

# VIRGINIA EPIDEMIOLOGY BULLETIN

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## Egg-Associated Salmonellosis

### Recent Trends

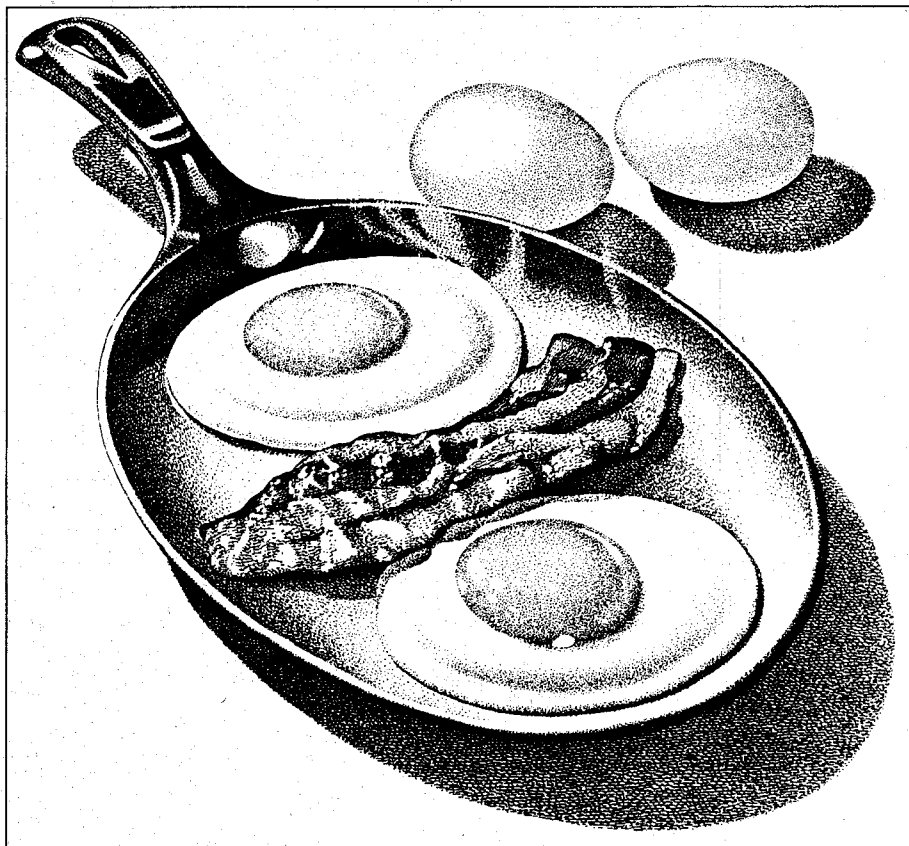
From 1976 to 1986, a steady increase in the number of reported cases of *Salmonella enteritidis* (SE) infection was first noted in the north-eastern United States. In that region, the percentage of *Salmonella* isolates that were serotype *enteritidis* was 28%, compared with only 9% for the rest of the United States. Eggs were implicated as the source of the SE in 77% of 35 foodborne outbreaks in that region during that time. The percentage of *Salmonella* isolates identified as SE has since increased to 16% in the rest of the United States. It is unclear whether this increased percentage is due to egg-related infection.

In Virginia, the percentage of *Salmonella* isolates reported as serotype *enteritidis* has increased from 9.5% in 1985 to 13.7% in the first 8 months of 1988. There also appears to be an increasing trend in the number of reported cases.

### Virginia Outbreaks

During a 10 week period this summer, three outbreaks of SE infection occurred in Virginia, in which raw or undercooked eggs were implicated as the source. No deaths occurred, but nine individuals were hospitalized.

The first outbreak began on June 15, 1988. Fifteen people made homemade ice cream and added raw eggs. Ten of the eleven who ate the ice cream became ill and three of those were hospitalized. Stool cultures from the hospitalized patients were positive for SE. Cultures of both fla-



vors of ice cream were positive for SE. Ingredients included pasteurized ice cream mix, chocolate flavoring, grape-nuts, condensed milk and raw eggs. These individual ingredients, however, were not available for culture. Given that pasteurized products, even if outdated, are unlikely to harbor SE, the eggs were considered to be the source.

