CENTERS FOR DISEASE CONTROL

June 8, 1990 / Vol. 39 / No. 22

MMWR

MORBIDITY AND MORTALITY WEEKLY REPORT

Outbreak of Multidrug-Resistant Tuberculosis — Texas, California, and Pennsylvania

On January 9, 1986, a 30-year-old black man (patient 8 in Tables 1–3) presented to a hospital emergency room with an illness of 2 months' duration. The illness was characterized by cough, weakness, malaise, fever, night sweats, shortness of breath, and hemoptysis. The patient's chest radiograph showed extensive cavitary disease that was highly suggestive of pulmonary tuberculosis (TB). Sputum cultures were positive for *Mycobacterium tuberculosis*, and the organisms demonstrated resistance to isoniazid (INH), rifampin (RIF), and streptomycin (Table 2). The patient was treated with pyrazinamide (PZA), ethambutol, capreomycin (CAP), ethionamide (ETH), and an experimental drug (ofloxacin). Although totally compliant with this treatment regimen, the patient, after initial improvement, experienced relapse on therapy, and surgery was recommended. In March 1987, he died of postoperative complications of a right pneumonectomy. The patient had been hospitalized from the time of diagnosis to death (nearly 14 months). Autopsy revealed active disease in his left lung.

Subsequent epidemiologic investigation revealed that patient 8 had been a close contact of four persons (patients 1–4) who were being treated for infectious drug-resistant TB. All four persons were members of an extended family whose members interacted extensively and lived intermittently in three states. From July 1971 through May 1990, eight persons in and two close contacts of this extended family have been diagnosed with clinically active pulmonary TB. The most recent case was diagnosed in January 1989.

TABLE 1. Characteristics of patients with multidrug-resistant tuberculosis — Texas, California, and Pennsylvania

Patient no.	Relationship to index patient	Date first diagnosed	Age at diagnosis	State of diagnosis	Status
1	Index patient	Jul. 1971	41 yrs.	Texas	Died (Aug. 1987)
2	Relative	Apr. 1976	26 yrs.	Texas	Recovered
3	Relative	Jan. 1981	48 yrs.	Texas	Recovered
4	Relative	Oct. 1981	27 yrs.	Texas	III
5	Relative	Feb. 1982	4 mos.	California	Recovered
6	Relative	Oct. 1984	31 yrs.	Texas	Recovered
7	Relative	Apr. 1985	37 yrs.	Texas	III
8	Friend	Jan. 1986	30 yrs.	Texas	Died (Mar. 1987)
9	Friend	Apr. 1986	29 yrs.	Texas	Recovered
10	Relative	Jan. 1989	10 yrs.	Pennsylvania	Recovered

Tuberculosis — Continued

The index patient (patient 1) was a 41-year-old man whose TB was diagnosed in Texas in 1971. He was hospitalized and treated with an unknown regimen from July 1971 to April 1972 and discharged on INH and para-amino salicylic acid. From 1971 to 1982, patient 1 was admitted to the hospital on six occasions because of recurrences of pulmonary TB; recurrence was attributed to his noncompliance with outpatient therapy. In January 1983, he was admitted to the hospital for 3 months because of persistently positive cultures and was treated with INH, PZA, RIF, ETH, CAP, and cycloserine. After discharge, he was placed on daily supervised therapy and was more compliant with this regimen. In November 1984, he was readmitted for nearly 4 months to optimize therapy before surgery. He declined surgery and died in August 1987 from hemoptysis caused by TB.

TABLE 2. Drug-resistance patterns of sputum cultures from patients with multidrug-resistant tuberculosis — Texas, California, and Pennsylvania

Patient no.	Initial resistance pattern*	Final resistance pattern*†
1	Sensitive to all drugs tested	INH, RIF, SM, PAS, CS
2	INH	INH, RIF, SM
3	RIF	RIF
4	INH, RIF, PAS	INH, RIF, SM, EMB, CS
5	§	§
6	INH	INH
7	INH, RIF, SM	INH, RIF, SM, EMB
8	INH, RIF, SM	INH, RIF, SM, EMB
9	INH, RIF, PZA	INH, RIF, PZA
10	¶	¶

*INH = isoniazid; RIF = rifampin; SM = streptomycin; PAS = para-amino salicylic acid; CS = cycloserine; EMB = ethambutol; PZA = pyrazinamide.
†Before cure or death.
§Diagnosis established on the basis of exposure to patients 1–4, positive skin test, and abnormal chest radiograph with hilar adenopathy.
¶Diagnosis established on the basis of exposure to patient 4, positive skin test, and abnormal chest radiograph with infiltrate.

TABLE 3. Characteristics of hospitalization of patients with multidrug-resistant tuberculosis — Texas, California, and Pennsylvania

Patient no.	Quarantine	No. hospitalizations	No. hospital days	Cost of hospitalization*
1	Yes	9	971	$251,320
2	Yes	7	617	217,445
3	No	3	81	20,250
4	No	5	509	263,500
5	No	1	14	11,200
6	No	0	0	0
7	Yes	4	128	57,158
8	No	2	427	119,560
9	No	2	40	10,000
10	No	0	0	0
Total cost				**$950,433**

*Based on average cost per day from respective institutions or actual cost when available.

Tuberculosis — Continued

In 1976 and 1981, TB was diagnosed in two different relatives (patients 2 and 3) of the index patient. Contact investigation and follow-up over time of these patients, and later of patient 8, by health agencies in the three states subsequently identified patients 4, 5, 6, 7, 9, and 10. In addition, investigations revealed that 60 (47%) of 127 contacts of the extended family were tuberculin positive (skin test reaction: ≥5 mm induration), including 27 (43%) of 63 contacts in Texas, 25 (56%) of 45 contacts in California, and eight (42%) of 19 contacts in Pennsylvania. Thirty (50%) of those infected were children or adolescents. Infected contacts were monitored by sputum smears and cultures and chest radiographs at 3, 6, and 12 months for the first year, and every 6 months for 2 years. No prophylaxis was given to infected contacts because the contacts were presumed infected with multidrug-resistant organisms.

At least five family members and numerous contacts suffered from alcohol and drug addiction; however, none of the patients reported using intravenous drugs. Seven of the 10 patients were tested for human immunodeficiency virus antibody and were seronegative. Because members of the family had been incarcerated at various times, the family was suspicious of outsiders and secretive about their contacts, which complicated and impeded contact investigation. In addition, some family members believed that TB was incurable and that medications were ineffective.

Several of the patients were hospitalized for extended periods until they became culture negative, only to experience relapse once they were released and again were noncompliant with their medications. Patients 1 and 2 were legally quarantined on three occasions each. Patients 2 and 3 recovered only after supervised therapy. Patient 4, although now undergoing therapy, was frequently lost to follow-up. Patient 7 experienced relapse because of noncompliance, twice left the hospital against medical advice, and ultimately was quarantined. Because of health department experiences with this outbreak, patient 9 was placed on supervised therapy from onset. As of June 1, 1990, patients 2, 3, 5, 6, 9, and 10 are culture negative; patient 4 remains culture positive; and patient 7, although culture negative, remains in treatment.

As a result of this outbreak, supervised therapy with an initial regimen of four drugs is now used for all patients with active TB treated by the Fort Worth/Tarrant County Health Department.

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Editorial Note: Community outbreaks of drug-resistant TB have been reported in Mississippi (*1*); California, Montana, Nevada, and Utah (*2*); and North Carolina (*3*). Although the epidemiologic investigation in this report did not conclusively establish that all the patients were infected with the same strain of tubercle bacilli (because phage typing was not performed), epidemiologic evidence and drug-resistance patterns suggest a link.

