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Historical Perspectives

Centennial: Koch's Discovery of the Tubercle Bacillus

On March 24, 1882, Robert Koch announced to the Berlin Physiological Society that he had discovered the cause of tuberculosis. Three weeks later, on April 10, he published an article entitled "The Etiology of Tuberculosis" (*1*). In 1884, in a second paper with the same title, he first expounded "Koch's postulates," which have since become basic to studies of all infectious diseases. He had observed the bacillus in association with all cases of the disease, had grown the organism outside the body of the host, and had reproduced the disease in a susceptible host inoculated with a pure culture of the isolated organism.

Koch continued his studies on tuberculosis, hoping to find a cure. In 1890, he announced the discovery of tuberculin, a substance derived from tubercle bacilli, which he thought was capable of arresting bacterial development *in vitro* and in animals. This news gave rise to tremendous hope throughout the world, which was soon replaced by disillusionment when the product turned out to be an ineffective therapeutic agent. Tuberculin later proved to be a valuable diagnostic tool.

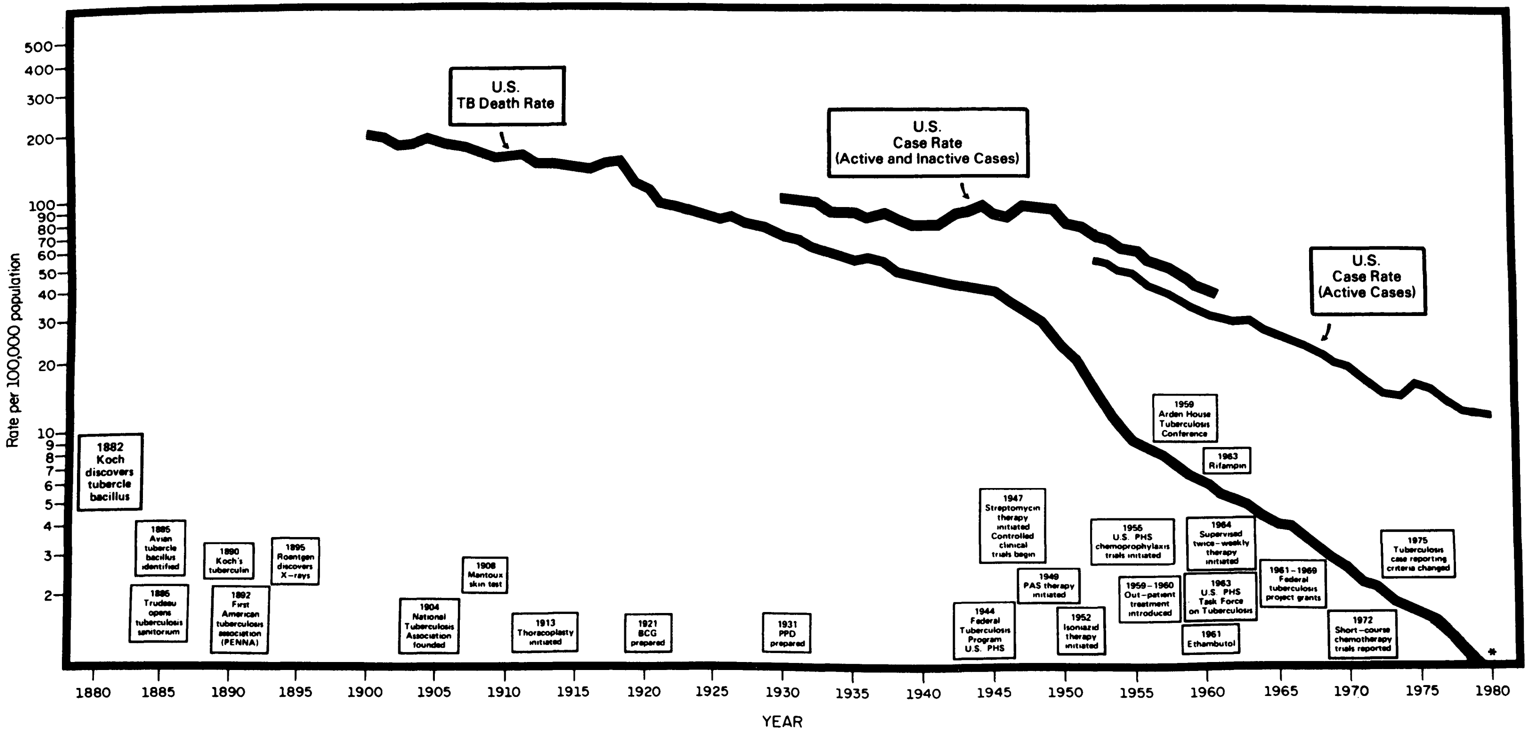
In 1905, when Koch was awarded the Nobel Prize in medicine, he devoted his acceptance speech to promoting greater understanding of tuberculosis and its causative agent. Koch died in 1910, leaving the scientific community and the world in general with a valuable inheritance of knowledge and understanding resulting from his seminal work on anthrax, cholera, trypanosomiasis, and especially tuberculosis.

In the wake of Koch's discoveries, subsequent progress in conquering tuberculosis has been relatively slow. In the laboratory, recognition of the avian bacillus by Nocard in 1885 and differentiation of bovine and human tubercle bacilli by Theobald Smith in 1898 laid the groundwork for identification of other (nontuberculous) mycobacterial species. Diagnosis of tuberculosis was aided by discovery of the acid-fast nature of the bacillus by Ehrlich in 1882, discovery of X rays by Roentgen in 1895, development of the tuberculin skin test by Von Pirquet and Mantoux in 1907-1908, and preparation of purified protein derivative (PPD) of tuberculin by Seibert in 1931.

In the 1930s, the epidemiologic work of Wade Hampton Frost led to a better understanding of the epidemiology of tuberculosis. In the 1940s, using Seibert's PPD administered by the Mantoux method and chest X-ray examinations, the United States Public Health Service began a series of studies that elucidated further the epidemiology of tuberculosis and made apparent the distinction between tuberculous infection without disease (a positive skin test in the absence of signs and symptoms) and overt clinical tuberculosis.

Treatment has progressed from bed rest, special diets and fresh air, through pneumothorax and other lung-collapse procedures and surgical resection, to specific chemotherapy (streptomycin in 1947, para-aminosalicylic acid in 1949, isoniazid in 1952, and drugs such

FIGURE 1. A century of advances in tuberculosis control, United States



*Provisional data: 1979 = 0.9; 1980 = 0.8.

Tubercle Bacillus — Continued

as rifampin in recent years). With combinations of modern drugs properly administered, tuberculosis is now virtually 100% curable.

Prevention of tuberculosis has been approached in 2 ways. In 1921, Calmette and Guerin developed an attenuated strain of *Mycobacterium bovis*, which many countries throughout the world have used, with variable results, as a vaccine. The other major approach to prevention has been the treatment of persons with subclinical tuberculous infection (tuberculous infection without disease) with isoniazid.

There have been recent improvements in tuberculosis-control methodology. Effective treatment regimens of 9 months' duration are now available, and research continues in attempts to further shorten treatment. Fluorescence microscopy has made the examination of sputum smears faster, easier, and more accurate. Phage typing is a useful tool for studying the epidemiology of tuberculosis. Newer immunologic techniques offer promise of improved diagnostic tests, and rapid radiometric methods of identifying *M. tuberculosis* and testing for drug susceptibility are being developed.

