CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

June 17, 1994 / Vol. 43 / No. 23

MMWR

MORBIDITY AND MORTALITY WEEKLY REPORT

Emerging Infectious Diseases

Update: Coccidioidomycosis — California, 1991–1993

Coccidioidomycosis is an infection caused by the fungus *Coccidioides immitis*, which resides in the soil in some areas of Arizona, California, Nevada, New Mexico, Texas, and Utah. Infection can occur when airborne, infective arthroconidia are inhaled. Symptomatic coccidioidomycosis, which occurs in approximately 40% of all infections, has a wide clinical spectrum, including mild influenza-like illness, severe pneumonia, and disseminated disease. Beginning in 1991, the number of cases of coccidioidomycosis reported annually to the California Department of Health Services (CDHS) increased dramatically (*1*) (Figure 1). This report summarizes the occurrence of coccidioidomycosis in California during 1991–1993.

In 1991, 1200 cases of coccidioidomycosis were reported to CDHS, compared with an annual average of 428 reported cases during 1981–1990. The number of reported cases continued to increase during 1992 (4516 cases) but declined during 1993 (4137 cases). During 1991–1993, most (70%) cases in California were reported from Kern County in the San Joaquin Valley, where the incidence of coccidioidomycosis is high; in contrast, during 1981–1990, Kern County accounted for 52% of all cases. Coccidioidomycosis surveillance data are reported to CDHS by the counties as weekly case counts only.

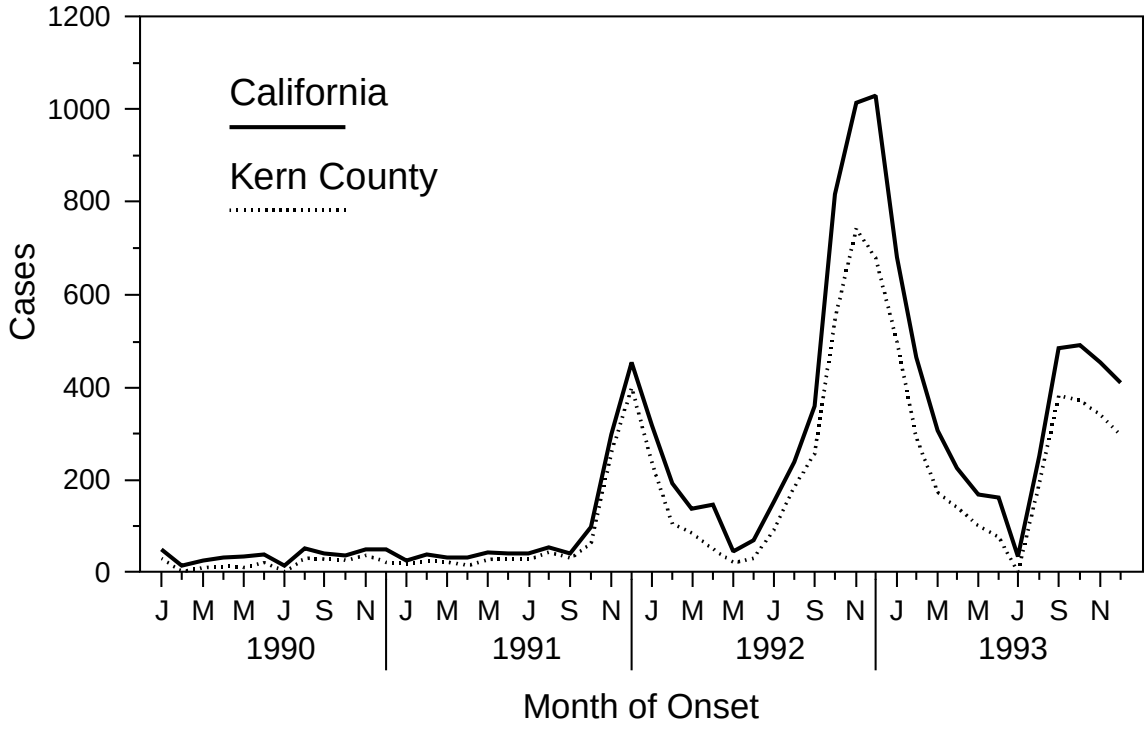
Reported by: BA Jinadu, MD, G Welch, R Talbot, PhD, Kern County Health Dept; J Caldwell, PharmD, R Johnson, MD, D Blume, PhD, H Einstein, MD, T Larwood, MD, M Hargrave, Bakersfield; RJ Jackson, MD, SB Werner, MD, P Duffey, PhD, GW Rutherford, III, MD, State Epidemiologist, California Dept of Health Svcs; T Kirkland, MD, San Diego; D Pappagianis, MD, Davis; F Swatek, PhD, Long Beach, California. DM Dixon, PhD, National Institute of Allergy and Infectious Disease, National Institutes of Health. Div of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, CDC.

Editorial Note: The public health impact of coccidioidomycosis in California during 1991–1993 was substantial. For example, based on a review of medical records in Kern County alone, coccidioidomycosis accounted for approximately $45 million in direct costs of hospitalization and outpatient care during that period (J. Caldwell, Pharm.D., Kern Medical Center, personal communication, 1994).

Factors potentially associated with the ongoing outbreak of coccidioidomycosis in California include weather conditions (e.g., protracted drought followed by heavy

Coccidioidomycosis — Continued

FIGURE 1. Reported cases of coccidioidomycosis, by month of report — Kern County and California, 1990–1993



rains) conducive to the growth and spread of *C. immitis*, activities that disturb the soil and facilitate airborne spread of the organism, and a large and increasing population of susceptible persons. These factors illustrate the association between environmental and demographic factors and the emergence of some infectious diseases (*2,3*).

During 1991–1993 and previously, the number of coccidioidomycosis cases probably has been underreported. In Kern County, unlike other counties in California, the local health department is the diagnostic laboratory for virtually all coccidioidomycosis serologic tests from suspected cases in the county and ensures that they are reported to CDHS. Although actual rates of coccidioidomycosis are probably higher in Kern County than in other California counties, the link between the diagnostic laboratory and case reporting in the county enhances coccidioidomycosis surveillance when compared with areas that rely primarily on health-care providers to report new cases.