Two prominent features of this outbreak are 1) its extended length and 2) its public health and economic burden. The cost of hospitalization of these 10 patients is estimated at $950,433 (Table 3). This is more than five times the yearly budget of the Fort Worth/Tarrant County Tuberculosis Control Program, which treats approximately 100 cases of TB and 1000 persons with TB infection per year.

Tuberculosis — Continued

Containment of a TB outbreak involves treatment of patients and preventive therapy for infected contacts. The preventive therapy regimen for infected persons is 6–12 months of INH or, for suspected infection with INH-resistant organisms, 12 months of RIF (*4*). However, in this outbreak, preventive therapy was not viable because the 60 infected contacts were presumably infected with organisms resistant to INH and RIF. Bacillus of Calmette and Guérin (BCG) vaccine should be considered for uninfected children exposed to persons with multidrug-resistant TB (*5*).

Regimens for treatment of TB must contain multiple drugs to which the organisms are susceptible. Administration of a single drug or the addition of a single drug to a failing regimen can lead to development of a bacterial population resistant to that drug. Although patients 2–10 were initially infected with drug-resistant tubercle bacilli, patient 1 acquired drug resistance because of noncompliance and/or inappropriate therapy. Drug-resistant TB is difficult to manage, and consultation with experts in treating mycobacterial diseases is warranted for such patients.

The duration of therapy for TB is usually 6–9 months, and noncompliance is a major problem. For patients at high risk for noncompliance, supervised therapy should be administered by a health department worker at a clinic or other location convenient for the patient (*6–8*). As evidenced by this outbreak, it is critical to initiate supervised therapy early, before patients develop drug-resistant disease or are lost to follow-up. Interstate and intrastate communication may be essential in managing TB in persons who frequently change their state of residence.

If supervised therapy is not successful in managing TB patients, other approaches must be considered. Long-term hospitalization (*9*) and TB treatment in special residential facilities for the homeless (*10*) have been used in some areas. Quarantine measures, including temporary institutionalization, should be used in those rare cases when an infectious TB patient refuses to comply with self-administered or supervised therapy (*11*). Documentation of the cost of treating patients with drug-resistant disease, as was done in this investigation, may help support the need for strengthening outpatient treatment of TB, especially the use of supervised therapy.

References

1. CDC. Drug-resistant tuberculosis—Mississippi. MMWR 1977;26:417–8,423.
2. CDC. Interstate outbreak of drug-resistant tuberculosis involving children—California, Montana, Nevada, Utah. MMWR 1983;32:516–8.
3. CDC. Multi-drug-resistant tuberculosis—North Carolina. MMWR 1987;35:785–7.
4. American Thoracic Society/CDC. Treatment of tuberculosis and tuberculosis infection in adults and children. Am Rev Respir Dis 1986;134:355–63.
5. CDC. Use of BCG vaccines in the control of tuberculosis: a joint statement by the ACIP and the Advisory Committee for Elimination of Tuberculosis. MMWR 1988;37:663–4,669–75.
6. Sbarbaro JA. Compliance: inducements and enforcements. Chest 1979;76:750–6.
7. Snider DE, Hutton MD. Improving patient compliance in tuberculosis treatment programs. Atlanta, Georgia: US Department of Health and Human Services, Public Health Service, CDC, 1989.
8. Cohn DL, Catlin BJ, Peterson KL, Judson FN, Sbarbaro JA. A 62 dose, 6-month therapy for pulmonary and extrapulmonary tuberculosis: a twice-weekly, directly observed, and cost-effective regimen. Ann Intern Med 1990;112:407–15.
9. Weidhaas S, Nardell E, Ford J. Is long term hospitalization an effective TB control intervention among the homeless? [Abstract]. Am Rev Respir Dis 1989;139(4[pt 2]):A398.
10. Adler JJ, Ruggiero D, Langhorne W, Heetderks A, Nivin B. Residential facility for homeless tuberculosis patients [Abstract]. Am Rev Respir Dis 1990;141(4[pt 2]):A458.
11. CDC. A strategic plan for the elimination of tuberculosis in the United States. MMWR 1989;38(no. S-3):7.

Occupational Fatalities Associated with Exposure to Epoxy Resin Paint in an Underground Tank — Makati, Republic of the Philippines

On October 31, 1988, three men who were plugging leaks in and waterproofing an underground water tank at a building in Salcedo Village, Makati, Republic of the Philippines, were overcome by paint fumes and died in the tank. The incident was investigated by the Philippines Department of Health Field Epidemiology Training Program.

The underground water storage tank measured 20 meters (66 feet) long by 6 meters (19.8 feet) wide by 3 meters (9.9 feet) high and was divided into three communicating compartments; entry and exit were through one access hole. Because of typhoon rains on the evening of October 30, the tank contained approximately 60 centimeters (2 feet) of water when the five-person crew began work at 8 a.m., although company procedures required that such tanks be dry before any waterproofing materials were applied. By 9 p.m., when the crew started to apply an epoxeal waterproofing paint, the water was 10.2 centimeters (4 inches) deep. Two 60-centimeter (2-foot) diameter electrically powered exhaust fans were provided to ventilate the tank, but the workers did not use them because of concern for a possible electrocution hazard from the standing water. At approximately 10 p.m., one worker left the tank because he had become drowsy and nauseated and was vomiting. At 10:30 p.m., a second worker left the tank to obtain coffee. When these two workers returned to the tank at approximately 11:30 p.m., they found the three other crewmembers dead.

Autopsy reports attributed the cause of death to asphyxia. A toxicology report from the Philippines National Bureau of Investigation indicated that blood specimens from the three men who died were negative for alcohol, sulfur, cyanide, and phosphorus. Analysis of samples of the paint by the Philippines Department of Science and Technology confirmed the presence of an epoxy resin.

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Editorial Note: Epoxy-based waterproofing paints contain several types of toxic chemicals, and precautionary measures are required when these paints are used in a confined space. Constituents of epoxy resins will displace oxygen in a confined space and may have an independent narcotic effect on exposed workers. In this episode, the epoxy paint contained glycidyl ether, a reactive dilutent used to decrease viscosity (*1*). Uncured glycidyl ether vapors are more dense than air and will settle to the bottom of a confined space, such as the water storage tank, thereby displacing oxygen. For this reason, in the United States, CDC's National Institute for Occupational Safety and Health (NIOSH) recommends use of appropriate personal protective equipment (i.e., a positive pressure-supplied air respirator and clothing) and adequate ventilation when persons work with (or assess the presence of) glycidyl ether in confined spaces.