In the century since Koch's discovery, advances in prevention, diagnosis, and treatment of tuberculosis—especially treatment—have produced a spectacular decline in tuberculosis mortality and a striking decline in tuberculosis morbidity—primarily in technically advanced countries (Figure 1). Progress has been less dramatic in developing countries. Tuberculosis stubbornly persists as a major worldwide health problem. It is estimated that as many as 10 million cases of tuberculosis may occur throughout the world each year—4-5 million of them highly infectious, and 2-3 million resulting in death. Eradication of tuberculosis, although possibly attainable in technical terms, remains an elusive goal.

Reported by Tuberculosis Control Div, Center for Prevention Svcs, Mycobacteriology Br, Bacterial Diseases Div, Center for Infectious Diseases, CDC.

Reference

1. Koch R. Die Atiologic der Tuberkulose. Berliner Klinische Wochenschrift 1882; 15:221-30.

Epidemiologic Notes and Reports

Transmission of Measles Across State Lines — Kentucky, New Hampshire, Tennessee, Virginia

A total of 25 cases of measles in 4 states have been linked to a single imported case. This illustrates the problem created by a highly contagious disease that can be spread rapidly without regard to geographic boundaries. States reporting measles associated with this outbreak in the period November 8, 1981-January 9, 1982, included: Virginia (18 cases), New Hampshire (3), Tennessee (3), and Kentucky (1) (Figure 2).

The index patient was a 15-year-old foreign-exchange student from El Salvador who had arrived in the United States on November 3, 1981, with her brother and 47 other Salvadoran students. The students were housed together in a dormitory in Washington, D.C., for 3 days. On November 6, they went to their temporary residences in 19 different states (Figure 3). The index patient went to Lee County, Virginia, and her brother went to Merrimack County, New Hampshire, where both were enrolled in public high schools. She developed a rash on November 8 in Virginia; her brother had rash onset on November 18 in New Hampshire. Both gave histories of having received measles vaccine in El Salvador at age 11-12 years.

Measles — Continued

FIGURE 2. Transmission of measles across state lines, Kentucky, New Hampshire, Tennessee, and Virginia, November 8, 1981-January 11, 1982

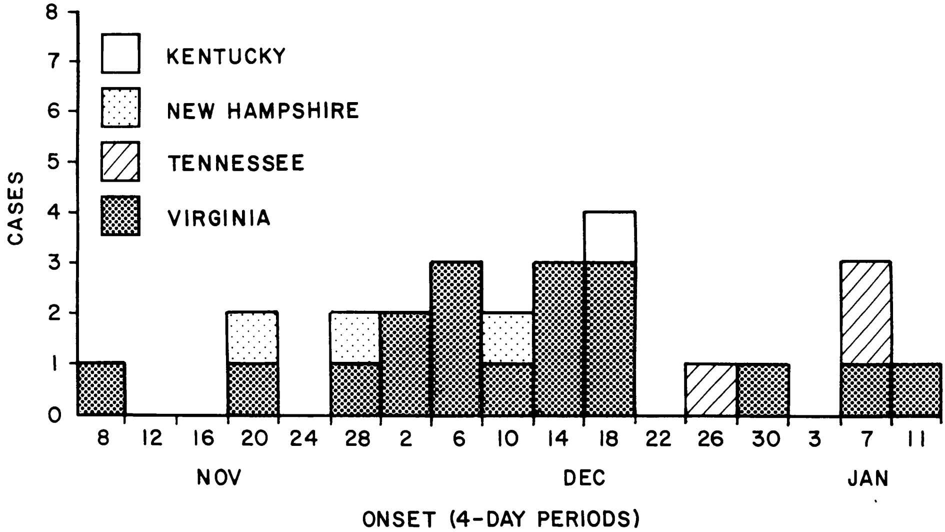
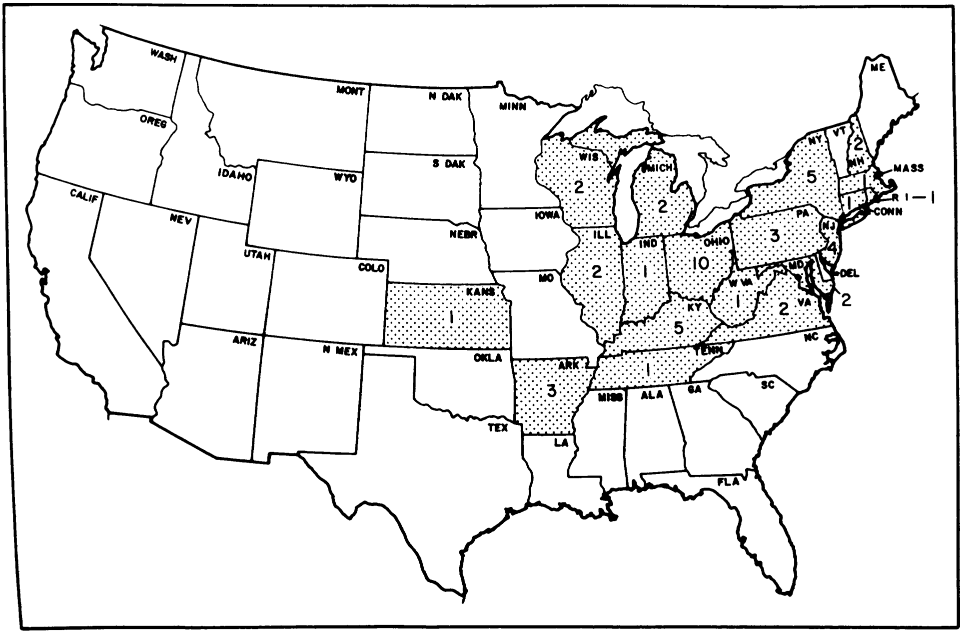


FIGURE 3. States of temporary residence of 49 foreign-exchange students and number of persons exposed to a student with imported measles, December 1981



Measles — Continued

Measles transmission in Lee County, Virginia (a rural, mountainous region in western Virginia, bordered by Kentucky and Tennessee), began with a high school classmate of the Salvadoran girl, who had rash onset on November 18. By January 9, a total of 17 cases that could be linked to the Salvadoran girl had occurred. One of the patients was a 20-year-old pregnant woman who had rash onset on January 5 following exposure to her 12-year-old brother. After delivering a healthy baby on January 6, the mother developed severe pneumonia that was followed by respiratory arrest. She was resuscitated and transferred to an intensive care unit in a larger hospital nearby in Tennessee. She recovered completely, and her baby remained well. Three additional measles cases occurred involving a 19-year-old woman and 2 pre-school children from Hancock and Sullivan counties, Tennessee. These cases were linked to the cases among school children in contiguous Lee County, Virginia. The woman developed high fever and dehydration, which necessitated her hospitalization. An additional case involved an elementary school student in Harlan County, Kentucky, who had rash onset on December 2, following exposure on a school bus in contiguous Lee County, Virginia.

Record reviews and mandatory school exclusions were instituted at 2 affected schools, and voluntary immunization programs were conducted at several other schools in Lee County, Virginia. A hospital in Sullivan County, Tennessee, excluded 21 employees who had direct contact with the 2 hospitalized patients and could not furnish evidence of immunity to measles.* A special immunization clinic was held in the hospital.

Measles transmission in Merrimack County, New Hampshire, was limited to 2 additional cases: a high school classmate of the Salvadoran boy, who had rash onset on December 1, and his 2-year-old cousin, who had rash onset on December 10. Susceptible contacts of these patients received immune globulin or measles vaccine. Record reviews at the local high school showed that 100% of the students had adequate evidence of immunity to measles.

Of the other 47 exchange students from El Salvador, 46 were contacted in their states of temporary residence and found to be well. One student had become ill and returned to El Salvador; further details of her illness were not available.

