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Epidemiologic Notes and Reports

Multiple Measles Outbreaks on College Campuses — Ohio, Massachusetts, Illinois

Since January 15, 1985, measles outbreaks have occurred on at least three college campuses in the United States, with probable spread to three additional campuses. The first outbreak, which occurred at The Ohio State University and involved 12 confirmed cases, has been reported previously (*1*). The index patient acquired measles while traveling to London and Sierra Leone. Three additional suspected cases are being investigated, and over 2,000 doses of measles vaccine have been administered to students as part of the control effort. Approximately 50,000 students are enrolled at this university.

Boston University, in Massachusetts, has been the site of a large outbreak that began at the end of January. The index patient was a student who had acquired measles while traveling in Venezuela and developed onset of rash on January 29, 1985. As of March 12, 82 confirmed cases have been reported among students at Boston University, which has approximately 28,000 students. In addition, related cases appear to have occurred in two students at the Massachusetts Institute of Technology, one student at Boston College, and two students at Northeastern University. To control the outbreak, Boston University required all students to provide proof of immunity to reenter school at the end of spring break on March 11. In addition, 5,000 doses of measles vaccine have been administered to students at college-based vaccination clinics. The Massachusetts Department of Public Health is also working with all other Boston-area colleges to adopt similar programs to review their students' immune status and vaccinate susceptibles. Eventually, all college campuses in Massachusetts will be contacted.

The largest outbreak has occurred at Principia College, a Christian Science college in Illinois with an enrollment of 712 students, with 128 confirmed or probable cases (113 among students and 15 among other residents) reported between January 15 and March 10. In addition, three deaths apparently related to respiratory complications from measles have occurred among students and residents at the college. Students are being required to remain on campus unless they receive vaccine or produce other evidence of immunity. To date, approximately 421 doses of vaccine have been given to students. Possible related cases have occurred in Indiana, Michigan, and New Jersey. One hundred thirty-nine students of 712 enrolled pupils had histories of previous immunity to measles. The source of the outbreak remains unknown.

Reported by TJ Halpin, MD, State Epidemiologist, Ohio Dept of Health; MA Barry, MD, Boston Health and Hospitals, JW Taylor, MD, Boston University, PH Etkind, P Gallagher, GF Grady, MD, State Epidemiologist, Massachusetts Dept of Public Health; CR March, CE Jennings, RJ Martin, DVM, N Kramer, Jersey County Health Dept, BJ Francis, MD, State Epidemiologist, Illinois Dept of Public Health; Div of Immunization, Center for Prevention Svcs, CDC.

Editorial Note: A major problem in controlling measles outbreaks in colleges relates to the inability to determine who truly needs vaccine, because immunization records are lacking. The

Measles — Continued

presence of records would allow rapid determination of susceptibles. The current spring breaks provide an excellent opportunity for students to obtain their immunization records before returning to campus. An aggressive approach, like that being taken by Boston University, will help ensure high levels of immunity and should end the outbreak quickly. The requirement to provide proof of immunity, such as that at Boston University, is much more effective than a voluntary vaccination clinic in ensuring that susceptibles are vaccinated.

The high attack rate (15.9%) at Principia College is undoubtedly due to these students' very low immunization levels. This outbreak illustrates the potential severity of measles and the rapidity of spread in an unvaccinated population. The very high apparent death-to-case ratio (2.3%) is unusual in the United States, which usually has a reported death-to-case ratio of 0.1% or lower. The reasons for this high mortality are under investigation.

Since 1980, when data on measles in colleges first began to be collected, at least 14 campuses have reported measles cases each year. During 1983, the 296 cases reported among college students accounted for 19.8% of all measles cases reported. If the present trend continues, college students will again account for a substantial proportion of the remaining morbidity from measles. Because susceptibility among college students may be as high as 15%, the potential for sustained outbreaks exists. To try to prevent outbreaks, the American College Health Association and the Immunization Practices Advisory Committee have both recommended that colleges require proof of measles immunity as a criterion for matriculation. To date, few colleges have such requirements, and it appears likely that measles will remain a problem in this population. It should be recognized that, for the next 5-7 years, a cohort of college students will exist that will not have optimal vaccination levels because its members were children during the start of the vaccination programs. State health department and college/university authorities should carefully consider measures to help decrease the vulnerability of this special cohort.

Reference

1. CDC. Measles on a college campus—Ohio. MMWR 1985;34:89-90.

Perspectives in Disease Prevention and Health Promotion

Fatal Occupational Injuries — Texas, 1982

A review of Texas death certificates for 1982 identified 710 deaths associated with occupational injuries. The average age at death was 37.2 years (range 16-84 years). This resulted in the premature loss (before age 65) of 19,924 potential years of life.

For this analysis, a case was defined as the fatality of a civilian male, 16 years of age or older, who died in Texas in 1982 as the result of traumatic injury occurring on the job in Texas. Only deaths coded as related to "external causes" according to the International Classification of Diseases were included in the analysis (ICD codes E800-E989, 9th revision). The leading causes of death were (1) motor vehicle-associated injuries (158 [22.3% of total]); (2) machinery- and tool-related injuries (105 [14.8%]); (3) homicide and firearm injuries (99 [13.9%]); (4) falls (84 [11.8%]); and (5) electrocutions (75 [10.6%]).

Industrial categories with the highest rates of fatal injury were: (1) mining (including crude petroleum and natural gas production) (51 per 100,000); (2) agriculture (35/100,000); and

Occupational Injuries — Continued

(3) construction (32/100,000) (Table 1). Analysis of the 10 occupations with the highest rates of fatal injuries are given below (Table 2).

Airplane pilots and navigators: Of the 18 deaths resulting from air accidents, five (27.8%) involved helicopter pilots, and three (16.7%) occurred during crop dusting or other agricultural spraying.

Oil well drillers: Machinery- and tool-related accidents accounted for 16 (47.1%) of the 34 deaths in this category, which includes roustabouts, roughnecks, and other unskilled oilfield workers.

TABLE 1. Fatal occupational injuries and rates for males 16 years of age or older for major industries and subindustries — Texas, 1982

Industry or type of business*	No. fatal injuries	Rate of fatal injuries/100,000†
Mining	**88**	**51**
Crude petroleum/natural gas production	87	55
Agriculture, forestry, and fisheries	**58**	**35**
Agricultural production, crops	28	34
Agricultural production, livestock	14	27
Construction	**170**	**32**
Transportation, communications, other public utilities	**114**	**31**
Trucking service	54	61
Water transportation	12	75
Air transportation	14	48
Electric light and power	10	26
Personal services	**11**	**19**
Business and repair services	**35**	**17**
Automotive repair shops	10	19
Miscellaneous repair services	12	39
Public administration	**27**	**15**
Justice, public order, safety	19	32
Retail trade	**53**	**10**
Grocery stores	18	21
Wholesale trade	**25**	**10**
Petroleum products	10	65
Professional and related services	**12**	**3**
All industries	**720**	**18**

*Industry as recorded on death certificates was coded according to U.S. Bureau of the Census 1980 Classified Index of Industries and Occupations. Only industries and subindustries with 10 or more deaths are included.