In the United States, acute traumatic occupational deaths are monitored by NIOSH through the National Traumatic Occupational Fatalities (NTOF) data file (*2*). The

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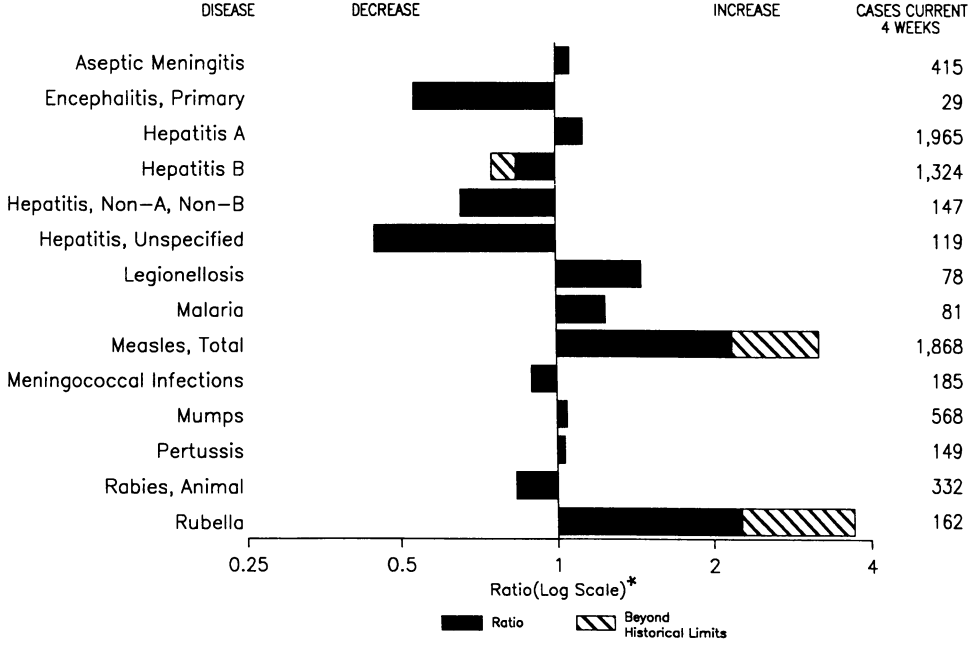
FIGURE I. Notifiable disease reports, comparison of 4-week totals ending June 2, 1990, with historical data — United States



*Ratio of current 4-week total to mean of 15 4-week totals (from comparable, previous, and subsequent 4-week periods for past 5 years).

TABLE I. Summary — cases of specified notifiable diseases, United States, cumulative, week ending June 2, 1990 (22nd Week)

	Cum. 1990		Cum. 1990
AIDS	18,394	Plague	-
Anthrax	-	Poliomyelitis, Paralytic*	-
Botulism: Foodborne	1	Psittacosis	56
Infant	17	Rabies, human	-
Other	2	Syphilis: civilian	20,547
Brucellosis	16	military	121
Cholera	1	Syphilis, congenital, age < 1 year	-
Congenital rubella syndrome	1	Tetanus	21
Diphtheria	1	Toxic shock syndrome	139
Encephalitis, post-infectious	41	Trichinosis	13
Gonorrhea: civilian	276,543	Tuberculosis	8,413
military	3,854	Tularemia	23
Leprosy	76	Typhoid fever	139
Leptospirosis	15	Typhus fever, tickborne (RMSF)	72
Measles: imported	564		
indigenous	8,219		

*Three cases of suspected poliomyelitis have been reported in 1990; none of 13 suspected cases in 1989 have been confirmed to date. Nine of 14 suspected cases in 1988 were confirmed and all were vaccine-associated.

TABLE II. Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	AIDS	Aseptic Meningitis	Encephalitis		Gonorrhea (Civilian)		Hepatitis (Viral), by type				Legionellosis	Leprosy
			Primary	Post-infectious			A	B	NA,NB	Unspecified		
	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990
UNITED STATES	18,394	1,998	252	41	276,543	280,121	12,284	8,479	811	730	450	76
NEW ENGLAND	679	83	9	-	7,588	8,111	249	415	22	33	21	5
Maine	21	2	1	-	94	113	4	17	3	1	1	-
N.H.	40	8	-	-	80	72	5	22	2	2	3	-
Vt.	7	9	2	-	27	28	2	25	3	-	4	-
Mass.	378	28	2	-	2,952	3,160	184	274	9	29	9	4
R.I.	34	24	-	-	449	571	26	23	-	1	4	1
Conn.	199	12	4	-	3,986	4,167	28	54	5	-	-	-
MID. ATLANTIC	5,963	241	19	3	38,925	45,360	1,789	1,335	94	52	112	14
Upstate N.Y.	824	108	18	1	5,617	6,838	406	294	15	17	49	1
N.Y. City	3,396	49	1	-	16,758	19,197	215	436	15	20	16	10
N.J.	1,178	-	-	-	6,017	5,889	182	277	23	-	10	2
Pa.	565	84	-	2	10,533	13,436	986	328	41	15	37	1
E.N. CENTRAL	1,292	310	62	6	53,265	48,985	892	1,084	51	53	109	-
Ohio	286	78	15	2	16,186	12,169	103	199	14	7	39	-
Ind.	116	57	2	2	4,504	3,767	62	239	3	17	18	-
Ill.	570	52	21	2	16,698	15,668	407	169	16	14	7	-
Mich.	218	107	22	-	12,916	13,239	177	299	16	15	32	-
Wis.	102	16	2	-	2,961	4,142	143	178	2	-	13	-
W.N. CENTRAL	410	86	18	1	14,924	12,616	704	409	48	15	26	-
Minn.	57	8	9	1	1,845	1,295	112	50	15	-	-	-
Iowa	20	11	2	-	1,128	1,046	155	32	2	2	2	-
Mo.	252	36	1	-	8,760	7,350	241	247	12	10	17	-
N. Dak.	-	7	-	-	47	60	7	4	2	1	-	-
S. Dak.	1	3	2	-	84	112	37	4	2	-	-	-
Nebr.	24	11	3	-	770	713	43	18	3	-	4	-
Kans.	56	10	1	-	2,290	2,040	109	54	12	2	3	-
S. ATLANTIC	3,862	483	62	13	77,914	75,910	1,501	1,580	122	108	68	3
Del.	40	15	3	-	1,306	1,199	66	44	4	1	4	-
Md.	388	65	8	1	8,241	8,293	608	218	16	4	21	1
D.C.	302	2	-	-	4,730	4,667	12	28	4	-	-	-
Va.	333	74	22	2	7,425	6,308	120	97	18	82	6	-
W. Va.	31	9	5	-	579	558	9	41	3	1	1	-
N.C.	259	42	18	-	12,751	11,543	293	458	54	-	11	1
S.C.	139	7	-	-	6,194	6,916	20	253	9	6	10	-
Ga.	562	64	3	1	17,499	15,145	134	179	3	6	11	-
Fla.	1,808	205	3	9	19,189	21,281	239	262	11	8	4	1
E.S. CENTRAL	432	170	21	1	23,040	22,582	163	664	50	4	34	-
Ky.	76	46	5	-	2,459	2,081	43	228	16	3	15	-
Tenn.	144	35	12	1	7,128	7,168	80	353	22	-	10	-
Ala.	100	67	4	-	7,844	7,484	39	79	10	-	9	-
Miss.	112	22	-	-	5,609	5,849	1	4	2	1	-	-
W.S. CENTRAL	1,871	139	9	5	27,604	29,254	1,176	674	65	105	30	17
Ark.	157	5	-	-	3,642	2,943	228	34	3	10	7	-
La.	298	20	3	-	5,697	6,194	66	126	1	3	10	-
Okla.	96	14	1	5	2,503	2,483	261	66	14	10	10	-
Tex.	1,320	100	5	-	15,762	17,634	621	448	47	82	3	17
MOUNTAIN	466	89	8	-	5,007	5,807	1,977	621	59	61	23	-
Mont.	7	2	-	-	74	92	52	36	2	4	1	-
Idaho	14	-	-	-	44	89	37	35	8	-	3	-
Wyo.	2	1	1	-	75	48	22	8	3	1	-	-
Colo.	131	21	1	-	1,081	1,330	121	79	16	21	3	-
N. Mex.	40	4	-	-	518	596	302	70	2	2	2	-
Ariz.	161	36	4	-	2,293	2,078	1,133	194	15	25	8	-
Utah	46	15	-	-	176	186	152	39	10	3	1	-
Nev.	65	10	2	-	746	1,388	158	160	3	5	5	-
PACIFIC	3,419	397	44	12	28,276	31,496	3,833	1,697	300	299	27	37
Wash.	272	-	3	1	2,439	2,632	640	264	59	10	7	2
Oreg.	142	-	-	-	1,108	1,212	415	198	17	5	-	-
Calif.	2,925	361	37	10	24,101	27,059	2,648	1,180	217	280	19	29
Alaska	16	8	3	-	436	381	86	30	3	-	-	-
Hawaii	64	28	1	1	192	212	44	25	4	4	1	6
Guam	1	-	-	-	71	59	3	1	-	5	-	-
P.R.	744	33	4	-	347	497	73	104	1	19	-	-
V.I.	4	-	-	-	189	287	-	7	-	-	-	-
Amer. Samoa	-	1	-	-	26	11	12	-	-	-	-	5
C.N.M.I.	-	-	-	-	66	38	4	2	-	-	-	1

