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Epidemiologic Notes and Reports

Suboptimal Response to Hepatitis B Vaccine Given by Injection into the Buttock

Hepatitis B (HB) vaccine was licensed in November 1981 as a highly immunogenic and effective vaccine against hepatitis B virus (HBV) infection. Large studies before licensure demonstrated, with one exception, that the vaccine induced antibody* in over 90% of healthy adult recipients of the three-dose series (*1-3*). The one exception, in which only 85% of recipients responded to vaccination, was later shown to be caused by partial freezing of the vaccine during shipment (*4*).

Since vaccine licensure, however, the vaccine manufacturer (Merck, Sharp & Dohme) and CDC have received reports of suboptimal response to vaccine in the health-care personnel of a number of hospitals and other vaccine users. Two such examples, in which only 82% and 68% of normal adults responded to vaccination, have recently been published (*5-6*). Initial investigations of these and other reports by the manufacturer and by CDC included site visits, repeat serologic testing of vaccine recipients to confirm poor response, assays of residual vaccine for evidence of freezing and for retention of potency, and review of vaccine lots used. These investigations generally confirmed suboptimal vaccine response but failed to identify any specific cause. The investigations did indicate that, in many such instances, vaccine had been given by buttock (gluteal) injection, in contrast to the arm (deltoid) injection used in all prelicensure vaccine studies.

Two recent investigations, one by the vaccine manufacturer and the other by CDC, indicate that site of vaccine injection is important in explaining suboptimal response to vaccine in many vaccine programs. Both studies were retrospective telephone surveys of hospitals or hemodialysis units that had vaccinated and then serotested significant numbers of persons after vaccination.

Vaccine manufacturer's study: In December 1984, the vaccine manufacturer surveyed two groups of vaccine users: over 90 hospitals that had contacted the manufacturer reporting suboptimal vaccine response and an additional 12 hospitals known to have conducted large vaccination programs and to have done postvaccination testing. The telephone survey verified the exact number of persons completing vaccination and the number failing to respond to vaccine and determined the vaccine injection site. Injection site for the hospital was classified as arm if over 90% of persons received vaccine in the arm; buttock if over 90% received vaccine in the buttock; and mixed for all others.

In both surveys, vaccine response rate was significantly higher in hospitals using arm injection than in those using buttock injection (Table 1). Among hospitals that reported suboptimal vaccine response, the pooled response rate for vaccinees was 88% in hospitals using arm injection and 73% in those using buttock injection ($p < 0.01$). Among the 12 other hospitals, re-

*Detectable by commercial radioimmunoassay or enzyme immunoassay tests.

Hepatitis B Vaccine — Continued

sponse rates were higher, as would be expected for hospitals not selected for poor vaccine response; however, response to arm injection was higher than for buttock injection. Furthermore, when 55 hospitals that had vaccinated and tested 50 or more persons were ranked by response rate to vaccine and compared, arm injection was clearly superior (Figure 1). Among 18 institutions reporting 90% or better response, 13 used arm injection, and one used buttock. Among 21 reporting lower than 80% response, 18 used buttock injection, and two used arm injection.

CDC's study: To avoid selection bias inherent in the above study and to more accurately assess vaccine response in a representative group of vaccine users, in January 1985, CDC's Hepatitis Branch assessed vaccine response among staff in all hemodialysis units known to have vaccinated 20 or more staff as of December 1983. Sixty-three centers were contacted and interviewed, and 57 were included in the final data. Among six centers not included, one refused to participate; two did not do postvaccination testing; two tested only a small sample of vaccinees; and one had participated in a prelicensure vaccine trial. In addition to the questions in the first survey, centers were asked to identify the laboratory method of postvaccination testing, length of needle used for injection, and proportions of vaccinees who were over 40 years of age or who were significantly overweight. Among the 57 centers, 20 used arm injection (as defined above); 23 used buttock injection; and 14 used mixed sites of injection.

Antibody response was significantly higher in centers using the arm as the injection site (Table 2). The average vaccine response in such centers was 93%, compared with 82% response in sites using buttock injection ($p < 0.01$). This difference remained highly significant when the method of postvaccination testing and the proportions of vaccinees who were over 40 years old or overweight were considered in the analysis. Despite overall poorer response with buttock injection, response in individual centers varied widely (Figure 1). Among centers using buttock injection, eight (35%) reported excellent response to vaccine (over 90% responding), and nine (39%) reported poor response rates (fewer than 80% responding). In contrast, 75% of centers using arm injection reported excellent response, and only one (5%) reported poor response. Seventeen centers using the buttock as injection site reported using 1½-inch needles, while the other six used 1-inch needles. There was no difference in response rates among these two groups.

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Editorial Note: Although these studies are preliminary, they strongly suggest that response

TABLE 1. Vaccine response in hospitals reporting suboptimal and normal response to HBV vaccine, by injection site — Merck, Sharp & Dohme study, December 1984

Group	Injection site	Reported seroconversion rate		p value*
		No. tested	% with antibody	
Suboptimal response†	Arm	1,780	88	< 0.01
	Mixed	764	85	
	Buttock	4,786	73	
Normal response§	Arm	2,058	96	< 0.05
	Mixed	307	94	
	Buttock	81	90	

*Arm, compared with buttock.

