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Emerging Infectious Diseases

Cryptosporidium Infections Associated with Swimming Pools — Dane County, Wisconsin, 1993

In March and April 1993, an outbreak of cryptosporidiosis in Milwaukee resulted in diarrheal illness in an estimated 403,000 persons (*1*). Following that outbreak, testing for *Cryptosporidium* in persons with diarrhea increased substantially in some areas of Wisconsin; by August 1, 1993, three of six clinical laboratories in Dane County were testing routinely for *Cryptosporidium* as part of ova and parasite examinations. In late August 1993, the Madison Department of Public Health and the Dane County Public Health Division identified two clusters of persons with laboratory-confirmed *Cryptosporidium* infection in Dane County (approximately 80 miles west of Milwaukee). This report summarizes the outbreak investigations.

On August 23, a parent reported to the Madison Department of Public Health that her daughter was ill with laboratory-confirmed *Cryptosporidium* infection and that other members of her daughter's swim team had had severe diarrhea. On August 26, public health officials inspected the pool where the team practiced (pool A) and interviewed a convenience sample of patrons at the pool. Seventeen (55%) of 31 pool patrons interviewed reported having had watery diarrhea for 2 or more days with onset during July or August. Eight (47%) of the 17 had had watery diarrhea longer than 5 days. Four persons who reported seeking medical care had stool specimens positive for *Cryptosporidium*.

On August 31, public health nurses at the Dane County Public Health Division identified a second cluster of nine persons with laboratory-confirmed *Cryptosporidium* infection while following up case-reports voluntarily submitted by physicians. Seven of the nine ill persons reported swimming at one large outdoor pool (pool B). Because of the potential for disease transmission in multiple settings, a community-based matched case-control study was initiated on September 3 to identify risk factors for *Cryptosporidium* infection among Dane County residents.

Laboratory-based surveillance was used for case finding. A case was defined as *Cryptosporidium* infection that was laboratory-confirmed during August 1–September 11, 1993, in a Dane County resident who was also the first person in a household to have signs or symptoms (i.e., watery diarrhea of 2 or more days' duration). During the study interval, 85 Dane County residents with stool specimens positive for *Cryptosporidium* were identified. Sixty-five (77%) persons were interviewed; 36 (55%) had illnesses meeting the case definition. Systematic digit-dialing was used to select 45 controls, who were matched with 34 case-patients by age group and telephone exchange. All study participants were interviewed by telephone using a standardized questionnaire to obtain information on demographics, signs and symptoms, recreational water use, child-care attendance, drinking water sources, and presence of diarrheal illness in household members.

The median age of ill persons was 4 years (range: 1–40 years). Reported signs and symptoms included watery diarrhea (94%), stomach cramps (93%), and vomiting (53%). Median duration of diarrhea was 14 days (range: 1–30 days). Swimming in a pool or lake during the 2 weeks preceding onset of illness was reported by 82% of case-patients and 50% of controls (matched odds ratio [MOR]=6.0; 95% confidence interval [CI]=1.4–25.3). Twenty-one percent of case-patients and 2% of controls (MOR=7.3; 95% CI=0.9–59.3) reported swimming in pool A. Fifteen percent of case-patients and 2% of controls (MOR=undefined [6/0]; p=0.02, paired sample sign test) reported swimming in pool B. When persons reporting pool A or B use were excluded from the analysis, the association with recreational water use was not statistically significant (MOR=3.4, 95% CI=0.8–15.7). Child-care attendance was reported for 74% of case-patients aged <6 years and 44% of controls (MOR=2.9; 95% CI=0.8–10.7). Two case-patients reported child-care attendance and use of pool A or pool B. No case-patients reported travel to the Milwaukee area during the March–April outbreak, and no associations were found between illness and drinking water sources.

To limit transmission of *Cryptosporidium* in Dane County pools, state and local public health officials implemented the following recommendations: 1) closing the pools that were epidemiologically linked to infection and hyperchlorinating those pools to achieve a disinfection (CT*) value of 9600; 2) advising all area pool managers of the increased potential for waterborne transmission of *Cryptosporidium*; 3) posting signs at all area pools stating that persons who have diarrhea or have had diarrhea during the previous 14 days should not enter the pool; 4) notifying area physicians of the increased potential for cryptosporidiosis in the community and requesting that patients with watery diarrhea be tested for *Cryptosporidium*; and 5) maintaining laboratory-based surveillance in the community to determine whether transmission was occurring at other sites (e.g., child-care centers and other pools).

On August 27, pool A was closed and hyperchlorinated for 18 hours; on September 3, pool B closed early for the season. Because many control measures were initiated less than 1 week before many pools closed for the season (after September 5), their impact on transmission could not be evaluated adequately.

Reported by: J Bongard, MS, Dane County Public Health Div, Madison; R Savage, MS, Madison Dept of Public Health; R Dern, MS, St. Mary's Medical Center, Madison; H Bostrum, J Kazmierczak, DVM, S Keifer, H Anderson, MD, State Epidemiologist for Occupation and Environmental Health, JP Davis, MD, State Epidemiologist for Communicable Diseases, Bur of Public Health, Wisconsin Div of Health. Div of Parasitic Diseases, National Center for Infectious Diseases; Div of Field Epidemiology, Epidemiology Program Office, CDC.

Editorial Note: Person-to-person, waterborne, and zoonotic transmission of *Cryptosporidium* has been well documented (*2*). A marked seasonality has been reported,

*CT=pool chlorine concentration (in parts per million) multiplied by time (in minutes).

with peaks occurring in North America during late summer and early fall (*3,4*). Cryptosporidiosis associated with use of swimming pools has been reported previously (*5–7*) but is probably underrecognized. Infection with *Cryptosporidium* resulting from recreational water use may contribute to the observed seasonal distribution.

The March–April 1993 Milwaukee waterborne outbreak stimulated increased testing for *Cryptosporidium* in Dane County, increasing the likelihood of outbreak detection. However, the number of cases described in this report was not sufficient to conduct a stratified matched analysis. Confounding of the associations found for child-care attendance and pool use is possible, although child-care attendance was reported in only one case for each implicated pool.

Cryptosporidium oocysts are small (4–6 μ), are resistant to chlorine, and have a high infectivity. The chlorine CT of 9600 needed to kill *Cryptosporidium* oocysts is approximately 640 times greater than required for *Giardia* cysts (*8*). The ability of pool sand-filtration systems to remove oocysts under field conditions has not been well documented, but would not be expected to be effective. Results of an infectivity study suggest that the infective dose among humans for *Cryptosporidium* is low (H. DuPont, University of Texas Medical School at Houston, personal communication, 1994). Because of the large number of oocysts probably shed by symptomatic persons, even limited fecal contamination could result in sufficient oocyst concentrations in localized areas of a pool to cause additional human infections.

This investigation underscores the potential for transmission of *Cryptosporidium* in swimming pools. Health-care providers should consider requesting *Cryptosporidium* testing of stool specimens from persons with watery diarrhea, and public health departments should consider establishing surveillance for *Cryptosporidium* to facilitate prompt recognition of outbreaks. Maintaining the high levels of chlorine necessary to kill *Cryptosporidium* in swimming pools is not feasible; therefore, such recreational water use should be recognized as a potential increased risk for cryptosporidiosis in immumocompromised persons, including those with human immunodeficiency virus infection, in whom this infection may cause lifelong, debilitating illness (*9*).