†Population at risk is obtained from U.S. Bureau of the Census 1980 estimates of the experienced civilian labor force in Texas, male, 16 years and over, by industry.

Occupational Injuries — Continued

Structural-metal workers: All 12 deaths occurred among iron or steel workers employed in construction; 10 (83.3%) resulted from falls. Four (33.3%) of these deaths occurred as the result of a single incident.

Electrical-power installers and repairers: All 11 deaths involved electrical linemen; nine (81.8%) deaths resulted from electrocution. Seven (63.6%) of the workers were employed in the construction industry.

Construction laborers: This category includes general construction workers and nonspe-

TABLE 2. Rates of fatal injuries for the 10 occupations with the highest risk, and leading causes of fatal injury, males, 16 years old or older — Texas, 1982

Occupation*	No. fatal injuries	Texas population at risk†	Fatal injury rate/100,000	Leading cause of fatal injury: External cause of death	Leading cause of fatal injury: No. deaths (%)
Airplane pilots and navigators	18	8,288	217	Air and space transport incidents	18 (100)
Oil well drillers	34	21,501	158	Machinery and tool-related incidents	16 (47)
Structural-metal workers	12	7,678	156	Falls	10 (83)
Electrical-power installers and repairers	11	7,494	147	Electric current	9 (82)
Construction laborers	45	67,225	67	Falls	11 (24)
Heavy-truck drivers	85	130,139	65	Motor vehicle incidents	64 (75)
Material-moving operating engineers	11	18,117	61	Machinery and tool-related incidents	4 (36)
Farmers, except horticultural	30	64,031	47	Machinery and tool-related incidents	10 (33)
Police and detectives, public service	10	21,620	46	Motor vehicle incidents	7 (70)
Electricians	18	43,148	42	Electric current	11 (61)
All occupations	**710**	**3,838,779**	**18**	**Motor vehicle incidents**	**158 (22)**

*Occupations as recorded on death certificates were coded according to U.S. Bureau of the Census 1980 Classified Index of Industries and Occupations.

†U.S. Bureau of the Census 1980 estimates of the experienced civilian labor force in Texas, male, 16 years and over, by occupation.

Occupational Injuries — Continued

cialized laborers. Falls (11 cases [24.4%]) and electrocutions (8 cases [17.8%]) were the major causes of the 45 deaths recorded here.

Heavy-truck drivers: Motor vehicle-related injuries accounted for 64 (75.3%) of the 85 deaths among truck drivers. These drivers were employed in a wide range of industries, including mining, construction, manufacturing, wholesale trade, and general trucking.

Material-moving operating engineers: This category consists of heavy-equipment operators. Eight (72.7%) of the 11 deaths occurred among workers employed in construction.

Farmers, except horticultural: Farmers and ranchers are included here; farm workers and other salaried agricultural laborers are not. Machinery- and tool-related injuries caused 10 (33.3%) of the 30 deaths, and motor vehicle-related injuries resulted in 6 deaths (20.0%). Four deaths (13.3%) were caused by electrocution (*1*).

Police and detectives, public service: Seven (70.0%) of the 10 deaths among state and municipal police officers were caused by motor vehicle-related injuries; 2 officers were killed by handguns. In five (71.4%) of the seven motor vehicle-related deaths, the police officers were pedestrians.

Electricians: The major causes of the 18 deaths among electricians were electrocution (11 cases [61.1%]) and falls (3 cases [16.7%]). Sixteen deaths (88.9%) occurred among electricians employed in the construction industry.

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Editorial Note: The National Institute for Occupational Safety and Health (NIOSH) estimates that at least 10 million persons in the United States suffer traumatic injuries on the job each year; about 3 million (30%) of these are severe, and 10,000 (0.1%) are fatal (*2*). In both Texas and the United States as a whole, mining, agriculture, and construction are the three industrial categories associated with the highest rates of mortality from injury.

A major impediment to the surveillance of work-related deaths is the absence of routinely coded occupation and industry information on death certificates in 22 states, including Texas. However, the accuracy of the occupation and industry information that is recorded on death certificates is generally high. In a recent examination of sample death certificates throughout the United States, data were found to be correct in 64.7% of the entries for occupation, and in 70.1% for industry (*3*). With the recognition of this accuracy, the review of death certificates has found increasing use as a technique for surveillance of deaths caused by occupational exposure (*4,5*). NIOSH and the National Center for Health Statistics have worked with state health departments extensively in recent years to develop universal coding from death certificates of data on occupation and industry; this coding is done with procedures developed by the U.S. Bureau of the Census (*6*).

In the present study, deaths among civilian males were included only when the answer, "yes," appeared on the death certificate in response to the question: "Injury at work?" Because of this restriction, the study probably underestimates the actual number of occupationally related deaths among males in 1982 that occurred in Texas.* However, because all the deaths studied were caused by occupational factors, and the interval between injury and death was less than 24 hours in 84% of the cases, the accuracy of these occupational data appears to be particularly high. All but 5 (0.7%) of the death certificates in this review provided information on occupation, and all but 25 (3.5%) provided an entry for industry.

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*Forty-seven deaths associated with occupational injuries were also identified among females but were not analyzed with the males.

Occupational Injuries — Continued

The prevention of deaths caused by occupational injury is a major priority of NIOSH (*2*). Efficient prevention of such deaths requires that research and intervention be targeted to those industries and occupations that present the highest risk (*7*). The data from this study indicate that a periodic review of death certificates provides an accurate and easily accessible approach to the surveillance of deaths caused by occupational injuries.

References
1. CDC. Irrigation-pipe-associated electrocution deaths—Washington. MMWR 1983;32:169-71.
2. CDC. Leading work-related diseases and injuries—United States. MMWR 1984;33:213-5.
3. Steenland K, Beaumont J. The accuracy of occupation and industry data on death certificates. J Occup Med 1984;26:288-96.
4. Milham S. Occupational mortality in Washington state, 1950-1979. Cincinnati: National Institute for Occupational Safety and Health, 1983. (DHHS [NIOSH] publication no. 83-116).

