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RESEARCH AND PRACTICE ARTICLE

Compliance with Hygiene Recommendations for Human-animal Contact at Petting Zoos

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ABSTRACT:

Background: Most children at petting zoos are at least somewhat naïve with respect to animal contact, which is probably why they are being taken to a petting zoo. Unfortunately, their immune systems may be equally naïve, thereby putting these children at high risk of contracting one of several enteric zoonotic diseases. A cross-sectional study was conducted to determine public and organizational compliance with current recommendations for hygiene and public safety for human-animal contact at permanent and temporary petting zoos.

Methods: A single investigator visited 17 petting zoos across Michigan to evaluate both facility-related and visitor-related risk factors for zoonotic enteric disease transmission. We observed 246 children at 6 permanent Michigan petting zoos and 11 temporary Michigan petting zoos associated with agricultural fairs. No contact was made with any petting zoo visitors, and factors such as age and gender were subjectively accessed by visual observation.

Results: Permanent zoos were more likely to have signs regarding hand hygiene and sanitizing facilities than did temporary or “traveling” petting zoos. Zoo personnel reminded 1.2% of visitors to wash their hands, and less than a third of all children were observed to have washed their hands following animal contact. Of the 246 children observed, about 50% (122) touched their own face, eyes, nose or mouth and 42% (104) touched the animals’ mouth. In addition, one child was seen ingesting goat feces, three were seen drinking out of the animals’ water trough, and one child was seen sucking on a fence rail; all in the presence of exhibit personnel who did not intervene. No association was observed between rates of hand washing and the degree of parental supervision.

Conclusions: We concluded that the current CDC hygiene recommendations for visits to petting zoos are generally not being followed by visitors or by exhibitors. Most parental and exhibitor supervision appeared to be focused on preventing physical trauma to the animals and to the children. Further educational outreach and/or regulation may be indicated to prevent enteric disease transmission from animal contact at petting zoos. However, it may be difficult for young children to understand that animal contact is safe and desirable only if proper hygiene practices are followed.



INTRODUCTION:

In recent years, there have been many outbreaks of enteric disease in children following direct fecal-oral contact with animals at petting zoos, fairs and other similar facilities or events¹⁻¹⁷. *Escherichia coli*, *Salmonella*, and *Campylobacter* are the most common agents, all of which are usually sub-clinical in farm animal species. While the majority of enteric infections with these agents are food-borne, transmission from direct animal contact is the second most common route of transmission, which can best be prevented by common enteric precautions to prevent feces from entering the nose, eyes and mouth.

It has been shown that many farmers and their families carry antibodies as a result of exposure to enteric organisms from the animals they raise²⁰⁻²⁵. In addition, farmers and their families seem less likely to develop clinical signs of infection, possibly due to frequent repeated antigenic stimulation. In contrast, because most of the general urban and suburban population has not been exposed to common animal-associated enteric pathogens, they are more likely to develop severe disease when they encounter animals carrying *E. coli*, *Salmonella*, and *Campylobacter*²⁴. Most children at petting zoos are at least somewhat naïve with respect to animal contact, which is why their parents are taking them to a petting zoo. Unfortunately, their immune systems may be equally naïve, putting these children at high risk of contracting one of several enteric zoonotic diseases.

Due to its virulence, *E. coli* might be the most often reported illness associated with petting zoos. One study suggests that the summer peak in enterohemorrhagic *E. coli* (EHEC) infections is at least partially due to animal contact related to agricultural fairs⁶. In the fall of 2004, there were 108 reported cases of EHEC infections in visitors to the North Carolina State Fair, 15 of which resulted in cases of hemolytic-uremic syndrome (HUS)^{26,27}. Similarly, in April of 2005, there was an outbreak of EHEC related to petting zoos in Florida with 63 cases, and 7 reports of HUS^{26, 28}.