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

TABLE II. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin-gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported*		Total									
	Cum. 1990	1990	Cum. 1990	1990	Cum. 1990	Cum. 1989	Cum. 1990	1990	Cum. 1990	1990	Cum. 1990	Cum. 1989	1990	Cum. 1990	Cum. 1989
UNITED STATES	404	804	8,219	21	564	6,542	1,247	116	2,660	30	1,152	964	46	456	182
NEW ENGLAND	40	-	107	-	13	263	80	2	20	7	151	205	-	4	5
Maine	-	-	27	-	-	-	8	-	-	-	4	4	-	-	-
N.H.	4	-	-	-	8	5	2	-	6	-	10	5	-	1	3
Vt.	4	-	-	-	1	1	5	-	1	-	6	5	-	-	1
Mass.	23	-	4	-	1	36	43	1	7	7	122	181	-	-	1
R.I.	3	-	27	-	3	37	5	1	4	-	-	2	-	1	-
Conn.	6	-	49	-	-	184	17	-	2	-	9	8	-	2	-
MID. ATLANTIC	83	-	495	-	128	641	183	5	157	1	282	51	-	2	11
Upstate N.Y.	17	-	155	-	101	111	72	5	69	1	229	25	-	1	3
N.Y. City	30	-	43	-	15	52	23	-	-	-	-	2	-	-	6
N.J.	21	-	22	-	5	357	34	-	30	-	11	20	-	-	2
Pa.	15	-	275	-	7	121	54	-	58	-	42	4	-	1	-
E.N. CENTRAL	20	60	2,283	-	139	1,401	169	5	280	-	223	112	-	26	20
Ohio	5	-	213	-	2	492	58	-	54	-	62	1	-	-	3
Ind.	-	25	260	-	1	17	17	-	10	-	34	8	-	-	-
Ill.	6	-	881	-	9	849	38	1	90	-	67	46	-	17	16
Mich.	6	35	300	-	125	6	37	4	96	-	33	20	-	9	-
Wis.	3	-	629	-	2	37	19	-	30	-	27	37	-	-	1
W.N. CENTRAL	5	55	471	-	12	496	38	4	77	1	38	24	2	5	4
Minn.	1	43	163	-	3	3	9	-	-	-	6	-	-	1	-
Iowa	-	1	23	-	-	5	1	-	12	-	4	9	2	3	-
Mo.	4	1	61	-	-	299	13	-	37	1	22	13	-	-	3
N. Dak.	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
S. Dak.	-	1	14	-	8	-	2	-	-	-	1	1	-	-	-
Nebr.	-	-	95	-	1	110	5	-	2	-	1	-	-	-	-
Kans.	-	9	115	-	-	79	8	4	26	-	3	1	-	-	1
S. ATLANTIC	92	49	536	8	88	350	237	76	1,062	5	108	78	-	12	7
Del.	2	-	8	-	3	34	1	-	2	-	2	1	-	-	-
Md.	24	29	95	-	12	48	24	45	614	3	28	7	-	1	2
D.C.	10	-	8	-	7	9	11	-	20	-	13	-	-	1	-
Va.	20	16	64	-	2	12	28	6	64	-	9	4	-	-	-
W. Va.	1	-	6	-	-	28	8	2	40	-	9	10	-	-	-
N.C.	7	-	3	8†§	9	167	37	20	127	2	20	18	-	-	1
S.C.	-	-	3	-	-	-	18	1	19	-	5	-	-	-	-
Ga.	8	-	6	-	12	-	48	-	56	-	14	9	-	-	-
Fla.	20	4	343	-	43	52	62	2	120	-	8	29	-	10	4
E.S. CENTRAL	11	1	70	-	2	60	75	1	60	4	61	39	-	1	2
Ky.	2	-	4	-	-	2	21	-	-	-	-	1	-	-	-
Tenn.	6	-	32	-	-	29	31	1	29	4	28	14	-	1	2
Ala.	3	1	8	-	2	29	21	-	9	-	30	20	-	-	-
Miss.	-	-	26	-	-	-	2	N	N	-	3	4	-	-	-
W.S. CENTRAL	13	306	1,466	11	64	2,349	82	5	476	-	23	27	-	1	11
Ark.	1	-	8	4§	19	2	8	1	114	-	1	10	-	1	-
La.	-	-	10	-	-	6	25	2	81	-	4	4	-	-	5
Okla.	5	6	142	-	-	60	9	-	97	-	18	13	-	-	1
Tex.	7	300	1,306	7†	45	2,281	40	2	184	-	-	-	-	-	5
MOUNTAIN	11	5	398	2	57	179	39	8	213	4	106	307	10	61	31
Mont.	-	-	-	-	1	13	9	-	-	-	5	-	-	13	1
Idaho	2	-	15	-	5	1	4	1	107	2	23	40	6	25	29
Wyo.	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-
Colo.	1	2	46	2†§	31	58	12	1	16	2	49	19	-	3	-
N. Mex.	2	3	75	-	4	30	3	N	N	-	7	4	-	-	-
Ariz.	6	-	123	-	11	41	3	6	73	-	13	238	4	18	-
Utah	-	-	4	-	-	36	4	-	4	-	5	5	-	1	-
Nev.	-	U	135	U	3	-	4	U	11	U	4	1	U	1	1
PACIFIC	129	328	2,393	-	61	803	344	10	315	8	160	121	34	344	91
Wash.	13	-	7	-	38	33	41	4	31	4	43	24	-	-	-
Oreg.	6	-	-	-	-	6	37	N	N	-	3	5	-	-	1
Calif.	107	328	2,308	-	20	751	258	6	280	4	97	90	34	337	70
Alaska	1	-	75	-	2	-	6	-	-	-	-	-	-	-	-
Hawaii	2	-	3	-	1	13	2	-	4	-	17	2	-	7	20
Guam	1	U	-	U	-	1	-	U	-	U	-	1	U	-	-
P.R.	-	-	808	-	-	386	8	1	4	1	5	3	-	-	5
V.I.	-	-	-	-	-	4	-	-	5	-	-	-	-	-	-
Amer. Samoa	-	U	-	U	-	-	-	U	-	U	-	-	U	-	-
C.N.M.I.	-	U	-	U	-	-	-	U	5	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 II. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending June 2, 1990, and June 3, 1989 (22nd Week)