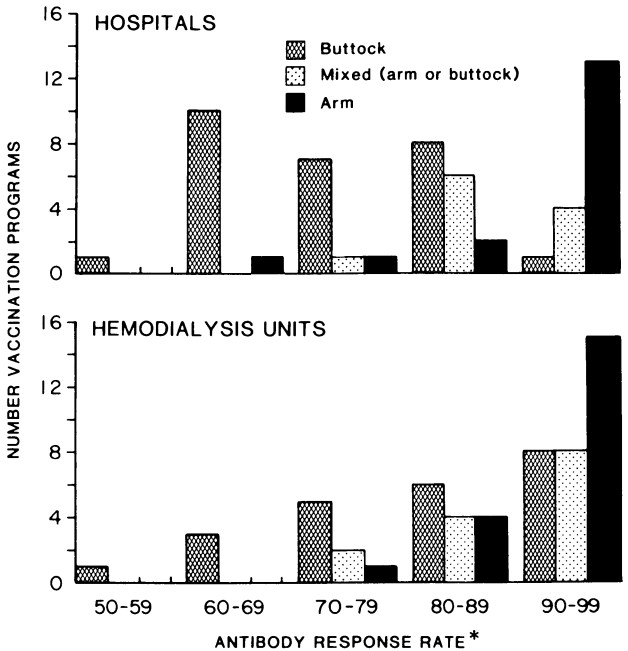
†Ninety-three institutions.

§Twelve institutions.

Hepatitis B Vaccine — Continued

to HB vaccine is higher when vaccine is given in the arm than in the buttock. Furthermore, they appear to provide an explanation for poor rates of response to HB vaccine reported in some vaccine programs. These data are the first to indicate that response to any inactivated vaccine given intramuscularly to adults may vary with injection site. The Immunization Practices Advisory Committee (ACIP) has previously recommended that the arm is the preferred site of injection for all adult vaccines (7). However, the present studies demonstrate that the buttock is a commonly used site for HB vaccination. Because of the important implications for use of HB vaccine and other killed vaccines, a prospective study has been initiated to confirm these data.

FIGURE 1. Response rates to hepatitis B vaccine in hospitals and hemodialysis units, by injection site — Merck, Sharp & Dohme and CDC studies, December 1984 and January 1985



*Percentage of vaccinated persons in each program who developed antibody after vaccination. Antibody was detected by commercial radioimmunoassay or enzyme immunoassay tests.

TABLE 2. Response to hepatitis B vaccine in hemodialysis staff, by injection site — CDC study, January 1985

Injection site	No. centers	Average response (%) Mean	S.D.	Total seroconversion rate in vaccinees No. vaccinated	% with antibody
Arm	20	93.0	± 7.3	733	93.9
Mixed	14	89.1	± 8.7	478	91.2
Buttock	23	81.9	± 12.1	664	81.0
Buttock, compared with arm		$p < 0.01$		$p < 0.001$	
Mixed, compared with arm		NS		NS	

Hepatitis B Vaccine — Continued

The physiologic reasons for lower response rate to vaccine injections in the buttock are yet to be defined. The most likely explanation is that injections given in the buttock frequently fail to reach muscle and are instead deposited in fat where the vaccine may not be well mobilized. The authors of a recent study using CAT scans to assess gluteal fat thickness estimated that, when adults are given injections in the buttock using a 3.5-cm (1-3/8-inch) needle, 85% of injections in men and 95% of those in women are deposited in fat rather than muscle (*8*). An earlier study showed that lidocaine is mobilized more slowly when injected in the buttock than when given in the arm (*9*).

Pending further data, the ACIP and CDC recommend that the arm be used as the site of HB vaccine administration in all adults. For hemodialysis patients, who do not respond as well to vaccine as immunocompetent individuals, vaccine should be given in the arm unless this will jeopardize shunt access. For infants born to HBV-carrier mothers, the preferred site for HB vaccination remains the anterolateral thigh.

References

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2. Szmuness W, Stevens CE, Harley EJ, et al. Hepatitis B vaccine: demonstration of efficacy in a controlled clinical trial in a high-risk population in the United States. N Engl J Med 1980;303:833-41.

(Continued on page 113)

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

Disease	8th Week Ending			Cumulative, 8th Week Ending		
	Feb. 23, 1985	Feb. 25, 1984	Median 1980-1984	Feb. 23, 1985	Feb. 25, 1984	Median 1980-1984
Acquired Immunodeficiency Syndrome (AIDS)	93	58	N	877	507	N
Aseptic meningitis	78	72	68	531	673	655
Encephalitis: Primary (arthropod-borne & unspec.)	18	9	16	109	111	123
Post-infectious	2	-	1	15	8	8
Gonorrhea: Civilian	14,959	13,903	16,561	119,389	127,294	144,841
Military	307	239	443	2,418	3,128	4,248
Hepatitis: Type A	440	504	527	2,977	3,065	3,576
Type B	499	473	450	3,452	3,506	2,783
Non A, Non B	80	83	N	542	516	N
Unspecified	56	134	195	602	657	1,232
Legionellosis	8	10	N	73	60	N
Leprosy	11	5	4	39	31	31
Malaria	18	10	23	93	83	111
Measles: Total*	24	58	58	89	281	281
Indigenous	24	52	N	40	218	N
Imported	-	6	N	49	63	N
Meningococcal infections: Total	83	75	75	438	478	478
Civilian	83	75	75	438	478	478
Military	-	-	-	-	-	3
Mumps	95	65	99	477	512	784
Pertussis	18	50	37	146	256	172
Rubella (German measles)	5	13	45	29	67	260
Syphilis (Primary & Secondary): Civilian	500	594	669	3,749	4,474	4,661
Military	-	7	8	24	52	64
Toxic Shock syndrome	10	7	N	55	64	N
Tuberculosis	346	391	476	2,440	2,784	3,364
Tularemia	3	1	1	18	6	13
Typhoid fever	5	12	9	38	51	60
Typhus fever, tick-borne (RMSF)	-	-	-	5	7	8
Rabies, animal	67	107	109	476	601	717