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Editorial Note: This was a small but geographically widespread outbreak of measles resulting from a single imported case involving a foreign-exchange student with a history of vaccination abroad. The resulting investigations covered 19 different states and the District of Columbia. When measles transmission occurs across state lines, communication between the states is essential to contain the outbreak successfully.

Outbreaks resulting from importations of measles have been described previously (*1-3*), and imported measles cases are a continuing source of measles in the United States (*4-5*). In 1980 and 1981, the substantial decline in total measles cases led to a rise in the proportion of imported cases.

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*Defined by CDC as a dated record showing administration of live measles vaccine on or after the first birthday or a history of physician-diagnosed measles illness.

Measles — Continued

The illness experienced by the young mother illustrates that serious complications can result from measles in an adult population. Communities can protect themselves from importations of measles by achieving and maintaining high immunization levels. Investigations of imported measles cases should include a search for susceptible contacts at all points of the traveler's itinerary, as well as in the local community. Rapid containment of measles requires effective surveillance and aggressive outbreak-control measures, which include locating and investigating contacts who have crossed state lines.

References

1. CDC. Multiple measles importations—New York. MMWR 1981;30:288-90.
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3. Frank JA Jr, Hoffmann RE, Mann JM, Crowe JD, Hinman AR. Imported measles: a potential control problem. JAMA 1981;245:264-6.
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TABLE I. Summary — cases of specified notifiable diseases, United States

DISEASE	10th WEEK ENDING			CUMULATIVE, FIRST 10 WEEKS		
	March 13 1982	March 14 1981	MEDIAN 1977-1981	March 13 1982	March 14 1981	MEDIAN 1977-1981
Aseptic meningitis	66	57	46	737	627	479
Brucellosis	2	-	3	14	12	33
Encephalitis: Primary (arthropod-borne & unspec.)	14	15	13	128	132	115
Post-infectious	-	-	3	6	13	27
Gonorrhea: Civilian	17,781	19,076	18,928	177,564	186,211	181,512
Military	509	376	442	5,474	5,513	5,361
Hepatitis: Type A	421	530	530	4,283	4,718	5,170
Type B	426	380	332	3,486	3,407	2,870
Non A, Non B	56	N	N	315	N	N
Unspecified	182	263	201	1,746	1,993	1,878
Legionellosis	4	N	N	48	N	N
Leprosy	8	2	3	28	43	29
Malaria	18	29	13	128	242	85
Measles (rubeola)	33	75	438	131	468	2,627
Meningococcal infections: Total	83	89	68	614	1,014	639
Civilian	82	88	67	610	1,012	632
Military	1	1	1	4	2	2
Mumps	142	115	594	1,026	1,033	3,544
Pertussis	21	12	15	183	189	201
Rubella(German measles)	61	40	332	601	466	1,986
Syphilis (Primary & Secondary): Civilian	636	540	506	6,282	5,816	4,630
Military	2	6	6	78	83	60
Tuberculosis	556	506	543	4,587	4,455	4,684
Tularemia	1	3	3	16	19	17
Typhoid fever	7	7	6	69	77	69
Typhus fever, tick-borne (RMSF)	1	-	2	16	11	11
Rabies, animal	109	134	64	855	1,035	561

TABLE II. Notifiable diseases of low frequency, United States

	CUM. 1982		CUM. 1982
Anthrax	-	Poliomyelitis: Total	1
Botulism (Calif. 1)	15	Paralytic	1
Cholera	1	Psittacosis (Mass. 1)	12
Congenital rubella syndrome	-	Rabies, human	-
Diphtheria	-	Tetanus	9
Leptospirosis	10	Trichinosis (Mass. 1, R.I. 3)	56
Plague	2	Typhus fever, flea-borne (endemic, murine) (Tex. 1)	3

N: Not notifiable

TABLE III. Cases of specified notifiable diseases, United States, weeks ending March 13, 1982 and March 14, 1981 (10th week)

REPORTING AREA	ASEPTIC MENINGITIS	BRUCELLOSIS	ENCEPHALITIS		GONORRHEA (Civilian)		HEPATITIS (Viral), by type				LEGIONELLOSIS	LEPROSY
			Primary	Post-infectious			A	B	NA,NB	Unspecified		
	1982	CUM. 1982	CUM. 1982	CUM. 1982	CUM. 1982	CUM. 1981	1982	1982	1982	1982	1982	CUM. 1982
UNITED STATES	66	14	128	6	177,564	186,211	421	426	56	182	4	28
NEW ENGLAND	1	-	5	3	4,126	4,728	13	16	-	24	-	1
Maine	1	-	-	-	205	232	2	-	-	-	-	-
N.H.	-	-	-	-	138	175	-	-	-	-	-	-
Vt.	-	-	-	-	87	71	1	1	-	-	-	-
Mass.	-	-	2	-	1,907	1,882	3	6	-	22	-	-
R.I.	-	-	-	-	295	221	1	3	-	-	-	-
Conn.	-	-	3	3	1,494	2,147	6	6	-	2	-	1
MID. ATLANTIC	10	-	17	-	21,989	21,177	53	59	5	14	-	1
Upstate N.Y.	2	-	7	-	3,477	3,198	13	14	-	6	-	-
N.Y. City	2	-	4	-	9,623	8,175	18	14	-	1	-	-
N.J.	6	-	3	-	3,826	4,639	22	31	5	7	-	-
Pa.	-	-	3	-	5,063	5,165	U	U	U	U	-	1
E.N. CENTRAL	6	-	28	1	21,722	30,520	47	51	4	13	-	-
Ohio	-	-	8	-	7,207	11,088	3	12	1	5	-	-
Ind.	-	-	9	1	3,021	2,459	7	4	1	5	-	-
Ill.	-	-	-	-	3,135	8,216	11	5	2	2	-	-
Mich.	6	-	9	-	6,018	6,269	23	29	-	1	-	-
Wis.	-	-	2	-	2,341	2,488	3	1	-	-	-	-
W.N. CENTRAL	1	2	8	-	8,349	8,830	14	12	3	3	2	-
Minn.	-	-	-	-	1,180	1,486	7	2	2	1	-	-
Iowa	-	1	3	-	934	915	2	2	-	2	-	-
Mo.	1	1	3	-	3,792	3,909	2	4	1	-	2	-
N. Dak.	-	-	-	-	108	110	-	-	-	-	-	-
S. Dak.	-	-	-	-	242	238	-	-	-	-	-	-
Nebr.	-	-	1	-	515	675	1	3	-	-	-	-
Kans.	-	-	1	-	1,578	1,497	2	1	-	-	-	-
S. ATLANTIC	7	5	18	1	46,509	46,566	50	91	9	23	1	-
Del.	-	-	-	-	713	719	1	-	-	-	-	-
Md.	1	-	9	-	6,243	4,906	3	13	2	2	-	-
D.C.	-	-	-	-	2,289	3,112	-	2	-	-	-	-
Va.	-	3	5	-	3,843	4,339	6	6	2	2	1	-
W. Va.	-	-	-	-	515	617	-	1	-	-	-	-
N.C.	-	-	1	-	7,587	7,667	1	13	-	9	-	-
S.C.	1	1	-	-	4,239	4,253	15	10	-	3	-	-
Ga.	-	-	-	-	7,650	9,028	2	19	-	3	-	-
Fla.	5	1	3	1	13,430	11,925	22	27	5	4	-	-
E.S. CENTRAL	3	2	7	-	14,914	15,596	19	35	4	1	-	-
Ky.	1	-	-	-	1,992	2,008	11	4	1	-	-	-
Tenn.	-	1	6	-	5,648	5,941	3	18	1	-	-	-
Ala.	2	1	1	-	4,544	4,894	3	10	2	1	-	-
Miss.	-	-	-	-	2,730	2,753	2	3	-	-	-	-
W.S. CENTRAL	8	2	10	-	25,115	26,238	70	27	1	47	-	-
Ark.	-	1	-	-	2,080	1,705	2	1	1	3	-	-
La.	-	-	1	-	4,158	3,993	10	5	-	6	-	-
Okla.	2	1	5	-	2,546	2,584	5	3	-	2	-	-
Tex.	6	-	4	-	16,331	17,956	53	18	-	36	-	-
MOUNTAIN	-	-	6	1	6,779	7,565	31	13	4	9	1	-
Mont.	-	-	-	-	305	285	-	-	-	-	-	-
Idaho	-	-	-	-	267	299	-	-	-	-	-	-
Wyo.	-	-	-	-	204	168	1	-	-	-	-	-
Colo.	-	-	1	1	1,856	1,983	7	2	-	1	-	-
N. Mex.	-	-	-	-	827	880	11	1	-	1	-	-
Ariz.	-	-	2	-	1,826	2,488	12	8	3	4	-	-
Utah	-	-	-	-	256	352	-	1	1	3	1	-
Nev.	-	-	3	-	1,238	1,110	-	1	-	-	-	-
PACIFIC	30	3	29	-	28,061	24,991	124	122	26	48	-	26
Wash.	1	-	2	-	2,392	2,477	13	14	3	1	-	2
Oreg.	-	-	-	-	1,537	2,014	7	7	2	2	-	-
Calif.	23	3	26	-	22,927	19,205	100	99	21	45	-	17
Alaska	3	-	1	-	722	695	1	-	-	-	-	-
Hawaii	3	-	-	-	483	600	3	2	-	-	-	7
Guam	U	-	-	-	5	35	U	U	U	U	U	-
P.R.	1	-	1	-	528	636	7	2	-	1	-	-
V.I.	U	-	-	-	41	7	U	U	U	U	U	-
Pac. Trust Terr.	U	-	-	-	36	99	U	U	U	U	U	1