At least two major barriers constrain the prevention of coccidioidomycosis. First, although measures to reduce exposure by minimizing dust in areas where coccidioidomycosis is endemic can lower incidence rates and may reduce severity of disease in persons who become infected, exposures to contaminated dust cannot be totally prevented (*4*). Second, although recovery from infection usually confers lasting protection against reinfection, suggesting a potential role for vaccination, efforts to develop a coccidioidomycosis vaccine for humans have been unsuccessful (*5*). Further efforts to develop vaccines can employ current genetic and biochemical methods.

In November 1993, CDHS and the Kern County Health Department convened a national meeting of experts to consider public health strategies for controlling and

Coccidioidomycosis — Continued

preventing coccidioidomycosis. Participants concluded that 1) surveillance is generally inadequate to assess the public health burden of coccidioidomycosis in the southwestern United States and that the approach used in Kern County (e.g., linking diagnostic testing to case reporting) enables more complete assessment of the public health impact of this disease; 2) despite a historical understanding of the epidemiology of coccidioidomycosis (*4,6–8*), efforts should be intensified to better characterize environmental, behavioral, and host risk factors for acquiring infection and developing disease; 3) although several serologic tests for the diagnosis of coccidioidomycosis (e.g., complement fixation and tube precipitin) are well characterized and perform well, the sensitivity, specificity, and reproducibility of enzyme immunoassay and other newer diagnostic tests need to be better defined (*9*); and 4) development of a vaccine may be the most effective strategy for preventing coccidioidomycosis.

References

1. CDC. Coccidioidomycosis—United States, 1991–1992. MMWR 1993;42:21–4.
2. Institute of Medicine. Factors in emergence. In: Lederberg J, Shope RE, Oaks SC, eds. Emerging infections: microbial threats to health in the United States. Washington, DC: National Academy Press, 1992:34–112.
3. CDC. Addressing emerging infectious disease threats to health: a prevention strategy for the United States. Atlanta: US Department of Health and Human Services, Public Health Service, 1994.
4. Smith CE, Beard RR, Rosenberger HG, Whiting EG. Effect of season and dust control on coccidioidomycosis. JAMA 1946;132:833–8.
5. Pappagianis D, Valley Fever Vaccine Study Group. Evaluation of the protective efficacy of the killed *Coccidioides immitis* spherule vaccine in humans. Am Rev Respir Dis 1993;148:656–60.
6. Pappagianis D. Epidemiology of coccidioidomycosis. Curr Top Med Mycol 1988;2:199–238.
7. Smith CE, Beard RR, Whiting EG, Rosenberger HG. Varieties of coccidioidal infection in relation to the epidemiology and control of the diseases. Am J Public Health 1946;36:1394–402.
8. Smith CE. Epidemiology of acute coccidioidomycosis with erythema nodosum ("San Joaquin" or "Valley Fever"). Am J Public Health 1940;30:600–11.
9. Pappagianis D, Zimmer BL. Serology of coccidioidomycosis. Clin Microbiol Rev 1990;3:247–68.

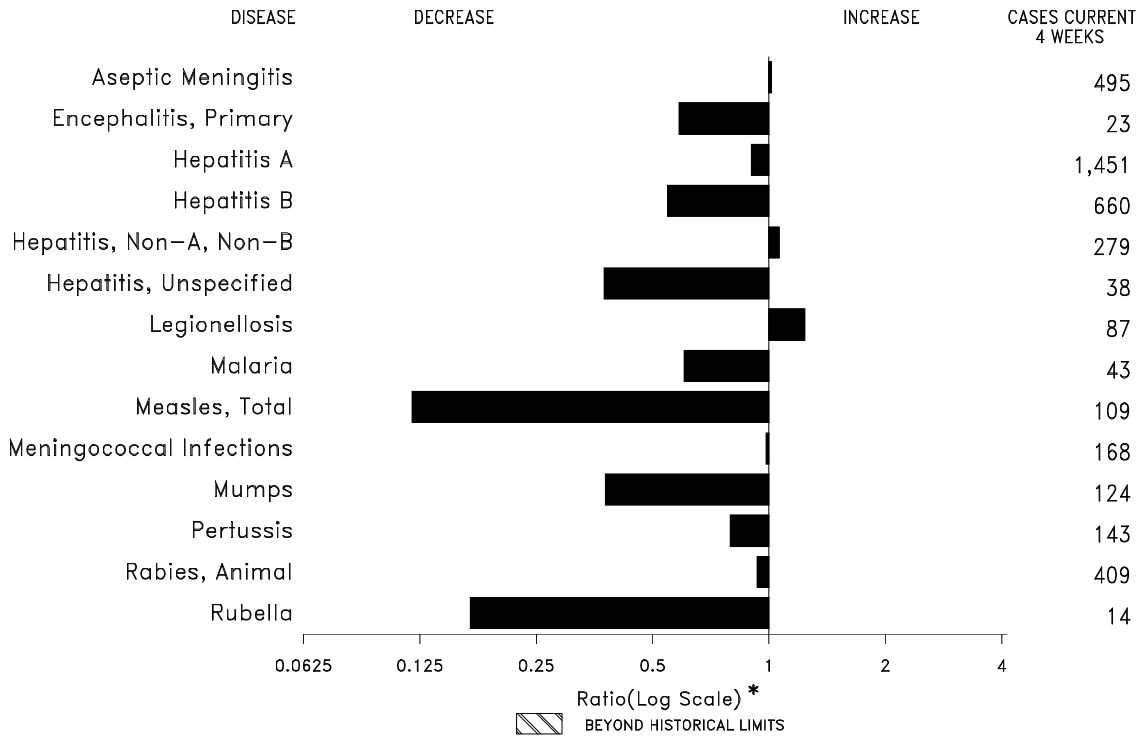
Effectiveness in Disease and Injury Prevention

Head Injuries Associated with Motorcycle Use — Wisconsin, 1991

From 1989 through 1991, a total of 9913 persons in the United States died as a result of crashes while operating or riding motorcycles (*1*). Although use of motorcycle helmets is an effective means for preventing crash-related fatal injuries (*2*), 25 states and the District of Columbia have not yet enacted laws requiring the universal use of motorcycle helmets (*1*). This report describes a study by the University of Wisconsin and the Wisconsin Department of Transportation in which linked police reports and hospital discharge records for 1991 were used to assess the risk for head injury for motorcyclists in motor-vehicle crashes, the initial inpatient hospital charges for motorcyclists with head injuries resulting from crashes, and the reduction in injuries and fatalities associated with universal helmet use.

