



VIRGINIA EPIDEMIOLOGY BULLETIN

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Reptile-Associated Salmonellosis -- Selected States, 1994-1995

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During 1994-1995, health departments in 13 states reported to CDC persons infected with unusual *Salmonella* serotypes in which the patients had direct or indirect contact with reptiles (i.e., lizards, snakes, or turtles). In many of those cases, the same serotype of *Salmonella* was isolated from patients and from reptiles with which they had had contact or a common contact. For some cases, infection resulted in invasive illness, such as sepsis and meningitis. This report summarizes clinical and epidemiologic information for six of these cases.

Connecticut. During January 1995, a 40-year-old man was hospitalized because of an acute illness characterized by constipation, lower back pain, chills, and fever. He reported having taken ranitidine and an antacid for symptoms of heartburn before onset of mild diarrhea 3 days before hospitalization. A blood culture yielded *Salmonella* serotype *wassenaar*. A magnetic resonance image scan of the right sacrum suggested osteomyelitis. Ciprofloxacin therapy was initiated for presumed *Salmonella* osteomyelitis, and he was discharged after 14 days. All household contacts were asymptomatic. The family had purchased two iguanas (*Iguana iguana*) in October 1994; although the patient denied directly handling the iguanas, he reported having recently cleaned their aquarium. Stool

samples obtained from both iguanas yielded *Salmonella wassenaar*.

New Jersey. During September 1994, a 5-month-old girl was hospitalized because of an acute illness including vomiting, lethargy, and fever; on admission, she had a bulging fontanelle and stiff neck. Blood cultures and cerebrospinal fluid yielded *Salmonella* serotype *rubislaw*. She



was treated with intravenous ceftazidime for *Salmonella* sepsis and meningitis and discharged from the hospital after 10 days. Other members of the family were asymptomatic. The infant routinely was fed infant formula. Although the family did not own a reptile, the infant frequently stayed at a babysitter's house where an iguana was kept. Culture of a stool sample from the iguana yielded *Salmonella rubislaw*. The infant was reported to have not touched the iguana; however, the iguana frequently was handled by the babysitter and other members of the babysitter's family. All members of the babysitter's family were asymptomatic, but stool cultures from two members, including a child who had fre-

quently played with and fed the infant, yielded *Salmonella rubislaw*.

New York. In December 1994, a 45-year-old man infected with human immunodeficiency virus was hospitalized because of weakness, nausea, vomiting, and diarrhea. His CD4+ T-lymphocyte count was less than 50 cells/uL. Cultures from blood and sputum samples yielded *Salmonella* serotype IIIa 41:ZAZ23:- (*S. subspecies arizonae*). He owned corn snakes and, until shortly before onset of illness, had worked at a pet store where he handled reptiles frequently. *Salmonella* sepsis was diagnosed, and he was treated with oral ciprofloxacin.

North Carolina. During December 1994, a 2-day-old boy born 8 weeks prematurely developed respiratory difficulties, had pneumothorax diagnosed, and was transferred to a referral hospital.

Blood obtained at birth for culture had been negative, but a culture of blood obtained 9 days later because of an elevated white blood cell count yielded *Salmonella* serotype *kintambo*. He was treated with intravenous ampicillin for *Salmonella* sepsis and was discharged from the hospital after 30 days. Eleven days after the positive culture was collected, *Salmonella kintambo* was cultured from a blood sample obtained from a 12-day-old acutely ill boy who was born at 28 weeks' gestation and had shared a room at the referral hospital with the first infant. The second infant was treated with intravenous cefotaxime for *Salmonella* sepsis and was discharged after 44 days. Both infants had been in the hospital continuously from birth until onset of illness. The mother of the first infant reported having had a diarrheal illness 4 days before the birth of the infant; she frequently handled a savanna monitor lizard (*Varanus*

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exanthematicus) that the family had purchased in September 1994 and kept in a cage in the kitchen. Culture of a stool sample from the lizard yielded *Salmonella kin-tambo*. The second family did not own a reptile.