N: Not notifiable U: Unavailable

TABLE III (Cont.'d). Cases of specified notifiable diseases, United States, weeks ending March 13, 1982 and March 14, 1981 (10th week)

REPORTING AREA	MALARIA		MEASLES (RUBEOLA)			MENINGOCOCCAL INFECTIONS (Total)		MUMPS		PERTUSSIS	RUBELLA		
	1982	CUM. 1982	1982	CUM. 1982	CUM. 1981	1982	CUM. 1982	1982	CUM. 1982	1982	1982	CUM. 1982	CUM. 1981
UNITED STATES	18	128	33	131	468	83	614	142	1,026	21	61	601	466
NEW ENGLAND	3	10	-	4	17	5	26	5	64	-	1	11	50
Maine	-	-	-	-	-	-	2	-	18	-	-	-	30
N.H.	-	1	-	-	3	1	7	2	8	-	-	9	18
Vt.	-	-	-	2	1	-	1	-	3	-	-	-	-
Mass.	3	6	-	-	9	1	2	-	21	-	1	2	2
R.I.	-	1	-	-	-	1	3	1	7	-	-	-	-
Conn.	-	2	-	2	4	2	11	2	7	-	-	-	-
MID. ATLANTIC	2	11	6	24	161	12	94	13	69	2	5	23	56
Upstate N.Y.	-	2	2	13	121	4	28	1	18	2	3	15	25
N.Y. City	-	4	4	9	13	1	17	3	12	-	2	8	10
N.J.	2	3	-	-	9	2	24	6	16	-	-	-	19
Pa.	-	2	-	2	18	5	25	3	23	-	-	-	2
E.N. CENTRAL	3	11	6	11	32	4	62	75	512	4	9	49	94
Ohio	-	1	2	2	11	-	22	45	308	3	4	4	-
Ind.	-	1	-	1	2	1	5	-	17	1	-	5	32
Ill.	-	-	-	2	5	-	13	-	24	-	1	11	25
Mich.	3	8	4	6	14	2	21	30	101	-	3	15	10
Wis.	-	1	-	-	-	1	1	-	62	-	1	14	27
W.N. CENTRAL	-	4	-	-	4	3	25	12	41	-	-	13	24
Minn.	-	-	-	-	1	2	7	-	3	-	-	1	6
Iowa	-	1	-	-	1	-	3	2	12	-	-	-	-
Mo.	-	1	-	-	-	-	9	6	9	-	-	8	-
N. Dak.	-	-	-	-	-	1	3	-	-	-	-	-	-
S. Dak.	-	-	-	-	-	-	-	-	-	-	-	1	-
Nebr.	-	1	-	-	1	-	1	-	-	-	-	-	-
Kans.	-	1	-	-	1	-	2	4	17	-	-	3	18
S. ATLANTIC	2	23	3	15	129	21	136	9	103	3	4	17	43
Del.	-	-	-	-	-	-	-	2	2	-	-	-	-
Md.	-	5	1	1	-	-	6	1	7	-	3	4	-
D.C.	-	3	-	1	1	-	-	-	-	1	-	-	-
Va.	1	8	1	9	3	-	11	1	14	-	-	8	-
W. Va.	-	-	-	1	6	1	4	5	52	-	-	1	10
N.C.	-	-	-	-	-	4	25	-	4	-	-	-	2
S.C.	-	2	-	-	-	5	17	-	3	-	-	1	4
Ga.	-	2	-	-	48	6	39	-	2	1	-	1	12
Fla.	1	3	1	3	71	5	34	-	19	1	1	2	15
E.S. CENTRAL	-	-	-	4	-	5	42	1	16	-	1	8	11
Ky.	-	-	-	1	-	-	2	-	7	-	1	8	7
Tenn.	-	-	-	3	-	1	20	1	5	-	-	-	4
Ala.	-	-	-	-	-	4	19	-	2	-	-	-	-
Miss.	-	-	-	-	-	-	1	-	2	-	-	-	-
W.S. CENTRAL	-	5	4	16	20	11	83	1	47	-	4	33	29
Ark.	-	1	-	-	-	1	8	-	3	-	-	-	-
La.	-	-	-	-	-	1	6	-	-	-	-	-	2
Okla.	-	-	-	-	2	-	6	-	-	-	-	1	-
Tex.	-	4	4	16	18	9	63	1	44	-	4	32	27
MOUNTAIN	-	3	-	-	8	10	40	2	24	2	-	10	21
Mont.	-	-	-	-	-	1	4	2	3	-	-	-	1
Idaho	-	-	-	-	-	1	3	-	2	-	-	-	1
Wyo.	-	-	-	-	-	-	2	-	1	1	-	3	1
Colo.	-	2	-	-	-	2	16	-	3	-	-	1	14
N. Mex.	-	-	-	-	-	6	7	-	-	1	-	1	-
Ariz.	-	1	-	-	1	-	4	-	8	-	-	1	1
Utah	-	-	-	-	-	-	1	-	5	-	-	3	2
Nev.	-	-	-	-	7	-	3	-	2	-	-	1	1
PACIFIC	8	61	14	57	97	12	106	24	150	10	37	437	138
Wash.	2	4	-	14	1	-	11	5	23	2	7	13	26
Oreg.	-	2	-	-	-	3	21	-	-	-	1	2	20
Calif.	6	54	14	42	96	8	68	19	123	8	29	420	92
Alaska	-	-	-	-	-	-	4	-	3	-	-	1	-
Hawaii	-	1	-	1	-	1	2	-	1	-	-	1	-
Guam	U	-	U	-	3	U	-	U	1	U	U	1	-
P.R.	-	1	10	29	46	-	2	1	10	2	-	2	-
V.I.	U	-	U	-	2	U	-	U	-	U	U	-	-
Pac. Trust Terr.	U	-	U	-	-	U	-	U	-	U	U	-	1