(Continued on page 429)

FIGURE I. Notifiable disease reports, comparison of 4-week totals ending June 11, 1994, with historical data — United States



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

TABLE I. Summary — cases of specified notifiable diseases, United States, cumulative, week ending June 11, 1994 (23rd Week)

	Cum. 1994		Cum. 1994
AIDS*	32,466	Measles: imported	131
Anthrax	-	indigenous	486
Botulism: Foodborne	24	Plague	2
Infant	30	Poliomyelitis, Paralytic[§]	-
Other	7	Psittacosis	16
Brucellosis	32	Rabies, human	-
Cholera	9	Syphilis, primary & secondary	9,286
Congenital rubella syndrome	3	Syphilis, congenital, age < 1 year	-
Diphtheria	-	Tetanus	17
Encephalitis, post-infectious	46	Toxic shock syndrome	98
Gonorrhea	158,307	Trichinosis	24
Haemophilus influenzae (invasive disease)[†]	556	Tuberculosis	8,915
Hansen Disease	49	Tularemia	13
Leptospirosis	12	Typhoid fever	155
Lyme Disease	1,519	Typhus fever, tickborne (RMSF)	84

*Updated monthly; last update May 24, 1994.
[†]Of 513 cases of known age, 149 (29%) were reported among children less than 5 years of age.
[§]No cases of suspected poliomyelitis have been reported in 1994; 3 cases of suspected poliomyelitis have been reported in 1993; 4 of the 5 suspected cases with onset in 1992 were confirmed; the confirmed cases were vaccine associated.

TABLE II. Cases of selected notifiable diseases, United States, weeks ending June 11, 1994, and June 12, 1993 (23rd Week)

Reporting Area	AIDS*	Aseptic Menin-gitis	Encephalitis		Gonorrhea		Hepatitis (Viral), by type				Legionel-losis	Lyme Disease
			Primary	Post-in-fectious			A	B	NA,NB	Unspeci-fied		
	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994
UNITED STATES	32,466	2,310	227	46	158,307	168,996	8,788	4,885	1,875	188	625	1,519
NEW ENGLAND	1,245	78	7	3	3,473	3,140	139	179	63	15	18	209
Maine	46	7	1	-	44	38	12	8	-	-	-	-
N.H.	28	7	-	2	-	25	5	15	6	-	-	8
Vt.	19	5	-	-	8	13	1	-	-	-	-	1
Mass.	638	28	4	-	1,270	1,266	63	132	46	14	12	71
R.I.	104	31	2	1	200	165	13	3	11	1	6	24
Conn.	410	-	-	-	1,951	1,633	45	21	-	-	-	105
MID. ATLANTIC	9,386	175	20	6	17,535	19,406	486	460	220	3	74	926
Upstate N.Y.	856	96	11	1	3,743	3,789	234	173	108	1	22	655
N.Y. City	5,924	9	1	-	6,289	6,056	56	39	-	-	-	2
N.J.	1,728	-	-	-	2,187	2,368	135	157	93	-	11	115
Pa.	878	70	8	5	5,316	7,193	61	91	19	2	41	154
E.N. CENTRAL	2,663	357	62	10	30,772	33,533	795	498	142	2	181	24
Ohio	479	92	18	1	10,065	8,850	286	86	12	-	81	18
Ind.	333	65	2	-	3,573	3,545	144	87	4	-	53	3
Ill.	1,310	56	22	3	7,560	11,747	184	85	25	1	5	2
Mich.	409	139	19	6	6,854	6,631	114	153	101	1	34	1
Wis.	132	5	1	-	2,720	2,760	67	87	-	-	8	-
W.N. CENTRAL	736	142	8	1	8,330	9,094	432	280	83	4	68	36
Minn.	198	13	1	-	1,463	1,088	83	28	6	-	-	7
Iowa	30	43	-	-	614	773	26	16	7	3	21	1
Mo.	315	46	-	-	4,541	4,964	182	207	57	1	33	17
N. Dak.	18	1	2	-	14	23	1	-	-	-	3	-
S. Dak.	9	-	1	-	85	90	15	-	-	-	-	-
Nebr.	41	5	3	1	-	476	65	12	4	-	9	8
Kans.	125	34	1	-	1,613	1,680	60	17	9	-	2	3
S. ATLANTIC	7,007	524	36	18	44,599	45,823	561	1,167	364	15	167	234
Del.	97	7	-	-	784	588	8	12	23	-	1	52
Md.	541	71	8	2	8,398	7,195	76	152	18	5	42	64
D.C.	595	15	-	-	3,187	2,301	10	16	-	-	4	1
Va.	517	73	12	5	5,466	5,110	59	54	17	2	4	22
W. Va.	10	8	-	-	313	257	4	10	15	-	1	7
N.C.	556	62	15	-	10,884	10,623	47	129	27	-	10	27
S.C.	554	13	-	-	5,312	4,429	12	17	3	-	9	3
Ga.	872	24	1	-	-	4,660	23	444	152	-	69	53
Fla.	3,265	251	-	11	10,255	10,660	322	333	109	8	27	5
E.S. CENTRAL	834	160	20	1	19,176	17,693	202	500	346	1	28	17
Ky.	147	54	8	1	1,973	1,973	85	44	12	-	4	10
Tenn.	235	25	8	-	5,733	4,787	65	420	326	1	14	6
Ala.	245	62	4	-	6,986	6,451	34	36	8	-	7	1
Miss.	207	19	-	-	4,484	4,482	18	-	-	-	3	-
W.S. CENTRAL	3,242	241	15	1	18,040	18,570	1,311	561	185	46	14	36
Ark.	97	10	-	-	2,906	2,554	22	10	3	-	4	1
La.	474	11	2	-	5,292	5,030	66	78	52	1	-	-
Okla.	111	-	-	-	496	1,645	112	136	102	1	8	19
Tex.	2,560	220	13	1	9,346	9,341	1,111	337	28	44	2	16
MOUNTAIN	1,052	72	4	-	3,703	4,978	1,768	239	192	16	38	4
Mont.	13	-	-	-	38	22	13	11	4	-	14	-
Idaho	24	3	-	-	34	83	149	42	46	1	-	1
Wyo.	11	-	-	-	36	40	11	9	63	-	2	-
Colo.	420	19	1	-	1,154	1,608	151	15	15	4	5	-
N. Mex.	69	6	-	-	456	426	525	96	33	6	1	3
Ariz.	284	28	-	-	1,234	1,775	608	20	7	3	1	-
Utah	60	4	-	-	139	153	196	21	15	-	3	-
Nev.	171	12	3	-	612	871	115	25	9	2	12	-
PACIFIC	6,301	561	55	6	12,679	16,759	3,094	1,001	280	86	37	33
Wash.	401	-	-	-	1,302	1,721	167	33	32	1	5	-
Oreg.	269	-	-	-	354	611	166	22	5	1	-	-
Calif.	5,519	485	54	5	10,346	13,984	2,641	918	238	82	29	33
Alaska	19	12	1	-	363	208	90	7	-	-	-	-
Hawaii	93	64	-	1	314	235	30	21	5	2	3	-
Guam	1	6	-	-	65	49	10	-	-	4	2	-
P.R.	903	15	-	1	205	229	34	134	57	3	-	-
V.I.	12	-	-	-	11	51	-	1	-	-	-	-
Amer. Samoa	-	-	-	-	15	12	4	-	-	-	-	-
C.N.M.I.	-	-	-	-	22	40	3	-	-	-	-	-