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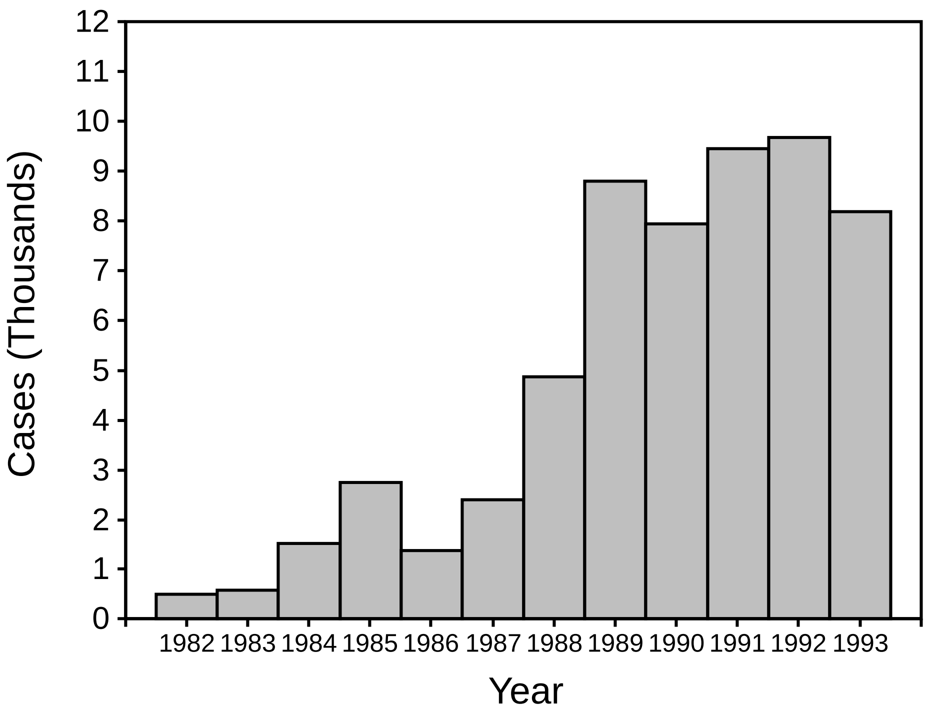
Current Trends

Lyme Disease — United States, 1993

In 1982, CDC initiated surveillance for Lyme disease (LD), and in 1990, the Council of State and Territorial Epidemiologists adopted a resolution making LD a nationally notifiable disease. This report summarizes surveillance data for LD in the United States during 1993.

LD is defined as the presence of an erythema migrans rash or at least one objective sign of musculoskeletal, neurologic, or cardiovascular disease and laboratory confirmation of infection (*1*). In 1993, 8185 cases of LD were reported to CDC by 44 state health departments, 1492 (15%) fewer cases than were reported in 1992 (9677) (Figure 1). Most cases were reported from the northeastern, mid-Atlantic, north-central, and Pacific coastal regions (Figure 2). Six states (Alaska, Arizona, Colorado, Mississippi, Montana, and South Dakota) reported no LD cases. The overall incidence rate was 3.3 per 100,000 population. Eight states in established LD-endemic northeastern and upper north-central regions reported rates of more than 3.3 per 100,000 (Connecticut, 41.3; Rhode Island, 27.3; Delaware, 21.0; New York, 15.5; New Jersey, 10.1; Pennsylvania, 8.9; Wisconsin, 8.2; and Maryland, 3.8); these states accounted for 6962 (85%) of the cases reported nationally. Of the total cases, 6132 (75%) were reported from 81 counties that had at least five cases and had rates of at least 10 per 100,000 population.

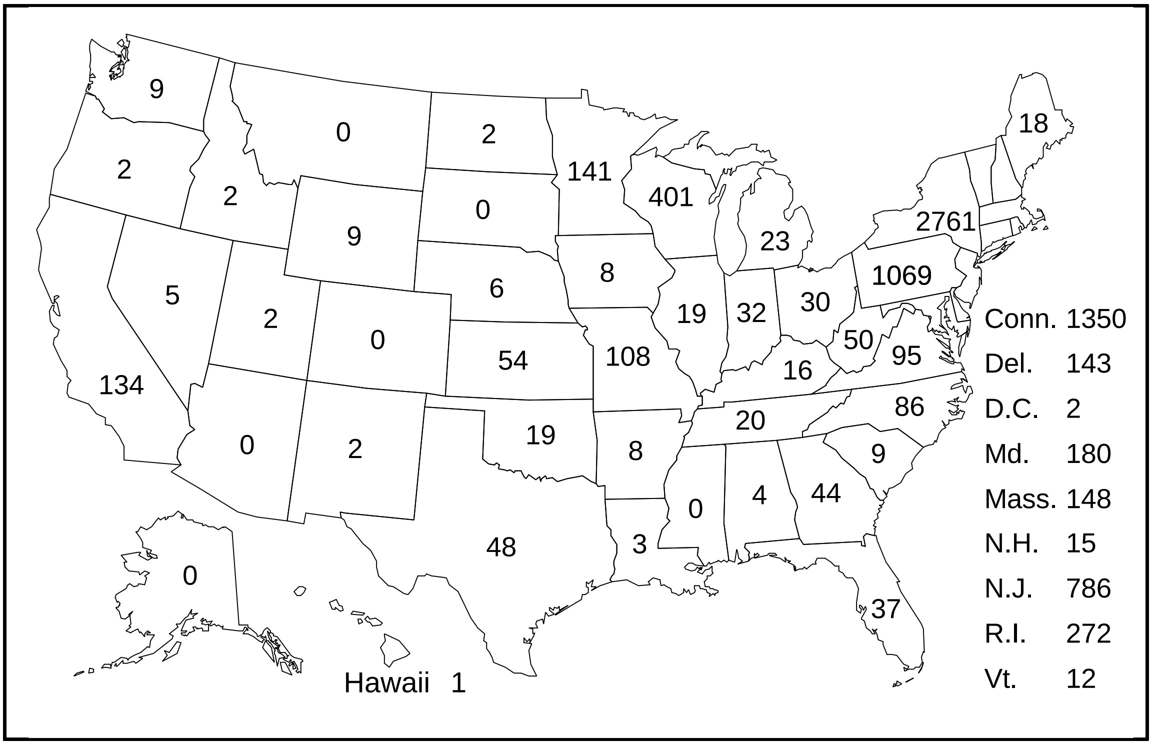
FIGURE 1. Reported cases of Lyme disease, by year — United States 1982–1993*



*In 1982, 11 states reported cases, compared with 44 in 1993.

Lyme Disease — Continued

FIGURE 2. Reported cases of Lyme disease, by state — United States, 1993



Most (83%) of the decrease in 1993 resulted from reductions in the numbers of case reports from four states in which LD is endemic (California, Connecticut, New York, and Wisconsin). New York, which reported 34% of the U.S. cases in 1993, accounted for 41% of the decrease (609 cases), and Connecticut accounted for 27% of the decrease (410 cases). Thirteen states reported small increases in the number of cases. New Jersey had the largest increase (786 cases, compared with 681 in 1992).