Ohio. During January 1994, a 6-week-old boy was hospitalized because of diarrhea, stiff neck, and fever; culture of samples of blood and cerebrospinal fluid yielded *Salmonella* serotype *stanley*. The infant was treated with intravenous cefotaxime for *Salmonella* sepsis and meningitis and discharged from the hospital after 56 days. He had been fed only formula and had not attended a child-care facility; household contacts were asymptomatic. The family had purchased a 4-inch water turtle in April 1993. A culture of stool from the turtle yielded *Salmonella stanley*. Although the infant had not had contact with the turtle, other family members had had direct contact, and the turtle's food and water bowls were washed in the kitchen sink.

Pennsylvania. During October 1994, a 21-day-old girl was hospitalized because of an illness including vomiting, bloody diarrhea, and fever. She received empirical treatment with intravenous ampicillin. A culture of stool yielded *Salmonella* serotype *poona*; she was discharged from the hospital after 11 days. Other members of the family were asymptomatic. The infant had been fed infant formula and had not attended a child-care center. The family owned an iguana, and culture of a stool sample from the iguana yielded *Salmonella poona*. Although the infant did not have contact with the iguana, the iguana

was handled frequently by her mother and other members of the family.

Additional investigations. In addition to the six states in this report, seven other states (California, Colorado, Florida, Illinois, Minnesota, Oregon, and Utah) have reported recent isolation of the same *Salmonella* serotype from samples obtained from patients and reptiles with which they had been in contact or associated. Several of these states issued press releases about the risk for acquiring salmonellosis from reptiles. In addition, some states have issued health alerts to pet stores to warn owners and prospective owners about the risks for salmonellosis associated with contact with reptiles and to provide instructions about proper handling of reptiles; store owners have been asked to post the alert and provide copies to all persons purchasing a reptile.

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Editorial Note: For most of the cases described in this report, the identification of rare *Salmonella* serotypes in persons who had no other apparent exposures was linked to direct or indirect contact with a pet reptile from which the same serotype was isolated. In addition, these cases are consistent with previous reports indicating that direct contact with a reptile is not necessary for transmission of *Salmonella* (1,2). This report also illustrates the severe complications of *Salmonella* infection that can occur in young children, immunocompromised persons, and infants during the peripartum period.

Reptiles are popular as pets in the United States: an estimated 7.3 million pet reptiles are owned by approximately 3% of households (G. Mitchell, Pet Industry Joint Advisory Council, personal communication, 1995). Because the most popular reptile species will not breed if closely confined, most reptiles are captured in the wild and imported. The number of reptiles imported into the United States has increased dramatically since 1986 and primarily reflects importation of iguanas (27,806 in 1986 to 798,405 in 1993) (M. Albert, Fish and Wildlife Service, U.S. Department of the Interior, personal communication, June, 1994).

A high proportion of reptiles are asymptomatic carriers of *Salmonella*. Fecal carriage rates can be more than 90% (3); attempts to eliminate *Salmonella* carriage in reptiles with antibiotics have been unsuccessful and have led to increased antibiotic resistance (1,4). A wide variety of *Salmonella* serotypes has been isolated from reptiles, including many that rarely are isolated from other animals (reptile-associated serotypes). Reptiles can become in-

Recommendations for Preventing Transmission of *Salmonella* From Reptiles to Humans

- 1 Persons at increased risk for infection or serious complications of salmonellosis (e.g., pregnant women, children aged less than 5 years, and immunocompromised persons such as persons with AIDS) should avoid contact with reptiles.
- 2 Reptiles should not be kept in child-care centers and may not be appropriate pets in households in which persons at increased risk for infection reside.
- 3 Veterinarians and pet store owners should provide information to potential purchasers and owners of reptiles about the increased risk of acquiring salmonellosis from reptiles.
- 4 Veterinarians and operators of pet stores should advise reptile owners always to wash their hands after handling reptiles and reptile cages.
- 5 To prevent contamination of food-preparation areas (e.g., kitchens) and other selected sites, reptiles should be kept out of these areas -- in particular, kitchen sinks should not be used to bathe reptiles or to wash reptile dishes, cages, or aquariums.

ected through transovarial transmission or direct contact with other infected reptiles or contaminated reptile feces. High rates of fecal carriage of *Salmonella* can be related to the eating of feces by hatchlings -- a typical behavior for iguanas and other lizards -- which can establish normal intestinal flora for hindgut fermentation (5).