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

*Updated monthly; last update May 24, 1994.

TABLE II. (Cont'd.) Cases of selected notifiable diseases, United States, weeks ending June 11, 1994, and June 12, 1993 (23rd Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin-gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported*		Total									
	Cum. 1994	1994	Cum. 1994	1994	Cum. 1994	Cum. 1993	Cum. 1994	1994	Cum. 1994	1994	Cum. 1994	Cum. 1993	1994	Cum. 1994	Cum. 1993
UNITED STATES	371	26	486	1	131	175	1,402	24	647	45	1,303	1,326	6	163	98
NEW ENGLAND	28	-	10	-	10	55	71	-	11	-	142	279	3	109	1
Maine	1	-	1	-	3	-	12	-	3	-	2	8	-	-	1
N.H.	3	-	1	-	-	-	6	-	4	-	38	70	-	-	-
Vt.	1	-	-	-	1	31	2	-	-	-	27	44	-	-	-
Mass.	11	-	1	-	4	15	28	-	-	-	61	135	3	108	-
R.I.	4	-	4	-	2	1	-	-	1	-	3	3	-	1	-
Conn.	8	-	3	-	-	8	23	-	3	-	11	19	-	-	-
MID. ATLANTIC	45	3	114	1	13	12	121	3	54	8	281	185	-	8	27
Upstate N.Y.	16	1	14	-	-	1	44	1	14	3	103	71	-	8	4
N.Y. City	6	2	8	1†	2	3	8	-	-	5	59	7	-	-	15
N.J.	16	-	88	-	9	8	33	-	4	-	6	36	-	-	7
Pa.	7	-	4	-	2	-	36	2	36	-	113	71	-	-	1
E.N. CENTRAL	40	8	40	-	40	9	204	5	109	7	191	288	-	8	2
Ohio	7	-	6	-	-	3	53	4	31	5	71	90	-	-	1
Ind.	10	-	-	-	1	-	37	-	6	1	35	24	-	-	-
Ill.	11	4	15	-	38	6	71	-	42	-	45	61	-	3	-
Mich.	11	4	16	-	1	-	25	1	27	1	22	16	-	5	-
Wis.	1	-	3	-	-	-	18	-	3	-	18	97	-	-	1
W.N. CENTRAL	18	-	109	-	41	3	102	2	32	1	58	84	-	-	1
Minn.	5	-	-	-	-	-	8	-	4	-	27	39	-	-	-
Iowa	4	-	-	-	-	-	12	1	9	1	6	1	-	-	-
Mo.	7	-	108	-	40	1	49	-	15	-	14	24	-	-	1
N. Dak.	-	-	-	-	-	-	-	1	2	-	2	3	-	-	-
S. Dak.	-	-	-	-	-	-	6	-	-	-	-	1	-	-	-
Nebr.	1	-	-	-	1	-	8	-	2	-	3	5	-	-	-
Kans.	1	-	1	-	-	2	19	-	-	-	6	11	-	-	-
S. ATLANTIC	82	-	7	-	2	22	249	2	100	2	156	117	2	7	7
Del.	3	-	-	-	-	-	-	-	-	-	-	1	-	-	2
Md.	36	-	1	-	1	4	16	-	23	-	51	35	-	-	1
D.C.	7	-	-	-	-	-	2	-	-	-	3	1	-	-	-
Va.	9	-	1	-	1	1	38	-	24	-	15	11	-	-	-
W. Va.	-	-	-	-	-	-	9	-	3	-	2	3	-	-	-
N.C.	2	-	-	-	-	-	37	-	26	-	44	21	-	-	-
S.C.	2	-	-	-	-	-	11	-	6	1	10	5	-	-	-
Ga.	11	-	2	-	-	-	56	-	7	-	11	11	-	-	-
Fla.	12	-	3	-	-	17	80	2	11	1	20	29	2	7	4
E.S. CENTRAL	11	-	28	-	-	1	93	2	13	6	82	58	-	-	-
Ky.	3	-	-	-	-	-	24	-	-	-	52	9	-	-	-
Tenn.	5	-	28	-	-	-	22	2	6	3	16	29	-	-	-
Ala.	2	-	-	-	-	1	41	-	1	3	13	15	-	-	-
Miss.	1	-	-	-	-	-	6	-	6	-	1	5	-	-	-
W.S. CENTRAL	14	-	7	-	5	1	182	2	151	2	40	31	-	7	12
Ark.	-	-	-	-	1	-	27	-	-	2	8	2	-	-	-
La.	2	-	-	-	1	1	23	-	15	-	5	5	-	-	1
Okla.	2	-	-	-	-	-	18	-	21	-	20	11	-	4	1
Tex.	10	-	7	-	3	-	114	2	115	-	7	13	-	3	10
MOUNTAIN	15	12	130	-	12	2	97	1	44	8	85	93	-	4	5
Mont.	-	-	-	-	-	-	2	-	-	-	3	-	-	-	-
Idaho	2	-	-	-	-	-	13	1	5	-	24	12	-	1	1
Wyo.	-	-	-	-	-	-	5	-	1	-	-	1	-	-	-
Colo.	5	1	13	-	1	2	12	-	1	-	18	43	-	-	-
N. Mex.	2	-	-	-	-	-	11	N	N	1	9	19	-	-	-
Ariz.	1	-	-	-	-	-	38	-	24	7	20	11	-	-	1
Utah	4	11	117	-	-	-	12	-	6	-	9	7	-	2	2
Nev.	1	-	-	-	11	-	4	-	6	-	2	-	-	1	1
PACIFIC	118	3	41	-	8	70	283	7	133	11	268	191	1	20	43
Wash.	4	-	-	-	-	-	20	1	4	1	13	19	-	-	-
Oreg.	7	-	-	-	-	-	46	N	N	-	22	2	-	-	1
Calif.	97	3	41	-	6	55	210	6	119	9	227	160	-	17	22
Alaska	-	-	-	-	-	-	2	-	2	-	-	3	-	1	1
Hawaii	10	-	-	-	2	15	5	-	8	1	6	7	1	2	19
Guam	-	U	211	U	-	2	-	U	3	U	-	-	U	1	-
P.R.	2	-	13	-	-	256	6	-	2	-	1	1	-	-	-
V.I.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amer. Samoa	-	-	-	-	-	1	-	-	1	-	1	2	-	-	-
C.N.M.I.	1	U	26	U	-	1	-	U	1	U	-	-	U	-	-