The age distribution of persons reported with LD was bimodal, with peaks occurring for children aged 5–14 years (1098 cases) and adults aged 30–49 years (2298 cases). Males (51%) and females were nearly equally affected.

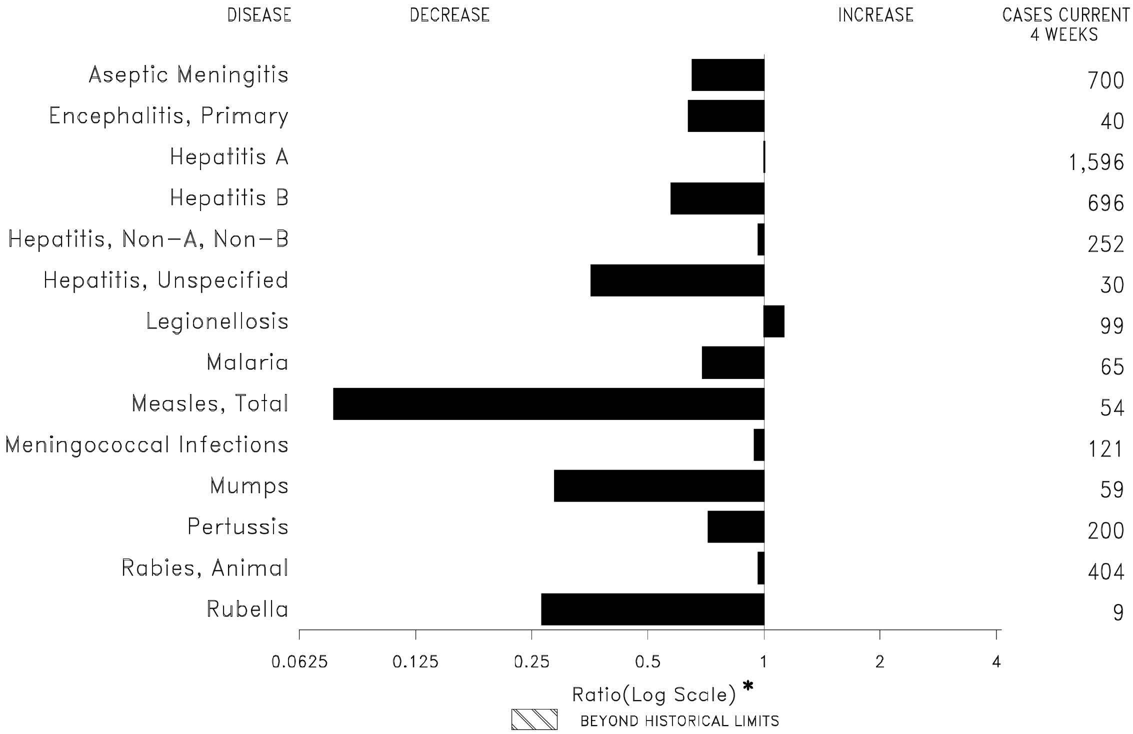
Reported by: State health departments. Bacterial Zoonoses Br, Div of Vector-Borne Infectious Diseases, National Center for Infectious Diseases, CDC.

Editorial Note: LD, the most commonly reported vectorborne infectious disease in the United States (*2*), is caused by the spirochete *Borrelia burgdorferi* and is transmitted by the bite of an infected *Ixodes* tick. In the northeastern and upper north-central regions of the United States, the principal tick vector is *Ixodes scapularis* (black-legged tick), and in Pacific coast states, the principal vector is *Ixodes pacificus* (western black-legged tick).

LD risks are geographically limited; rates vary substantially by town or other geopolitical area within counties (*3,4*), and the distribution of vector ticks varies greatly, even within individual residential properties (*5*). LD can be prevented by avoiding contact with the tick vector or by applying insect repellents and acaricides as directed,

(Continued on page 571)

FIGURE I. Notifiable disease reports, comparison of 4-week totals ending August 6, 1994, with historical data — United States



*Ratio of current 4-week total to mean of 15 4-week totals (from previous, comparable, and subsequent 4-week periods for the past 5 years). The point where the hatched area begins is based on the mean and two standard deviations of these 4-week totals.

TABLE I. Summary — cases of specified notifiable diseases, United States, cumulative, week ending August 6, 1994 (31st Week)

	Cum. 1994		Cum. 1994
AIDS*	45,801	Measles: imported	154
Anthrax	-	indigenous	634
Botulism: Foodborne	41	Plague	10
Infant	42	Poliomyelitis, Paralytic§	-
Other	7	Psittacosis	23
Brucellosis	54	Rabies, human	-
Cholera	9	Syphilis, primary & secondary	12,699
Congenital rubella syndrome	2	Syphilis, congenital, age < 1 year¶	532
Diphtheria	-	Tetanus	21
Encephalitis, post-infectious	70	Toxic shock syndrome	119
Gonorrhea	221,308	Trichinosis	26
Haemophilus influenzae (invasive disease)†	719	Tuberculosis	12,408
Hansen Disease	69	Tularemia	50
Leptospirosis	16	Typhoid fever	218
Lyme Disease	4,753	Typhus fever, tickborne (RMSF)	203

*Updated monthly; last update July 26, 1994.
†Of 678 cases of known age, 193 (28%) were reported among children less than 5 years of age.
§No cases of suspected poliomyelitis have been reported in 1994; 3 cases of suspected poliomyelitis have been reported in 1993; 4 of the 5 suspected cases with onset in 1992 were confirmed; the confirmed cases were vaccine associated.
¶Total through first quarter 1994.

TABLE II. Cases of selected notifiable diseases, United States, weeks ending August 6, 1994, and August 7, 1993 (31st Week)