The second outbreak occurred on July 30, 1988, when 11 people from

two households had dessert together. The dessert consisted of homemade ice cream with raw eggs added. They also consumed crackers, peanuts and popcorn. Beverages included iced tea and apple juice. All eleven people experienced severe diarrhea of more than 15 bowel movements per day, most had fever and chills, while 20% experienced nau-

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sea and vomiting. The median incubation period was 19 hours. Ten stool cultures were collected and all were positive for SE. All ingredients of the ice cream (except eggs), other foods and the iced tea were cultured and found negative for SE. The apple juice and the ice cream itself were not available for culture. Since the processing for apple juice involved heating to high temperatures and flash freezing, the eggs were considered to be the source.

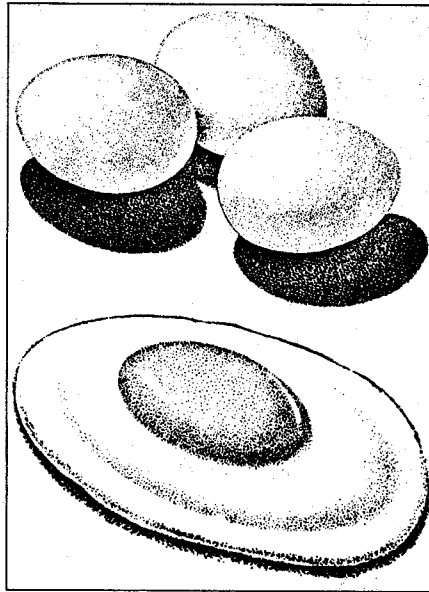
The third outbreak occurred in Patrick County, Virginia, beginning August 9, 1988. In this outbreak, 33 individuals become ill. Their only common association was working at a factory and eating in its cafeteria. Six individuals were hospitalized, and SE was cultured from their stools. The cafeteria was inspected and foods that were suspect for producing illness were cultured. Foods cultured were eggs, eggshells, bulk mayonnaise and chicken livers; all were negative. Analysis of interview data collected from approximately 200 employees revealed that consumption of scrambled eggs was highly significantly correlated with illness. Although the eggs cultured were negative, the epidemiologic association and the history of loosely scrambled eggs maintained at less than adequate storage temperatures strongly suggested inadequately cooked eggs as the source.

#### Mode of Transmission

The risk of SE infection from eggs is very low. The proportion of infected eggs has been estimated to be much less than 1%. If infected, eggs then need to be mishandled, either by inappropriate storage, and/or inadequate cooking to produce disease in humans. Nevertheless, gastroenteritis from SE can cause morbidity and, in higher risk populations, mortality. The risk of this disease associated with eggs can be eliminated by avoiding foods prepared with raw eggs and by thorough cooking of all eggs and egg products.

The epidemiology of SE in eggs remains largely unknown. Transmission of the organism in poultry is hypothesized to be transovarian. Transovarian transmission has been established for *S. pullorum* in chickens, for *S. arizona* in turkeys and for SE in ducks. The recent increase in

SE infection appears to be associated with intact Grade A eggs, and not with broken or cracked eggs as in the past. SE has been isolated



from the yolk of intact eggs. If transovarian transmission is the major means by which the infection is transmitted in chickens, then by routinely screening primary breeder and multiplier flocks, rather than the egg-laying flocks, the disease can be essentially eliminated as was *S. pullorum* in the 1950's. Horizontal transmission (chicken to chicken), and transmission through the environment have not been ruled out. Investigators in Maryland have seen increasing seropositivity in poultry that correlates with increasing age. This suggests that horizontal transmission may also have an impact on incidence of infection in chickens.

#### Control in Poultry

Screening for the disease in chickens is controversial, because the antigen used for testing is the *S. pullorum* antigen and the rate of cross-reactivity is unknown. Antigen against SE is not yet available commercially because of inadequate supplies. Commercial antigen test kits now available may vary both in sensitivity and specificity, as well as with the experience of the individual performing the test. Current recommendations by CDC are to screen multiplier and breeder flocks, and only those egg-laying flocks which have been linked to disease in man or those flocks which are the progeny of multiplier flocks found to be infected. It is very difficult to trace infection back to specific flocks implicated in outbreaks, because egg

distributors may acquire their eggs from multiple sources and may not maintain records for specific eggs.