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

TABLE II. (Cont'd.) Cases of selected notifiable diseases, United States, weeks ending June 11, 1994, and June 12, 1993 (23rd Week)

Reporting Area	Syphilis (Primary & Secondary)		Toxic-Shock Syndrome	Tuberculosis		Tula-remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1993	Cum. 1994	Cum. 1994	Cum. 1994	Cum. 1994
UNITED STATES	9,286	12,007	98	8,915	9,007	13	155	84	2,617
NEW ENGLAND	97	179	1	174	175	-	13	5	811
Maine	4	2	-	-	7	-	-	-	-
N.H.	-	18	-	7	7	-	-	-	91
Vt.	-	-	-	2	3	-	-	-	64
Mass.	37	83	1	85	93	-	9	5	314
R.I.	9	6	-	18	30	-	1	-	5
Conn.	47	70	-	62	35	-	3	-	337
MID. ATLANTIC	593	1,214	17	1,622	1,918	-	39	-	295
Upstate N.Y.	75	102	8	112	273	-	6	-	79
N.Y. City	288	628	-	1,064	1,168	-	23	-	-
N.J.	86	167	-	306	187	-	10	-	139
Pa.	144	317	9	140	290	-	-	-	77
E.N. CENTRAL	1,194	1,998	20	868	934	1	29	14	17
Ohio	491	523	8	128	130	-	2	9	-
Ind.	106	174	2	73	99	-	2	1	3
Ill.	323	801	4	438	484	-	16	2	3
Mich.	144	290	6	205	187	1	3	2	5
Wis.	130	210	-	24	34	-	6	-	6
W.N. CENTRAL	529	778	15	219	199	6	-	5	83
Minn.	22	38	1	46	28	-	-	-	8
Iowa	21	35	6	15	17	-	-	1	35
Mo.	456	619	4	110	106	5	-	-	9
N. Dak.	-	2	-	2	4	-	-	-	3
S. Dak.	-	-	-	9	9	-	-	3	11
Nebr.	-	10	2	9	8	-	-	1	-
Kans.	30	74	2	28	27	1	-	-	17
S. ATLANTIC	2,600	3,148	6	1,762	1,951	-	23	38	840
Del.	13	61	-	-	17	-	1	-	16
Md.	99	172	-	141	163	-	4	-	279
D.C.	109	172	-	47	80	-	1	-	2
Va.	306	290	1	157	217	-	3	2	170
W. Va.	8	2	-	39	39	-	-	-	33
N.C.	783	860	1	212	196	-	-	11	84
S.C.	308	491	-	185	177	-	-	1	80
Ga.	589	560	-	394	340	-	1	22	168
Fla.	385	540	4	587	722	-	13	2	8
E.S. CENTRAL	1,658	1,527	2	559	601	-	1	5	87
Ky.	100	137	1	143	154	-	1	-	3
Tenn.	424	374	1	157	144	-	-	3	34
Ala.	319	363	-	191	196	-	-	1	50
Miss.	815	653	-	68	107	-	-	1	-
W.S. CENTRAL	2,150	2,353	-	1,014	723	2	8	13	331
Ark.	231	290	-	111	79	2	-	2	14
La.	831	1,072	-	14	-	-	3	-	41
Okla.	15	160	-	107	77	-	1	9	18
Tex.	1,073	831	-	782	567	-	4	2	258
MOUNTAIN	137	106	4	186	213	3	6	4	36
Mont.	1	1	-	9	5	1	-	2	-
Idaho	5	-	1	6	6	-	-	-	-
Wyo.	-	3	-	3	1	-	-	1	9
Colo.	70	31	1	1	29	-	2	1	-
N. Mex.	6	17	-	27	18	1	-	-	2
Ariz.	27	42	-	100	100	-	1	-	23
Utah	5	2	2	-	11	1	1	-	-
Nev.	23	10	-	40	43	-	2	-	2
PACIFIC	328	704	33	2,511	2,293	1	36	-	117
Wash.	22	25	-	117	114	-	3	-	-
Oreg.	17	28	-	54	41	1	-	-	-
Calif.	285	647	30	2,188	1,986	-	32	-	88
Alaska	3	2	-	30	25	-	-	-	29
Hawaii	1	2	3	122	127	-	1	-	-
Guam	3	1	-	18	25	-	1	-	-
P.R.	134	252	-	33	82	-	-	-	38
V.I.	22	24	-	-	2	-	-	-	-
Amer. Samoa	1	-	-	3	1	-	1	-	-
C.N.M.I.	1	2	-	16	16	-	1	-	-