Reporting Area	AIDS*	Aseptic Menin-gitis	Encephalitis		Gonorrhea		Hepatitis (Viral), by type				Legionel-losis	Lyme Disease
			Primary	Post-in-fectious			A	B	NA,NB	Unspeci-fied		
	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994
UNITED STATES	45,801	3,798	332	70	221,308	233,190	12,470	6,709	2,526	262	885	4,753
NEW ENGLAND	1,811	122	9	4	4,767	4,360	185	228	85	15	24	1,441
Maine	70	17	1	-	54	53	17	10	-	-	2	7
N.H.	37	16	-	2	66	39	11	16	7	-	-	14
Vt.	21	10	-	-	16	16	4	-	-	-	-	4
Mass.	934	42	6	1	1,778	1,737	77	150	62	14	16	117
R.I.	146	37	2	1	283	233	15	6	16	1	6	190
Conn.	603	-	-	-	2,570	2,282	61	46	-	-	-	1,109
MID. ATLANTIC	13,256	279	27	11	24,266	25,947	789	702	285	4	132	2,598
Upstate N.Y.	1,145	135	16	2	5,962	5,271	365	237	138	2	30	1,713
N.Y. City	8,180	20	1	1	7,812	7,880	175	79	-	-	-	9
N.J.	2,786	-	-	-	3,009	3,041	160	201	121	-	17	482
Pa.	1,145	124	10	8	7,483	9,755	89	185	26	2	85	394
E.N. CENTRAL	3,645	603	89	15	42,988	48,274	1,189	698	197	6	263	55
Ohio	649	146	24	1	13,301	12,356	427	102	14	-	127	38
Ind.	389	88	5	1	5,029	4,829	228	118	9	-	57	9
Ill.	1,759	129	30	5	10,703	17,306	271	140	41	3	13	3
Mich.	650	233	26	8	10,113	10,013	163	240	130	3	50	5
Wis.	198	7	4	-	3,842	3,770	100	98	3	-	16	-
W.N. CENTRAL	981	206	19	4	11,850	12,999	612	366	103	8	84	77
Minn.	256	16	2	-	1,878	1,397	133	41	14	1	1	33
Iowa	51	52	-	-	761	1,033	31	18	7	6	25	5
Mo.	431	83	7	3	7,183	7,584	276	270	64	1	39	28
N. Dak.	18	2	2	-	18	30	2	-	-	-	4	-
S. Dak.	10	-	2	-	106	167	17	-	-	-	-	-
Nebr.	57	9	4	1	-	484	81	18	7	-	13	8
Kans.	158	44	2	-	1,904	2,304	72	19	11	-	2	3
S. ATLANTIC	10,074	838	63	23	60,163	60,415	806	1,504	405	26	207	436
Del.	163	18	-	-	853	823	13	4	1	-	3	18
Md.	1,284	111	14	2	10,949	9,305	106	205	21	5	58	181
D.C.	879	25	-	1	4,343	2,821	16	36	-	-	8	3
Va.	725	120	16	5	6,495	7,191	91	72	18	3	5	77
W. Va.	27	14	2	-	448	369	6	24	21	-	1	12
N.C.	719	129	30	1	15,539	14,638	70	172	40	-	13	49
S.C.	665	20	-	-	7,642	6,191	27	22	6	-	9	7
Ga.	1,186	37	1	-	-	4,660	23	503	156	-	78	80
Fla.	4,426	364	-	14	13,894	14,417	454	466	142	18	32	9
E.S. CENTRAL	1,239	267	23	2	26,775	26,297	287	640	478	2	39	25
Ky.	207	80	9	1	2,857	2,726	98	54	17	-	6	14
Tenn.	390	43	10	-	7,959	8,206	112	538	452	1	21	8
Ala.	366	115	4	1	9,733	9,296	52	48	9	1	9	3
Miss.	276	29	-	-	6,226	6,069	25	-	-	-	3	-
W.S. CENTRAL	4,667	428	26	2	27,622	25,644	1,791	809	308	50	28	66
Ark.	160	34	-	-	4,141	3,704	46	15	5	1	6	3
La.	740	23	4	-	7,448	6,915	89	108	94	1	8	-
Okla.	183	-	-	-	2,419	2,713	158	192	175	1	10	35
Tex.	3,584	371	22	2	13,614	12,312	1,498	494	34	47	4	28
MOUNTAIN	1,405	137	6	3	5,080	6,645	2,467	381	260	36	61	6
Mont.	17	1	-	-	52	42	15	18	5	-	14	-
Idaho	30	3	-	-	51	117	197	61	56	1	1	1
Wyo.	13	2	1	2	47	55	14	14	84	-	3	1
Colo.	529	58	1	-	1,676	2,200	321	61	42	11	14	-
N. Mex.	106	6	-	-	577	559	689	130	38	9	2	3
Ariz.	380	38	-	-	1,899	2,489	801	24	8	9	3	-
Utah	93	12	-	1	166	71	289	40	16	1	7	1
Nev.	237	17	4	-	612	1,112	141	33	11	5	17	-
PACIFIC	8,723	918	70	6	17,797	22,609	4,344	1,381	405	115	47	49
Wash.	588	-	-	-	1,595	2,318	205	40	39	1	5	-
Oreg.	386	-	-	-	570	769	278	27	7	1	-	-
Calif.	7,613	827	69	5	14,723	18,848	3,689	1,282	354	111	39	49
Alaska	29	16	1	-	506	333	137	8	-	-	-	-
Hawaii	107	75	-	1	403	341	35	24	5	2	3	-
Guam	1	9	-	-	77	66	16	2	-	4	2	-
P.R.	1,424	21	-	3	301	285	39	197	83	6	-	-
V.I.	34	-	-	-	14	70	-	1	-	-	-	-
Amer. Samoa	-	-	-	-	18	30	4	-	-	-	-	-
C.N.M.I.	-	-	-	-	26	50	3	1	-	-	-	-

N: Not notifiable U: Unavailable C.N.M.I.: Commonwealth of Northern Mariana Islands

*Updated monthly; last update July 26, 1994.