Reporting Area	Syphilis (Civilian) (Primary & Secondary)		Toxic-shock Syndrome	Tuberculosis		Tula-remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1989	Cum. 1990	Cum. 1990	Cum. 1990	Cum. 1990
UNITED STATES	20,547	17,524	139	8,413	8,343	23	139	72	1,618
NEW ENGLAND	798	702	11	201	215	-	11	-	3
Maine	5	5	3	-	3	-	-	-	-
N.H.	32	3	1	3	14	-	-	-	2
Vt.	1	-	-	2	4	-	-	-	-
Mass.	301	215	6	106	109	-	10	-	-
R.I.	6	14	-	30	29	-	-	-	-
Conn.	453	465	1	60	56	-	1	-	1
MID. ATLANTIC	4,567	3,651	13	2,116	1,624	1	40	3	368
Upstate N.Y.	339	383	4	197	135	-	8	-	17
N.Y. City	2,033	1,479	4	1,219	943	-	21	-	-
N.J.	724	587	-	369	242	1	9	3	109
Pa.	1,471	1,202	5	331	304	-	2	-	242
E.N. CENTRAL	1,373	678	36	853	883	-	18	4	36
Ohio	236	51	14	120	177	-	4	2	3
Ind.	19	27	2	52	75	-	-	-	-
Ill.	513	302	5	430	380	-	10	-	13
Mich.	457	261	15	217	205	-	3	2	5
Wis.	148	37	-	34	46	-	1	-	15
W.N. CENTRAL	178	146	16	225	231	6	-	10	229
Minn.	43	11	-	39	49	-	-	-	94
Iowa	23	17	2	27	28	-	-	-	10
Mo.	88	73	11	107	95	5	-	9	10
N. Dak.	1	1	-	10	9	-	-	-	31
S. Dak.	1	-	-	6	12	-	-	-	55
Nebr.	6	16	2	12	10	1	-	-	3
Kans.	16	28	1	24	28	-	-	1	26
S. ATLANTIC	6,418	6,322	7	1,674	1,741	3	12	24	471
Del.	77	73	1	19	20	-	-	1	7
Md.	500	323	-	145	155	-	6	1	182
D.C.	397	402	1	54	70	-	-	-	-
Va.	362	228	-	152	152	1	-	2	85
W. Va.	7	7	-	31	33	-	-	-	12
N.C.	762	386	3	203	203	1	-	14	3
S.C.	338	328	1	193	185	1	-	5	56
Ga.	1,615	1,361	-	247	259	-	1	1	88
Fla.	2,360	3,214	1	630	664	-	5	-	38
E.S. CENTRAL	1,771	1,098	5	661	708	2	-	9	86
Ky.	30	24	-	173	155	-	-	-	24
Tenn.	721	460	3	178	197	2	-	7	22
Ala.	555	373	2	222	210	-	-	2	40
Miss.	465	241	-	88	146	-	-	-	-
W.S. CENTRAL	3,278	2,247	7	1,064	980	9	3	19	219
Ark.	196	146	-	110	101	6	-	1	12
La.	1,007	509	1	115	125	-	-	1	-
Okla.	95	36	6	86	84	3	1	15	68
Tex.	1,980	1,556	-	753	670	-	2	2	139
MOUNTAIN	383	325	19	192	203	1	7	2	73
Mont.	-	1	-	10	7	-	-	-	20
Idaho	6	-	1	6	8	-	-	-	-
Wyo.	-	-	1	1	-	-	-	-	27
Colo.	20	51	6	6	18	-	-	-	-
N. Mex.	20	12	4	43	36	1	-	2	5
Ariz.	269	88	5	91	93	-	5	-	19
Utah	4	10	2	12	19	-	-	-	-
Nev.	64	163	-	23	22	-	2	-	2
PACIFIC	1,781	2,355	25	1,427	1,758	1	48	1	133
Wash.	146	178	3	118	82	1	1	-	-
Oreg.	63	121	-	49	56	-	1	-	-
Calif.	1,558	2,048	21	1,175	1,526	-	43	1	111
Alaska	6	2	-	18	28	-	-	-	22
Hawaii	8	6	1	67	66	-	3	-	-
Guam	1	3	-	14	30	-	-	-	-
P.R.	150	232	-	43	135	-	-	-	19
V.I.	1	1	-	4	3	-	-	-	-
Amer. Samoa	-	-	-	6	2	-	-	-	-
C.N.M.I.	1	4	-	13	7	-	4	-	-

U: Unavailable

TABLE III. Deaths in 121 U.S. cities,* week ending June 2, 1990 (22nd Week)