TABLE II. Notifiable diseases of low frequency, United States

	Cum 1985		Cum 1985
Anthrax	-	Plague	-
Botulism: Foodborne	1	Poliomyelitis: Total	1
Infant (Wash. 1, Calif. 3)	8	Paralytic (Calif. 1)	1
Other	-	Psittacosis	18
Brucellosis (Mo. 1, Fla. 2, Miss. 1, Okla. 1)	10	Rabies, human	-
Cholera	-	Tetanus	5
Congenital rubella syndrome	-	Trichinosis (Mich. 2)	6
Diphtheria	-	Typhus fever, flea-borne (endemic, murine) (Hawaii 2)	2
Leptospirosis	4		

*There were no cases of internationally imported measles reported for this week.

TABLE III. Cases of specified notifiable diseases, United States, weeks ending February 23, 1985 and February 25, 1984 (8th Week)

Reporting Area	AIDS	Aseptic Meningitis	Encephalitis		Gonorrhea (Civilian)		Hepatitis (Viral), by type				Legionellosis	Leprosy
			Primary	Post-infectious			A	B	NA,NB	Unspecified		
	Cum 1985	1985	Cum 1985	Cum 1985	Cum 1985	Cum 1984	1985	1985	1985	1985	1985	Cum 1985
UNITED STATES	877	78	109	15	119,389	127,294	440	499	80	56	8	39
NEW ENGLAND	25	1	2	-	3,534	4,148	7	28	-	6	-	-
Maine	1	-	-	-	167	156	-	-	-	-	-	-
N H	-	-	1	-	77	90	-	-	-	-	-	-
Vt	-	-	-	-	37	59	1	-	-	-	-	-
Mass	17	1	1	-	1,208	1,541	5	19	-	6	-	-
R I	1	-	-	-	295	246	-	2	-	-	-	-
Conn	6	-	-	-	1,750	2,056	1	7	-	-	-	-
MID ATLANTIC	360	8	8	-	17,416	15,884	51	94	14	10	-	2
Upstate N Y	49	6	3	-	2,114	2,267	13	21	2	3	-	-
N Y City	238	-	-	-	7,778	7,067	1	-	-	-	-	2
N J	53	-	3	-	3,326	2,152	17	38	4	5	-	-
Pa	20	2	2	-	4,198	4,398	20	35	8	2	-	-
E N CENTRAL	49	11	33	2	17,432	18,512	23	40	7	3	-	1
Ohio	15	4	11	1	4,599	4,542	7	18	-	2	-	1
Ind	3	-	7	-	1,347	2,102	7	8	1	1	-	-
Ill	16	2	1	-	5,618	5,003	3	2	3	-	-	-
Mich	11	5	12	-	4,995	4,990	6	12	3	-	-	-
Wis	4	-	2	1	873	1,875	-	-	-	-	-	-
W N CENTRAL	11	5	7	1	6,383	5,809	15	19	2	-	-	-
Minn	3	1	3	1	1,020	839	4	6	1	-	-	-
Iowa	2	-	4	-	689	713	1	1	-	-	-	-
Mo	4	4	-	-	2,828	2,546	5	12	1	-	-	-
N Dak	-	-	-	-	38	71	3	-	-	-	-	-
S Dak	-	-	-	-	123	193	2	-	-	-	-	-
Nebr	-	-	-	-	623	419	-	-	-	-	-	-
Kans	2	-	-	-	1,062	1,028	-	-	-	-	-	-
S ATLANTIC	130	14	15	7	24,963	32,073	52	91	17	13	2	-
Del	1	-	1	-	534	560	-	-	-	-	-	-
Md	14	1	4	-	3,479	4,208	3	5	2	2	1	-
D C	17	-	-	-	2,110	2,308	-	1	-	-	-	-
Va	6	2	1	3	2,674	3,181	14	18	1	3	-	-
W Va	1	-	1	-	345	348	3	3	-	-	-	-
N C	6	3	7	-	5,016	5,314	5	15	3	2	-	-
S C	1	-	1	-	3,367	2,893	-	7	-	-	-	-
Ga	18	2	-	-	-	6,389	5	20	-	-	-	-
Fla	66	6	-	4	7,438	6,872	22	22	11	6	1	-
E S CENTRAL	9	16	3	3	10,603	10,645	5	20	4	1	1	-
Ky	4	2	1	-	1,098	1,325	-	1	-	-	-	-
Tenn	-	5	1	-	4,225	4,342	3	11	2	-	-	-
Ala	4	9	1	3	3,228	3,413	2	5	2	1	1	-
Miss	1	-	-	-	2,052	1,565	-	3	-	-	-	-
W S CENTRAL	39	5	8	-	17,784	17,904	59	36	2	11	-	-
Ark	-	-	-	-	1,766	1,554	-	-	-	-	-	-
La	1	-	-	-	3,732	4,224	2	2	-	-	-	-
Okla	1	2	4	-	1,840	1,973	22	9	1	1	-	-
Tex	37	3	4	-	10,446	10,153	35	25	1	10	-	-
MOUNTAIN	16	3	4	1	3,887	3,785	64	36	4	3	2	-
Mont	-	-	-	-	115	197	-	1	-	-	-	-
Idaho	-	-	-	-	128	170	1	1	-	-	-	-
Wyo	-	-	-	-	107	97	-	1	-	-	-	-
Colo	5	3	2	-	1,166	959	6	3	-	1	-	-
N Mex	2	-	-	-	475	504	7	6	-	-	1	-
Ariz	6	-	-	-	1,197	982	20	8	3	1	-	-
Utah	-	-	2	1	162	214	12	5	-	-	1	-
Nev	3	-	-	-	537	662	18	11	1	1	-	-
PACIFIC	238	15	29	1	17,387	18,534	164	135	30	9	3	36
Wash	10	1	2	-	1,155	1,245	28	12	2	-	1	6
Oreg	5	-	-	-	1,024	999	25	16	4	-	-	1
Calif	221	12	27	1	14,533	15,573	110	95	23	8	2	26
Alaska	-	-	-	-	409	439	-	3	-	-	-	-
Hawaii	2	2	-	-	266	278	1	9	1	1	-	3
Guam	-	U	-	-	-	50	U	U	U	U	U	-
P R	16	1	1	-	678	488	4	15	-	2	-	1
V I	-	-	-	-	57	68	-	1	-	-	-	-
Pac Trust Terr	-	U	-	-	-	-	U	U	U	U	U	-