TABLE II. (Cont'd.) Cases of selected notifiable diseases, United States, weeks ending August 6, 1994, and August 7, 1993 (31st Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin-gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported*		Total									
	Cum. 1994	1994	Cum. 1994	1994	Cum. 1994	Cum. 1993	Cum. 1994	1994	Cum. 1994	1994	Cum. 1994	Cum. 1993	1994	Cum. 1994	Cum. 1993
UNITED STATES	534	4	634	4	154	231	1,713	6	835	98	1,883	2,471	1	205	144
NEW ENGLAND	43	-	14	2	12	57	85	-	14	2	180	442	-	125	1
Maine	2	-	1	1§	4	-	13	-	3	-	2	7	-	-	1
N.H.	3	-	1	-	-	-	6	-	4	1	43	109	-	-	-
Vt.	1	-	2	-	1	31	2	-	-	-	27	57	-	-	-
Mass.	20	-	3	-	4	16	35	-	-	-	84	225	-	122	-
R.I.	5	-	4	1§	3	1	-	-	1	-	5	4	-	2	-
Conn.	12	-	3	-	-	9	29	-	6	1	19	40	-	1	-
MID. ATLANTIC	82	-	165	-	22	13	164	1	71	7	325	327	-	9	49
Upstate N.Y.	29	-	25	-	3	1	59	-	19	1	126	103	-	6	13
N.Y. City	18	-	14	-	2	4	11	-	5	-	65	21	-	1	16
N.J.	17	-	122	-	14	8	37	-	6	-	8	45	-	2	15
Pa.	18	-	4	-	3	-	57	1	41	6	126	158	-	-	5
E.N. CENTRAL	55	-	59	-	40	22	270	-	139	4	266	590	-	11	3
Ohio	8	-	15	-	-	7	74	-	41	3	100	144	-	-	1
Ind.	11	-	-	-	1	-	44	-	6	1	41	39	-	-	1
Ill.	20	-	17	-	38	9	91	-	57	-	54	193	-	3	-
Mich.	14	-	24	-	1	5	36	-	31	-	25	24	-	8	-
Wis.	2	-	3	-	-	1	25	-	4	-	46	190	-	-	1
W.N. CENTRAL	28	-	116	-	42	3	119	1	40	4	93	175	-	2	1
Minn.	8	-	-	-	-	-	10	-	4	-	39	82	-	-	-
Iowa	4	-	6	-	1	-	14	1	11	-	6	2	-	-	-
Mo.	11	-	108	-	40	1	58	-	21	2	27	63	-	2	1
N. Dak.	1	-	-	-	-	-	1	-	2	-	6	3	-	-	-
S. Dak.	-	-	-	-	-	-	7	-	-	-	1	5	-	-	-
Nebr.	3	-	1	-	1	-	8	-	2	-	5	7	-	-	-
Kans.	1	-	1	-	-	2	21	-	-	2	9	13	-	-	-
S. ATLANTIC	103	-	45	-	4	21	290	2	132	10	201	233	-	9	5
Del.	3	-	-	-	-	-	4	-	-	-	1	4	-	-	-
Md.	47	-	1	-	2	4	24	1	36	-	59	75	-	-	2
D.C.	8	-	-	-	-	-	3	-	-	-	4	3	-	-	-
Va.	12	-	1	-	1	1	49	1	30	-	17	27	-	-	-
W. Va.	-	-	36	-	-	-	11	-	3	1	3	7	-	-	-
N.C.	2	-	2	-	1	-	41	-	34	6	58	38	-	-	-
S.C.	2	-	-	-	-	-	12	-	6	1	11	8	-	-	-
Ga.	13	-	2	-	-	-	58	-	8	2	16	19	-	-	-
Fla.	16	-	3	-	-	16	88	-	15	-	32	52	-	9	3
E.S. CENTRAL	20	-	28	-	-	1	112	-	15	2	98	107	-	-	-
Ky.	7	-	-	-	-	-	30	-	-	-	52	16	-	-	-
Tenn.	7	-	28	-	-	-	25	-	6	-	18	46	-	-	-
Ala.	5	-	-	-	-	1	52	-	3	2	22	36	-	-	-
Miss.	1	-	-	-	-	-	5	-	6	-	6	9	-	-	-
W.S. CENTRAL	25	-	9	-	7	5	221	-	177	19	85	65	-	12	16
Ark.	2	-	-	-	1	-	36	-	1	2	14	6	-	-	-
La.	5	-	-	-	1	1	26	-	20	-	9	6	-	-	1
Okla.	2	-	-	-	-	-	22	-	23	-	21	34	-	4	1
Tex.	16	-	9	-	5	4	137	-	133	17	41	19	-	8	14
MOUNTAIN	22	3	147	-	17	3	118	1	55	48	243	178	-	5	9
Mont.	-	-	-	-	-	-	6	-	-	1	4	1	-	-	-
Idaho	2	-	-	-	-	-	15	-	7	-	24	39	-	-	1
Wyo.	1	-	-	-	-	-	5	-	1	-	-	1	-	-	-
Colo.	10	-	16	-	3	3	23	1	2	2	108	64	-	-	2
N. Mex.	3	-	-	-	-	-	12	N	N	-	16	24	-	1	-
Ariz.	1	-	-	-	1	-	39	-	24	44	78	33	-	-	2
Utah	4	3	131	-	2	-	13	-	11	1	11	16	-	3	3
Nev.	1	-	-	-	11	-	5	-	9	-	2	-	-	1	1
PACIFIC	156	1	51	2	10	106	334	1	192	2	392	354	1	32	60
Wash.	5	-	-	-	-	-	23	-	6	-	17	25	-	-	-
Oreg.	7	-	-	-	-	3	52	N	N	-	29	23	-	1	-
Calif.	132	1	47	2†	8	83	251	1	174	-	333	299	1	27	35
Alaska	-	-	4	-	-	1	2	-	2	-	-	3	-	1	1
Hawaii	12	-	-	-	2	19	6	-	10	2	13	4	-	3	24
Guam	2	U	211	U	-	2	1	U	4	U	-	-	U	1	-
P.R.	2	-	13	-	-	315	7	-	2	-	1	1	-	-	-
V.I.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amer. Samoa	-	-	-	-	-	1	-	-	1	-	1	2	-	-	-
C.N.M.I.	1	U	26	U	-	1	-	U	2	U	-	-	U	-	-

*For measles only, imported cases include both out-of-state and international importations.
N: Not notifiable U: Unavailable † International § Out-of-state

TABLE II. (Cont'd.) Cases of selected notifiable diseases, United States, weeks ending August 6, 1994, and August 7, 1993 (31st Week)

Reporting Area	Syphilis (Primary & Secondary)		Toxic-Shock Syndrome	Tuberculosis		Tula-remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994
UNITED STATES	12,699	15,897	119	12,408	13,093	50	218	203	3,595
NEW ENGLAND	137	216	3	274	276	-	17	9	1,095
Maine	4	3	-	-	5	-	-	-	-
N.H.	3	21	-	14	15	-	-	-	106
Vt.	-	1	1	3	3	-	-	-	95
Mass.	57	94	2	140	149	-	13	7	417
R.I.	11	8	-	32	36	-	1	-	5
Conn.	62	89	-	85	68	-	3	2	472
MID. ATLANTIC	788	1,481	21	2,281	2,762	1	51	3	357
Upstate N.Y.	94	133	11	112	417	1	6	1	79
N.Y. City	346	773	-	1,518	1,646	-	31	-	-
N.J.	120	202	-	460	293	-	14	-	172
Pa.	228	373	10	191	406	-	-	2	106
E.N. CENTRAL	1,675	2,682	23	1,257	1,358	4	40	27	32
Ohio	670	707	7	189	191	1	5	16	-
Ind.	153	223	2	101	132	1	4	3	9
Ill.	478	1,071	5	648	724	-	20	6	8
Mich.	174	374	9	282	255	1	4	2	9
Wis.	200	307	-	37	56	1	7	-	6
W.N. CENTRAL	715	1,026	17	322	260	20	1	18	128
Minn.	29	43	1	72	35	1	-	-	13
Iowa	33	47	7	28	37	-	-	1	53
Mo.	619	827	5	149	126	13	1	8	10
N. Dak.	-	2	-	5	5	-	-	-	5
S. Dak.	-	2	-	16	10	1	-	8	22
Nebr.	-	10	2	10	16	1	-	1	-
Kans.	34	95	2	42	31	4	-	-	25
S. ATLANTIC	3,655	4,129	6	2,312	2,621	1	34	99	1,238
Del.	13	80	-	-	29	-	1	-	29
Md.	151	234	-	183	226	-	5	9	338
D.C.	149	221	-	70	98	-	1	-	2
Va.	420	368	1	206	267	-	5	9	228
W. Va.	8	7	-	51	49	-	-	2	48
N.C.	1,038	1,170	1	269	300	-	-	35	102
S.C.	453	613	-	217	249	-	-	9	114
Ga.	910	707	-	529	444	1	2	32	247
Fla.	513	729	4	787	959	-	20	3	130
E.S. CENTRAL	2,218	2,306	2	761	932	-	2	16	113
Ky.	124	187	1	196	230	-	1	4	8
Tenn.	579	661	1	207	270	-	1	9	34
Ala.	405	510	-	250	286	-	-	1	71
Miss.	1,110	948	-	108	146	-	-	2	-
W.S. CENTRAL	2,848	3,054	1	1,618	1,396	14	10	21	432
Ark.	301	348	-	174	116	13	-	4	15
La.	1,072	1,499	-	14	89	-	3	-	47
Okla.	93	200	1	165	93	1	2	14	24
Tex.	1,382	1,007	-	1,265	1,098	-	5	3	346
MOUNTAIN	170	145	6	298	323	9	8	10	65
Mont.	3	1	-	9	13	3	-	4	-
Idaho	1	-	1	11	9	-	-	-	2
Wyo.	-	6	-	5	2	-	-	2	14
Colo.	88	42	3	21	52	1	3	3	7
N. Mex.	18	21	-	43	35	2	-	-	2
Ariz.	31	60	-	136	126	-	1	1	30
Utah	6	1	2	29	19	2	2	-	7
Nev.	23	14	-	44	67	1	2	-	3
PACIFIC	493	858	40	3,285	3,165	1	55	-	135
Wash.	36	34	-	165	149	-	3	-	-
Oreg.	21	32	-	90	-	1	1	-	2
Calif.	430	785	37	2,832	2,816	-	49	-	104
Alaska	4	5	-	33	39	-	-	-	29
Hawaii	2	2	3	165	161	-	2	-	-
Guam	4	2	-	58	35	-	1	-	-
P.R.	181	334	-	73	132	-	-	-	51
V.I.	22	31	-	-	2	-	-	-	-
Amer. Samoa	1	-	-	3	2	-	1	-	-
C.N.M.I.	1	3	-	22	19	-	1	-	-