During the early 1970s, small pet turtles were an important source of *Salmonella* infection in the United States; an estimated 4% of families owned turtles, and 14% of salmonellosis cases were attributed to exposure to turtles (6). In 1975, the Food and Drug Administration prohibited the distribution and sale of turtles with a carapace less than 4 inches; many states prohibited the sale of such turtles. These measures resulted in the prevention of an estimated 100,000 cases of salmonellosis annually (6). However, since 1986, the popularity of iguanas and other reptiles that can transmit

infection to humans has been paralleled by an increased incidence of *Salmonella* infections caused by reptile-associated serotypes (7).

Because young children are at increased risk for reptile-associated salmonellosis and severe complications (e.g., septicemia and meningitis) (7-9), reducing exposure of infants or children aged less than 5 years to reptiles is particularly important. The risks for transmission of *Salmonella* from reptiles to humans can be reduced by avoiding direct and indirect contact with reptiles (see box, page 2).

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* MMWR 44(17):347-350, May 5, 1995

Reptile-Associated Salmonellosis in Virginia

On March 8, 1995, an 8-month-old Amelia County girl was seen by a pediatrician for fever and diarrhea. A stool culture was obtained and subsequently reported as positive for *Salmonella litchfield*. Based on a report by the physician, the Amelia County Health Department investigated and identified the same *Salmonella* serotype in stool samples from both adult family members, one of whom was also suffering from fever and diarrhea.

Although initial suspicions regarding the source of infection focused on possible foodborne, person-to-person, or waterborne transmission, attention eventually turned to the family's pet snake, a boa constrictor. The health department submitted a sample of the snake's droppings to the Division of Consolidated Laboratory Services, Department of General Services, for culture and the same rare *Salmonella* serotype as that previously isolated from the affected family members was identified. Since the child had not handled the snake or items in the cage, investigators speculated that one of the adult family members

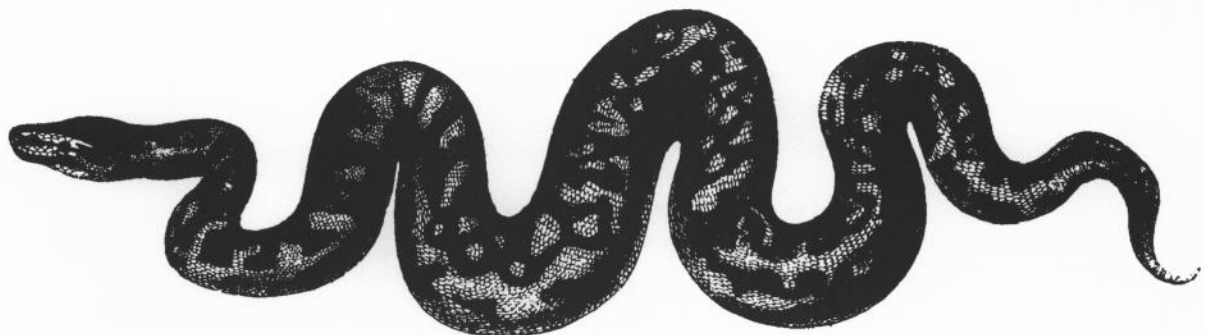
acquired the infection from the snake or the cage and then subsequently passed the organism to the child by direct contact or through contamination of the child's food.

In addition to the investigation in Amelia County, the Bureau of Disease Surveillance and Epidemiologic Studies, Virginia Department of Health, was requested by the Centers for Disease Control and Prevention, to obtain further information regarding three 1994 Virginia reports of the reptile-associated *Salmonella* species, *S. marina*. The following items are brief descriptions of those cases; in each, a reptile pet was identified in the household.

- On January 26, 1994, a 6-week-old bottle-fed male infant presented with bloody diarrhea. A stool culture collected on February 2 revealed *Salmonella marina*. The family owned a reptile that was kept in a cage in the living room. When the cage was cleaned, the reptile was maintained on the mother's shoulder and the infant was reported to have frequent contact with the pet.