N Not notifiable U Unavailable

TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending February 23, 1985 and February 25, 1984 (8th Week)

Reporting Area	Malaria	Measles (Rubeola)					Menin-gococcal Infections	Mumps		Pertussis			Rubella		
		Indigenous		Imported *		Total									
	Cum. 1985	1985	Cum 1985	1985	Cum. 1985	Cum. 1984	Cum. 1985	1985	Cum. 1985	1985	Cum 1985	Cum 1984	1985	Cum 1985	Cum 1984
UNITED STATES	93	24	40	-	49	281	438	95	477	18	146	256	5	29	67
NEW ENGLAND	3	-	-	-	-	-	22	-	12	3	6	7	-	2	1
Maine	-	-	-	-	-	-	1	-	1	2	2	-	-	-	1
N.H.	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-
Vt.	-	-	-	-	-	-	4	-	-	-	1	4	-	-	-
Mass.	1	-	-	-	-	-	4	-	9	1	2	-	-	1	-
R.I.	-	-	-	-	-	-	6	-	1	-	1	1	-	-	-
Conn.	2	-	-	-	-	-	7	-	1	-	-	-	-	-	-
MID ATLANTIC	14	-	-	-	2	4	44	3	64	8	29	17	-	6	-
Upstate N.Y.	7	-	-	-	1	-	16	2	45	2	10	9	-	1	-
N.Y. City	3	-	-	-	1	3	1	1	3	-	5	-	-	4	-
N.J.	-	-	-	-	-	1	13	-	5	-	-	-	-	1	-
Pa.	4	-	-	-	-	-	14	-	11	6	14	8	-	-	-
E.N. CENTRAL	5	12	23	-	-	171	88	68	227	-	25	72	2	6	11
Ohio	1	-	-	-	-	1	30	2	49	-	8	12	-	-	-
Ind.	-	-	-	-	-	1	16	1	8	-	11	41	-	-	-
Ill.	-	1	2	-	-	20	8	2	24	-	1	8	-	-	9
Mich.	4	11	11	-	-	149	25	63	122	-	2	4	2	6	1
Wis.	-	-	10	-	-	-	9	-	24	-	3	7	-	-	1
W.N. CENTRAL	1	-	-	-	-	-	23	2	9	1	12	48	-	1	6
Minn.	-	-	-	-	-	-	6	-	-	1	6	2	-	-	-
Iowa	-	-	-	-	-	-	3	1	2	-	1	3	-	-	-
Mo.	1	-	-	-	-	-	13	1	5	-	3	2	-	-	-
N. Dak.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	1
S. Dak.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Nebr.	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
Kans.	-	-	-	-	-	-	-	-	2	-	-	39	-	1	5
S. ATLANTIC	14	-	1	-	2	2	88	6	35	3	23	32	-	1	7
Del.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Md.	2	-	-	-	1	-	8	-	5	-	3	1	-	-	-
D.C.	2	-	-	-	1	-	4	-	-	-	-	-	-	-	-
Va.	3	-	-	-	-	1	11	-	6	-	1	5	-	-	-
W. Va.	1	-	-	-	-	-	3	2	10	-	-	3	-	-	-
N.C.	1	-	-	-	-	-	15	2	3	1	6	12	-	-	-
S.C.	-	-	-	-	-	-	10	-	1	-	-	1	-	1	-
Ga.	1	-	-	-	-	-	15	-	2	-	3	4	-	-	1
Fla.	4	-	1	-	-	1	21	2	8	2	10	6	-	-	6
E.S. CENTRAL	2	-	-	-	-	2	22	1	3	-	3	2	-	1	-
Ky.	-	-	-	-	-	-	2	-	-	-	1	1	-	1	-
Tenn.	-	-	-	-	-	2	10	1	2	-	1	1	-	-	-
Ala.	2	-	-	-	-	-	8	-	-	-	1	-	-	-	-
Miss.	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-
W.S. CENTRAL	4	-	-	-	-	39	36	12	33	-	9	24	-	1	4
Ark.	-	-	-	-	-	-	3	-	1	-	5	9	-	1	1
La.	-	-	-	-	-	-	2	-	-	-	-	1	-	-	-
Okla.	-	-	-	-	-	-	7	N	N	-	4	8	-	-	-
Tex.	4	-	-	-	-	39	24	12	32	-	-	6	-	-	3
MOUNTAIN	2	6	6	-	32	39	29	2	41	2	6	30	1	1	3
Mont.	-	6	6	-	32	-	3	-	2	-	-	15	-	-	-
Idaho	-	-	-	-	-	-	-	-	2	-	-	1	-	-	1
Wyo.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Colo.	-	-	-	-	-	-	5	-	8	-	2	11	-	-	-
N. Mex.	2	-	-	-	-	17	4	N	N	-	1	2	-	-	-
Ariz.	-	-	-	-	-	-	10	1	24	-	1	-	1	1	-
Utah	-	-	-	-	-	22	4	-	2	2	2	1	-	-	2
Nev.	-	-	-	-	-	-	2	1	3	-	-	-	-	-	-
PACIFIC	48	6	10	-	13	24	86	1	53	1	33	24	2	10	35
Wash.	4	-	-	-	-	5	11	-	2	1	3	6	-	-	-
Oreg.	1	-	-	-	-	-	6	N	N	-	4	4	-	-	-
Calif.	35	4	8	-	11	17	69	1	44	-	24	11	2	10	34
Alaska	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Hawaii	7	2	2	-	2	2	-	-	6	-	2	3	-	-	1
Guam	-	U	-	U	-	28	-	U	-	U	-	-	U	-	1
P.R.	-	-	20	-	-	-	2	1	26	-	1	-	-	4	1
V.I.	-	-	-	1	6	-	-	2	3	-	-	-	-	-	-
Pac. Trust Terr.	-	U	-	U	-	-	-	U	-	U	-	-	U	-	-