U: Unavailable

TABLE III (Cont.'d). Cases of specified notifiable diseases, United States, weeks ending March 13, 1982 and March 14, 1981 (10th week)

REPORTING AREA	SYPHILIS (Civilian) (Primary & Secondary)		TUBERCULOSIS		TULA-REMIA	TYPHOID FEVER		TYPHUS FEVER (Tick-borne) (RMSF)		RABIES, Animal
	CUM. 1982	CUM. 1981	1982	CUM. 1982	CUM. 1982	1982	CUM. 1982	1982	CUM. 1982	CUM. 1982
UNITED STATES	6,282	5,816	556	4,587	16	7	69	1	16	855
NEW ENGLAND	117	135	14	125	-	1	7	-	-	5
Maine	-	1	-	8	-	-	-	-	-	5
N.H.	-	7	-	6	-	-	-	-	-	-
Vt.	-	2	1	5	-	-	2	-	-	-
Mass.	85	82	12	80	-	1	4	-	-	-
R.I.	8	10	-	16	-	-	-	-	-	-
Conn.	24	33	1	10	-	-	1	-	-	-
MID. ATLANTIC	851	873	116	748	1	-	5	-	-	9
Upstate N.Y.	70	78	27	135	1	-	1	-	-	5
N.Y. City	547	549	50	275	-	-	4	-	-	-
N.J.	95	102	5	140	-	-	-	-	-	1
Pa.	139	144	34	198	-	-	-	-	-	3
E.N. CENTRAL	229	393	88	742	-	-	5	-	-	89
Ohio	64	54	15	137	-	-	2	-	-	11
Ind.	45	24	10	105	-	-	-	-	-	11
Ill.	41	220	31	280	-	-	1	-	-	27
Mich.	60	75	29	178	-	-	2	-	-	-
Wis.	19	20	3	42	-	-	-	-	-	40
W.N. CENTRAL	123	108	32	131	5	-	2	-	1	234
Minn.	22	35	4	23	-	-	-	-	-	52
Iowa	3	5	4	22	-	-	1	-	-	78
Mo.	75	58	19	53	4	-	1	-	1	26
N. Dak.	3	1	-	2	-	-	-	-	-	30
S. Dak.	-	-	-	3	-	-	-	-	-	12
Nebr.	3	3	-	4	-	-	-	-	-	17
Kans.	17	6	5	24	1	-	-	-	-	19
S. ATLANTIC	1,755	1,517	92	939	5	2	9	-	10	149
Del.	2	3	-	9	-	-	-	-	-	-
Md.	110	114	14	131	1	1	3	-	7	9
D.C.	112	140	9	38	-	-	-	-	-	-
Va.	118	142	10	86	1	-	2	-	-	78
W. Va.	6	3	4	22	-	1	2	-	-	6
N.C.	140	109	9	153	-	-	-	-	3	-
S.C.	95	109	5	79	3	-	-	-	-	8
Ga.	375	388	14	151	-	-	-	-	-	39
Fla.	797	509	27	270	-	-	2	-	-	9
E.S. CENTRAL	505	420	22	384	1	-	7	-	3	88
Ky.	28	19	4	103	-	-	-	-	-	12
Tenn.	132	164	12	137	1	-	2	-	-	58
Ala.	167	119	6	121	-	-	5	-	3	18
Miss.	178	118	-	23	-	-	-	-	-	-
W.S. CENTRAL	1,657	1,400	65	438	2	-	3	1	1	133
Ark.	46	25	8	38	1	-	-	-	-	19
La.	347	291	9	89	-	-	-	-	-	3
Okla.	29	27	11	78	1	-	2	-	-	33
Tex.	1,235	1,057	37	233	-	-	1	1	1	78
MOUNTAIN	179	139	11	120	1	-	3	-	-	15
Mont.	1	5	-	11	-	-	-	-	-	10
Idaho	13	2	2	6	-	-	-	-	-	-
Wyo.	7	2	-	3	-	-	-	-	-	1
Colo.	58	40	-	15	-	-	-	-	-	-
N. Mex.	34	30	4	21	-	-	-	-	-	2
Ariz.	32	33	5	44	-	-	2	-	-	2
Utah	5	2	-	5	1	-	1	-	-	-
Nev.	29	25	-	15	-	-	-	-	-	-
PACIFIC	866	831	116	960	1	4	28	-	1	133
Wash.	24	31	11	58	1	-	-	-	-	-
Oreg.	32	18	9	37	-	-	1	-	-	-
Calif.	781	763	91	805	-	4	26	-	1	100
Alaska	6	1	-	13	-	-	-	-	-	33
Hawaii	23	18	5	47	-	-	1	-	-	-
Guam	-	-	U	2	-	U	-	U	-	-
P.R.	90	144	-	30	-	-	-	-	-	6
V.I.	-	-	U	1	-	U	-	U	-	-
Pac. Trust Terr.	-	-	U	19	-	U	-	U	-	-

U: Unavailable

TABLE IV. Deaths in 121 U.S. cities,* week ending March 13, 1982 (10th week)