Salmonella is also commonly transmitted from chicks and reptiles. In 1999, a 60-person multi-state outbreak of Salmonellosis was reportedly linked to handling chickens¹³. Cryptosporidiosis has also been linked to farm visits¹⁵⁻¹⁹. A recent study at petting zoos in Tennessee demonstrated the sub-clinical presence of *Salmonella spp.* and *E. coli* O157 in petting zoo animals³⁹.

The CDC and other governmental organizations have issued guidelines for safer practices for petting zoos and other animal exhibits²⁹⁻³³. First, and most importantly, CDC guidelines recommend that the public wash their hands immediately after animal exposure, and again prior to eating. Hand washing should be soap and water, and should include drying with a disposable towel or air dryer. Various studies have looked at the most effective ways to cleanse hands and prevent disease transmission^{30, 34-37}. Washing with soap and water followed by drying with a paper towel has been shown to be effective even on visibly soiled hands. In a petting zoo situation, sinks with soap and water that are operated by hand or foot pedal are preferred to the use of sanitizing gel²⁹. Sanitizing gel may be used instead, but has been shown to be ineffective when hands are visibly soiled, and is most effective when used in combination with soap and water^{30, 34-37}. It is the responsibility of the facility to provide adequate hand washing stations to



promote public compliance. The exhibitors should provide facilities for hand washing that are easily accessible to people of all ages and handicaps.

It must be remembered that hand washing does not remove all potential pathogens from a person's hands⁴⁰. The effectiveness of hand washing in removing pathogens would certainly be improved by repeated washes, and by repetition immediately before eating.

According to the CDC guidelines, it is also the responsibility of the exhibit to educate their staff and their patrons about preventing hand-mouth contact while in the exhibit area. This means advising visitors from eating, drinking, or using items such as pacifiers. The exhibitors should also discourage patrons from handling animal waste and should discourage public contact with the animal's sources of food and water. The exhibitors should always have at least one properly educated staff member to supervise the human-animal contact. Their role should be to help ensure that safe practices are being followed and that each child and parent is aware of the need to wash their hands and to prevent physical injury to both animal and visitor. Finally, areas for animal contact and areas for eating should be separated from each other, preferably with hand washing stations located between them.

A recently published study by Weese et al³⁸ showed that the overall rate of hand washing after animal contact was increased in part by strategic placement of washing facilities in exit routes, adequate signage regarding hand washing, and the presence of running water. The percentage of patrons who washed their hands was very low, indicating that the mere presence of hand washing facilities does not promote hand washing in all patrons. Another study showed that patrons to petting zoos participated in a number of risk behaviors, including eating and drinking in the exhibit and touching their face with their hands during or after animal contact³⁹.

The goal of this study was to measure compliance with CDC guidelines regarding animal contact at petting zoos among visitors and exhibitors at permanent and temporary or traveling Michigan petting zoos.

MATERIALS AND METHODS:

The study was conducted at 6 permanent and 11 temporary petting zoos throughout the state of Michigan during June and July of 2005. These zoos represented a cluster sample of almost all the petting zoos that were operating in Central Michigan during these two months. Each zoo was visited once.

Risk factors recorded relating to the zoo included: The average number of adults present to supervise the exhibit, the number of signs regarding hand washing, the availability of hand washing facilities within 20 feet of the encounter area, and the number of times the employees were seen reminding patrons to wash their hands.

Factors pertaining to the visitors included the presence or absence of adult supervision with each child, the gender and estimated age of each child observed, the number of times the child was seen touching his or her own face, eyes, nose, and/or mouth, the number of times the child touched the body or mouth of an animal, the number of times the child touched the ground, and



whether the child was eating or drinking while in the exhibit. Finally, it was noted whether or not each child washed or sanitized their hands before he or she left the exhibit area. Collected hand washing data included any attempt to wash his or her hands and how it was done. For example, washing may have been with a sanitizing gel or foam, with sanitizing wipes, with soap and water, or just with just water. Note was made if paper towels were used at any point.