Reporting Area	All Causes, By Age (Years)						P&I**
	All Ages	≥65	45-64	25-44	1-24	<1	Total
NEW ENGLAND	599	412	103	43	18	23	41
Boston, Mass.	158	91	35	16	10	6	18
Bridgeport, Conn.	42	28	5	3	3	3	1
Cambridge, Mass.	17	14	3	-	-	-	-
Fall River, Mass.	19	14	5	-	-	-	-
Hartford, Conn.	57	40	10	6	-	1	4
Lowell, Mass.	25	21	2	1	-	1	4
Lynn, Mass.	12	10	1	1	-	-	-
New Bedford, Mass.	33	28	5	-	-	-	-
New Haven, Conn.	46	31	6	6	2	1	5
Providence, R.I.	56	45	7	3	-	1	2
Somerville, Mass.	3	3	-	-	-	-	-
Springfield, Mass.	35	21	8	3	1	2	5
Waterbury, Conn.	39	29	7	2	1	-	2
Worcester, Mass.	57	37	9	2	1	8	-
MID. ATLANTIC	2,365	1,538	436	269	61	60	144
Albany, N.Y.	46	34	9	3	-	-	2
Allentown, Pa.	21	17	4	-	-	-	-
Buffalo, N.Y.	100	52	21	18	4	4	3
Camden, N.J.	32	15	12	3	-	2	-
Elizabeth, N.J.	18	13	2	2	-	1	3
Erie, Pa.†	32	27	4	1	-	-	4
Jersey City, N.J.§	55	32	12	7	-	4	1
N.Y. City, N.Y.	1,273	798	238	174	37	26	64
Newark, N.J.	63	34	10	14	2	3	3
Paterson, N.J.	32	22	6	3	1	-	2
Philadelphia, Pa.	308	203	63	25	11	6	25
Pittsburgh, Pa.†	55	37	10	5	-	3	5
Reading, Pa.	27	24	3	-	-	-	3
Rochester, N.Y.	136	102	19	4	5	6	23
Schenectady, N.Y.	20	15	4	1	-	-	2
Scranton, Pa.†	21	18	2	1	-	-	2
Syracuse, N.Y.	46	34	6	4	-	2	1
Trenton, N.J.	36	28	5	1	-	2	-
Utica, N.Y.	21	17	3	1	-	-	-
Yonkers, N.Y.	23	16	3	2	1	1	1
E.N. CENTRAL	2,065	1,346	430	151	54	84	96
Akron, Ohio	38	28	7	2	-	1	-
Canton, Ohio	35	25	7	1	1	1	2
Chicago, Ill.§	564	362	125	45	10	22	16
Cincinnati, Ohio	117	72	24	10	4	7	13
Cleveland, Ohio	129	79	35	6	4	5	6
Columbus, Ohio	136	80	30	9	9	8	1
Dayton, Ohio	81	56	16	8	-	1	4
Detroit, Mich.	194	97	47	24	12	14	4
Evansville, Ind.	40	32	6	1	-	1	3
Fort Wayne, Ind.	62	43	12	4	2	1	6
Gary, Ind.	18	12	3	3	-	-	-
Grand Rapids, Mich.	92	74	10	4	-	4	4
Indianapolis, Ind.	136	87	28	11	4	6	3
Madison, Wis.	34	22	4	4	1	3	2
Milwaukee, Wis.	103	72	19	6	1	5	8
Peoria, Ill.	46	29	12	2	1	2	2
Rockford, Ill.	43	34	7	1	-	1	7
South Bend, Ind.	36	26	6	2	2	-	3
Toledo, Ohio§	98	68	21	4	3	2	6
Youngstown, Ohio§	63	48	11	4	-	-	6
W.N. CENTRAL	653	469	123	40	10	11	36
Des Moines, Iowa	57	43	11	2	1	-	4
Duluth, Minn.	22	20	2	-	-	-	2
Kansas City, Kans.	28	21	5	2	-	-	-
Kansas City, Mo.	107	75	17	9	1	5	7
Lincoln, Nebr.	27	22	4	-	1	-	2
Minneapolis, Minn.	112	84	20	7	-	1	8
Omaha, Nebr.	84	64	15	3	-	2	10
St. Louis, Mo.	115	74	29	7	2	3	-
St. Paul, Minn.	61	41	12	4	4	-	1
Wichita, Kans.	40	25	8	6	1	-	2
S. ATLANTIC	1,194	719	261	145	30	37	61
Atlanta, Ga.	140	86	35	17	1	1	3
Baltimore, Md.	273	159	64	34	7	9	14
Charlotte, N.C.	77	49	10	13	4	1	6
Jacksonville, Fla.	88	55	22	6	2	3	10
Miami, Fla.	118	71	24	18	4	1	1
Norfolk, Va.	45	29	10	2	1	3	6
Richmond, Va.	54	35	10	7	-	2	3
Savannah, Ga.	62	35	15	9	-	2	4
St. Petersburg, Fla.	73	52	9	3	2	7	4
Tampa, Fla.	56	34	11	6	2	2	6
Washington, D.C.	182	93	48	29	7	5	4
Wilmington, Del.	26	21	3	1	-	1	-
E.S. CENTRAL	751	475	160	62	29	25	39
Birmingham, Ala.	123	78	24	8	7	6	1
Chattanooga, Tenn.	46	36	7	-	1	2	3
Knoxville, Tenn.	82	50	22	7	2	1	3
Louisville, Ky.§	92	68	15	5	1	3	4
Memphis, Tenn.	139	72	30	20	10	7	13
Mobile, Ala.	125	75	33	10	5	2	2
Montgomery, Ala.§	51	39	8	3	-	1	4
Nashville, Tenn.	93	57	21	9	3	3	9
W.S. CENTRAL	1,771	1,094	352	197	80	48	87
Austin, Tex.	66	44	10	9	2	1	3
Baton Rouge, La.	48	32	6	6	2	2	2
Corpus Christi, Tex.§	51	34	11	5	-	1	1
Dallas, Tex.	181	88	45	23	14	11	8
El Paso, Tex.	52	40	6	3	2	1	6
Fort Worth, Tex	78	53	15	6	3	1	5
Houston, Tex.§	734	436	169	89	24	16	18
Little Rock, Ark.	64	35	14	9	3	3	7
New Orleans, La.	152	94	21	17	17	3	-
San Antonio, Tex.	175	117	28	18	7	5	17
Shreveport, La.	81	60	9	7	2	3	11
Tulsa, Okla.	89	61	18	5	4	1	9
MOUNTAIN	649	427	118	52	26	25	37
Albuquerque, N. Mex.	78	51	14	8	3	1	2
Colo. Springs, Colo.	43	29	7	2	2	3	5
Denver, Colo.	110	76	17	8	-	9	5
Las Vegas, Nev.	104	65	19	10	6	4	6
Ogden, Utah	20	19	1	-	-	-	6
Phoenix, Ariz.	118	79	20	9	6	4	6
Pueblo, Colo.	21	10	7	2	2	-	1
Salt Lake City, Utah	53	32	11	5	2	3	-
Tucson, Ariz.	102	66	22	8	5	1	6
PACIFIC	1,696	1,086	323	182	58	43	100
Berkeley, Calif.	21	17	1	3	-	-	3
Fresno, Calif.	73	44	13	11	2	3	7
Glendale, Calif.	22	15	4	2	1	-	-
Honolulu, Hawaii	80	48	19	9	4	-	6
Long Beach, Calif.	66	37	14	10	-	5	7
Los Angeles Calif.	418	272	76	44	18	5	18
Oakland, Calif.	47	26	12	6	-	3	3
Pasadena, Calif.	30	20	3	2	-	5	-
Portland, Oreg.	108	78	17	6	2	5	3
Sacramento, Calif.	124	71	28	12	11	2	13
San Diego, Calif.	143	84	24	19	10	5	14
San Francisco, Calif.	141	95	23	18	3	2	6
San Jose, Calif.	150	91	38	15	2	4	6
Seattle, Wash.	183	120	38	20	4	1	3
Spokane, Wash.	42	30	7	3	1	1	6
Tacoma, Wash.	48	38	6	2	-	2	5
TOTAL	11,743††	7,566	2,306	1,141	366	356	641

*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.

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

Paint Exposure — Continued

NTOF data file uses death certificates as the source of information for work-related fatalities resulting from external causes of injury and poisoning (*International Classification of Diseases, Ninth Revision* [ICD-9], rubrics E800–E899). From 1980 through 1985, the NTOF data file included 286 deaths (an average of 48 work-related deaths per year) that involved workers in confined spaces with cause of death directly attributable to asphyxiation, explosion, or drowning. This figure probably underestimates the number of such confined-space–related fatalities in the United States because of misclassification and the lack of a specific ICD-9 code for "confined spaces" on the death certificate.

NIOSH defines a confined space as one that "by design has limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and which is not intended for continuous employee occupancy" (*3*). The water storage tank in the incident reported here not only met these criteria, but also contained dangerous air contaminants introduced by the workers through the use of epoxeal waterproofing paint.

Companies, municipalities, and other organizations who assign workers to perform tasks within confined spaces should develop and implement a comprehensive program for working in confined spaces (*3,4*). Important considerations for such recommendations are whether 1) entry is necessary or the assigned task can be completed from the outside; 2) a confined space safe entry permit has been issued by the company; 3) warning signs are posted where they will be noticed by employees; 4) air quality in the confined space has been tested for safety according to basic criteria*; 5) employees and supervisors have been trained in the proper selection and use of appropriate respiratory protection (*6,7*), protective clothing, lifelines, and emergency rescue equipment; 6) employees have been trained to work in confined spaces and in confined space rescue procedures; and 7) ventilation equipment is available and/or used and air quality is tested when the ventilation system is operating.

In addition, confined space procedures for work performed inside tanks should specifically incorporate use of explosion-proof lighting and fixtures in and near flammable atmospheres† and use of nonflammable paints (when possible) for coating the interior of tanks.

References

1. NIOSH. Criteria for a recommended standard...occupational exposure to glycidyl ethers. Cincinnati, Ohio: US Department of Health, Education, and Welfare, Public Health Service, CDC, 1978; DHEW publication no. (NIOSH)78-166.
2. NIOSH. National traumatic occupational fatalities: 1980–85. Morgantown, West Virginia: US Department of Health and Human Services, Public Health Service, CDC, 1990.
3. NIOSH. Criteria for a recommended standard...working in confined spaces. Cincinnati, Ohio: US Department of Health, Education, and Welfare, Public Health Service, CDC, 1979; DHEW publication no. (NIOSH)80-106.
4. NIOSH. A guide to safety in...confined spaces. Morgantown, West Virginia: US Department of Health and Human Services, Public Health Service, CDC, 1987; DHHS publication no. (NIOSH)87-113.
5. Office of the Federal Register. Code of federal regulations: labor. Subpart Z, revised as of

*Oxygen concentration, ≥19.5%; concentration of flammable substances, <10% of their respective lower explosive limits (i.e., the lowest concentration at which explosive combustion can occur); and toxic air contaminants, less than the concentration levels referenced in 29 CFR §1910.1000, subpart Z (*5*).