REPORTING AREA	ALL CAUSES, BY AGE (YEARS) ALL AGES	≥65	45-64	25-44	1-24	<1	P&I** TOTAL
NEW ENGLAND	665	458	131	33	20	22	43
Boston, Mass.	175	115	34	13	6	7	15
Bridgeport, Conn.	41	30	6	3	-	2	4
Cambridge, Mass.	28	23	3	2	-	-	2
Fall River, Mass.	30	22	8	-	-	-	-
Hartford, Conn.	59	40	11	1	3	4	2
Lowell, Mass.	40	19	11	3	5	2	1
Lynn, Mass.	18	12	6	-	-	-	-
New Bedford, Mass.	27	21	5	-	-	1	-
New Haven, Conn.	64	39	17	4	4	-	2
Providence, R.I. §	57	55	-	-	1	-	4
Somerville, Mass.	14	9	3	2	-	-	-
Springfield, Mass.	32	19	8	2	-	3	7
Waterbury, Conn.	28	22	4	-	-	2	4
Worcester, Mass.	52	32	15	3	1	1	2
MID. ATLANTIC	2,809	1,851	659	153	78	68	148
Albany, N.Y.	52	36	12	4	-	-	-
Allentown, Pa.	26	18	8	-	-	-	1
Buffalo, N.Y.	150	99	39	5	3	4	9
Camden, N.J.	45	26	16	1	1	1	3
Elizabeth, N.J.	33	25	7	1	-	-	2
Erie, Pa.†	49	30	15	2	1	1	2
Jersey City, N.J.	57	36	14	1	2	4	1
N.Y. City, N.Y.	1,504	1,005	335	94	38	32	72
Newark, N.J.	89	34	30	9	12	4	4
Paterson, N.J.	23	12	4	2	4	1	3
Philadelphia, Pa.†	314	187	90	17	12	8	29
Pittsburgh, Pa.†	100	70	23	5	-	2	2
Reading, Pa.	29	26	3	-	-	-	5
Rochester, N.Y.	123	97	18	4	1	3	9
Schenectady, N.Y.	25	19	4	1	1	-	1
Scranton, Pa.†	24	15	9	-	-	-	-
Syracuse, N.Y.	93	63	18	7	1	4	-
Trenton, N.J.	27	18	7	-	1	1	1
Utica, N.Y.	21	15	4	-	1	1	-
Yonkers, N.Y.	25	20	3	-	-	2	4
E.N. CENTRAL	2,350	1,424	598	143	80	105	41
Akron, Ohio	37	25	9	1	-	2	-
Canton, Ohio	41	31	8	1	1	-	-
Chicago, Ill.	563	307	158	41	19	38	9
Cincinnati, Ohio	145	92	33	10	4	6	6
Cleveland, Ohio	177	81	61	15	9	11	1
Columbus, Ohio	140	67	43	11	11	8	1
Dayton, Ohio	116	80	21	8	3	4	1
Detroit, Mich.	262	145	71	15	13	18	3
Evansville, Ind.	57	49	6	2	-	-	1
Fort Wayne, Ind.	49	32	16	1	-	-	1
Gary, Ind.	21	12	6	2	1	-	-
Grand Rapids, Mich.	57	40	13	3	1	-	-
Indianapolis, Ind.	169	108	34	16	6	5	2
Madison, Wis.	40	23	11	2	3	1	-
Milwaukee, Wis.	151	107	27	8	2	7	3
Peoria, Ill.	62	48	11	1	1	1	5
Rockford, Ill.	54	37	15	1	1	-	1
South Bend, Ind.	47	32	11	2	2	-	2
Toledo, Ohio	98	68	23	1	3	3	5
Youngstown, Ohio	64	40	21	2	-	1	-
W.N. CENTRAL	765	520	153	37	21	34	38
Des Moines, Iowa	62	44	13	4	-	1	-
Duluth, Minn.	30	21	7	-	2	-	3
Kansas City, Kans.	33	15	9	3	-	6	2
Kansas City, Mo.	124	77	33	6	3	5	4
Lincoln, Nebr.	28	20	5	-	1	2	1
Minneapolis, Minn.	104	78	17	2	3	4	2
Omaha, Nebr.	79	50	14	5	3	7	1
St. Louis, Mo.	179	126	27	12	6	8	12
St. Paul, Minn.	70	51	15	3	1	-	3
Wichita, Kans.	56	38	13	2	2	1	10
S. ATLANTIC	1,186	727	317	79	22	41	52
Atlanta, Ga.	159	86	47	18	4	4	8
Baltimore, Md.	91	49	22	10	4	6	1
Charlotte, N.C.	72	40	24	3	1	4	5
Jacksonville, Fla.	120	72	35	5	1	7	3
Miami, Fla.	124	67	39	14	3	1	3
Norfolk, Va.	59	40	15	2	-	2	5
Richmond, Va.	80	45	25	6	2	2	6
Savannah, Ga.	50	30	14	3	-	3	5
St. Petersburg, Fla.	118	101	13	3	-	1	5
Tampa, Fla.	68	43	21	1	2	1	2
Washington, D.C.	189	114	51	12	4	8	5
Wilmington, Del.	56	40	11	2	1	2	4
E.S. CENTRAL	708	443	183	36	15	31	25
Birmingham, Ala.	114	62	33	9	4	6	1
Chattanooga, Tenn.	56	33	11	5	1	6	3
Knoxville, Tenn.	49	39	10	-	-	-	-
Louisville, Ky.	102	58	34	4	1	5	1
Memphis, Tenn.	165	119	36	5	3	2	9
Mobile, Ala.	72	44	16	5	3	4	4
Montgomery, Ala.	35	21	8	3	-	3	-
Nashville, Tenn.	115	67	35	5	3	5	7
W.S. CENTRAL	1,140	683	266	68	61	62	44
Austin, Tex.	32	23	2	1	4	2	3
Baton Rouge, La.	54	37	7	1	3	6	4
Corpus Christi, Tex.	43	35	6	1	-	1	1
Dallas, Tex.	225	130	52	22	14	7	7
El Paso, Tex.	76	51	12	5	2	6	5
Fort Worth, Tex.	99	55	25	3	1	15	4
Houston, Tex.	160	87	34	12	14	13	2
Little Rock, Ark.	83	48	22	5	5	3	3
New Orleans, La.	78	51	20	2	2	3	2
San Antonio, Tex.	154	88	43	10	10	3	4
Shreveport, La.	19	9	10	-	-	-	1
Tulsa, Okla.	117	69	33	6	6	3	8
MOUNTAIN	755	446	169	58	50	32	42
Albuquerque, N.Mex.	95	31	20	18	24	2	2
Colo. Springs, Colo.	43	30	8	3	1	1	7
Denver, Colo.	126	76	35	7	4	4	2
Las Vegas, Nev.	80	45	21	7	6	1	4
Ogden, Utah	19	14	1	3	1	-	1
Phoenix, Ariz.	185	122	37	9	7	10	13
Pueblo, Colo.	34	25	6	2	-	1	3
Salt Lake City, Utah	52	21	12	4	5	10	2
Tucson, Ariz.	121	82	29	5	2	3	8
PACIFIC	1,963	1,248	455	131	54	75	97
Berkeley, Calif.	17	13	2	2	-	-	1
Fresno, Calif.	67	31	26	1	4	5	3
Glendale, Calif.	25	22	3	-	-	-	2
Honolulu, Hawaii	54	28	15	6	3	2	-
Long Beach, Calif.	99	67	23	5	1	3	3
Los Angeles, Calif.	664	410	158	54	19	23	23
Oakland, Calif.	74	52	12	6	2	2	3
Pasadena, Calif.	37	25	9	1	-	2	1
Portland, Oreg.	122	80	22	9	4	7	10
Sacramento, Calif.	71	44	19	4	1	3	2
San Diego, Calif.	165	112	40	7	2	4	19
San Francisco, Calif.	153	102	29	9	4	9	4
San Jose, Calif.	177	99	50	14	7	7	12
Seattle, Wash.	127	84	24	9	6	4	3
Spokane, Wash.	67	45	18	2	-	2	8
Tacoma, Wash.	44	34	5	2	1	2	3
TOTAL	12,341††	7,800	2,931	738	401	470	530

*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.

Current Trends

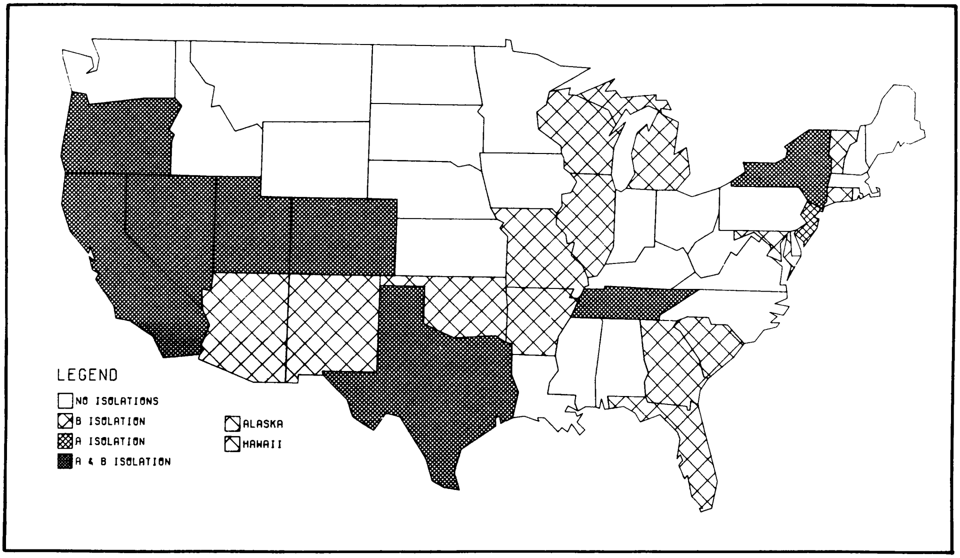
Influenza Update — United States

Influenza activity in the 1981-1982 influenza season continues to be at a relatively low level. Isolations of influenza type B virus have been reported by 23 states (including the first reports this season from Alaska, Maryland, Missouri, and Oklahoma); 8 of these states have also reported isolating type A(H1N1) virus, and 1 state, New Jersey, has reported isolating type A(H1N1) virus only (Figure 4). From October 1981 through February 1982, the total number of viruses isolated by laboratories participating in the nationwide reporting system was about 200. This compared with about 1,500 isolates reported by the participating laboratories in the United States in each of the 3 preceding winters, reflecting the generally low levels of morbidity throughout the country this winter.