U: Unavailable

TABLE III. Deaths in 121 U.S. cities,* week ending August 6, 1994 (31st Week)

Reporting Area	All Causes, By Age (Years)						P&I† Total
	All Ages	≥65	45-64	25-44	1-24	<1	
NEW ENGLAND	573	374	114	62	9	14	46
Boston, Mass.	165	101	37	18	1	8	25
Bridgeport, Conn.	45	25	15	4	-	1	4
Cambridge, Mass.	18	15	3	-	-	-	-
Fall River, Mass.	26	23	2	1	-	-	-
Hartford, Conn.	60	34	11	12	1	2	-
Lowell, Mass.	30	21	7	2	-	-	-
Lynn, Mass.	10	9	1	-	-	-	2
New Bedford, Mass.	26	21	2	2	1	-	1
New Haven, Conn.	46	21	15	6	3	1	4
Providence, R.I.	33	22	6	5	-	-	-
Somerville, Mass.	2	2	-	-	-	-	-
Springfield, Mass.	38	29	3	6	-	-	1
Waterbury, Conn.	21	14	4	2	1	-	2
Worcester, Mass.	53	37	8	4	2	2	7
MID. ATLANTIC	2,362	1,532	431	306	65	28	93
Albany, N.Y.	40	25	7	6	1	1	-
Allentown, Pa.	17	13	1	1	2	-	-
Buffalo, N.Y.	100	71	18	6	4	1	1
Camden, N.J.	U	U	U	U	U	U	U
Elizabeth, N.J.	22	14	5	3	-	-	1
Erie, Pa.§	38	28	5	4	1	-	-
Jersey City, N.J.	50	32	6	11	-	1	-
New York City, N.Y.	1,290	787	251	203	35	14	41
Newark, N.J.	48	25	9	9	3	2	4
Paterson, N.J.	23	17	3	2	-	1	-
Philadelphia, Pa.	396	267	70	42	13	4	27
Pittsburgh, Pa.§	52	35	11	2	2	2	4
Reading, Pa.	12	9	2	1	-	-	1
Rochester, N.Y.	113	89	14	5	3	2	6
Schenectady, N.Y.	28	22	5	1	-	-	-
Scranton, Pa.§	22	19	3	-	-	-	-
Syracuse, N.Y.	64	45	15	3	1	-	5
Trenton, N.J.	31	21	4	6	-	-	2
Utica, N.Y.	16	13	2	1	-	-	1
Yonkers, N.Y.	U	U	U	U	U	U	U
E.N. CENTRAL	1,919	1,140	385	205	133	56	84
Akron, Ohio	18	12	3	-	2	1	-
Canton, Ohio	37	28	6	1	1	1	3
Chicago, Ill.	394	160	76	77	71	10	6
Cincinnati, Ohio	89	61	21	1	4	2	12
Cleveland, Ohio	133	88	25	11	4	5	-
Columbus, Ohio	148	94	34	10	4	6	10
Dayton, Ohio	105	71	21	11	-	2	9
Detroit, Mich.	227	109	53	39	15	11	9
Evansville, Ind.	42	33	7	1	-	1	-
Fort Wayne, Ind.	56	41	11	2	2	-	3
Gary, Ind.	16	10	3	3	-	-	1
Grand Rapids, Mich.	42	30	6	3	1	2	1
Indianapolis, Ind.	163	104	29	13	11	6	10
Madison, Wis.	45	29	9	2	4	1	3
Milwaukee, Wis.	119	83	22	8	3	3	11
Peoria, Ill.	54	41	7	5	-	1	4
Rockford, Ill.	49	34	9	3	1	2	1
South Bend, Ind.	33	22	8	2	-	1	1
Toledo, Ohio	92	48	28	8	7	1	-
Youngstown, Ohio	57	42	7	5	3	-	-
W.N. CENTRAL	722	497	136	46	24	19	46
Des Moines, Iowa	42	33	7	2	-	-	4
Duluth, Minn.	16	5	8	2	1	-	1
Kansas City, Kans.	12	8	3	1	-	-	-
Kansas City, Mo.	84	55	16	6	2	5	2
Lincoln, Nebr.	42	32	5	1	3	1	2
Minneapolis, Minn.	227	158	38	19	8	4	21
Omaha, Nebr.	70	45	16	2	3	4	4
St. Louis, Mo.	125	87	27	6	3	2	6
St. Paul, Minn.	62	45	11	3	2	1	4
Wichita, Kans.	42	29	5	4	2	2	2
S. ATLANTIC	1,333	810	286	176	31	27	62
Atlanta, Ga.	176	97	37	34	4	4	2
Baltimore, Md.	261	155	55	38	9	4	17
Charlotte, N.C.	112	63	29	12	3	5	7
Jacksonville, Fla.	112	67	26	10	4	5	6
Miami, Fla.	126	85	28	13	-	-	1
Norfolk, Va.	42	24	8	7	1	2	-
Richmond, Va.	66	42	13	9	2	-	2
Savannah, Ga.	38	29	6	2	1	-	4
St. Petersburg, Fla.	62	43	8	8	-	3	2
Tampa, Fla.	157	107	35	10	2	2	16
Washington, D.C.	174	94	40	33	5	2	5
Wilmington, Del.	7	4	1	-	-	-	-
E.S. CENTRAL	786	505	176	66	23	16	42
Birmingham, Ala.	123	76	29	10	5	3	2
Chattanooga, Tenn.	61	37	17	6	1	-	5
Knoxville, Tenn.	99	67	22	9	-	1	4
Lexington, Ky.	67	40	18	5	1	3	5
Memphis, Tenn.	172	113	36	18	4	1	7
Mobile, Ala.	90	55	24	5	4	2	9
Montgomery, Ala.	36	29	3	-	3	1	-
Nashville, Tenn.	138	88	27	13	5	5	10
W.S. CENTRAL	1,335	831	259	152	55	38	70
Austin, Tex.	55	37	10	4	4	-	4
Baton Rouge, La.	36	24	7	4	-	1	-
Corpus Christi, Tex.	50	33	10	4	2	1	4
Dallas, Tex.	216	126	42	29	9	10	3
El Paso, Tex.	60	41	8	4	7	-	9
Ft. Worth, Tex.	95	57	24	9	4	1	5
Houston, Tex.	341	190	72	56	15	8	26
Little Rock, Ark.	47	28	9	3	1	6	-
New Orleans, La.	88	50	19	11	6	2	-
San Antonio, Tex.	177	122	33	15	3	4	8
Shreveport, La.	54	36	13	3	2	-	5
Tulsa, Okla.	116	87	12	10	2	5	6
MOUNTAIN	834	549	147	78	30	30	46
Albuquerque, N.M.	86	61	9	9	5	2	2
Colo. Springs, Colo.	34	15	8	2	3	6	3
Denver, Colo.	133	81	28	17	2	5	4
Las Vegas, Nev.	147	86	43	12	6	-	7
Ogden, Utah	25	22	2	-	-	1	3
Phoenix, Ariz.	187	135	15	23	8	6	15
Pueblo, Colo.	18	15	2	1	-	-	-
Salt Lake City, Utah	80	52	13	4	5	6	7
Tucson, Ariz.	124	82	27	10	1	4	5
PACIFIC	2,407	1,510	473	260	106	51	172
Berkeley, Calif.	U	U	U	U	U	U	U
Fresno, Calif.	81	58	11	5	5	2	14
Glendale, Calif.	38	28	4	2	-	2	3
Honolulu, Hawaii	72	55	9	4	2	2	7
Long Beach, Calif.	85	55	17	8	3	2	12
Los Angeles, Calif.	1,206	699	260	160	69	14	66
Pasadena, Calif.	31	24	4	1	1	1	2
Portland, Oreg.	133	100	18	6	6	3	5
Sacramento, Calif.	U	U	U	U	U	U	U
San Diego, Calif.	161	94	39	9	7	11	19
San Francisco, Calif.	137	75	28	29	3	2	9
San Jose, Calif.	157	106	30	15	3	3	14
Santa Cruz, Calif.	36	26	7	1	-	2	5
Seattle, Wash.	132	89	22	13	4	4	4
Spokane, Wash.	61	44	12	3	1	1	7
Tacoma, Wash.	77	57	12	4	2	2	5
TOTAL	12,271¶	7,748	2,407	1,351	476	279	661