#### Prevention of Human Infection

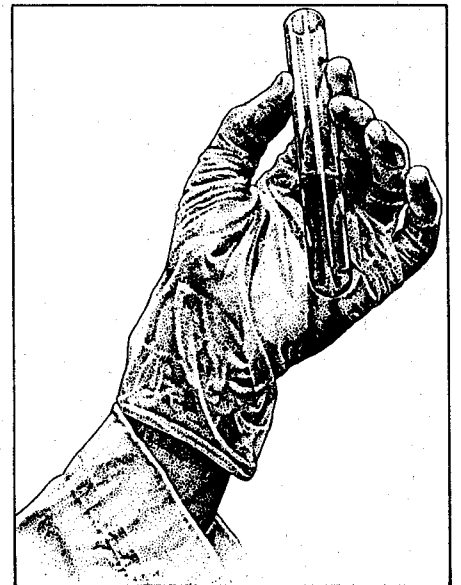
Although SE has other potential sources such as mishandled poultry, that which is egg-associated may be the most readily preventable by avoiding raw and undercooked eggs and by limiting vertical transmission through screening of multiplier and breeder flocks.

The following recommendations have been made to prevent SE infection associated with egg consumption:

1. Avoid eating raw eggs. Thoroughly cook all egg products. This includes foods such as Monte Cristo sandwiches, French toast, meringue and scrambled eggs. "Sunny side up" eggs may not attain temperatures adequate to kill any organisms present.

2. Food recipes that call for raw eggs should substitute pasteurized eggs. Examples are Caesar's salad, hollandaise sauce, Bearnaise Sauce, homemade mayonnaise and eggnog.

3. Institutions in which large numbers of eggs are pooled should substitute egg products. This is especially true for institutions such as hospitals and nursing homes in which patients may be elderly and/or debilitated. These patients are at highest risk for death from SE infection.



4. As with salmonellosis from any other source, symptomatic individuals should avoid high risk situations such as food handling, day care settings and care of hospitalized or

debilitated patients. Asymptomatic individuals may be excluded from high risk situations at the discretion of the local health department.

**Treatment**

Treatment of uncomplicated SE enterocolitis in a patient with no impairment of host defenses is generally supportive using rehydration as necessary. The disease is usually self-limited with symptoms abating in 5-7 days. Antibiotics tend to prolong the excretion of the organism in the stool and do not shorten the duration of uncomplicated illness. Even without the use of antibiotics, approximately 1% of adults and 5% of children less than five years old will shed the organism for up to one year.

**Bibliography**

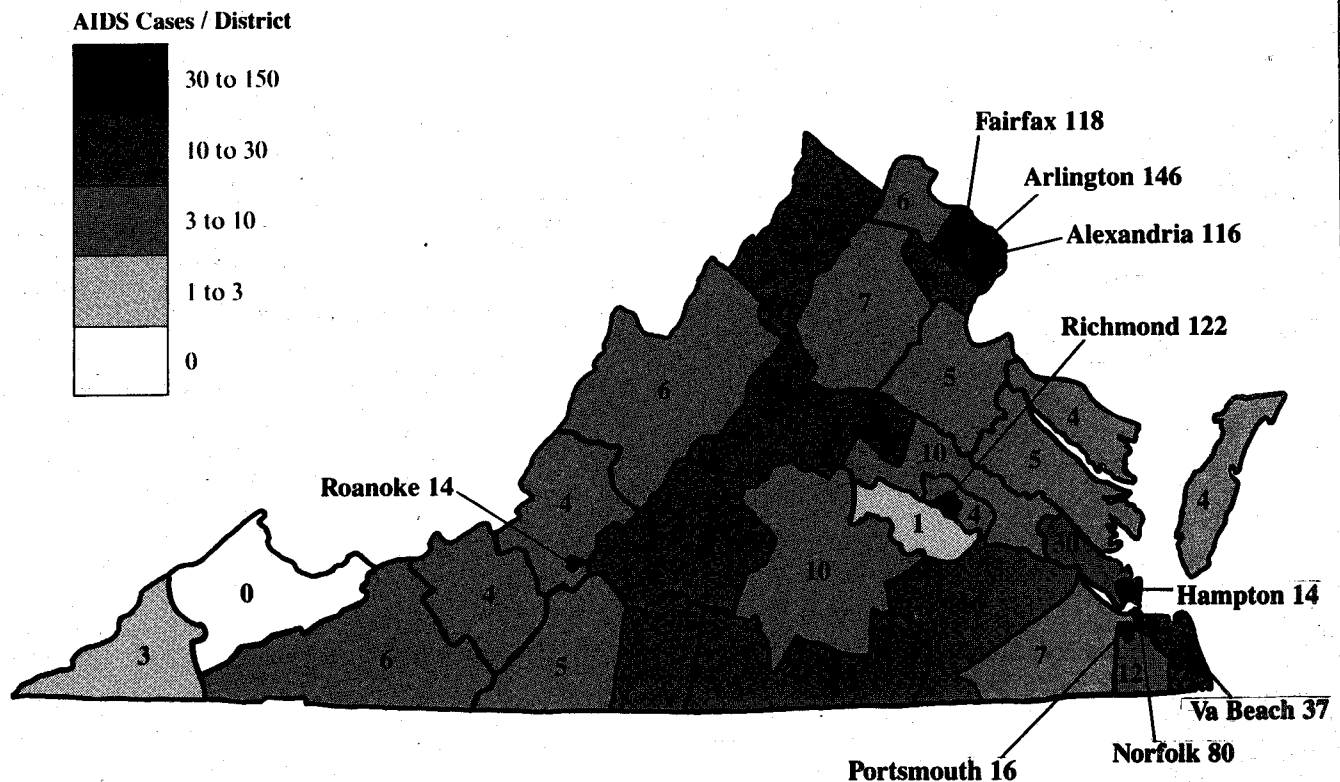
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Submitted by Lynne Penberthy, MD, MPH, Assistant State Epidemiologist.