The actual extent of virus transmission may not be fully indicated by nationwide laboratory reports in the absence of major outbreaks which cause concern to public health authorities and physicians. Thus, in Houston, Texas, where all patients with acute febrile respiratory illness are cultured for viral isolates when seen by a group of sentinel physicians and clinics participating in a long-term virus surveillance system, more than 500 isolates of influenza virus were obtained through February 1982. Preliminary analysis of a random sample from a survey of Houston city schools indicates that even during the peak of virus isolations in Houston during the third week of February, when 41% (114/277) of cultures were positive for influenza, only moderate increases of overall school absenteeism rates occurred in the Houston Independent School District. This pattern of moderate increases is consistent with findings in other communities where influenza viruses have been isolated in smaller numbers than in Houston.

The ratio of pneumonia-influenza related deaths has barely exceeded the statistically established threshold level in the 1981-1982 season. In contrast, the ratio consistently exceed-

FIGURE 4. Influenza virus isolations, United States, 1981-1982 season



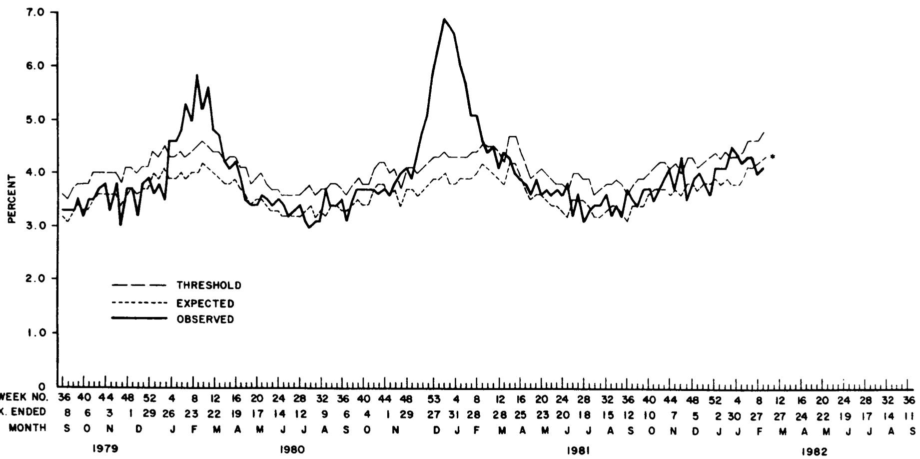
Influenza — Continued

ed the threshold level by a wide margin for a substantial period during each of the 2 previous winters (Figure 5).

Although most isolates of influenza virus this season were obtained from children and young adults, 1 outbreak of influenza has been reported in a nursing home in St. Louis County, Missouri, where about 34 of 120 residents experienced an influenza-like illness during 1 week. On March 4, shortly after the outbreak began, influenza type B virus was isolated from 8 elderly patients.

Reported by P Glezen, MD, Influenza Research Center, Baylor University, J Craven, MD, Houston City Health Department, R Beauchamp, MD, C Webb, Jr, MD, State Epidemiologist, Texas State Dept of Health; KL Scruggs, MD, St. Louis County, WC Banton, II, MD, District 7, ER Spurrier, PhD, D Donnell, Jr, MD, State Epidemiologist, Missouri Dept of Social Svcs; other state laboratory directors and state epidemiologists; Field Services Division, Consolidated Surveillance and Communications Activity, Epidemiology Program Office, Influenza Br, Viral Diseases Div, Center for Infectious Diseases, CDC.

FIGURE 5. Observed and expected ratio of deaths attributed to pneumonia and influenza in 121 United States cities, 1979-1982



Blood-Lead Levels in U.S. Population

One component of the Second National Health and Nutrition Examination Survey (NHANES II) (*1*), conducted between 1976-1980, was developed to measure degrees of exposure of the U.S. population to certain toxic substances, including lead. The primary measure of human exposure to this substance is the determination of lead levels in whole blood. The NHANES II sample design is a stratified, multistage, probability cluster sample of households throughout the United States, selected to represent the non-institutionalized U.S. civilian population between 6 months and 74 years of age.

Preliminary analysis suggests that in the 4-year period February 1976-February 1980 there was a 36.7% reduction in the overall mean blood-lead level from 15.8 μg/dL to 10.0 μg/dL. Decreases were found in all races, ages, and both sexes (Figure 6). Further analysis indicates that the reduction was not due to seasonal sampling, income sampling, geographic

Blood-Lead Levels — Continued

region sampling, urban vs. rural sampling, laboratory-measurement error, or chance.

The most discernible change in environmental lead sources was the reduced use of lead in gasoline as measured by 3 separate data sets (Figure 7). Figure 8 presents a comparison over the 4-year period of the amount of lead used in gasoline production and the NHANES II mean blood-lead concentrations. The decrease in mean blood-lead levels reflects the decrease in lead used in gasoline production.

Reported by National Center for Health Statistics, and Center for Environmental Health (CDC).

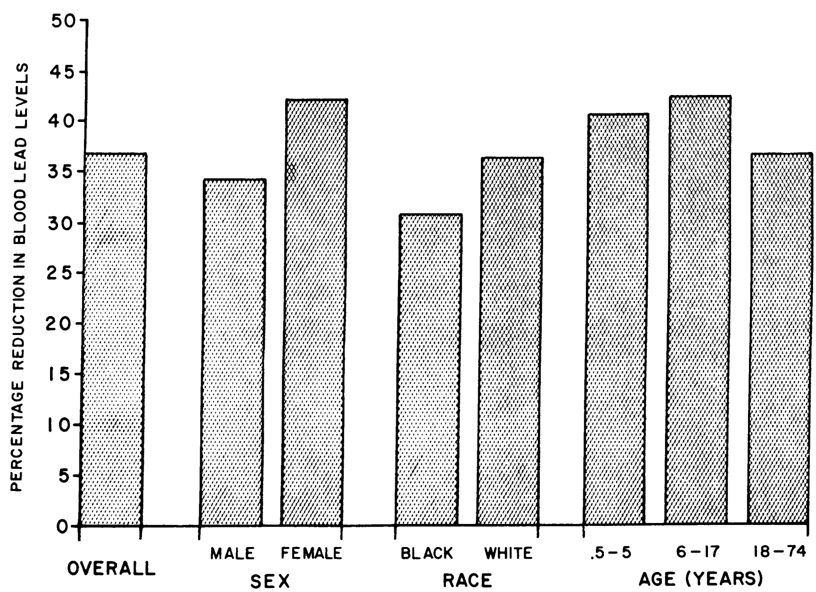
Editorial Note: Although the decrease in mean blood-lead levels was dramatic, the problem of pediatric lead poisoning in the United States has not been solved. In 1980, 502,900 children were reported to have been screened, and 26,500 were identified with lead toxicity (*2*). The reduction in mean blood-lead levels does mean that the high-risk young children living in environments with high-dose sources of lead (i.e., leaded paint, lead already deposited in dust and soil, etc.) will have a greater margin of safety. If the current downward trend in the amount of lead used in gasoline production continues, that margin of safety is expected to increase.