*Mortality data in this table are voluntarily reported from 121 cities in the United States, most of which have populations of 100,000 or more. A death is reported by the place of its occurrence and by the week that the death certificate was filed. Fetal deaths are not included.

†Pneumonia and influenza.

§Because of changes in reporting methods in these 3 Pennsylvania cities, these numbers are partial counts for the current week. Complete counts will be available in 4 to 6 weeks.

¶Total includes unknown ages.

U: Unavailable.

Lyme Disease — Continued

wearing long pants and long-sleeved shirts, tucking pants into socks, checking regularly for ticks, and promptly removing attached ticks.

The decrease in reported cases in 1993 may reflect a combination of three factors: decreased reporting by physicians, decreased case detection (*6*), and a true decrease in the number of cases. In Connecticut and New York, vector surveillance data suggest that *I. scapularis* population densities were lower in 1993 than in previous years. The decrease in New York also may be attributed to limitations in staffing and decreased reporting by physicians (D. White, Bureau of Communicable Diseases, New York State Department of Health, personal communication, 1994). The increase in New Jersey was attributed to an increase in reported cases from Hunterdon County as a result of improved reporting by physicians and a true increase in disease incidence (CDC, unpublished data, 1993). The actual incidence of LD in the United States is unknown, and estimates are subject to the influences of underreporting, misclassification, and overdiagnosis.

Accurate surveillance data are needed to target populations for LD prevention strategies (e.g., vaccination). In 1993, two U.S. manufacturers received Food and Drug Administration approval to conduct field trials of LD vaccines in humans. One manufacturer is conducting Phase III efficacy trials involving approximately 10,000 participants from endemic areas of the north central, mid-Atlantic, and New England states. The second manufacturer is conducting Phase II safety and immunogenicity trials involving approximately 400 persons residing in New England. Results of Phase I trials conducted in the United States have been published (*7*), and preliminary results of Phase II safety and efficacy trials (*8,9*) suggest the vaccine is safe and immunogenic. Both candidate vaccines use a recombinant outer-surface protein as the immunogen. The candidate vaccines stimulate production of antibodies that target *B. burgdorferi* in the midguts of infected ticks while they extract blood from a vaccinated animal (*10*).

Reliable identification of risks is required for targeting individually applied interventions for LD. LD surveillance data will be needed to determine the effectiveness of control and prevention efforts.

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Current Trends

Assessment of Undervaccinated Children Following a Mass Vaccination Campaign — Kansas, 1993

A 1992 retrospective survey by the Kansas Department of Health and Environment (KDHE) of children entering school in Kansas indicated that 52% were completely vaccinated by 24 months of age (i.e., received four doses of diphtheria and tetanus toxoids and pertussis vaccine [DTP], three doses of poliomyelitis vaccine, and one dose of measles-mumps-rubella vaccine [MMR]). In response to this low vaccination coverage rate, the KDHE set a goal for 1995 of completely vaccinating 90% of children by age 24 months. A major new initiative—Operation Immunize (OI)—undertaken to accomplish this goal consisted of three statewide vaccination campaigns on weekends during 1993–1994. This report summarizes the results of an assessment of the short-term impact of OI on children who remained undervaccinated following the first campaign.

OI was designed to reach children, particularly those aged <24 months, who were not up-to-date with their vaccinations. An extensive promotional effort was made throughout the state to encourage participation in OI. Vaccinations were available free or at reduced cost at 192 sites in the state during the campaigns.

During the first campaign (April 24–25, 1993), 7120 children were vaccinated; 2616 (37%) were aged <24 months. Of the children aged <24 months, 71% were not up-to-date with their vaccinations; 29% were due for their next series of vaccinations but were not yet considered behind schedule. OI reached 6% of the estimated 31,498 children (based on the 1992 retrospective survey) aged <24 months in Kansas who were not up-to-date.

A follow-up study begun in November 1993 assessed the vaccination status of children aged <24 months who were vaccinated during the April campaign but who needed additional vaccinations to be brought up-to-date during the next 6 months. OI records were available for 331 of these children. Each child's vaccination status was determined as of October 25, 1993 (6 months after the first OI campaign), using the recommendations of the Advisory Committee on Immunization Practices for DTP, polio, and MMR (*1*). Information on vaccinations was obtained from local health departments, parents, and physicians.