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

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

TABLE III. (Cont'd.) Cases of specified notifiable diseases, United States, weeks ending February 23, 1985 and February 25, 1984 (8th Week)

Reporting Area	Syphilis (Civilian) (Primary & Secondary)		Toxic-shock Syndrome	Tuberculosis		Tula-remia	Typhoid Fever	Typhus Fever (Tick-borne) (RMSF)	Rabies, Animal
	Cum 1985	Cum 1984	1985	Cum 1985	Cum 1984	Cum 1985	Cum 1985	Cum 1985	Cum 1985
UNITED STATES	3,749	4,474	10	2,440	2,784	18	38	5	476
NEW ENGLAND	81	102	1	87	78	-	3	-	-
Maine	2	1	1	3	4	-	-	-	-
N H	-	-	-	-	7	-	-	-	-
Vt	-	-	-	-	2	-	-	-	-
Mass	45	62	-	55	36	-	2	-	-
R I	1	4	-	13	10	-	-	-	-
Conn	33	35	-	16	19	-	1	-	-
MID ATLANTIC	501	607	-	526	525	-	5	-	79
Upstate N Y	26	49	-	66	87	-	3	-	13
N Y City	331	340	-	294	209	-	-	-	-
N J	90	128	-	36	102	-	1	-	-
Pa	54	90	-	130	127	-	1	-	66
E N CENTRAL	191	213	1	307	365	-	2	1	6
Ohio	16	37	-	62	90	-	1	1	1
Ind	10	32	-	36	37	-	1	-	-
Ill	119	94	-	128	138	-	-	-	2
Mich	38	35	1	64	81	-	-	-	-
Wis	8	15	-	17	19	-	-	-	3
W N CENTRAL	45	68	1	57	59	6	2	-	88
Minn	18	13	-	7	10	-	2	-	7
Iowa	8	5	1	14	9	-	-	-	34
Mo	11	40	-	22	24	5	-	-	6
N Dak	-	-	-	-	2	-	-	-	9
S Dak	1	-	-	2	1	-	-	-	26
Nebr	1	3	-	4	6	1	-	-	6
Kans	6	7	-	8	7	-	-	-	-
S ATLANTIC	946	1,343	1	498	643	4	6	2	62
Del	6	4	-	3	7	-	-	-	-
Md	65	67	-	53	71	-	1	-	-
D C	47	45	-	23	19	-	-	-	-
Va	49	73	-	27	46	-	1	-	21
W Va	1	5	-	13	22	-	-	-	-
N C	117	151	1	52	121	4	-	1	-
S C	124	134	-	65	89	-	-	1	5
Ga	-	233	-	73	77	-	-	-	24
Fla	537	631	-	189	191	-	4	-	12
E S CENTRAL	369	304	-	199	269	1	1	2	31
Ky	12	16	-	44	71	-	-	-	3
Tenn	73	66	-	50	84	1	-	1	2
Ala	131	111	-	83	94	-	1	1	26
Miss	153	111	-	22	20	-	-	-	-
W S CENTRAL	910	1,081	-	203	242	2	2	-	95
Ark	60	43	-	11	11	-	-	-	9
La	165	226	-	41	36	-	-	-	3
Okla	31	27	-	28	24	2	-	-	10
Tex	654	785	-	123	171	-	2	-	73
MOUNTAIN	120	90	1	39	43	3	-	-	62
Mont	1	-	-	5	2	-	-	-	29
Idaho	2	5	-	1	3	-	-	-	-
Wyo	3	1	1	1	-	-	-	-	2
Colo	25	18	-	-	-	-	-	-	-
N Mex	18	12	-	5	13	1	-	-	1
Ariz	66	31	-	23	21	-	-	-	30
Utah	1	3	-	1	3	2	-	-	-
Nev	4	20	-	3	1	-	-	-	-
PACIFIC	586	666	5	524	560	2	17	-	53
Wash	12	29	-	15	30	-	-	-	-
Oreg	19	19	1	16	21	1	-	-	-
Calif	545	602	4	446	464	1	17	-	53
Alaska	-	-	-	18	8	-	-	-	-
Hawaii	10	16	-	29	37	-	-	-	-
Guam	-	-	U	-	3	-	-	-	-
P R	153	149	-	45	29	-	1	-	1
V I	-	4	-	-	1	-	-	-	-
Pac Trust Terr	-	-	U	-	-	-	-	-	-