†Required by the National Electric Code Articles 501-9(a)(1) and 501-9(b)(1) (*8*) and the National Fire Protection Association Standard 33 (*9*).

Paint Exposure — Continued

July 1, 1989. Washington, DC: Office of the Federal Register, National Archives and Records Administration, 1989. (29 CFR §1910.1000).
6. NIOSH. NIOSH respirator decision logic. Morgantown, West Virginia: US Department of Health and Human Services, Public Health Service, CDC, 1987; DHHS publication no. (NIOSH)87-108.
7. NIOSH. Guide to industrial respiratory protection. Morgantown, West Virginia: US Department of Health and Human Services, Public Health Service, 1987; DHHS publication no. (NIOSH)87-166.
8. National Fire Protection Association. The national electric code handbook: the national electric code 1990. Quincy, Massachusetts: National Fire Protection Association, 1989. (Article nos. 501-9[a][1] and 501-9[b][1]).
9. National Fire Protection Association. Standard for spray application using flammable and combustible materials. Quincy, Massachusetts: National Fire Protection Association, 1989. (NFPA standard no. 33.)

Update: Serologic Testing for HIV-1 Antibody — United States, 1988 and 1989

In 1985, the first enzyme immunoassay (EIA) for detection of human immunodeficiency virus type 1 (HIV-1) antibody was licensed by the Food and Drug Administration; since then, the number of HIV-1 tests performed and the number of laboratories performing HIV-1 tests has increased steadily. Because of the need to assess the quality of existing laboratory technology and to ensure the quality of testing, the Model Performance Evaluation Program (MPEP) was implemented by CDC in 1986 to evaluate the performance of laboratories testing for HIV-1 infection (*1*). Approximately 1400 U.S. and international laboratories participated in the MPEP during 1988 and 1989. The total number of laboratories performing HIV-1 testing is unknown.

Laboratories in the MPEP voluntarily report results from coded plasma samples for which HIV-1–antibody reactivity has been determined through composite testing at CDC and verified at candidate reference laboratories (Table 1). Participants also complete survey forms describing laboratory characteristics and testing practices. This report summarizes data for the 752 U.S. MPEP laboratories that returned complete results in both May 1988 and August 1989*. Performance is described in terms of analytic sensitivity, analytic specificity, and overall analytic performance.† Performance was calculated based on a laboratory's test results for samples that were typical of most samples routinely tested for HIV-1 antibody.

Enzyme Immunoassays

The analytic sensitivity of EIAs for HIV-1 antibody performed for MPEP in 1988 was 99.7% (6545 reactive test results out of 6566 positive samples) (Table 2); analytic

*Provisional data for 1989.

†Analytic sensitivity is the proportion of reactive test results in positive specimens. To calculate analytic sensitivity, Western blot (WB) "indeterminate" test results are combined with nonreactive test results. Analytic specificity is the proportion of nonreactive test results in negative specimens. To calculate analytic specificity, WB "indeterminate" test results are combined with reactive test results. Overall analytic performance is the proportion of "correct" test results in all specimens tested. Because seroreactivity of included samples was defined as positive or negative, WB "indeterminate" test results are not considered "correct" for calculating overall analytic performance.

Serologic Testing — Continued

specificity was 98.5% (3004 nonreactive test results out of 3051 negative samples). The overall analytic performance of EIAs was 99.3% (9549 correct results out of 9617 tests).

Laboratories performing HIV-1–antibody tests were classified into 15 laboratory types. Five types of laboratories accounted for 709 (94.7%) of the 749 MPEP laboratories performing EIAs: non–blood-bank hospital (241 [32.2%]), laboratories identifying themselves as independent (140 [18.7%]), hospital blood bank (124 [16.6%]), nonhospital blood bank (122 [16.3%]), and health department (82 [10.9%]). For EIAs performed in 1988, laboratory type-specific analytic sensitivity among the major laboratory types ranged from 99.3% to 100.0%; analytic specificity, from 98.1% to 99.5%; and overall analytic performance, from 98.9% to 99.8%.

Non–blood-bank hospital laboratories reported the largest percentages of EIA results in both 1988 and 1989 (2868 [29.8%] of 9617 results in 1988 and 2372 [29.0%] of 8190 results in 1989). However, the percentages of EIA results reported on MPEP samples decreased from 1988 to 1989 for both non–blood-bank hospital and hospital blood bank laboratories (from 1488 [15.5%] in 1988 to 1247 [15.2%] in 1989 for hospital blood bank laboratories). The percentages of EIA results reported increased in independent (from 18.4% to 18.6%), nonhospital blood bank (from 17.7% to 17.9%), health department (from 12.5% to 13.0%), and other types of laboratories (from 6.0% to 6.3%). Health department and other types of laboratories had the largest distribution increases (4.0% and 5.0%, respectively).

Western Blot

In 1988, the analytic sensitivity for Western blot (WB) tests[§] performed for MPEP was 99.3% (1345 reactive test results out of 1355 positive samples); analytic specific

[§]WBs were performed with both the licensed test kit available in the United States and with laboratories' own WB test reagents using viral antigen purchased from commercial sources.

TABLE 1. Sample panels used to evaluate enzyme immunoassay (EIA) and Western blot (WB) for human immunodeficiency virus type 1 (HIV-1) antibody — Model Performance Evaluation Program, May 1988 and August 1989*

	1988†			1989§		
HIV-1 test	Positive¶ samples	Negative¶ samples	Total	Positive¶ samples	Negative¶ samples	Total
EIA	18	8	26	19	8	27
WB	18	7	25	6	7	13

*Includes 752 U.S. laboratories that returned complete results in both May 1988 and August 1989.

†In May 1988, 53 coded plasma samples were tested by 25 reference and 727 participating laboratories. Reference laboratories were selected because of extensive experience and excellent long-term performance in proficiency testing programs.

§In August 1989, 28 coded plasma samples were tested by 28 reference and 724 participating laboratories. Three participating laboratories in 1988 were reference laboratories in 1989.

¶Seroreactivity of samples sent to laboratories was defined (positive or negative) on the basis of 1) agreement on reactivity to HIV-1 antibody by at least 90% of the reference laboratories, 2) agreement with reactivity to HIV-1 antibody as determined by testing at CDC using licensed WB kits and using Public Health Service-endorsed interpretive criteria (*3*), 3) no diluted samples except pooled samples of identical HIV-1–antibody reactivity, and 4) availability of additional information on the specimen source. Samples that met these inclusion criteria were likely to be typical of most samples tested routinely for HIV-1 antibody.

Serologic Testing — Continued

ity was 91.6% (306 nonreactive test results out of 334 negative samples) (Table 2). Overall analytic performance of WB in 1988 was 97.8% (1651 correct results out of 1689 tests). Analytic sensitivity, analytic specificity, and overall analytic performance were similar for WBs performed with licensed and unlicensed test kits.

Four types of laboratories accounted for 115 (82.1%) of the 140 laboratories performing WB tests in 1988: health department (41 [29.3%]), independent (27 [19.3%]), non–blood-bank hospital (27 [19.3%]), and nonhospital blood bank (20 [14.3%]). For WBs performed in 1988, laboratory type-specific analytic sensitivity among the major laboratory types ranged from 98.7% to 100.0%; analytic specificity, from 85.0% to 98.7%; and overall analytic performance, from 96.2% to 99.1%.