Up to 15 children under the age of 15 were selected for observation at each of the petting zoos. Study subjects did not know that they were being observed from a distance. We observed each child upon his or her entry into the exhibit area, and would continue our observation of this child until the child left the petting zoo area. Only one child was observed at a time, and only one child was observed from any given group or family. In general, the youngest child was selected for observation when a family or group entered the petting zoo area. When the selected study subject left the petting zoo area, the next child for observation would be selected from the next family or group that entered the exhibit area.

Statistical analysis: Zoo-specific and child-specific risk factors were calculated for both permanent and temporary zoos. The Mantel-Haenszel Chi square test was employed to compare permanent zoos to temporary zoos on the basis of each risk factor.

RESULTS:

Facilities

As seen in Table 1, permanent facilities were more likely to have sanitizer and signs present and more likely to offer children the opportunity to feed animals, although these differences were not statistically significant ($P > .05$). No facilities had sinks with soap and water, but a single temporary facility had a sink with running water. In zoos that offered sanitizing stations, 34% of children sanitized their hands. The greatest percentage of children (40%) made an effort to wash their hands in the zoo that had a sink with running water. In the 4 zoos without sanitizing or rinsing facilities, only 8% of children washed their hands with sanitizer their parents supplied. The amount of supervision present was similar between temporary and permanent zoos. In spite of the fact that over half of the facilities (59%) had at least 1 adult present at all times, only 1.2% of children observed were reminded by the staff to wash their hands. In addition, permanent facilities were nearly twice as likely to offer the opportunity to feed animals.



Table 1:*Summary of facility risk factors*

	Permanent Zoos	Temporary Zoos	Total
Total Facilities:	6	11	17
Available hand washing sinks	0	1 (9%)	1 (5.9%)
Soap available for hand washing	0	0	0
Sanitizer available for hand washing	6 (100%)	6 (55%)	12 (71%)
Signs recommending hand washing	5 (83%)	6 (55%)	11 (65%)
At least 1 adult supervising at all times	3 (50%)	6 (55%)	9 (53%)
No adult supervision	2 (33%)	2 (18%)	4 (24%)
Provided visitors with animal feed	5 (83%)	3 (27%)	8 (47%)

* Chi-square analysis comparing permanent zoos to temporary zoos on the basis of each dichotomous risk factor showed a $P > .05$ in each instance.

Behavior

Risk behaviors for enteric transmission compared between permanent and temporary zoos are shown in Table 2. A higher percentage of children were seen touching an animal's mouth at permanent zoos, but more permanent zoos offered children the opportunity to feed the animals. Over twice as many children sanitized their hands at permanent zoos than at temporary zoos. In addition, 3 children (1.2%) were seen drinking water from the animals' water trough at 2 different zoos. Single children were also seen using a pacifier and picking up goat feces and eating them or throwing them at other children, both at permanent facilities. Another child was seen sucking on a lower handrail of a goat pen while next to their parent. Overall, less than a third of all children observed (28%) washed or sanitized their hands in some manner. The analysis in table 3 indicates that hand washing was significantly associated with type of zoo (permanent vs. temporary) at $P = .002$ after adjusting for the level of supervision by Mantel-Haenszel Chi square test.



Table 2:
Summary of observed risk behaviors of children

	Permanent Zoos	Temporary Zoos	Total	P value
Children observed (number)	81	165	246	
Observed eating	5 (6.2%)	12 (7.3%)	17 (6.9%)	> .05
Touched their face	29 (36%)	50 (30%)	79 (32%)	> .05
Touched their nose	5 (6.2%)	17 (10%)	22 (8.9%)	> .05
Touched their eyes	4 (4.9%)	8 (4.8%)	12 (4.9%)	> .05
Touched their mouth	11 (14%)	40 (24%)	51 (21%)	= .05
Touched the mouth of an animal	44 (54%)	60 (36%)	104 (42%)	= .007
Touched the body of an animal	69 (85%)	164 (99%)	233 (95%)	<.0001
Touched ground	11 (14%)	22 (13%)	33 (13%)	> .05
Washed their hands in any way	34 (42%)	36 (22%)	70 (28%)	= .001
Used waterless hand sanitizer	34 (42%)	30 (18%)	64 (26%)	= .006
Reminded by employees to wash hands	2 (0.8%)	1 (0.4%)	3 (1.2%)	> .05