U Unavailable

TABLE IV. Deaths in 121 U.S. cities,* week ending February 23, 1985 (8th Week)

ıses, By Age (Years)				P&I** Total	Reporting Area	All Causes, By Age (Years)						P&I* Tota
45-64	25-44	1-24	<1			All Ages	≥65	45-64	25-44	1-24	<1	
172	37	16	19	74	S. ATLANTIC	1,384	894	316	105	32	36	115
59	15	5	8	15	Atlanta, Ga.	175	108	42	20	3	2	10
10	2	2	3	3	Baltimore, Md.	168	103	47	11	5	2	8
3	-	-	-	2	Charlotte, N.C.	88	66	14	8	-	-	8
8	-	1	-	3	Jacksonville, Fla.	150	85	45	10	4	6	20
13	3	1	3	8	Miami, Fla.	68	41	18	6	-	3	3
6	-	-	-	2	Norfolk, Va.	68	42	11	7	6	2	8
3	1	1	-	1	Richmond, Va.	56	32	16	5	2	1	7
7	-	1	-	3	Savannah, Ga.	51	36	8	3	-	4	12
11	4	1	-	5	St. Petersburg, Fla.	157	134	15	1	3	4	17
17	1	1	2	13	Tampa, Fla.	103	59	28	9	2	4	6
-	1	-	-	-	Washington, D.C.	265	165	64	24	4	8	13
6	3	2	1	2	Wilmington, Del.	35	23	8	1	3	-	3
11	4	1	-	1								
18	3	-	2	16	E.S. CENTRAL	769	521	162	39	20	27	68
					Birmingham, Ala.	129	89	26	2	4	8	10
533	207	64	58	174	Chattanooga, Tenn.	73	55	10	2	3	3	11
12	4	-	4	2	Knoxville, Tenn.	74	51	14	5	3	1	12
1	-	-	-	-	Louisville, Ky.	98	67	22	1	1	7	6
36	9	1	1	18	Memphis, Tenn.	166	114	35	10	4	3	9
17	5	-	4	2	Mobile, Ala.	52	36	9	6	1	-	5
5	1	-	-	4	Montgomery, Ala.	17	11	3	2	-	1	2
7	3	-	-	2	Nashville, Tenn.	160	98	43	11	4	4	13
13	2	-	1	1								
260	122	45	31	75	W.S. CENTRAL	1,305	861	243	91	47	63	86
14	6	3	4	10	Austin, Tex.	51	29	12	9	-	1	7
3	2	1	-	-	Baton Rouge, La.	47	25	14	3	1	4	2
58	26	7	7	24	Corpus Christi, Tex.	47	27	13	3	-	4	1
17	5	-	1	4	Dallas, Tex.	225	132	58	16	13	6	12
2	-	-	-	5	El Paso, Tex.	83	51	16	9	3	4	5
22	5	2	2	11	Fort Worth, Tex.	101	65	18	8	1	9	5
5	3	2	1	2	Houston, Tex. §	228	189	4	10	11	14	10
5	-	-	-	4	Little Rock, Ark.	63	38	16	4	4	1	9
31	6	1	2	4	New Orleans, La.	111	72	22	8	6	3	1
14	4	1	-	1	San Antonio, Tex.	209	140	40	12	7	10	23
7	3	1	-	-	Shreveport, La.	52	35	11	3	-	3	4
4	1	-	-	5	Tulsa, Okla.	88	58	19	6	1	4	7
425	136	72	92	142	MOUNTAIN	685	451	141	42	26	25	45
11	4	4	1	3	Albuquerque, N.Mex.	93	60	22	5	5	1	5
10	1	-	1	2	Colo. Springs, Colo.	48	33	6	4	4	1	4
11	26	16	37	16	Denver, Colo.	97	65	23	5	-	4	5
52	7	7	7	35	Las Vegas, Nev.	77	52	18	2	4	1	7
45	15	5	3	10	Ogden, Utah	20	14	3	2	-	1	5
28	8	1	2	3	Phoenix, Ariz.	146	87	32	13	7	7	2
17	3	-	1	4	Pueblo, Colo.	29	20	8	-	1	-	3
64	29	8	17	6	Salt Lake City, Utah	40	25	4	2	1	9	1
17	3	1	3	3	Tucson, Ariz.	135	95	25	9	4	2	13
13	2	1	1	4								
11	3	1	-	2	PACIFIC	2,031	1,425	379	133	48	42	200
16	-	2	-	1	Berkeley, Calif.	24	20	3	1	-	-	-
41	9	7	7	9	Fresno, Calif.	102	69	14	10	5	4	13
8	2	2	1	3	Glendale, Calif.	22	16	3	2	1	-	1
23	9	6	3	8	Honolulu, Hawaii	55	38	12	3	1	1	9
8	2	1	2	7	Long Beach, Calif.	125	88	28	5	3	1	8
4	-	2	1	9	Los Angeles, Calif.	466	323	80	35	20	4	30
13	4	3	1	9	Oakland, Calif.	73	47	17	7	1	1	6
17	4	3	3	3	Pasadena, Calif.	33	27	4	2	-	-	5
16	5	2	1	5	Portland, Oreg.	119	88	20	7	1	3	11
					Sacramento, Calif.	138	90	34	10	2	2	16
122	31	20	30	64	San Diego, Calif.	156	109	33	7	2	5	26
2	1	1	1	8	San Francisco, Calif.	182	119	40	17	2	4	9
6	-	2	3	2	San Jose, Calif.	231	170	40	14	3	4	27
4	3	-	1	-	Seattle, Wash.	141	104	21	8	3	5	8
23	5	4	5	14	Spokane, Wash.	76	56	11	2	3	4	13
3	-	-	1	4	Tacoma, Wash.	88	61	19	3	1	4	18
18	4	5	2	3								
13	6	3	7	9	TOTAL	13,219 ††	9,162	2,493	821	345	392	968
29	6	3	9	7								
16	1	-	1	4								
8	5	2	-	13								