**Have an Idea for the Bulletin?**

The editor welcomes any reports of cases, outbreaks, or public health problems of interest to the Bulletin's readers. Such accounts and any other comments or suggestions regarding the Bulletin should be addressed to: Editor, Epidemiology Bulletin, Office of Epidemiology, Room 700, 109 Governor Street, Richmond, Virginia 23219.

**Virginia AIDS Cases  
1982 To October 1, 1988**



Cases of selected notifiable diseases, Virginia, for the period September 1, through September 31, 1988.

Disease	State					Regions				
	This Month	Last Month	Total to Date		Mean 5 Year To Date	This Month				
			1987	1988		N.W.	N.	S.W.	C.	E.
Measles	23	0	1	166	23	0	0	23	0	0
Mumps	0	15	69	119	39	0	0	0	0	0
Pertussis	2	3	47	21	32	2	0	0	0	0
Rubella	0	0	1	11	1	0	0	0	0	0
Meningitis—Aseptic	26	13	178	106	200	2	9	1	2	12
*Bacterial	7	12	127	116	172	1	1	1	0	4
Hepatitis A (Infectious)	23	14	183	293	115	2	4	1	4	12
B (Serum)	29	11	337	239	384	5	2	8	4	10
Non-A, Non-B	3	3	38	57	58	1	0	1	0	1
Salmonellosis	228	311	1347	1207	1138	13	60	30	84	41
Shigellosis	29	67	154	337	119	2	8	0	9	10
Campylobacter Infections	56	130	455	473	466	16	9	3	16	12
Tuberculosis	34	40	323	300	315	3	8	4	8	11
Syphilis (Primary & Secondary)	50	21	216	317	294	1	4	13	23	9
Gonorrhea	1643	1325	11113	10625	14026	—	—	—	—	—
Rocky Mountain Spotted Fever	2	1	17	15	36	0	0	1	1	0
Rabies in Animals	32	20	285	284	253	9	6	0	15	2
Meningococcal Infections	2	2	58	43	54	0	0	0	0	2
Influenza	1	8	1234	2429	1635	0	0	0	0	1
Toxic Shock Syndrome	1	0	0	1	5	0	0	0	0	1
Reye Syndrome	0	0	0	0	3	0	0	0	0	0
Legionellosis	3	0	7	9	15	1	0	0	1	1
Kawasaki's Disease	0	3	20	11	23	0	0	0	0	0
Acquired Immunodeficiency Syndrome	43	34	173	288	—	3	16	3	11	10

**Counties Reporting Animal Rabies:** Animal Rabies: Amelia 2 raccoons; Caroline 1 fox; Charles City 1 fox, 1 goundhog; Chesterfield 2 raccoons; Fairfax 1 bat, 3 raccoons, 1 skunk; Fauquier 1 raccoon Goochland 1 racoon; Hanover 1 bat, 1 raccoons, 1 skunk; Henrico 3 raccoons; Highland 1 raccoon; James City 1 fox; Loudoun 1 raccoon; Louisa 1 cat, 1 fox, 1 raccoon; Northumberland 1 cat; Page 1 skunk; Richmond City 2 raccoons; Rockingham 1 skunk; Shenendoah 1 skunk.

**Occupational Illnesses:** Asbestosis 21; Carpal Tunnel Syndrome 2; Loss of Hearing 10; Pneumoconioses 47; Poisoning, chemical 1.

\*other than meningococcal

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