Children were considered up-to-date if they were within 1 month of being age-appropriately vaccinated by October 25, 1993. If the local health department had no record of vaccinations given since April 24–25, 1993, and the child's parents could not be contacted by phone and did not respond to two written requests for information, the child was considered lost to follow-up. As of October 25, 1993, 102 (31%) children were up-to-date; 35 (11%) had received additional vaccinations but remained behind schedule; 102 (31%) had received no additional vaccinations; and 92 (28%) were lost to follow-up.

Vaccination Campaign — Continued

Reported by: S Dismuke, MD, Univ of Kansas Medical Center, Kansas City; N McWilliams, Johnson County Health Dept, Mission; S Bowden, M Burt, J Hansen, M Miller, L Perry, A Pelletier, MD, Acting State Epidemiologist, Bur of Disease Control, Kansas Dept of Health and Environment. Div of Field Epidemiology, Epidemiology Program Office, CDC.

Editorial Note: Mass vaccination campaigns have been successful in developing countries (*2–4*); however, during the past decade, mass campaigns have not been used widely in the United States. Mass campaigns such as OI can focus public attention on the control of vaccine-preventable diseases and increase support for vaccination programs. However, mass campaigns are resource-intensive, and in some cases, increases in vaccination coverage rates have been difficult to sustain (*5,6*).

Options for the evaluation of OI were limited by the low incidence in Kansas of the vaccine-preventable diseases targeted by OI and the lack of current data on the vaccination status of Kansas children. The only population-based vaccination data available in Kansas are from retrospective surveys of children entering school. When collected, these data are 3–4 years old and therefore are not useful for evaluating the immediate impact of a mass vaccination campaign.

Calculating the limited percentage of the target population reached by OI provided one measure of the campaign's effectiveness; the study also sought to assess the ongoing impact of the campaign on children's vaccination status. This study indicated that many children reached by OI did not maintain up-to-date vaccination status during the 6 months after the campaign.

The experience with OI demonstrates that reaching undervaccinated children with mass campaigns can be difficult, even when the level of effort and commitment are high, as in Kansas. When used, mass campaigns should be an adjunct to ongoing, comprehensive vaccination programs (as outlined in the Childhood Immunization Initiative [*7*]), which are designed to meet local needs. Such programs for routine vaccination should include efforts to reduce barriers to vaccination, establish vaccination record information systems, improve surveillance, and use vaccination coverage assessments to monitor program performance.

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Epidemiologic Notes and Reports

Update: Outbreak of Legionnaires' Disease Associated with a Cruise Ship, 1994

On July 15, 1994, CDC was notified by the New Jersey State Department of Health of six persons with pneumonia who had recently traveled to Bermuda on the cruise ship *Horizon* (*1*). In conjunction with local and state health departments, an investigation was initiated; as of August 10, a total of 14 passengers had Legionnaires' disease (LD) confirmed by either sputum culture (one patient), detection of antigens of *Legionella pneumophila* serogroup 1 (Lp1) in urine by radioimmunoassay (seven patients) (*2*), or fourfold rise in titer of antibodies to Lp1 between acute- and convalescent-phase serum specimens (six patients). Possible cases in 28 other passengers with pneumonia that occurred within 2 weeks after sailing aboard the *Horizon* are under investigation. Cases have occurred from nine separate week-long cruises during April 30–July 9, 1994.

To identify the source of *Legionella* sp., a case-control study was conducted, and environmental sampling of the ship's water system was performed. Exposure to the whirlpool baths was strongly associated with illness (odds ratio=16.4; 95% confidence interval=3.7–72.3). Cultures taken from a sand filter used for recirculation of whirlpool water yielded an isolate of Lp1; this isolate and the clinical isolate had matching monoclonal antibody subtyping patterns (*3*).

A variety of interventions were completed, including hyperchlorination of the ship's potable water supply, removal of the whirlpool filters, and discontinuation of the whirlpool baths. Following completion of these interventions, on July 30 the *Horizon* resumed its weekly sailing schedule from New York City to Bermuda.

Reported by: I Guerrero, MD, Community Medical Center, Toms River; C Genese, MJ Hung, S Paul, MD, H Ragazzoni, DVM, J Brook, MD, L Finelli, PhD, KC Spitalny, MD, State Epidemiologist, New Jersey State Dept of Health. BA Mojica, MD, KJ Mahoney, MSW, RT Heffernan, MPH, Div of Disease Intervention, New York City Dept of Health; SF Kondracki, DL Morse, MD, State Epidemiologist, New York State Dept of Health. ML Cartter, MD, J Hadler, MD, State Epidemiologist, Connecticut Dept of Public Health and Addiction Svcs. JT Rankin, Jr, DVM, State Epidemiologist, Pennsylvania Dept of Health. C Groves, MS, Maryland State Dept of Health and Mental Hygiene. Div of Quarantine, National Center for Prevention Svcs; Office of the Director, National Center for Environmental Health; Div of Field Epidemiology, Epidemiology Program Office; Childhood and Respiratory Diseases Br, Div of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, CDC.

Editorial Note: This outbreak represents the first documented instance of LD aboard a cruise ship docking in U.S. ports. Whirlpool spas previously have been associated with transmission of *Legionella* (*4,5*); hyperchlorination of water systems and replacement of filter devices have successfully terminated outbreaks of LD linked to whirlpool spas. CDC recommends post-intervention environmental sampling of whirlpool circulation systems in conjunction with ongoing surveillance for cases of pneumonia to ensure the efficacy of these interventions. Suspected cases of LD among *Horizon* passengers should be reported to CDC through state and local health departments.

Additional recommendations to reduce the transmission of *Legionella* sp. from whirlpool baths and aboard cruise ships will be the subject of a special meeting of public health officials, LD experts, and members of the whirlpool and cruise line indus-

Legionnaires' Disease — Continued

tries; the meeting is tentatively scheduled for the fall of 1994 in Atlanta. Additional information about the meeting is available from CDC's Office of the Director, National Center for Environmental Health, telephone (404) 488-7093.

References

1. CDC. Outbreak of pneumonia associated with a cruise ship, 1994. MMWR 1994;43:521.
2. Kohler RB, Zimmerman SE, Wilson E, et al. Rapid radioimmunoassay diagnosis of Legionnaires' disease: detection and partial characterization of urinary antigen. Ann Intern Med 1981;94:601–5.
3. Joly JR, McKinney RM, Tobin JO, Bibb WF, Watkins ID, Ramsay D. Development of a standardized subgrouping scheme for *Legionella pneumophila* serogroup 1 using monoclonal antibodies. J Clin Microbiol 1986;23:768–71.
4. Vogt RL , Hudson PJ, Orciari L, Heun EM, Woods TC. Legionnaires' disease and a whirlpool spa [Letter]. Ann Intern Med 1987;107:596.
5. Spitalny KC, Vogt RL, Orciari LA, Witherell LE, Etkind P, Novick LF. Pontiac fever associated with a whirlpool spa. Am J Epidemiol 1984;120:809–16.

Erratum: Vol. 43, No. RR-11

In the *MMWR Recommendations and Reports*, "Recommendations of the U.S. Public Health Service Task Force on the Use of Zidovudine to Reduce Perinatal Transmission of Human Immunodeficiency Virus," on page i, two numerals in the telephone number for the CDC National AIDS Clearinghouse were transposed. The correct telephone number is (800) 458-5231.

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