(Continued on page 139)

TABLE I. Summary—cases of specified notifiable diseases, United States

Disease	10th Week Ending			Cumulative, 10th Week Ending		
	Mar. 9, 1985	Mar. 10, 1984	Median 1980-1984	Mar. 9, 1985	Mar. 10, 1984	Median 1980-1984
Acquired Immunodeficiency Syndrome (AIDS)	111	52	N	1,084	633	N
Aseptic meningitis	69	67	65	635	817	797
Encephalitis: Primary (arthropod-borne & unspec.)	23	11	15	147	140	150
Post-infectious	4	1	1	20	9	14
Gonorrhea: Civilian	14,835	15,398	18,146	147,625	156,903	181,034
Military	455	325	506	3,634	3,743	5,361
Hepatitis: Type A	432	460	460	3,811	4,007	4,504
Type B	512	534	430	4,407	4,536	3,663
Non A, Non B	102	70	N	734	653	N
Unspecified	152	88	158	853	818	1,595
Legionellosis	15	20	N	102	88	N
Leprosy	7	6	3	65	44	43
Malaria	16	9	21	121	108	142
Measles: Total*	78	105	72	235	445	445
Indigenous	75	103	N	188	378	N
Imported	3	2	N	47	67	N
Meningococcal infections: Total	79	76	90	596	648	648
Civilian	79	76	89	596	648	648
Military	-	-	-	-	-	4
Mumps	91	82	115	659	690	1,054
Pertussis	26	34	20	205	333	201
Rubella (German measles)	11	19	43	46	103	369
Syphilis (Primary & Secondary): Civilian	407	535	547	4,634	5,477	5,814
Military	-	1	3	27	58	78
Toxic Shock syndrome	9	6	N	73	80	N
Tuberculosis	509	490	502	3,389	3,595	4,409
Tularemia	1	1	1	20	12	17
Typhoid fever	2	8	7	41	63	67
Typhus fever, tick-borne (RMSF)	1	-	1	5	10	10
Rabies, animal	64	74	108	759	761	889

TABLE II. Notifiable diseases of low frequency, United States

	Cum 1985		Cum 1985
Anthrax	-	Plague	-
Botulism: Foodborne	1	Poliomyelitis: Total	1
Infant	8	Paralytic	1
Other	-	Psittacosis (N.Y. City 1, Ga. 1)	23
Brucellosis (Calif. 5)	17	Rabies, human	-
Cholera	-	Tetanus (Ill. 1, Calif. 2)	11
Congenital rubella syndrome	-	Trichinosis (Upstate N.Y. 1)	7
Diphtheria	-	Typhus fever, flea-borne (endemic, murine) (Calif. 1)	3
Leptospirosis	4		

*Three of the 78 reported cases for this week were imported from a foreign country or can be directly traceable to a known internationally imported case within two generations.

TABLE III. Cases of specified notifiable diseases, United States, weeks ending March 9, 1985 and March 10, 1984 (10th Week)

Reporting Area	AIDS	Aseptic Menin-gitis	Encephalitis		Gonorrhea (Civilian)		Hepatitis (Viral), by type				Legionel-losis	Leprosy
			Primary	Post-in-fectious			A	B	NA,NB	Unspeci-fied		
	Cum. 1985	1985	Cum. 1985	Cum. 1985	Cum. 1985	Cum. 1984	1985	1985	1985	1985	1985	Cum. 1985
UNITED STATES	1,084	69	147	20	147,625	156,903	432	512	102	152	15	65
NEW ENGLAND	32	1	3	-	4,815	5,061	11	32	5	8	-	-
Maine	1	-	-	-	198	190	-	2	2	-	-	-
N.H.	-	-	1	-	102	120	-	-	-	-	-	-
Vt	-	-	-	-	45	74	-	1	1	-	-	-
Mass	21	1	2	-	1,795	1,891	8	18	1	8	-	-
R.I.	1	-	-	-	363	331	-	5	1	-	-	-
Conn.	9	-	-	-	2,312	2,455	3	6	-	-	-	-
MID ATLANTIC	423	8	15	-	20,256	20,130	17	50	3	4	-	6
Upstate N.Y.	57	3	6	-	2,738	2,910	10	27	2	1	-	-
N.Y. City	267	1	-	-	8,844	8,751	-	-	-	-	-	6
N.J.	66	3	5	-	3,990	2,939	7	23	1	3	-	-
Pa.	33	1	4	-	4,684	5,530	-	-	-	-	-	-
E.N. CENTRAL	64	9	41	3	21,563	21,540	21	49	9	5	2	1
Ohio	15	2	14	1	5,148	5,141	5	19	5	1	2	1
Ind.	3	2	9	-	2,176	2,364	7	6	1	2	-	-
Ill.	25	3	2	1	6,676	5,485	3	3	-	1	-	-
Mich.	11	2	14	-	6,194	6,140	6	21	3	1	-	-
Wis.	10	-	2	1	1,369	2,410	-	-	-	-	-	-
W.N. CENTRAL	11	4	10	2	7,832	7,313	8	13	2	2	-	-
Minn.	3	1	3	1	1,239	974	3	2	-	-	-	-
Iowa	2	-	6	-	824	858	1	2	-	1	-	-
Mo.	4	2	-	-	3,552	3,385	2	9	2	1	-	-
N. Dak.	-	-	-	1	59	92	-	-	-	-	-	-
S. Dak.	-	1	-	-	144	237	1	-	-	-	-	-
Nebr.	-	-	1	-	668	522	1	-	-	-	-	-
Kans.	2	-	-	-	1,346	1,245	-	-	-	-	-	-
S. ATLANTIC	151	21	20	8	31,559	40,386	29	98	17	10	7	1
Del.	2	1	1	-	645	651	3	-	-	1	1	-
Md.	21	2	6	-	4,773	5,223	1	10	4	1	1	-
D.C.	21	1	-	-	2,719	2,985	-	2	-	-	-	-
Va.	8	9	1	3	3,500	3,960	4	21	4	5	1	-
W. Va.	1	-	1	-	404	459	-	2	-	-	1	-
N.C.	8	1	9	-	6,271	6,574	3	6	1	1	3	1
S.C.	1	2	2	-	4,124	3,703	-	10	-	-	-	-
Ga.	22	1	-	-	-	7,777	-	17	1	-	-	-
Fla.	67	4	-	5	9,123	9,054	18	30	7	2	-	-
E.S. CENTRAL	9	4	6	3	13,087	13,229	10	36	8	-	-	-
Ky.	4	3	1	-	1,449	1,634	4	5	2	-	-	-
Tenn.	-	1	4	-	5,124	5,407	1	10	1	-	-	-
Ala.	4	-	1	3	4,035	4,161	2	19	5	-	-	-
Miss.	1	-	-	-	2,479	2,027	3	2	-	-	-	-
W.S. CENTRAL	62	5	13	-	21,698	21,794	79	43	4	27	2	7
Ark.	-	-	-	-	2,178	1,770	-	-	-	-	-	-
La.	3	-	-	-	4,590	5,109	8	12	-	1	-	-
Okla.	1	-	7	-	2,183	2,365	24	4	1	-	-	-
Tex.	58	5	6	-	12,747	12,550	47	27	3	26	2	7
MOUNTAIN	18	4	6	2	4,802	4,809	68	26	9	5	-	-
Mont.	-	-	-	-	150	238	-	3	-	1	-	-
Idaho	-	-	-	-	167	240	6	-	1	-	-	-
Wyo.	-	-	-	-	143	138	-	-	-	-	-	-
Colo.	5	1	2	-	1,398	1,329	7	4	1	-	-	-
N. Mex.	3	-	-	-	590	590	16	3	1	1	-	-
Ariz.	6	2	-	-	1,402	1,226	29	10	6	3	-	-
Utah	1	-	4	2	198	269	-	-	-	-	-	-
Nev.	3	1	-	-	754	779	10	6	-	-	-	-
PACIFIC	314	13	33	2	22,013	22,641	189	165	45	91	4	50
Wash.	17	2	2	-	1,535	1,602	29	11	3	6	-	7
Oreg.	8	-	-	-	1,309	1,271	32	8	4	-	-	1
Calif.	285	11	31	2	18,320	18,820	125	135	38	84	4	38
Alaska	-	-	-	-	509	574	2	1	-	-	-	-
Hawaii	4	-	-	-	340	374	1	10	-	1	-	4
Guam	-	U	-	-	-	59	U	U	U	U	U	-
P.R.	19	-	1	-	810	678	6	3	1	6	-	2
V.I.	-	-	-	-	68	79	-	-	-	-	-	-
Pac. Trust Terr.	-	U	-	-	-	-	U	U	U	U	U	-

