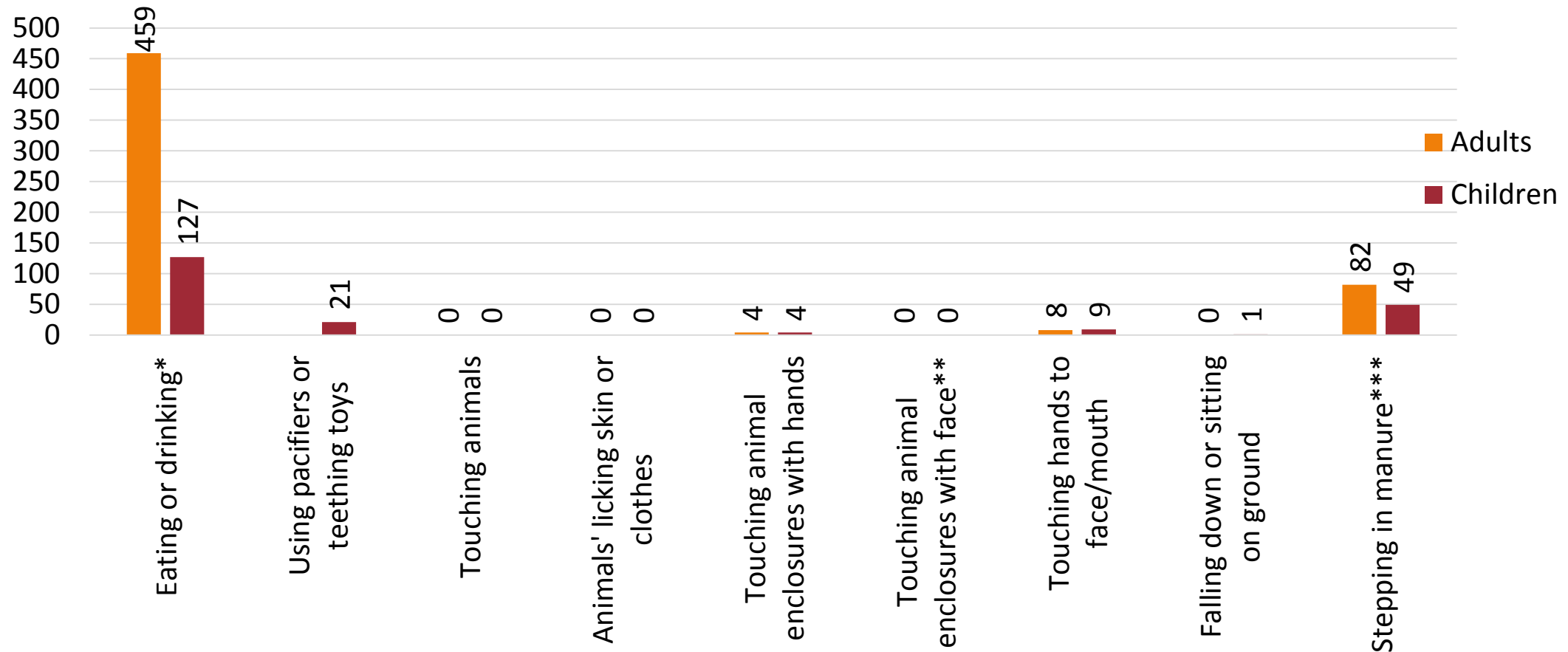
Total number of high-risk behaviors observed being performed by visitors in the Petting Zoo over nine days of observation