U: Unavailable

TABLE III. Deaths in 121 U.S. cities,* week ending June 11, 1994 (23rd Week)

Reporting Area	All Causes, By Age (Years)						P&I† Total
	All Ages	≥65	45-64	25-44	1-24	<1	
NEW ENGLAND	584	398	98	61	16	11	38
Boston, Mass.	163	97	36	19	8	3	17
Bridgeport, Conn.	42	33	4	2	1	2	4
Cambridge, Mass.	25	21	2	2	-	-	-
Fall River, Mass.	33	27	3	2	1	-	-
Hartford, Conn.	52	24	11	13	2	2	2
Lowell, Mass.	18	14	2	1	1	-	2
Lynn, Mass.	11	7	3	1	-	-	-
New Bedford, Mass.	25	21	2	2	-	-	-
New Haven, Conn.	46	29	10	3	2	2	-
Providence, R.I.	38	28	6	4	-	-	4
Somerville, Mass.	6	5	-	1	-	-	-
Springfield, Mass.	41	26	7	7	-	1	2
Waterbury, Conn.	26	21	4	1	-	-	2
Worcester, Mass.	58	45	8	3	1	1	5
MID. ATLANTIC	2,678	1,758	530	279	56	55	122
Albany, N.Y.	52	36	9	5	-	2	2
Allentown, Pa.	21	17	2	2	-	-	-
Buffalo, N.Y.	100	73	16	5	4	2	2
Camden, N.J.	31	14	6	5	5	1	1
Elizabeth, N.J.	19	13	6	-	-	-	-
Erie, Pa.§	40	28	10	1	1	-	7
Jersey City, N.J.	33	19	7	7	-	-	-
New York City, N.Y.	1,289	796	270	170	26	27	40
Newark, N.J.	66	32	17	9	3	5	4
Paterson, N.J.	29	9	7	10	2	1	-
Philadelphia, Pa.	596	428	105	44	11	8	41
Pittsburgh, Pa.§	55	41	12	2	-	-	2
Reading, Pa.	15	10	2	3	-	-	1
Rochester, N.Y.	124	93	20	5	-	6	11
Schenectady, N.Y.	20	14	4	2	-	-	3
Scranton, Pa.§	37	31	6	-	-	-	2
Syracuse, N.Y.	104	68	24	7	3	2	5
Trenton, N.J.	24	19	3	1	-	1	1
Utica, N.Y.	23	17	4	1	1	-	-
Yonkers, N.Y.	U	U	U	U	U	U	U
E.N. CENTRAL	2,389	1,462	438	279	131	79	142
Akron, Ohio	43	31	6	4	1	1	2
Canton, Ohio	31	24	3	3	-	1	2
Chicago, Ill.	527	222	96	97	75	37	49
Cincinnati, Ohio	113	74	29	8	-	2	10
Cleveland, Ohio	146	91	32	18	2	3	5
Columbus, Ohio	197	122	31	27	9	8	7
Dayton, Ohio	118	84	19	11	2	2	9
Detroit, Mich.	276	153	61	37	18	7	3
Evansville, Ind.	51	36	10	4	-	1	4
Fort Wayne, Ind.	65	46	13	3	3	-	3
Gary, Ind.	33	21	8	3	1	-	1
Grand Rapids, Mich.	59	41	9	4	4	1	5
Indianapolis, Ind.	226	152	41	23	8	2	9
Madison, Wis.	48	31	9	7	1	-	1
Milwaukee, Wis.	121	79	27	11	1	3	9
Peoria, Ill.	45	33	6	2	1	3	5
Rockford, Ill.	59	44	8	4	2	1	4
South Bend, Ind.	32	23	4	3	1	1	1
Toledo, Ohio	118	98	12	5	2	1	9
Youngstown, Ohio	81	57	14	5	-	5	4
W.N. CENTRAL	779	559	116	57	23	23	42
Des Moines, Iowa	58	45	8	4	1	-	4
Duluth, Minn.	27	20	3	2	1	1	2
Kansas City, Kans.	33	22	6	3	1	1	-
Kansas City, Mo.	83	57	14	8	2	2	2
Lincoln, Nebr.	38	34	1	2	1	-	4
Minneapolis, Minn.	186	131	34	10	6	5	13
Omaha, Nebr.	82	60	10	7	2	3	3
St. Louis, Mo.	124	86	22	6	4	6	8
St. Paul, Minn.	58	40	10	5	2	1	3
Wichita, Kans.	90	64	8	10	3	4	3