N: Not notifiable U: Unavailable

TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending March 9, 1985 and March 10, 1984 (10th Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin-gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported *		Total									
	Cum. 1985	1985	Cum 1985	1985	Cum. 1985	Cum. 1984	Cum. 1985	1985	Cum. 1985	1985	Cum. 1985	Cum. 1984	1985	Cum 1985	Cum 1984
UNITED STATES	121	75	188	3	47	445	596	91	659	26	205	333	11	46	103
NEW ENGLAND	6	-	-	-	-	1	30	2	17	-	8	11	1	3	10
Maine	-	-	-	-	-	-	1	1	2	-	2	-	-	-	1
N.H.	-	-	-	-	-	1	2	-	1	-	2	3	-	1	-
Vt.	-	-	-	-	-	-	4	-	2	-	1	4	-	-	-
Mass.	3	-	-	-	-	-	7	-	9	-	2	3	1	2	9
R.I.	1	-	-	-	-	-	6	1	2	-	1	1	-	-	-
Conn.	2	-	-	-	-	-	10	-	1	-	-	-	-	-	-
MID ATLANTIC	18	1	7	1	3	10	81	9	81	3	37	21	1	9	1
Upstate N.Y.	8	1	3	-	1	-	24	7	53	2	15	11	1	2	-
N.Y. City	4	-	4	1†	2	7	9	-	8	-	7	1	-	6	-
N.J.	2	-	-	-	-	3	20	2	9	1	1	1	-	1	1
Pa.	4	-	-	-	-	-	28	-	11	-	14	8	-	-	-
E.N. CENTRAL	5	14	45	1	13	244	108	35	311	1	34	94	-	5	23
Ohio	1	-	-	1†	13	2	39	7	60	-	8	19	-	-	1
Ind.	-	-	-	-	-	2	17	1	10	-	11	52	-	-	1
Ill.	-	-	3	-	-	46	16	3	50	-	2	8	-	-	16
Mich.	4	14	32	-	-	193	25	24	161	1	5	7	-	5	3
Wis.	-	-	10	-	-	1	11	-	30	-	8	8	-	-	2
W.N. CENTRAL	2	-	-	-	-	-	27	1	10	2	15	57	-	1	11
Minn.	1	-	-	-	-	-	7	-	-	-	7	2	-	-	-
Iowa	-	-	-	-	-	-	4	1	3	-	1	3	-	-	-
Mo.	1	-	-	-	-	-	15	-	5	2	5	10	-	-	-
N. Dak.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1
S. Dak.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Nebr.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Kans.	-	-	-	-	-	-	-	-	2	-	-	40	-	1	10
S. ATLANTIC	17	4	5	-	2	4	124	9	53	8	38	37	3	4	9
Del.	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Md.	2	-	-	-	1	-	15	-	6	5	11	1	1	1	-
D.C.	3	-	-	-	1	-	4	-	-	-	-	-	-	-	-
Va.	4	3	3	-	-	1	18	4	10	-	1	7	-	-	-
W. Va.	1	-	-	-	-	-	3	5	21	-	-	3	-	-	-
N.C.	1	-	-	-	-	-	20	-	3	-	6	13	-	-	-
S.C.	-	-	-	-	-	-	10	-	1	-	-	1	1	2	-
Ga.	1	-	-	-	-	-	21	-	2	2	8	4	-	-	1
Fla.	5	1	2	-	-	3	31	-	10	1	12	8	1	1	8
E.S. CENTRAL	2	-	-	-	-	2	25	1	6	-	3	2	-	1	-
Ky.	-	-	-	-	-	-	2	1	1	-	1	1	-	1	-
Tenn.	-	-	-	-	-	2	10	-	4	-	1	1	-	-	-
Ala.	2	-	-	-	-	-	10	-	-	-	1	-	-	-	-
Miss.	-	-	-	-	-	-	3	-	1	-	-	-	-	-	-
W.S. CENTRAL	5	-	2	-	-	55	53	14	59	-	11	42	-	4	4
Ark.	-	-	-	-	-	-	6	-	1	-	7	9	-	1	1
La.	-	-	-	-	-	-	5	-	-	-	-	1	-	-	-
Okla.	-	-	-	-	-	-	9	N	N	-	4	24	-	-	-
Tex.	5	-	2	-	-	55	33	14	58	-	-	8	-	3	3
MOUNTAIN	3	35	94	-	16	69	34	4	51	4	12	32	-	1	3
Mont.	-	35	94	-	16	-	3	-	3	1	1	16	-	-	-
Idaho	-	-	-	-	-	-	-	-	3	-	-	1	-	-	1
Wyo.	-	-	-	-	-	-	3	-	-	-	-	1	-	-	-
Colo.	1	-	-	-	-	-	7	-	9	2	5	11	-	-	-
N. Mex.	2	-	-	-	-	45	4	N	N	-	1	2	-	-	-
Ariz.	-	-	-	-	-	-	11	3	30	-	2	-	-	1	-
Utah	-	-	-	-	-	24	4	-	2	1	3	1	-	-	2
Nev.	-	-	-	-	-	-	2	1	4	-	-	-	-	-	-
PACIFIC	63	21	35	1	13	60	114	16	71	8	47	37	6	18	42
Wash.	5	-	-	-	-	13	18	-	2	2	5	7	-	-	-
Oreg.	2	-	-	-	-	-	11	N	N	-	5	4	-	1	-
Calif.	47	21	33	1†	11	45	85	15	61	6	35	13	5	15	41
Alaska	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Hawaii	8	-	2	-	2	2	-	1	7	-	2	13	1	2	1
Guam	-	U	-	U	-	50	-	U	-	U	-	-	U	-	1
P.R.	-	2	35	-	-	-	3	3	33	-	1	-	-	4	1
V.I.	-	-	1	-	5	-	-	-	3	-	-	-	-	-	-
Pac. Trust Terr.	-	U	-	U	-	-	-	U	-	U	-	-	U	-	-

*For measles only, imported cases includes both out-of-state and international importations.

