Risk behaviors for disease transmission among petting zoo attendees

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Objective—To evaluate risk behaviors for transmission of zoonotic diseases at petting zoos during a period without a recognized disease outbreak.

Design—Observational survey with environmental microbiologic sampling.

Sample Population—6 petting zoos in Tennessee.

Procedures—Attendees were observed for animal and environmental contact, eating or drinking, hand-to-face contact, and use of a hand sanitizer. Hands were examined via bacteriologic culture on some attendees. Environmental samples were collected at 3 petting zoos.

Results—991 attendees were observed; of these, 74% had direct contact with animals, 87% had contact with potentially contaminated surfaces in animal contact areas, 49% had hand-to-face contact, and 22% ate or drank in animal contact areas. Thirty-eight percent used hand sanitizer; children had better compliance than adults. Results of bacteriologic cultures of hands were negative for Salmonella spp and Escherichia coli O157; Salmonella spp were isolated from 63% and E. coli O157 from 6% of environmental samples.

Conclusions and Clinical Relevance—High-risk behaviors were common among petting zoo visitors, and disease prevention guidelines were inconsistently followed. This is an example of the importance of one-medicine, one-health initiatives in protecting the public health. Veterinarians, venue operators, and public health authorities must work together on targeted education to improve implementation of existing disease prevention guidelines. (J Am Vet Med Assoc 2007;231:1036-1038)
Materials and Methods

Behaviors of visitors to 6 petting zoos in Tennessee were observed by volunteers from the Tennessee Department of Health from August through September 2005. Visitors were observed from the time they entered the petting zoo until they exited the animal contact area or until they were observed to have had all of the behaviors of interest.

Observations (yes or no) were recorded for each visitor for the following behaviors in animal contact areas: direct contact with animals, contact with potentially contaminated environmental surfaces, hand-to-face contact, eating or drinking, and hand sanitizer use. Volunteers were instructed to remain discrete while observing visitor behavior. Detailed instructions, including specific definitions of behaviors, were reviewed with all observers.

An adult was defined as anyone who appeared to be > 14 years of age. Contact with animals was defined as touching an animal with any part of the body. Contact with the environment was defined as touching any potentially contaminated environmental surface in the animal contact area (eg, handrails, animal pens, or the ground) with a hand. Eating or drinking was defined as a visitor with food or drink in their hands or putting any inanimate object such as a cigarette, pacifier, or gum into the mouth while in the animal contact area. Hand-to-face contact was defined as a visitor touching their mouth, nose, or eyes or being touched there by another visitor. A different observer assessed hand sanitizer use by all visitors as they exited the animal contact area.

Bacteriologic sampling of hands was performed at 3 petting zoos. Upon exiting the petting zoo, randomly selected visitors were instructed to rub both hands thoroughly with a sterile premoistened hand wipe that was then collected in a sterile container. Wipes were examined via bacteriologic culture for E coli O157 and Salmonella spp at the USDA laboratory in Clay Center, Neb.

Environmental samples including soil, livestock feces, bedding, and surface swab specimens were collected from animal contact areas at 3 petting zoos where behaviors were observed. Samples were evaluated via bacteriologic culture for Salmonella spp and E coli O157 at the same USDA laboratory. Isolation of E coli O157 included use of selective broth enrichment, immunomagnetic separation, and plating on chromogenic selective agar.

Statistical analysis—χ² Tests were used for statistical comparisons. For all comparisons, P < 0.05 was considered significant.

Results

Hand contact of various kinds and eating behaviors were observed in 991 visitors at 6 petting zoos in middle Tennessee. The total number of visitors to the petting zoos was unknown. Among those 991 visitors, 731 (74%) visitors touched animals, 858 (87%) had contact with potentially contaminated environmental surfaces, 484 (49%) had hand-to-face contact, and 217 (22%) ate or drank in animal contact areas (Table 1). Rates of eating and drinking varied substantially among venues (range, < 1% to 47%). Hand sanitizer use was observed in 1,700 petting zoo visitors. Of these, 646 (38%) used hand sanitizer on exiting the animal contact areas (range among venues where it was available, 13% to 66%). Hand sanitizer was not available at 1 venue.

Children were significantly more likely than adults to have contact with animals (RR, 1.41; 95% CI, 1.30 to 1.52), the environment (RR, 1.18; 95% CI, 1.13 to 1.24), and their faces (RR, 1.35; 95% CI, 1.19 to 1.54) and less likely than adults to eat or drink in that setting (RR, 0.70; 95% CI, 0.55 to 0.89). Children were also more likely to use hand sanitizer than adults (RR, 1.19; 95% CI, 1.06 to 1.35). None of the observed behaviors differed significantly between males and females, although sex was not recorded for hand sanitizer use observations.