Reporting Area	All Causes, By Age (Years)						P&I† Total
	All Ages	≥65	45-64	25-44	1-24	<1	
S. ATLANTIC	1,350	844	261	167	53	24	71
Atlanta, Ga.	143	73	35	30	3	2	4
Baltimore, Md.	229	134	49	36	9	1	19
Charlotte, N.C.	107	64	27	5	10	1	9
Jacksonville, Fla.	145	97	25	14	6	3	5
Miami, Fla.	131	76	23	25	5	2	-
Norfolk, Va.	66	43	12	4	4	3	4
Richmond, Va.	107	71	14	13	7	2	5
Savannah, Ga.	53	39	9	3	1	1	3
St. Petersburg, Fla.	71	48	17	2	2	2	4
Tampa, Fla.	174	121	30	18	2	2	14
Washington, D.C.	115	72	20	15	4	4	4
Wilmington, Del.	9	6	-	2	-	1	-
E.S. CENTRAL	774	509	167	56	29	13	42
Birmingham, Ala.	115	71	26	7	7	4	1
Chattanooga, Tenn.	77	64	7	5	1	-	3
Knoxville, Tenn.	65	36	17	7	3	2	6
Lexington, Ky.	44	25	12	2	4	1	2
Memphis, Tenn.	167	113	40	9	4	1	17
Mobile, Ala.	85	63	8	8	3	3	8
Montgomery, Ala.	53	25	21	6	1	-	-
Nashville, Tenn.	168	112	36	12	6	2	5
W.S. CENTRAL	1,432	881	307	150	57	37	93
Austin, Tex.	76	50	12	14	-	-	5
Baton Rouge, La.	68	47	9	6	3	3	4
Corpus Christi, Tex.	71	42	19	8	2	-	4
Dallas, Tex.	187	100	44	26	10	7	3
El Paso, Tex.	66	40	15	5	5	1	4
Ft. Worth, Tex.	115	71	23	13	6	2	10
Houston, Tex.	369	212	82	49	14	12	28
Little Rock, Ark.	85	59	18	4	2	2	3
New Orleans, La.	U	U	U	U	U	U	U
San Antonio, Tex.	219	146	50	15	5	3	16
Shreveport, La.	34	23	6	2	2	1	6
Tulsa, Okla.	142	91	29	8	8	6	10
MOUNTAIN	936	614	183	87	29	21	70
Albuquerque, N.M.	84	55	15	11	2	1	2
Colo. Springs, Colo.	51	29	12	8	1	1	7
Denver, Colo.	98	62	20	9	3	4	5
Las Vegas, Nev.	205	137	43	17	7	1	7
Ogden, Utah	30	20	7	2	1	-	2
Phoenix, Ariz.	216	142	37	25	5	7	24
Pueblo, Colo.	21	16	2	-	1	2	3
Salt Lake City, Utah	92	55	20	7	6	2	6
Tucson, Ariz.	139	98	27	8	3	3	14
PACIFIC	2,194	1,469	398	224	60	41	145
Berkeley, Calif.	15	7	2	3	1	2	-
Fresno, Calif.	109	72	22	9	4	2	12
Glendale, Calif.	33	29	3	1	-	-	2
Honolulu, Hawaii	67	42	14	5	2	4	7
Long Beach, Calif.	88	64	16	4	2	2	11
Los Angeles, Calif.	672	458	113	70	20	9	25
Pasadena, Calif.	34	22	8	2	2	-	3
Portland, Oreg.	138	90	26	15	5	2	5
Sacramento, Calif.	182	131	30	16	3	2	15
San Diego, Calif.	148	85	40	15	5	3	15
San Francisco, Calif.	150	92	31	25	2	-	17
San Jose, Calif.	219	155	32	22	2	8	24
Santa Cruz, Calif.	25	15	4	2	4	-	2
Seattle, Wash.	165	107	28	21	5	4	3
Spokane, Wash.	54	42	7	3	1	1	1
Tacoma, Wash.	95	58	22	11	2	2	3
TOTAL	13,116¶	8,494	2,498	1,360	454	304	765

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

†Pneumonia and influenza.

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

¶Total includes unknown ages.

U: Unavailable.

Head Injuries — Continued

For this report, motorcyclists were defined as persons who were operating or riding as a passenger on a motorcycle. Wisconsin was one of seven states funded under the Crash Outcome Data Evaluation Systems project of the National Highway Traffic Safety Administration to generate linked statewide data systems. Because personal identifiers were not available, Police Accident Reports from the Wisconsin Department of Transportation and inpatient discharge records for acute-care hospitals from the state's Office of the Commissioner of Insurance were linked through a probabilistic method (which calculates the likelihood that a police report and a discharge record represent the same person) using date of the event—the crash or the hospital admission—and the motorcyclist's birth date, sex, and zip code of residence. Secondary linking variables were the county of the event, the health service area of the event, the injury, and whether the person was transported by ambulance from the crash. Uncertain matches were reviewed manually using additional corroborating information, such as *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) external cause of injury codes and consistency with known patterns of trauma referral and injury resulting from motor-vehicle crashes. Approximately 7% of the matches made by computer between police reports and hospital records were incorrect.

Based on ICD-9-CM diagnostic codes in the discharge record, head injuries were classified into three mutually exclusive categories: 1) brain injury, defined as any diagnosis of intracranial injury with or without skull fracture, intracranial hemorrhage following injury, or loss of consciousness for 1 hour or more; 2) skull fracture with no intracranial injury; and 3) concussion with only brief (less than 1 hour) or no loss of consciousness.

Of the 3184 motorcyclists involved in police-reported crashes in Wisconsin in 1991, 2015 (63.3%) were unhelmeted and 994 (31.2%) were helmeted at the time of the crash. Helmet use was unknown for 175 (5.5%), four of whom were fatally injured; of 32 who were hospitalized, 13 incurred head injuries. Of those motorcyclists for whom helmet status was known, 545 were hospitalized and 74 died, including 55 who were unhelmeted and 19 who were helmeted. Of the 545 hospitalized, 187 (34.3%) had sustained a head injury (Table 1). Overall, unhelmeted motorcyclists involved in police-reported crashes were more than twice as likely to be hospitalized for a head injury (153 [7.6%]) than were helmeted riders (34 [3.4%]). Brain injury occurred among 97 (4.8%) of those who were unhelmeted and 17 (1.7%) of those who were helmeted (rate ratio [RR]=2.9, 95% confidence interval [CI]=1.7–4.9); the rate for skull fracture among unhelmeted riders (0.9%) was 4.5 times (95% CI=1.0–19.2) that among helmeted riders (0.2%). The rate for concussions among unhelmeted motorcyclists involved in crashes (1.9%) was higher than that for helmeted riders (1.5%) (RR=1.3; 95% CI=0.7–2.3).

Total initial* inpatient hospital charges for the 97 unhelmeted motorcyclists with brain injuries was $2,396,366—compared with $333,619 for the 17 helmeted motorcyclists with brain injuries (Table 1). Average initial hospital charges for unhelmeted motorcyclists with brain injuries were $24,705, compared with $19,624 for helmeted motorcyclists with brain injuries.

*Initial hospital charges were used as a proxy for hospital costs, which are only a portion of direct medical costs. Initial hospital charges do not include physician fees, emergency department charges, or costs after discharge for subsequent hospitalizations, long-term care, and rehabilitation.