N: Not notifiable U: Unavailable †International §Out-of-state

TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending March 9, 1985 and March 10, 1984 (10th Week)

Reporting Area	Syphilis (Civilian) (Primary & Secondary)		Toxic-shock Syndrome	Tuberculosis		Tula-remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum. 1985	Cum. 1984	1985	Cum. 1985	Cum. 1984	Cum. 1985	Cum. 1985	Cum. 1985	Cum. 1985
UNITED STATES	4,634	5,477	9	3,389	3,595	20	41	5	759
NEW ENGLAND	99	119	-	111	98	-	3	-	-
Maine	3	1	-	9	6	-	-	-	-
N.H.	-	-	-	-	8	-	-	-	-
Vt.	-	-	-	-	2	-	-	-	-
Mass.	53	73	-	66	48	-	2	-	-
R.I.	2	5	-	16	11	-	-	-	-
Conn.	41	40	-	20	23	-	1	-	-
MID ATLANTIC	607	744	1	665	665	1	5	-	87
Upstate N.Y.	29	57	-	88	109	-	3	-	16
N.Y. City	417	427	-	380	266	1	-	-	-
N.J.	107	149	-	47	124	-	1	-	-
Pa.	54	111	1	150	166	-	1	-	71
E.N. CENTRAL	230	249	1	452	473	-	3	-	8
Ohio	16	44	1	83	102	-	1	-	1
Ind.	17	35	-	50	51	-	1	-	1
Ill.	126	94	-	211	182	-	1	-	2
Mich.	60	57	-	85	110	-	-	-	-
Wis.	11	19	-	23	28	-	-	-	4
W.N. CENTRAL	58	85	1	89	92	7	2	-	121
Minn.	18	15	-	16	13	1	2	-	14
Iowa	10	8	1	17	17	-	-	-	37
Mo.	18	51	-	36	38	5	-	-	6
N. Dak.	-	-	-	-	3	-	-	-	15
S. Dak.	3	-	-	5	3	-	-	-	43
Nebr.	1	3	-	5	8	1	-	-	6
Kans.	8	8	-	10	10	-	-	-	-
S. ATLANTIC	1,174	1,680	1	686	821	4	7	3	242
Del.	9	4	-	7	10	-	-	-	-
Md.	91	83	-	76	89	-	1	-	150
D.C.	57	62	-	31	22	-	-	-	-
Va.	61	97	-	43	62	-	1	-	29
W. Va.	1	7	-	17	29	-	-	-	2
N.C.	142	192	-	72	149	4	-	2	-
S.C.	155	167	-	95	101	-	-	1	6
Ga.	-	284	-	99	95	-	-	-	33
Fla.	658	784	1	246	264	-	5	-	22
E.S. CENTRAL	415	361	-	279	319	1	2	2	37
Ky.	13	17	-	52	80	-	-	-	3
Tenn.	95	84	-	81	97	1	-	1	6
Ala.	154	131	-	111	116	-	2	1	28
Miss.	153	129	-	35	26	-	-	-	-
W.S. CENTRAL	1,167	1,316	2	344	331	2	2	-	131
Ark.	64	52	-	22	20	1	-	-	13
La.	214	266	-	58	52	-	-	-	3
Okla.	40	36	2	40	32	1	-	-	17
Tex.	849	962	-	224	227	-	2	-	98
MOUNTAIN	157	118	-	51	69	3	-	-	67
Mont.	1	-	-	5	2	-	-	-	32
Idaho	2	8	-	1	3	-	-	-	-
Wyo.	3	1	-	1	-	-	-	-	2
Colo.	36	27	-	3	7	-	-	-	-
N. Mex.	18	12	-	8	18	1	-	-	1
Ariz.	88	46	-	28	31	-	-	-	32
Utah	2	4	-	2	5	2	-	-	-
Nev.	7	20	-	3	3	-	-	-	-
PACIFIC	727	805	3	712	727	2	17	-	66
Wash.	12	33	-	23	37	-	-	-	-
Oreg.	22	22	-	24	29	1	-	-	-
Calif.	681	731	3	590	597	1	17	-	66
Alaska	-	1	-	38	17	-	-	-	-
Hawaii	12	18	-	37	47	-	-	-	-
Guam	-	-	U	-	4	-	-	-	-
P.R.	188	189	-	56	62	-	1	-	4
V.I.	-	6	-	-	1	-	-	-	-
Pac. Trust Terr.	-	-	U	-	-	-	-	-	-

U: Unavailable

TABLE IV. Deaths in 121 U.S. cities,* week ending March 9, 1985 (10th Week)

Reporting Area	All Causes, By Age (Years)						P&I** Total
	All Ages	≥65	45-64	25-44	1-24	<1	
NEW ENGLAND	738	519	143	38	13	25	79
Boston, Mass.	181	117	35	11	6	12	22
Bridgeport, Conn.	43	29	11	2	1	-	6
Cambridge, Mass.	31	24	4	3	-	-	7
Fall River, Mass.	37	30	4	3	-	-	1
Hartford, Conn.	74	50	21	2	1	-	5
Lowell, Mass.	39	34	3	2	-	-	4
Lynn, Mass.	16	8	5	1	1	1	3
New Bedford, Mass.	27	23	2	-	1	1	1
New Haven, Conn.	56	31	13	6	1	5	3
Providence, R.I.	70	52	15	1	-	2	4
Somerville, Mass.	10	7	3	-	-	-	1
Springfield, Mass.	62	44	12	4	1	1	6
Waterbury, Conn.	24	16	3	2	-	3	5
Worcester, Mass.	68	54	12	1	1	-	11
MID. ATLANTIC	2,914	1,938	607	219	59	91	161
Albany, N.Y.	39	23	6	2	2	6	1
Allentown, Pa.	12	12	-	-	-	-	-
Buffalo, N.Y.	131	96	26	5	-	4	16
Camden, N.J.	37	26	9	1	1	-	2
Elizabeth, N.J.	27	20	6	1	-	-	1
Erie, Pa.†	46	34	9	3	-	-	2
Jersey City, N.J.	42	32	7	2	-	1	-
N.Y. City, N.Y.	1,441	943	298	135	27	38	53
Newark, N.J.	71	25	21	13	4	8	9
Paterson, N.J.	31	19	3	3	1	5	2
Philadelphia, Pa.†	510	325	125	28	18	14	37
Pittsburgh, Pa.†	91	60	21	2	4	4	3
Reading, Pa.	36	31	3	-	-	2	4
Rochester, N.Y.	125	84	32	4	2	3	13
Schenectady, N.Y.	34	27	4	3	-	-	1
Scranton, Pa.†	36	29	7	-	-	-	4
Syracuse, N.Y.	111	84	15	6	-	6	3
Trenton, N.J.	40	23	10	7	-	-	2
Utica, N.Y.	21	16	4	1	-	-	1
Yonkers, N.Y.	33	29	1	3	-	-	7
E.N. CENTRAL	2,371	1,673	410	142	59	86	112
Akron, Ohio	45	34	9	1	-	1	5
Canton, Ohio	41	32	7	2	-	-	3
Chicago, Ill. §	553	462	11	26	16	37	16
Cincinnati, Ohio	191	127	46	12	3	3	19
Cleveland, Ohio	163	106	38	12	4	3	6
Columbus, Ohio	158	101	33	16	4	4	3
Dayton, Ohio	115	72	33	3	2	5	4
Detroit, Mich.	290	180	60	29	11	10	12
Evansville, Ind.	63	45	8	6	3	1	2
Fort Wayne, Ind.	74	43	19	6	-	6	5
Gary, Ind.	19	9	5	4	1	-	1
Grand Rapids, Mich.	62	46	13	1	2	-	8
Indianapolis, Ind.	168	103	39	12	6	8	3
Madison, Wis.	35	27	7	-	-	1	6
Milwaukee, Wis.	133	101	24	2	3	3	3
Peoria, Ill.	38	24	13	-	-	1	5
Rockford, Ill.	43	33	6	3	1	-	2
South Bend, Ind.	24	17	5	-	-	2	3
Toledo, Ohio	95	66	22	4	3	-	4
Youngstown, Ohio	61	45	12	3	-	1	2
W.N. CENTRAL	766	531	157	34	21	23	56
Des Moines, Iowa	78	53	17	3	5	-	4
Duluth, Minn.	20	16	1	1	-	2	1
Kansas City, Kans.	36	25	7	1	3	-	1
Kansas City, Mo.	119	85	24	4	4	2	15
Lincoln, Nebr.	36	29	2	4	-	1	3
Minneapolis, Minn.	64	43	14	2	3	2	3
Omaha, Nebr.	96	66	26	2	-	2	10
St. Louis, Mo.	161	113	28	7	4	9	7
St. Paul, Minn.	60	46	11	2	1	-	2
Wichita, Kans.	96	55	27	8	1	5	10