- On June 27, 1994, a three-month-old male infant, also bottle-fed, developed symptoms of non-bloody diarrhea, vomiting and fever. A stool specimen collected on July 7 revealed *Salmonella marina*. The family had a two-year-old iguana which was kept in a cage and handled primarily by a sibling who had not displayed any symptoms.
- On September 15, 1994, a 12-year-old boy presented with bloody diarrhea, a fever and abdominal pain. A stool culture revealed *Salmonella marina*. The family had a cat, a turtle, an iguana and a cayman. The iguana was reported to have frequent loose stools so the family chose to have it tested but not the other reptiles in the household. A stool culture run six months after onset of illness in the child revealed *Salmonella abaeetuba* in the iguana.

Submitted by staff of the Piedmont Health District and the Bureau of Disease Surveillance and Epidemiologic Studies.



Cases of Selected Notifiable Diseases, Virginia, May 1 through May 31, 1995.*

Disease	Total Cases Reported This Month						Total Cases Reported to Date in Virginia		
	State	Regions					This Yr	Last Yr	5 Yr Avg
		NW	N	SW	C	E			
AIDS	81	5	26	5	31	14	481	526	429
Campylobacteriosis	36	9	7	5	12	3	154	216	175
Gonorrhea	647	37	63	87	176	284	4411	5071	6238
Hepatitis A	15	1	6	4	0	4	80	54	71
Hepatitis B	6	1	4	0	1	0	37	47	76
Hepatitis NANB	2	0	0	1	1	0	4	17	15
Influenza	3	2	0	1	0	0	861	816	680
Kawasaki Syndrome	3	0	0	1	0	2	10	11	12
Legionellosis	2	1	0	1	0	0	5	3	6
Lyme Disease	8	1	0	1	6	0	11	22	19
Measles	0	0	0	0	0	0	0	2	16
Meningitis, Aseptic	20	0	5	3	1	11	69	59	73
Meningitis, Bacterial†	14	2	2	2	1	7	67	30	53
Meningococcal Infections	4	1	0	0	2	1	29	35	26
Mumps	3	0	0	0	1	2	13	24	30
Pertussis	0	0	0	0	0	0	7	15	9
Rabies in Animals	36	10	5	6	9	6	159	166	126
Reye Syndrome	0	0	0	0	0	0	0	1	1
Rocky Mountain Spotted Fever	0	0	0	0	0	0	0	2	1
Rubella	0	0	0	0	0	0	0	0	0
Salmonellosis	87	12	26	11	19	19	313	324	330
Shigellosis	17	1	3	4	1	8	74	252	137
Syphilis, Early‡	88	0	1	0	17	70	546	564	629
Tuberculosis	43	5	18	3	4	13	105	122	145

Localities Reporting Animal Rabies: Accomack 5 raccoons; Albemarle 1 raccoon; Appomatox 1 raccoon; Bedford 1 fox; Carroll 1 cat; Charles City 1 cat; Chesterfield 1 raccoon; Clarke 1 bobcat; Cumberland 1 raccoon; Fairfax 1 raccoon, 1 skunk; Fauquier 1 raccoon, 1 skunk; Floyd 1 raccoon; Frederick 1 fox; Halifax 1 bat; Hanover 1 raccoon, 1 skunk; Henrico 1 raccoon; Hopewell 1 raccoon; Loudoun 1 fox, 1 raccoon; Louisa 1 raccoon; Nottoway 1 raccoon; Orange 1 cat; Page 1 skunk; Patrick 1 dog; Prince William 1 raccoon; Russell 1 dog; Shenandoah 1 raccoon; Stafford 1 raccoon; Virginia Beach 1 raccoon.

Occupational Illnesses: Asbestosis 11; Carpal Tunnel Syndrome 55; Coal Workers' Pneumoconiosis 16; Lead Poisoning 2; Loss of Hearing 20.

*Data for 1995 are provisional.

†Other than meningococcal.

‡Includes primary, secondary, and early latent.

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