Of 150 bacteriologic cultures of hands, none yielded Salmonella spp or E coli O157. Both pathogens were isolated from 1 fairground petting zoo, where samples of alpaca, pony, calf, cow, pig, horse, and mule fecal material; pooled material from the floors of sheep, goat, and calf pens, chicken cages, pen railings, seating benches, and hand gel dispensers were collected. Salmonella spp were isolated from 20 of 32 (62%) samples including cow and mule feces, calf pen railings, sheep and goat pens, chicken cages, a seating area within the petting zoo, and hand gel dispensers. Escherichia coli O157 was isolated from 2 of 32 (6%) specimens, both of which were calf feces. Environmental surfaces (eg, rails and benches) accounted for 10 of 22 (45%) of the samples with positive results.

Discussion

Potentially modifiable risk behaviors for acquiring zoonotic diseases are common among petting zoo attendees. Not surprisingly, most visitors had contact with animals and potentially contaminated surfaces in such settings. The high proportion of visitors observed eating or drinking, having hand-to-face contact in animal contact areas, and failing to sanitize their hands after visiting the petting zoo is disturbing.

The identification of Salmonella spp and E coli O157 in petting zoos in the absence of an outbreak confirms that petting zoo settings should be assumed to be contaminated when developing and implementing disease prevention interventions. Animals infected with enteric pathogens may have no signs of illness, and pathogens may be shed intermittently. Resulting environmental contamination can be widespread and persistent. Routine testing or treating of animals is not recommended as a reliable means of preventing the spread of infection.

National recommendations to prevent disease associated with animals in public settings are available, and...
most venues included in the present study were implementing those guidelines to various degrees. All venues with hand-sanitizing gel available had prominently displayed signs encouraging its use. Variations in the placement and number of signs and sanitation stations likely played a role in the wide range of proportions of visitors that used hand sanitizer appropriately. Subjective reports from observers suggested that signs posted higher on walls where children might be less likely to see them and sanitizing stations placed in less convenient locations contributed to markedly less usage. One venue had warning signs regarding the importance of hand sanitizing prominently displayed at the entrance, exit, and throughout the exhibit, with sanitizer dispensers at each animal pen and in an enclosed animal contact area exitway through which all visitors had to pass. At another venue where staff appeared acutely aware of the presence of study observers, staff actively approached exiting visitors to direct them to sanitizer stations. It is of substantial concern that even with such vigorous efforts on the part of operators to encourage compliance, a third of visitors ignored warnings and did not sanitize their hands.

Similarly, rates of eating and drinking varied widely, despite signs prohibiting it in all animal contact areas. In 1 setting at which half the attendees were observed eating or drinking, an unrelated fair exhibit was offering free ice cream treats at the entrance to the petting zoo. Clearly, optimizing visitor safety at animal exhibits requires the coordinated efforts of not only visitors and venue operators but also managers and organizers of event settings.

This study had clear limitations. Venues included in the study represented a small cross-section of the wide variety of settings in which human-animal interactions occur. Limited observational data were collected, with rough estimates of age and observed behaviors that were undoubtedly affected by interobserver variability, potential operator awareness of observers, and the limitations of describing behavior differences in diverse settings that are difficult to describe quantitatively. Despite this, these findings provide important baseline information.

Recent outbreaks associated with petting zoos have substantial legal implications for the industry. Anecdotal reports of difficulty obtaining insurance and of fairs discontinuing petting zoo exhibits are increasingly common, leading to concerns that important opportunities for education and experience with animals may be lost. Contamination of animal environments cannot be eliminated entirely; thus, effective implementation of existing disease-prevention recommendations is critical to ensure that opportunities for interaction with animals can continue under the safest conditions possible.

Animal contact is a common risk factor for disease outbreaks as well as sporadic infections. Although modifiable behaviors of petting zoo attendees have been well documented as risk factors in outbreak settings, the present study is the first, to the authors' knowledge, to reveal the ubiquity of such behaviors in nonoutbreak settings. Our findings provide evidence that the current state of implementation of national recommendations for disease prevention is inadequate. The reasons for this are complex. Recent calls to improve the integration of human and animal medicine (the One Medicine concept) highlight the importance of better understanding such risks. Additional studies are urgently needed to systematically identify specific measures that will help venue operators, event managers, and visitors effectively maximize safety in such settings.

References

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