Reporting Area	All Causes, By Age (Years)						P&I** Total
	All Ages	≥65	45-64	25-44	1-24	<1	
S. ATLANTIC	1,540	976	357	108	39	58	90
Atlanta, Ga.	155	99	38	10	6	2	9
Baltimore, Md.	404	264	97	28	4	11	20
Charlotte, N.C.	87	55	22	3	4	3	13
Jacksonville, Fla.	111	77	21	8	2	3	7
Miami, Fla.	90	40	29	12	7	2	4
Norfolk, Va.	62	35	17	4	2	4	5
Richmond, Va.	85	50	23	5	2	5	7
Savannah, Ga.	49	38	6	2	1	2	2
St. Petersburg, Fla.	133	109	19	2	1	2	8
Tampa, Fla.	78	51	15	4	1	6	5
Washington, D.C.	256	137	63	29	8	18	10
Wilmington, Del.	30	21	7	1	1	-	-
E.S. CENTRAL	962	640	216	67	16	23	58
Birmingham, Ala.	153	98	37	10	2	6	10
Chattanooga, Tenn.	72	53	14	4	-	1	5
Knoxville, Tenn.	95	65	19	8	-	3	10
Louisville, Ky.	124	75	36	10	1	2	3
Memphis, Tenn.	218	150	49	13	4	2	17
Mobile, Ala.	103	73	16	8	3	3	9
Montgomery, Ala.	43	29	8	1	1	4	2
Nashville, Tenn.	154	97	37	13	5	2	2
W.S. CENTRAL	1,537	914	377	112	67	67	74
Austin, Tex.	56	35	12	2	3	4	5
Baton Rouge, La.	50	35	13	-	1	1	4
Corpus Christi, Tex.	48	28	12	4	3	1	-
Dallas, Tex.	226	120	71	14	9	12	10
El Paso, Tex.	48	34	10	3	1	-	3
Fort Worth, Tex.	113	67	27	7	6	6	6
Houston, Tex.	387	201	100	42	23	21	14
Little Rock, Ark.	55	41	8	2	3	1	4
New Orleans, La.	162	90	42	15	5	10	3
San Antonio, Tex.	185	122	37	13	7	6	12
Shreveport, La.	75	53	13	5	2	2	5
Tulsa, Okla.	132	88	32	5	4	3	8
MOUNTAIN	752	510	139	70	18	14	64
Albuquerque, N.Mex.	96	68	14	11	2	-	14
Colo. Springs, Colo.	37	29	5	3	-	-	5
Denver, Colo.	125	79	24	16	3	3	2
Las Vegas, Nev.	83	52	23	4	3	1	5
Ogden, Utah	28	20	2	6	-	-	5
Phoenix, Ariz.	176	118	28	18	6	6	9
Pueblo, Colo.	23	19	3	1	-	-	3
Salt Lake City, Utah	53	35	10	5	1	2	2
Tucson, Ariz.	131	90	30	6	3	2	19
PACIFIC	2,093	1,571	283	110	62	61	155
Berkeley, Calif.	17	13	2	-	2	-	-
Fresno, Calif.	84	61	10	6	2	5	13
Glendale, Calif. §	33	33	-	-	-	-	1
Honolulu, Hawaii	75	43	19	6	4	3	6
Long Beach, Calif.	113	84	17	6	2	4	4
Los Angeles, Calif. §	562	526	5	2	16	7	24
Oakland, Calif.	94	66	14	6	3	5	8
Pasadena, Calif.	32	20	8	-	1	3	2
Portland, Oreg.	115	79	26	7	1	2	10
Sacramento, Calif.	146	101	29	9	5	2	13
San Diego, Calif.	191	137	30	16	4	4	29
San Francisco, Calif.	147	86	28	24	7	2	6
San Jose, Calif.	169	113	29	12	7	8	18
Seattle, Wash.	158	104	32	10	3	9	8
Spokane, Wash.	67	42	14	2	4	5	7
Tacoma, Wash.	90	63	20	4	1	2	6
TOTAL	13,673††	9,272	2,689	900	354	448	849

* 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 4 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.

§ Data not available. Figures are estimates based on average of past 4 weeks.

TABLE V. Years of potential life lost, deaths, and death rates, by cause of death, and estimated number of physician contacts, by principal diagnosis, United States

Cause of morbidity or mortality (Ninth Revision ICD, 1975)	Years of potential life lost before age 65 by persons dying in 1983*†	Estimated mortality October 1984		Estimated number of physician contacts October 1984*¶
		Number*§	Annual Rate/100,000*§	
ALL CAUSES (TOTAL)	9,170,000	165,910	825.3	106,500,000
Accidents and adverse effects (E800-E949)	2,219,000	7,500	37.3	6,200,000
Malignant neoplasms (140-208)	1,808,000	38,020	189.1	1,800,000
Diseases of heart (390-398, 402, 404-429)	1,559,000	60,690	301.9	6,500,000
Suicides, homicides (E950-E978)	1,218,000	3,980	19.8	—
Chronic liver disease and cirrhosis (571)	248,000	2,150	10.7	100,000
Cerebrovascular diseases (430-438)	226,000	12,280	61.1	900,000
Congenital anomalies (740-759)	134,000	1,010	5.0	400,000
Chronic obstructive pulmonary diseases and allied conditions (490-496)	123,000	5,430	27.0	1,600,000
Diabetes mellitus (250)	115,000	3,035	15.1	3,300,000
Pneumonia and influenza (480-487)	106,000	4,520	22.5	900,000
Prenatal care*				2,800,000
Infant mortality*††		3,200	10.4 /1,000 live births	

*For details of calculation, see footnotes for Table V, *MMWR* 1985;34:2.