*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

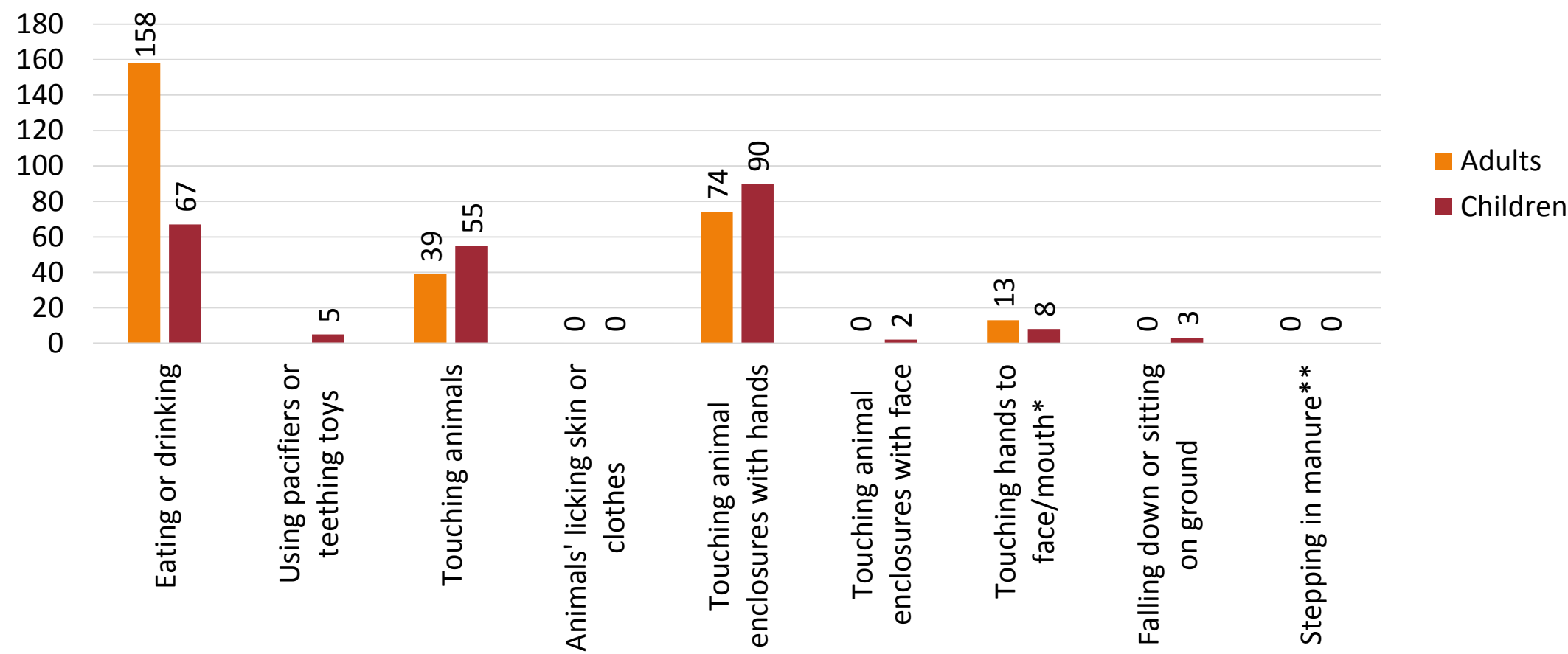


*The "Cattleman's Café" concession stand is located inside this exhibit.

** 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.

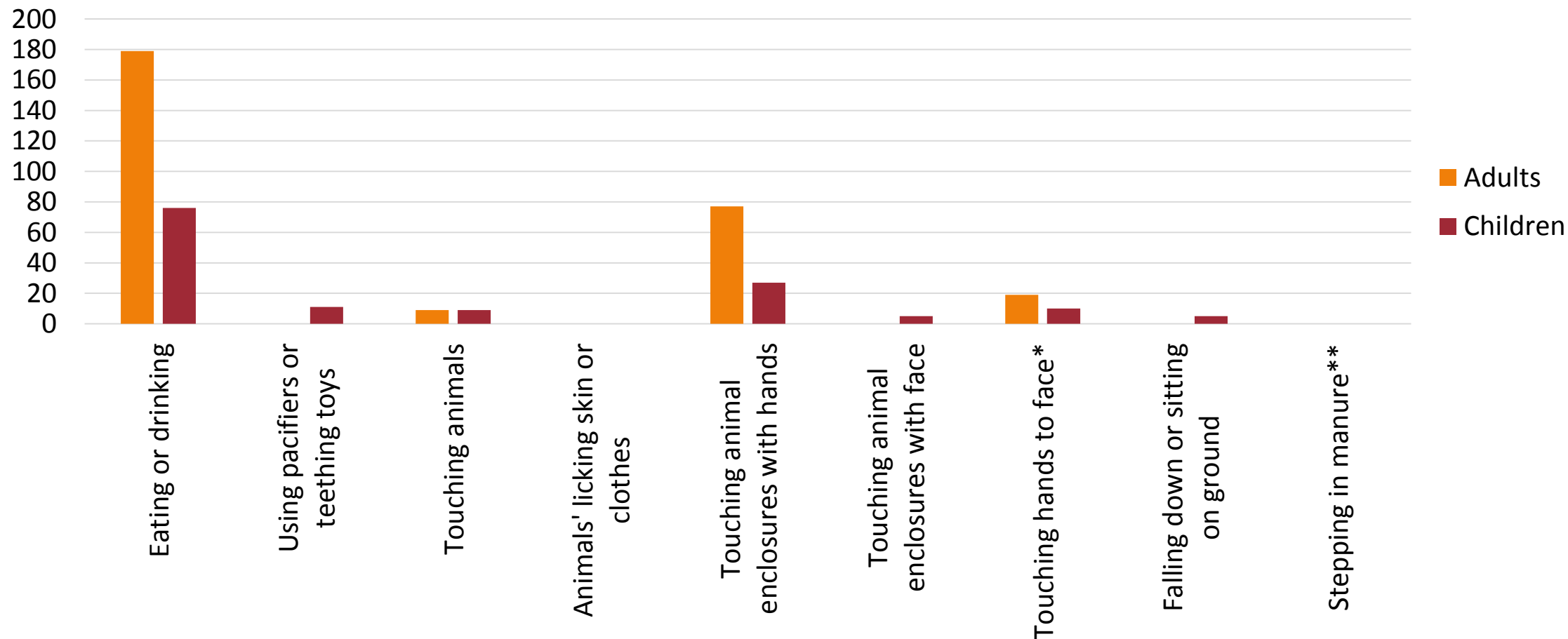
Total number of high-risk behaviors observed being performed by visitors in the Rabbit and Poultry Barn over nine days of observation