In 1989, analytic specificity for WB tests was 97.8% (364 nonreactive test results out of 372 negative samples)—a 6.8% increase over specificity in 1988 (Table 2). In 1989, 159 (21.1%) MPEP laboratories performed WBs, an increase of 13.6% over the number in 1988. Four types of laboratories continued to report most WB results on MPEP samples and accounted for 129 (81.1%) of the laboratories performing WBs: health department (47 [29.6%]), independent (33 [20.8%)], non–blood-bank hospital (31 [19.5%]), and nonhospital blood bank (18 [11.3%]).

The percentages of WB results reported from the two largest categories of WB laboratories (health department and independent) increased from 1988 to 1989 (from 453 [26.8%] of 1689 results in 1988 to 246 [27.3%] of 900 results in 1989 for health department and from 349 [20.7%] in 1988 to 204 [22.7%] in 1989 for independent). In nonhospital blood bank and other types of laboratories, the percentages of WB results reported decreased (from 16.9% to 14.7% for nonhospital blood bank and from 17.5% to 16.6% for other laboratories).

For WBs performed in 1989, laboratory type-specific analytic sensitivity among the major laboratory types ranged from 97.1% to 100.0%; analytic specificity, from 96.0% to 100.0%; and overall analytic performance, from 97.1% to 99.2%.

Reported by: Div of Laboratory Systems, Public Health Practice Program Office, CDC.

TABLE 2. Performance measures of enzyme immunoassay (EIA) and Western blot (WB) for human immunodeficiency virus type 1 (HIV-1) antibody — Model Performance Evaluation Program, May 1988 and August 1989

Performance measure	1988 (%)	1989 (%)	Change (from 1988 to 1989 (%)
EIA			
Analytic sensitivity*	99.7	99.3	–0.4
Analytic specificity†	98.5	99.7	+1.2
Overall analytic performance§	99.3	99.4	+0.1
WB			
Analytic sensitivity*	99.3	98.9	–0.4
Analytic specificity†	91.6	97.8	+6.8
Overall analytic performance§	97.8	98.4	+0.6

*Analytic sensitivity is the proportion of reactive test results in positive specimens. For calculating analytic sensitivity, WB "indeterminate" test results are combined with nonreactive test results.

†Analytic specificity is the proportion of nonreactive test results in negative specimens. For calculating analytic specificity, WB "indeterminate" test results are combined with reactive test results.

§Overall analytic performance is the proportion of "correct" test results in all specimens tested.

Serologic Testing — Continued

Editorial Note: Assuring accurate results in tests for HIV-1 antibody remains a critical component of surveillance for HIV-1 infections. Results from proficiency testing programs can measure the operational performance of participating laboratories but must be interpreted cautiously. HIV-1 proficiency testing programs rarely use fresh single-donor specimens from persons who may or may not be infected with HIV-1. Because of the necessity to use large volumes of sample materials, proficiency testing programs often use pooled human plasma samples and dilutions of single reactive plasma samples in HIV-1-antibody–negative serum. These samples may react nonspecifically and may be difficult to test and interpret. Despite limitations, proficiency testing is capable of identifying problems with particular types of samples, with particular tests, with reagents of kit manufacturers (*2*), and with interpretations and reporting of testing results (*3*). Proficiency testing can also serve as a valuable education tool.

The MPEP incorporates useful elements of proficiency testing programs but also contains features, such as frequently using single-donor undiluted plasma for samples, that avoid some of the problems encountered by proficiency testing programs. By using survey data, the MPEP can evaluate parameters such as analytic sensitivity and analytic specificity for particular HIV-1 tests along with laboratory characteristics such as laboratory type.

EIAs have proven valuable for screening donated blood for HIV-1 antibody to reduce HIV-1 transmission through blood transfusions and administration of clotting factors. In addition, an EIA is usually the first step in diagnosing HIV-1 infection. Thus, maintaining high analytic sensitivity of EIAs is important.

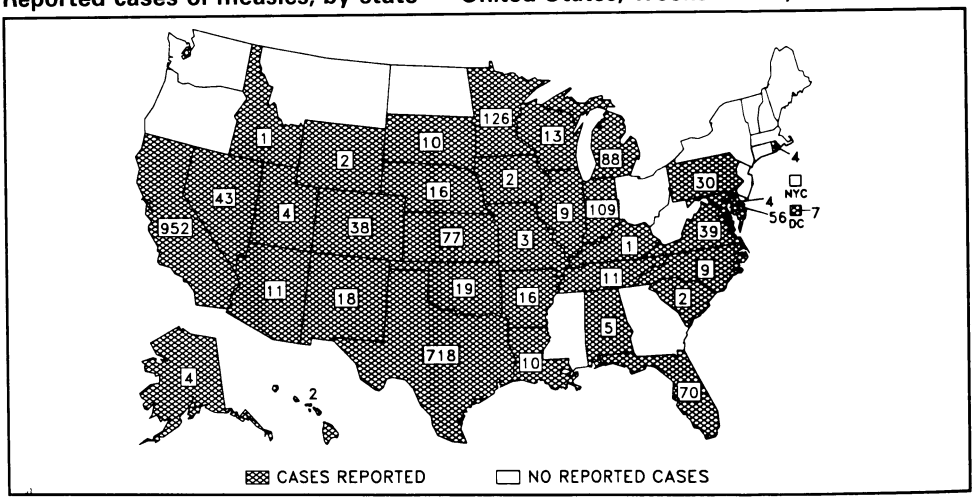
WBs are frequently used as the independent supplemental test of higher specificity to confirm HIV-1 antibody following repeatedly reactive EIA test results. Possible reasons for increases in analytic specificity for WBs include improvements in the intrinsic properties of available tests, increased use of more standardized test methods, increased experience and training in the use of WBs by laboratory personnel, and increased use of more standardized interpretive criteria for test results. The Public Health Service endorsed the WB interpretive criteria for HIV-1 antibody in public health and clinical practice in July 1989 (*4*), within one month of the 1989 sample panel evaluation.

Continued monitoring of performance data is important to assure quality performance of HIV-1–antibody tests, particularly if HIV-1 testing trends continue and testing capabilities and sophistication expand in both the private and public health sectors.

References

1. Taylor RN, Przybyszewski VA. Summary of the Centers for Disease Control human immunodeficiency virus (HIV) performance evaluation surveys for 1985 and 1986. Am J Clin Pathol 1988;89:1–13.
2. Polesky HF, Hanson MR. Human immunodeficiency virus type 1 proficiency testing: the American Association of Blood Banks/College of American Pathologists program. Arch Pathol Lab Med 1990;114:268–71.
3. Benenson AS, Peddecord KM, Hofherr LK, Ascher MS, Taylor RN, Hearn TL. Reporting the results of human immunodeficiency virus testing. JAMA 1989;262:3435–8.
4. CDC. Interpretation and use of the Western blot assay for serodiagnosis of human immunodeficiency virus type 1 infections. MMWR 1989;38(no. S-7).

Reported cases of measles, by state — United States, weeks 18–22, 1990



The *Morbidity and Mortality Weekly Report* is prepared by the Centers for Disease Control, Atlanta, Georgia, and available on a paid subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, (202) 783-3238.

The data in this report are provisional, based on weekly reports 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 of interesting cases, outbreaks, environmental hazards, or other public health problems of current interest to health officials. Such reports and any other matters pertaining to editorial or other textual considerations should be addressed to: Editor, *Morbidity and Mortality Weekly Report*, Centers for Disease Control, Atlanta, Georgia 30333; telephone (404) 332-4555.

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HHS Publication No. (CDC) 90-8017