†Years of potential life lost for persons between 1 year and 65 years old at the time of death are derived from the number of deaths in each age category as reported by the National Center for Health Statistics, *Monthly Vital Statistics Report* (MVSR), Vol. 32, No. 13, September 21, 1984.

§National Center for Health Statistics, *Monthly Vital Statistics Report* (MVSR), Vol. 33, No. 11, February 27, 1985, pp. 8-9.

¶IMS America *National Disease and Therapeutic Index* (NDTI), Monthly Report, October 1984, Section III.

††MVSR Vol. 33, No. 10, January 29, 1985, p. 1.

Occupational Injuries – Continued

5. Dubrow R, Wegman DH. Occupational characteristics of cancer victims in Massachusetts, 1971-1973. Cincinnati: National Institute for Occupational Safety and Health, 1984. (DHHS [NIOSH] publication no. 84-109).
6. U.S. Bureau of the Census. 1980 census of population: classified index of industries and occupations. U.S. Bureau of the Census, 1980.
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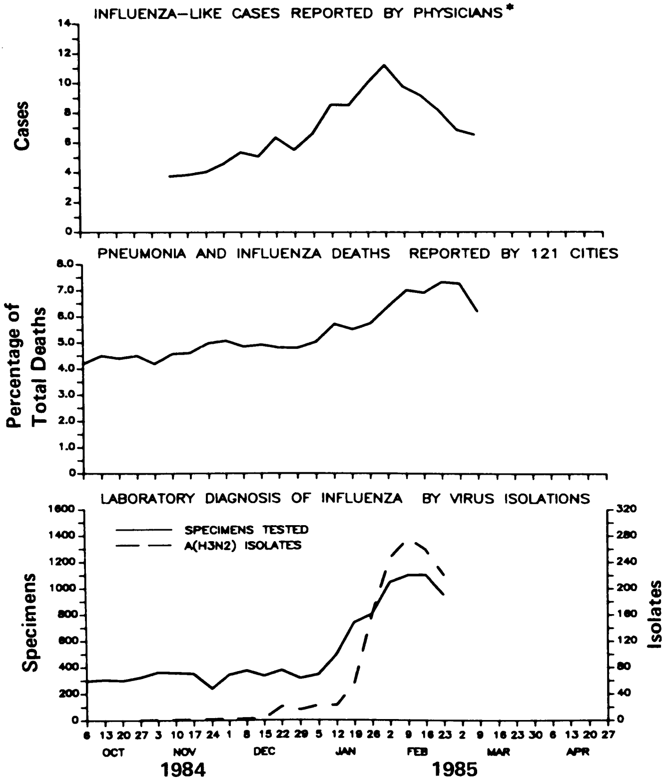
Epidemiologic Notes and Reports

Update: Influenza Activity — United States

Trends of national influenza activity and morbidity associated with pneumonia and influenza are shown in Figure 1. A total of 16 states indicated the occurrence of widespread or regional outbreaks of influenza-like illness for the week ending March 9, 1985, compared with 21 states and 26 states, respectively, that indicated similar levels for the 2 preceding weeks. Following the trend shown recently by other indices of influenza activity, the percentage of total deaths associated with pneumonia and influenza that were reported from 121 cities declined sharply to 6.2% for the week ending March 9.

Reported by Participating physicians of the American Academy of Family Physicians; State and Territorial Epidemiologists; State Laboratory Directors; Other collaborating laboratories; Statistical Svcs Br, Div of Surveillance and Epidemiologic Studies, Epidemiology Program Office, Influenza Br, Div of Viral Diseases, Center for Infectious Diseases, CDC.

FIGURE 1. Indicators of influenza activity, by week — United States, 1984-1985



*Reported to CDC by approximately 125 physician-members of the American Academy of Family Physicians. A case was defined as a patient with fever 37.8 C (100 F) or greater and at least cough or sore throat.

†Reported to CDC from 121 cities in the United States. Pneumonia and influenza deaths include all deaths where pneumonia is listed as a primary or underlying cause or where influenza is listed on the death certificate.

§Reported to CDC by WHO Collaborating Laboratories (including military sources).

Intestinal Myiasis — Washington

In June and August 1984, the mother of a 12-month-old Washington girl periodically observed "moving worms" in the child's stool. The child was asymptomatic. She was treated by her physician for a presumptive diagnosis of pinworm infection, first with pyrvinium pamoate and then with piperazine. However, the mother continued to see "worms" in the child's stool. In early September, fly larvae (maggots) were seen in each of two stool specimens collected on different days. These larvae were identified as living third-instars of *Muscina stabulans*, the false stable fly. Examinations of stool specimens from other family members showed no larvae. Careful questioning about the child's dietary history revealed that she was fed overripened bananas, which were kept in a hanging wire basket in the kitchen. Flies were frequently observed on and around the fruit. No treatment was prescribed, but the parents were instructed to cover all fruit kept in the house and to wash it before consumption. By the end of September, the mother ceased to find larvae in the child's stool.

Reported by KL Madison, DE North, S Helgerson, MD, Seattle-King County Dept of Public Health, EP Catts, PhD, Washington State University, Pullman, L Baum, Dept of Social and Health Svcs, J Kobayashi, MD, State Epidemiologist, Washington State Dept of Health; Div of Parasitic Diseases, Center for Infectious Diseases, CDC.

Editorial Note: Myiasis is the infestation of live human and vertebrate animals with fly (dipterous) larvae, which, at least for a certain period, feed on dead or living tissue or ingested food of the host (*1*). Intestinal myiasis occurs when fly eggs or larvae previously deposited in food are ingested and survive in the gastrointestinal tract. Some infested patients have been asymptomatic; others have had abdominal pain, vomiting, and diarrhea (*2,3*).

Many fly species are capable of producing intestinal myiasis. Of 28 cases reported in 1963, *M. stabulans* was responsible for 4 (14%) (*4*). *M. stabulans* are common houseflies, and the females frequently oviposit from 140-200 eggs on food or decaying matter. These develop through three larval stages before pupation. The larval development is temperature-dependent and requires 10-20 days (*2*).

The finding of fly larvae in stool specimens does not necessarily denote intestinal myiasis. Many species of fly larvae that might be accidentally ingested with food cannot survive in the gastrointestinal environment. In such cases, although the dead larvae may be recognized on subsequent stool examinations, true host infestation is never established, and the condition is properly termed pseudomyiasis (*5*). Pseudomyiasis can also occur when female flies oviposit on uncovered fecal specimens before laboratory processing (*6*).