References

1. Plan and Operation of Second National Health and Nutrition Examination Survey, 1976-1980. Washington, D.C.: National Center for Health Statistics, 1977. (Vital and Health Statistics. PHS Pub. No. 81-1317, Series 1-No. 15, Public Health Service, U.S. Govt. Printing Office).
2. CDC. Annual summary 1980: reported morbidity and mortality in the United States. MMWR 1981:29(54).

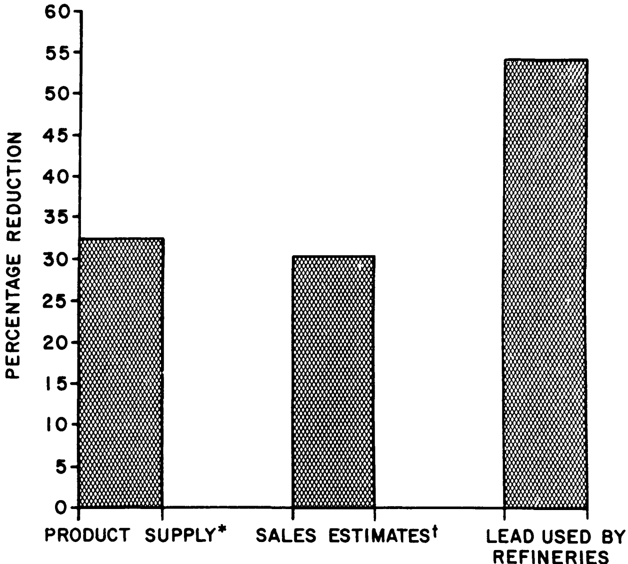
Note: Technical inquiries should be addressed to Division of Health Examination and Statistics, National Center for Health Statistics, 3700 East West Highway, Hyattsville, Maryland 20782.

FIGURE 6. Percentage reduction in blood-lead levels, NHANES II, February 1976-February 1980



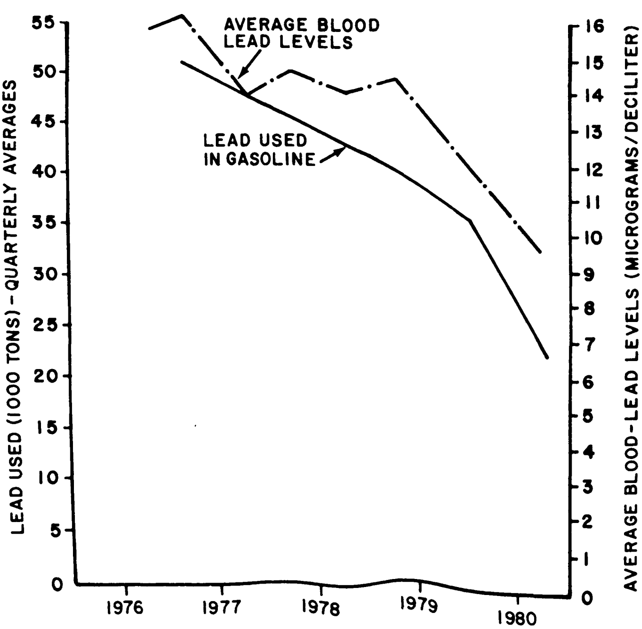
Blood-Lead Levels — Continued

FIGURE 7. Percentage reduction in production/use of leaded gasoline, United States, 1976-1980



*Data from 1977-1980 (1976 not available).
†Excludes military.

FIGURE 8. Lead used in gasoline production and average NHANES II blood-lead levels, February 1976-February 1980



Epidemiologic Notes and Reports

Human Rabies — Rwanda

On May 7, 1981, a 29-year-old American woman living in Kigali, Rwanda, was bitten several times on the right foot and probably the left hand by a dog that later escaped. The patient immediately sought medical attention. Her wounds were sutured, and the first dose of human diploid cell vaccine was given intramuscularly later that morning (day 0) and on days 3, 7, and 14. No human rabies globulin was given at that time. Twenty-two days later, she had fever and paresthesias of the left arm and rapidly became lethargic with paresis of arms and legs, dysarthria, and bilaterial facial paresis. She was flown to a Belgian hospital 26 days after the bites, where she was treated intramuscularly with 20 International Units (IU) of human rabies immune globulin/kg body weight. She rapidly developed a flaccid quadraplegia and coma, and died 62 days after being bitten.

Immunofluorescence and isolation studies for rabies virus were negative; however, rabies antibody titer was 827 IU/ml in the serum, and 82 IU/ml in the cerebrospinal fluid (CSF). No previous exposure to another animal was reported.

Reported by J Devriendt, MD, M Staroukine, MD, Hospital Universitaire Brugmann, Brussels, Belgium; Viral Diseases Div, Center for Infectious Diseases, CDC.

Editorial Note: Rabies antibody, especially in such high titers, has not been reported in the CSF of persons who have received only rabies vaccine. However, high titers of rabies antibody do occur with clinical rabies, and such high CSF antibody levels are commonly accepted as diagnostic for rabies. Therefore, the diagnosis of rabies is most probable for this patient. Despite the prompt and correct use of the human diploid cell rabies vaccine, human rabies immune globulin was omitted from this patient's initial post-exposure prophylactic regimen, and may be related to the failure of treatment. Studies have shown that the combination of human rabies immune globulin plus vaccine is better than either alone in preventing rabies (*1,2*), presumably because globulin provides passive antibody protection during the period when vaccine has not yet induced active antibody protection.

This episode, by demonstrating that even the new, highly potent human diploid cell vaccine cannot by itself prevent rabies, reinforces the need for human rabies immune globulin for all persons receiving post-exposure rabies prophylaxis who have not had prior rabies vaccination.

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1. Boltazard M, Bahmanyar M, Ghodssi M, Sabeti A, Gajdusek C, Rouzebbi E. Practical trail of antirabies serum in those bitten by rabid wolves. Bull WHO 1955;13:747-72.
2. Selimov M, Boltucij L, Semenova E, Kobrinskij G, Zmusko L. Anwendung des Anti-Rabies Gama-Globulins bei Menschen, die von tollwutigen Wolfen oder anderen Tieren schwer gebissen wurden. J of Hygiene, Epidemiology, Microbiology, and Immunology 1959;3:168-80.

The Morbidity and Mortality Weekly Report, circulation 104,000, is published by the Centers for Disease Control, Atlanta, Georgia. The data in this report are provisional, based on weekly telegraphs to CDC by state health departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the succeeding Friday.

The editor welcomes accounts on interesting cases, outbreaks, environmental hazards, or other public health problems of current interest to health officials. Send reports to: Attn: Editor, Morbidity and Mortality Weekly Report, Centers for Disease Control, Atlanta, Georgia 30333.

Send mailing list additions, deletions and address changes to: Attn: Distribution Services, Management Analysis and Services Office, 1-SB-419, Centers for Disease Control, Atlanta, Georgia 30333. When requesting changes be sure to give your former address, including zip code and mailing list code number, or send an old address label.

Erratum, Vol, 31, No. 9

p118. In the article "Surveillance of Childhood Lead Poisoning—United States" in the first sentence of the third paragraph the words "and adults" should be deleted. The sentence should read: "Since 1973, childhood lead-poisoning prevention programs have reported screening almost 3,900,000 children, 243,000 (6.2%) with lead toxicity."

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