Head Injuries — Continued

TABLE 1. Number and rate of head injury outcomes and hospital charges* for motorcyclists and rate ratios for unhelmeted versus helmeted crash-involved motorcycle riders† — Wisconsin, 1991

	Unhelmeted motorcyclists (n=2015)			Helmeted motorcyclists (n=994)				
Injury	No.	Rate§	Hospital charges	No.	Rate§	Hospital charges	Rate ratio	95% CI¶
Brain injury	97	4.8	$2,396,366	17	1.7	$333,619	2.9	(1.7– 4.9)
Skull fracture without intracranial injury	18	0.9	$ 222,707	2	0.2	$ 10,838	4.5	(1.0–19.2)
Concussion	38	1.9	$ 278,786	15	1.5	$ 60,037	1.3	(0.7– 2.3)
Total	**153**	**7.6**	**$2,897,859**	**34**	**3.4**	**$404,494**	**2.2**	**(1.6– 3.4)**

*Includes charges for initial hospitalization; does not include physician fees, emergency department charges, or medical costs after discharge.
†n=3184. Excludes 175 persons for whom helmet use was unknown.
§Per 100 crash-involved motorcyclists.
¶Confidence interval.

Although some crashes will be so severe that a motorcycle helmet will not prevent brain injury or death, the proportion of injuries that could have been prevented if a motorcycle helmet had been worn by all riders was estimated for each category of head injury and death (*3*). These estimates assume that if unhelmeted motorcyclists wore helmets and experienced a similar distribution of outcomes as helmeted motorcyclists, then universal helmet use by all motorcyclists in Wisconsin during 1991 potentially would have prevented 60 brain injuries, 13 skull fractures with no intracranial injury, and eight concussions. In addition, universal helmet use potentially would have prevented 14 (18.9%) deaths.

Reported by: TA Karlson, PhD, CA Quade, Center for Health Systems Research and Analysis, Univ of Wisconsin, Madison; Wisconsin Dept of Transportation. Div of Unintentional Injury Prevention, National Center for Injury Prevention and Control, CDC.

Editorial Note: Motorcycle helmets are designed to protect users against injury to the brain and other head injuries. The findings in this report indicate that the use of motorcycle helmets lowers the rate of head injury. Although helmet use is approximately 99% in states with universal requirements, use is substantially less in states with laws that apply only to subgroups of the population (*4*). For example, in Wisconsin, where the law applies only to riders aged <19 years, observed helmet use is 42% for all motorcycle riders (*5*).

The findings in this report are subject to at least four limitations. First, incorrectly matched police reports and hospital records diminish the measure of the protective effect of helmets. Second, some motorcycle crashes in Wisconsin may not have been reported to police—in particular, crashes occurring in areas adjacent to other states for which medical treatment may have been obtained in those states. Third, this study evaluated only hospitalized motorcycle riders; the differences in injury rates and health-care costs for unhelmeted riders compared with helmeted riders probably would have been greater if data from emergency departments and long-term–care facilities had been available and analyzed. Skull fractures and concussions are usually associated with complete recovery, but more severe injuries to the brain can result in lifelong disability (*6*). Fourth, this study did not control for injuries other than head

Head Injuries — Continued

injuries. In a Washington study that controlled for severity of injuries other than head injury, motorcycle helmets were effective in limiting the occurrence of head injury, the need for and duration of mechanical ventilation, the length of intensive-care stay, and the need for rehabilitation (*7*). Previous studies indicate that unhelmeted riders who are injured are more likely be admitted to a hospital as an inpatient, be permanently impaired, and require ambulance service, neurosurgery, intensive care, rehabilitation, and long-term care (*4*).

Although the source of payment for hospitalization was not analyzed in this report, findings from previous reports indicate that public monies underwrite 25%–50% of the costs associated with motorcycle crashes (*4*). State-specific data on the costs for hospitalizations—initial, long-term, and public—for unhelmeted riders may assist state legislators in making informed decisions regarding the passage and retention of these laws.

This report illustrates how linked data can help provide information on the potential health-care costs associated with public policies intended to prevent motor-vehicle–related injuries. Linkage of existing data systems can assist in the characterization of motorcycle and other motor-vehicle–crash events, injury severity, and cost for nonfatal injuries. Probabilistic linkage allows large files to be linked rapidly, potentially providing information about persons involved in crashes and the severity of their injuries, the treatment they received, and charges for treatment; this information could be linked with data on the public costs of injuries associated with risk-taking behavior (e.g., drinking and driving), nonuse of safety belts and motorcycle helmets, and speeding. The Wisconsin Department of Transportation is using information from linked data about medical outcomes and the costs of crash-related injuries resulting from motorcycle and other motor-vehicle crashes to plan interventions and evaluate their impact.

References

1. National Highway Traffic Safety Administration. Fatal Accident Reporting System, 1991; a review of information on fatal traffic crashes in the United States. Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration, 1992.
2. Wilson D. The effectiveness of motorcycle helmets in preventing fatalities. Washington, DC: US Department of Transportation, National Highway Traffic Safety Administration, 1989; National Highway Traffic Safety Administration Technical Report DOT no. HS-807-416.
3. CDC. A framework for assessing the effectiveness of disease and injury prevention. MMWR 1992;41(no. RR-3).
4. US Government Accounting Office. Motorcycle helmet laws save lives and reduce costs to society. Washington, DC: Government Accounting Office, 1990; report no. GAO/RCED-91-170, 1991.
5. Wisconsin Office of Transportation Safety. Motorcycle helmet use in Wisconsin, 1993. Madison, Wisconsin: Wisconsin Department of Transportation, Office of Transportation Safety, 1994.
6. Kraus JF, Rock A, Hemyari P. Brain injuries among infants, children, adolescents, and young adults. Am J Dis Child 1990;144:684–91.
7. Offner PJ, Rivara FP, Maier RV. The impact of motorcycle helmet use. J Trauma 1992;32:636–42.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available on a paid subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone (202) 783-3238.

The data in the weekly *MMWR* 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. Inquiries about the *MMWR* Series, including material to be considered for publication, should be directed to: Editor, *MMWR* Series, Mailstop C-08, Centers for Disease Control and Prevention, Atlanta, GA 30333; telephone (404) 332-4555.

☆**U.S. Government Printing Office: 1994-533-178/05011 Region IV**