In addition to the intestine, myiasis can occur in other anatomic sites, including skin, eye, ear, nasopharynx, and the genitourinary tract; infestation may also occur in wounds (*7,8*). Over 50 fly species have been reported to cause human myiasis (*2*). Treatment of all forms of myiasis includes occlusive salves and dressings for cutaneous myiasis (*7,8*); manual removal of larvae in aural, genitourinary, and nasopharyngeal myiasis (*7,9*); application of a 15% chloroform in light vegetable oil solution (followed by manual removal) in wound myiasis (*8*); and administration of a mild cathartic agent in intestinal myiasis (*10*). Steroids, photocoagulation, and surgery have been tried with variable success to treat the various ocular manifestations of the disease (*11*). No effective chemotherapeutic agents are available for the treatment of any form of myiasis (*7,8,10*). Prevention of myiasis involves controlling the source of the larvae, the ovipositing female fly.

Although human myiasis is not reportable, CDC's Division of Parasitic Diseases was notified of 24 cases from 15 states in 1984. In nine (38%) of these, the larvae were found on stool examination. Four cases (17%) were cutaneous: three (13%), aural; one (4%), urinary; one (4%), nasopharyngeal; and six (25%), from unspecified sites. In a summary of 102 myiasis

Intestinal Myiasis — Continued

cases reported during the 11-year period 1952-1962 from 29 states, Canada, and Puerto Rico, 38 cases were cutaneous; 28 were enteric; and 46 involved other anatomic sites (nasopharyngeal, ocular, aural, and wound). Sixty-five percent of cases occurred during the warmer months (April through September), when fly populations are at their greatest (*4*). Myiasis has occasionally been reported as a hospital-acquired infection; case reports of these infections in obtunded intensive-care unit and convalescent home patients have recently been published (*9,12*).

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Detection of Elevated Levels of Coliform Bacteria in a Public Water Supply — Connecticut

In August 1984, routine bacteriologic monitoring of a water distribution system serving 350,000 people in Connecticut revealed elevated total coliform counts (mean 12.1 coliforms/100 ml) (standard 1 coliform/100 ml). Speciation of coliforms identified *Klebsiella pneumoniae, Enterobacter cloacae*, and *E. aerogenes*, but not *Escherichia coli*. An investigation was begun to determine the source and public health significance of the bacteria in the water supply. Interim control measures included increased chlorination and flushing of the distribution system but not a boil-water order.

The distribution system received water from four reservoir systems and five well fields. Water from three of the reservoir systems was filtered and chlorinated. Water from the other reservoir and from the well fields was chlorinated but not filtered. Free-chlorine residuals were maintained at 0.6-1.0 ppm in treatment effluents from surface sources and 0.2-0.4 ppm at the well fields and ranged from 0.2 ppm to 0.5 ppm at points distant in the distribution system.

Some distribution system sample sites received water from only one source rather than a mix from several sources. When coliform counts from these sites were stratified by water source and type of treatment, the percentage of samples with more than 4 coliforms/100 ml in each stratum was significantly greater than the standard of less than 5% ($p < 0.05$). The percentage was 15% (13/87) from sites receiving water from the five well fields; 18%

Coliform Bacteria — Continued

(25/139) from the unfiltered reservoir system; and 21% (19/92) from the three filtered reservoir systems.

Because elevated coliform bacteria counts were found throughout the distribution system, it was felt that fecal contamination originating from one part of the system was unlikely. Further evaluation to rule out fecal contamination included inspections of water-treatment facilities to identify lapses in chlorination and cross-connection incidents; review of surveillance data from 1982 to 1984 for *Salmonella, Shigella,* and hepatitis A from the towns served by the distribution system and all other Connecticut towns; expanded daily bacteriologic monitoring; fecal coliform testing; and continued speciation of coliforms. No evidence was found of fecal coliform contamination. After the initiation of control measures, the percentage of specimens with more than 4 coliforms/100 ml remained elevated for 2 weeks, then decreased to below 5%.

The types of coliforms found in this distribution system, while not in themselves enteric pathogens, have been associated with infections in compromised patients, particularly in the hospital setting. A review of nosocomial infections occurring in April-September 1984 in intensive-care units of a large hospital served by the utility found no increase in the number of *K. pneumoniae* infections with antimicrobial sensitivity (gentamicin-sensitive) similar to the water system isolates. Data from another local hospital revealed no significant increase in the percentage of hospital isolates of *K. pneumoniae, E. cloacae,* or *E. aerogenes* that were gentamicin-sensitive in July-August 1984, compared to 1983.

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Editorial Note: Water distribution systems normally contain living microorganisms and nutrients that may enter a system with raw water during treatment failures or from sources, such as leaks, cross-connections, and back-flows. Bacterial growth may occur at or near the pipe surfaces (biofilms), the interface of suspended particulates, and within the water itself. Factors that influence bacterial growth include water temperature, flow rate, and chlorination. The bacteria commonly found in biofilms grow on minimal nutrients and are able to encapsulate or develop a gelatinous slime that protects them from the effects of chlorine (*1*).

The data from the Connecticut investigation were consistent with the hypothesis that the elevated total coliform counts were due to the sloughing of coliform bacteria that had accumulated within a biofilm on inner pipe surfaces. The coliforms were of the same types commonly found in biofilms (*1*). Persistent elevations in coliform counts during the first few weeks of control measures were consistent with biofilm sloughing. Two of the major control measures, increased chlorination and flushing of the distribution system, promote sloughing of biofilm with corresponding elevations in coliform counts (*2*). Because the coliform speciation data and the above analyses supported the biofilm hypothesis and no evidence of adverse health effects due to coliforms of the types isolated from the water distribution system was found, state and federal water-quality officials recommended against issuing a boil-water order.

Water-quality problems caused by the bacterial colonization of water distribution systems are probably much more common than reported. In two cities where these problems were well described (*2,3*), water-quality crises were highly publicized, expensive to manage, and difficult to resolve. Increased chlorination and flushing were eventually successful in eliminating the coliforms from the distribution systems in both cities. Health officials in one city as-

Coliform Bacteria — Continued

sumed that the bacteria were a potential health risk in the absence of information to the contrary and issued a boil-water order. In the other city, officials waited until the mean coliform bacteria count for the system exceeded 200 coliforms/100 ml before issuing an order to boil water. While Connecticut water-quality regulations give health officials the power to issue a boil-water order, criteria on which to base the decision to issue such an order do not exist.

No outbreaks of waterborne disease due to coliforms in potable water of the types found in biofilms have been reported to CDC. No association was found between hospital infections and biofilm sloughing in Connecticut, but additional studies are needed.

Historically, total coliform standards were established because it was felt that the total coliform count was an index of the presence of fecally associated bacterial and viral pathogens. This relationship may not be consistently true, especially in the setting of biofilm sloughing. At present, elevated coliform counts in community water distribution systems must be evaluated on a case-by-case basis to determine whether the counts are due to biofilm growth and sloughing or represent fecal contamination. Biofilm growth in water distribution systems may be a recurrent issue for water utility managers and public health officials and a challenge to those who are asked to interpret water-quality standards when they are not met.

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