*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.

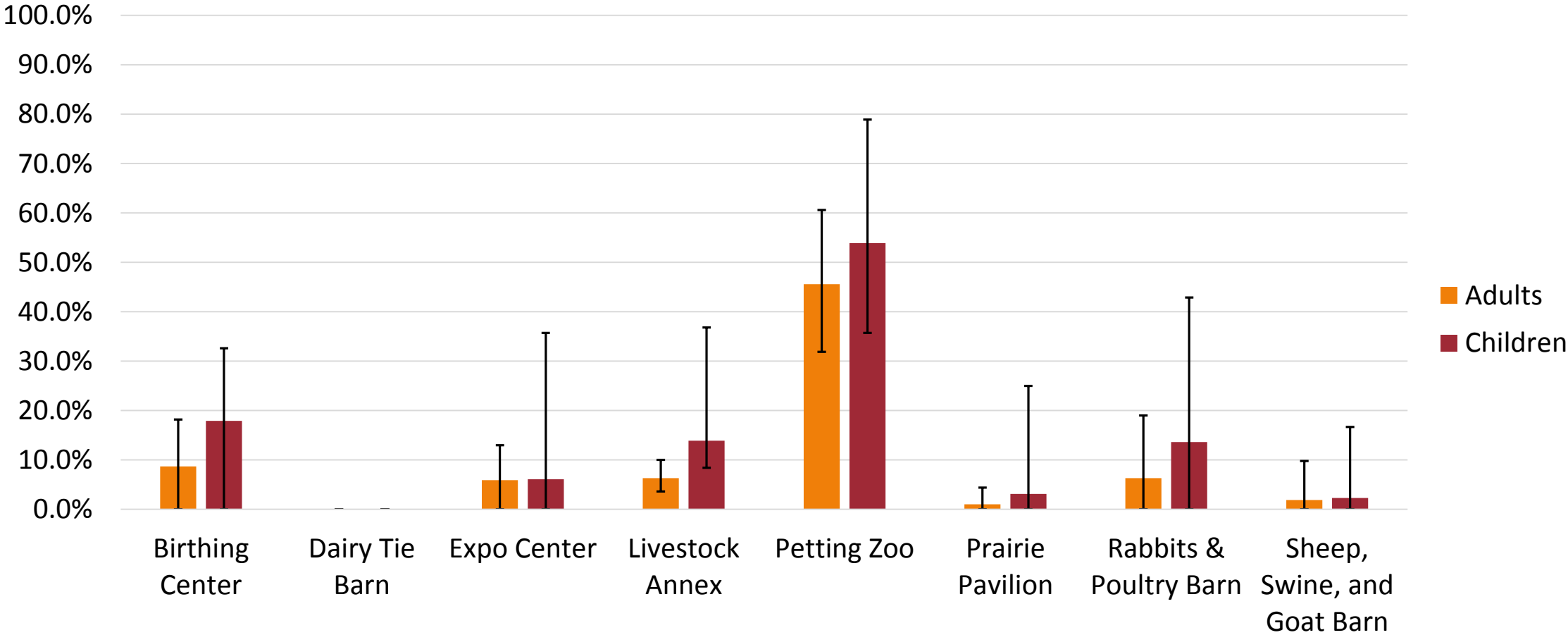
Total number of visitor-owned fomites observed in each animal exhibit during the observation period

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

*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
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 - Barta Stevenson

Questions?



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