oluntarily reported from 121 cities in the United States, most of which have populations of 100,000 or
he place of its occurrence and by the week that the death certificate was filed. Fetal deaths are not

methods in these 4 Pennsylvania cities, these numbers are partial counts for the current week. Com-
to 6 weeks

Hepatitis B Vaccine — Continued

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Carbon Monoxide Poisoning — South Dakota

On October 17, 1984, a physician of the Pierre (South Dakota) Service Unit, Indian Health Service, reported a nighttime incident of poisoning by an unknown substance involving a family of six that resided in a newly renovated, well-insulated house.

Shortly after midnight, the mother and two youngest children were taken by ambulance to a local hospital, with symptoms of nausea, dyspnea, vomiting, tachycardia, cyanosis, and faintness. Around 1:00 a.m., the mother called home and learned that the oldest child had developed similar symptoms. A second call, 45 minutes later, found the father and second oldest child to be symptomatic also. All family members were evacuated and recovered without treatment.

On October 18, the district and service unit sanitarians visited the house to search for hazardous conditions. Also present were the tribal housing authority director, a liquid propane gas dealer, and the furnace dealer. Before arrival, the heat had been turned off, and the house ventilated. MSA carbon monoxide (CO) dosimeters were placed in one bedroom and in the living room. Within 1 hour of closing the windows and starting the furnace, high levels of CO (35 or more parts per million [ppm])* were detected in the two rooms. Examination of the furnace and water heater (both propane-fired) revealed improper venting and faulty furnace operation. The air shutters on the furnace burners were closed to such an extent that sufficient air supply was precluded, causing incomplete combustion. As a consequence, soot accumulated in the combustion chambers' flues to the extent that proper venting/drafting became impossible. The products of combustion then leaked from the furnace into the basement air, where they were drawn into the air-return duct and disseminated throughout the house.

The system was rectified by providing sufficient air to the burners, cleaning the soot from the flues, and closing the basement intake vent in the air-return duct.

Reported by D Mosier, R Baldwin, Pierre Svc Unit, Office of Environmental Health, Indian Health Svc, Health Svcs and Mental Health Administration, US Public Health Svc; Investigations Section, Special Studies Br, Chronic Diseases Div, Center for Environmental Health, CDC.

Editorial Note: Despite efforts to reduce the number of unintentional CO poisonings through public education, standards, and improved product design, nonfatal and fatal CO poisonings continue to occur. Each year, an estimated 10,000 persons in the United States seek medical attention because of exposure to CO gas, and approximately 1,500 die from CO poisoning (*1*).

CO is a common gas produced by the incomplete combustion of any carbon-containing or

*There are currently no indoor air pollution standards. However, the U.S. Environmental Protection Agency ambient air quality standards for CO are: 9 ppm, maximum 8-hour concentration, and 35 ppm, maximum 1-hour concentration, neither to be exceeded more than once per year.

Carbon Monoxide Poisoning — Continued

organic solid, liquid, or gaseous fuel. The amount of CO produced during fuel burning is increased by incorrect air-fuel mixture, insufficient ventilation of combustion gases, and insufficient intake of fresh air. Although CO is odorless, colorless, tasteless, and nonirritating, it is often combined with other products of combustion that may produce a sharp odor and may irritate the eyes (*1,2*). CO exerts its toxic effect by binding to circulating hemoglobin in the lungs to reduce the oxygen-carrying capacity of the blood. Hemoglobin absorbs CO over 200 times more readily than oxygen (*3*). CO-bound hemoglobin, called carboxyhemoglobin (COHb), is unavailable to transport oxygen. Exposure to low levels of CO causes headache, dizziness, and sleepiness. Continued exposure brings on nausea, vomiting, and heart palpitation. Prolonged exposure to high levels of CO causes unconsciousness or death. Death can occur when blood contains from 60% to 80% COHb (*4*).

Because CO is one of the most widely encountered toxic gases, an understanding of hazard prevention and of the symptoms that result from exposure is necessary for preventing CO poisonings (*5*). Symptoms of low-level exposure should always be considered a warning of a potentially serious problem. If CO exposure is suspected, the health department should be contacted, and the dwelling in question should be inspected.