* P values shown are for Mantel-Haenszel chi-square analysis comparing permanent zoos to temporary zoos on the basis of each dichotomous risk factor

Table 3:
Summary of parental supervision relative to hand washing

Parental supervision	Number of children that washed hands		Average estimated age of child within group	
	Temporary Zoo	Permanent Zoo	Temporary Zoo	Permanent Zoo
Adequate*	21% (23/111)	44% (24/54)	5.6 years	6.1 years
Inadequate**	24% (13/54)	37% (10/27)	7.4 years	7.2 years

*Adequate: Within 5 feet or less of the child for 50% or greater of the time spent in the exhibit

**Inadequate: Greater than 5 feet or more away from the child for more than 50% of the time spent in the exhibit, or absent

*** Hand washing was significantly associated with type of zoo (permanent vs temporary) at P = .002 after adjusting for the level of supervision by Mantel-Haenszel Chi square test.



DISCUSSION:

Although more than half of facilities had supervision available in the exhibit areas, the zoo personnel and the parents/guardians appeared to primarily focus on the physical safety of the children and animals, and on teaching the children be respectful of the animals. Supervision for personal hygiene was rarely observed. Given that zoo personnel were already present, it would seemingly take a minimum amount of re-training to have the supervisors also become involved in preventing fecal oral transmission of enteric zoonotic pathogens. The Michigan Department of Agriculture has supplied information regarding sanitation and hygiene to petting zoo manager⁴¹.

Because permanent facilities were more likely to have signs and hand sanitizing facilities, it is reasonable that more children at permanent zoos washed or sanitized their hands at these facilities. The degree of supervision was similar between permanent and temporary facilities, but the degree of supervision was not associated with hand washing behavior. This supports the explanation that the supervision was focused on matters other than hygiene. Data from our single zoo with running water for hand washing supports the findings of Weese in that the availability of hand washing facilities seemed to encourage hand washing behavior³⁸. Signs regarding hand washing were present most of the time in both permanent and temporary petting zoos, but appeared to be minimally effective in inducing zoo visitors to wash their hands.

While parents appeared to be attentive to their children and were usually within close proximity of their child, children were still permitted to eat and drink within the exhibit, touch their own face or mouth, and often did not wash or sanitize their hands before leaving the facility. Adult supervision was present, but it was not directed at preventing fecal oral transmission. Our observations correspond with the earlier study by McMillian et al showing that risky behaviors are frequently seen, and that hand washing is uncommon³⁹. These findings suggest that both petting zoo exhibitors and parents should be the target of educational outreach programs and possible regulatory action aimed at minimizing the risks associated with animal contact. Given that adults are already present, a few simple actions may possibly help prevent the zoonotic transmission of enteric disease when children visit petting zoos.

The motivation of parents and the petting zoo supervisors in encouraging children to have an animal contact experience at a petting zoo may conflict to some extent with public health recommendations regarding sanitation and hygiene. If the educational mission at the petting zoo is to encourage children to lose their fear of touching animals, then this lesson may be obscured when parents and zoo supervisors must simultaneously teach children that animals are “dirty” and that touching animals may make you ill if you do not keep your hands out of your eyes, nose and mouth before they are washed. These somewhat conflicting messages may be difficult for parents and other adult supervisors to convey to young children, who need to understanding that animal contact is safe and desirable only if proper hygiene practices are followed.



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