To prevent CO poisoning, the air inlet to any device that burns fuel must be properly adjusted and regularly cleaned. If the air inlet to such equipment is improperly adjusted, or the inlet is blocked by dirt, soot, or grease, the amount of CO produced will increase sharply. Sufficient ventilation of combustion gases to the outside air is also critical. One should periodically inspect vents for defects and obstructions and ensure that all horizontal vent pipes rise steadily from the appliance to the chimney. Annually, a qualified technician should adjust all fuel-burning appliances for correct fuel-air mixture, proper ventilation of combustion gases, and sufficient fresh-air intake (*1*).

Other prevention recommendations include: (1) never burn charcoal inside the home or in confined spaces; (2) never use a gas oven to warm a room; (3) never burn anything in an improperly vented stove or fireplace; (4) never run an automobile engine, lawn mower, or any combustion engine in an enclosed area; and (5) always ensure adequate natural ventilation for portable, fuel-fired space heaters.

References

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Update: Influenza Activity — Worldwide, United States

Worldwide: During late 1984 and early 1985, influenza activity has occurred at low levels in most countries, but outbreaks have been reported from North America, Europe, and Asia. Influenza A(H3N2) has predominated, and infrequent outbreaks associated with influenza B viruses have also been reported. Influenza A(H1N1) isolates have been rare.

In addition to the previously reported outbreaks of type A(H3N2) influenza in the United States, widespread influenza A(H3N2) activity occurred in Norway and the Union of Soviet Socialist Republics during January and early February. At the same time, some outbreaks were reported from northern China, the Federal Republic of Germany, the German Democratic

Influenza — Continued

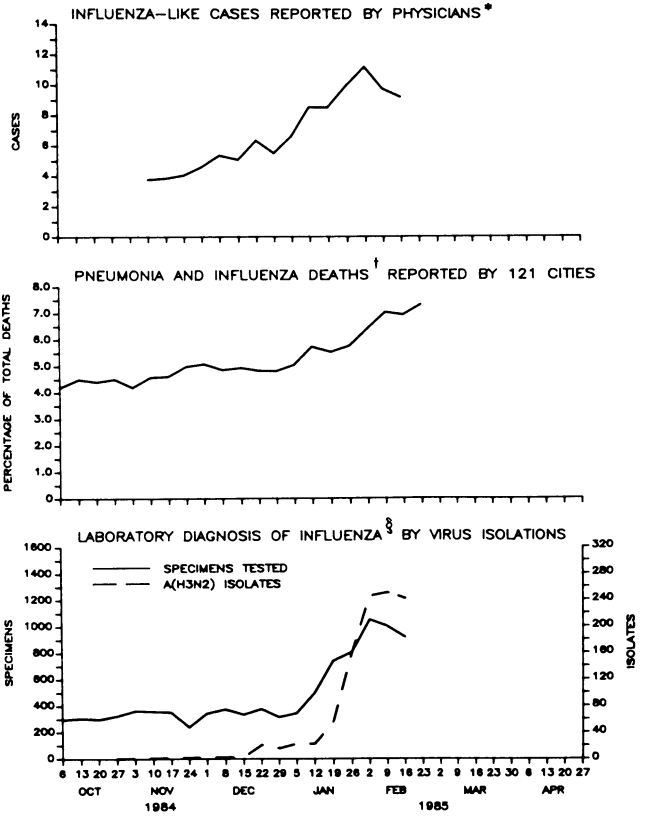
Republic, and the United Kingdom. Sporadic cases were also reported from Canada, Finland, France, Hong Kong, Italy, The Netherlands, Sweden, and Switzerland.

Influenza A(H1N1) viruses were isolated from young adults in a single outbreak that occurred in Finland in November 1984; from an outbreak in February at a boarding school in England; and from a small number of sporadic cases in China, France, and Switzerland during late 1984 and early 1985.

Influenza B viruses were isolated during outbreaks in Indonesia, Taiwan Province of China, and the United Kingdom in January. Otherwise, only sporadic cases of influenza B infection have been reported in China, France, New Zealand, Portugal, Singapore, Sweden, and Brazil.

United States: Trends of recent surveillance data suggest that national influenza activity began to level off in February (Figure 2). For the week ending February 23, 1985, 26 states reported widespread or regional outbreaks of influenza-like illness, compared with the previous week, when 28 states reported similar levels.

FIGURE 2. Indicators of influenza activity, by week — United States, 1984-1985



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

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

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

Influenza — Continued

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

Update: Reye Syndrome Pilot Study — United States, 1984

The results of a pilot study examining the possible relationship between Reye syndrome and medications were recently reported for 29 Reye syndrome patients and 143 controls (*1*). An independent expert panel that reviewed hospital records for cases included in this analysis has determined that supplemental laboratory and autopsy results obtained for one additional patient, originally excluded because of insufficient information, are consistent with the diagnosis of Reye syndrome.

Analysis of medication data for the 30 patients, including information obtained for this case and its matched controls, revealed that 28 (93%) of 30 cases (compared with the originally reported 28 [97%] of 29 cases) were exposed to salicylates during antecedent respiratory or chickenpox illnesses (and before a clinically defined onset of Reye syndrome), compared with 28% of emergency room, 23% of inpatient, 59% of school, and 51% of random digit-dialing controls matched for similar antecedent illnesses. The association between Reye syndrome and salicylates remains statistically significant.

Reported by the Reye Syndrome Task Force, consisting of members from US Food and Drug Administration, National Institutes of Health, Office of the Assistant Secretary of Health, and CDC.

Reference

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