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Epidemiologic Notes and Reports

Deaths Following Female Sterilization with Unipolar Electrocoagulating Devices

The number of women undergoing tubal sterilization in U.S. hospitals increased from 200,000 in 1970 to 700,000 in 1978 (*1*). Since 1979, CDC has been collecting information on deaths associated with tubal sterilization. Of 20 reported deaths, only 3 can be directly attributed to complications of a particular sterilization technique. All 3 followed thermal bowel injury sustained with unipolar electrocoagulating devices. Two of these deaths (Cases 1 and 2) were recently reported elsewhere (*2*). These and a third death are summarized below.

Case 1: A 41-year-old woman, gravida 6, para 5, abortus 1, underwent an apparently uneventful sterilization via laparoscopy with a unipolar coagulating instrument. Twenty-three days after sterilization, she returned to the hospital with a history of abdominal pain and vomiting for several hours. At laparotomy, the peritoneal cavity contained copius amounts of pus, and a perforation was noted on the anterior wall of the mid-portion of the sigmoid colon. A colectomy and a diverting colostomy were performed. The patient's condition deteriorated, and she died 41 days after laparotomy. Histologic review of the colectomy specimen revealed that the perforation had occurred at the site of a thermal injury.

Case 2: A 22-year-old woman, gravida 4, para 4, underwent a dilation and curettage followed by laparoscopic coagulation sterilization with a unipolar device. The curettage was without incident and yielded a scant amount of normal tissue. Electrocoagulation of the tubes was performed without apparent difficulty. Seven days after the operation, she returned to the hospital with fever, abdominal pain, and vomiting. At emergency laparotomy, the patient was noted to have massive peritonitis. An attempt to identify a perforation site was unsuccessful because the bowel was covered with purulent material. The pelvis appeared entirely normal. Material from the abdominal cavity was cultured, the cavity was irrigated, and the abdominal incision was closed. The patient continued to deteriorate, and she died 2 days later from septic shock. At the postmortem examination, no source of the peritonitis could be identified. Cultures of the abdominal cavity material grew *Enterobacter cloacae, Citrobacter freundii, Escherichia coli, Klebsiella pneumoniae, Clostridium perfringens,* and *Bacteroides* spp.

Case 3: A 27-year-old woman, gravida 1, para 1, had an apparently uneventful laparoscopic sterilization with a unipolar coagulating instrument. Thirty-six hours after sterilization, she developed abdominal pain. Over the next 24 hours, her pain increased and she began vomiting. On the third day after sterilization, she was seen in the emergency room with peritonitis and was found to be in septic shock. The patient had a cardiorespiratory arrest before an emergency laparotomy could be performed. After the

Female Sterilization – Continued

patient was resuscitated, she underwent laparotomy. Findings included diffuse peritonitis with an area of hyperemia and necrosis at the distal ileum, where a perforation had occurred. An attempt was made to surgically correct the injury, but the patient had a second cardiorespiratory arrest before the operation was completed. She could not be resuscitated.

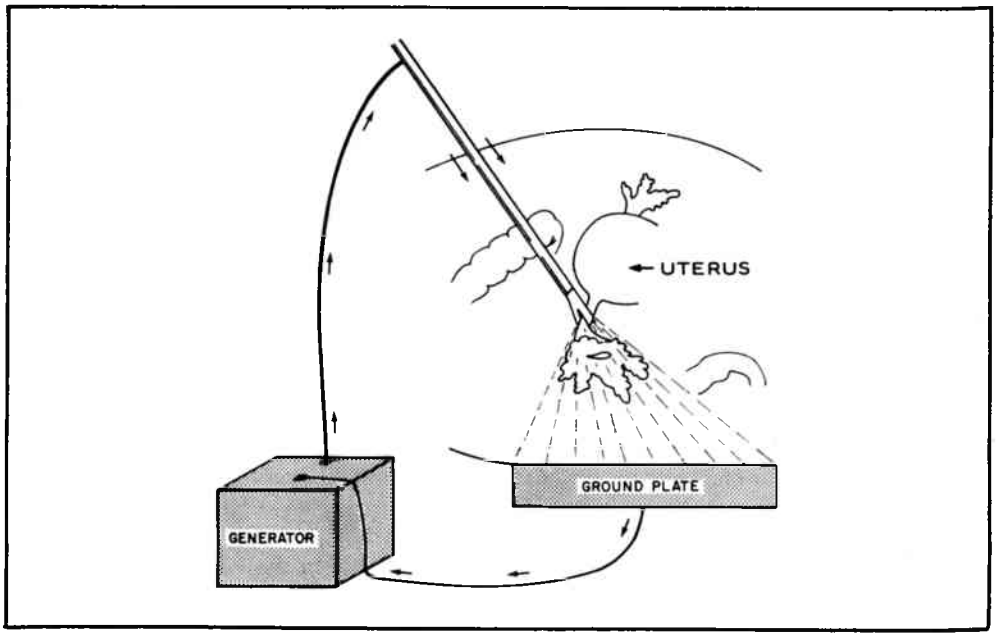
Reported by the Epidemiology Studies Br, Family Planning Evaluation Div, Center for Health Promotion and Education, CDC.

Editorial Note: These 3 deaths apparently resulted from bowel injury following electrical accidents with unipolar electrocoagulating devices. For the first and third patients there was both gross and histologic evidence that bowel burns had occurred. For the second case, there was microbiologic evidence that the patient's peritonitis most likely followed a bowel perforation.

In the early 1970s, laparoscopy became popular as a technique for female sterilization (*1*). Until the mid-1970s most laparoscopic sterilizations were performed with unipolar electrocoagulating devices (*3*). Unipolar instruments are used to coagulate the fallopian tube by applying an electric current that proceeds through the operating instrument to the grasping forceps (active electrode). The current coagulates the tube and courses through the patient's body to a ground plate (return electrode) on the patient's skin. This system (Figure 1), which makes the patient an integral part of the electrical circuit, has resulted in major accidents; over 100 cases of thermal bowel injury have been reported (*2*). These serious complications occur in approximately 0.5 of every 1,000 cases of unipolar electrocoagulation (*4*). Burns of the abdominal wall (*5*) and burns to the face and hands of the operator have also been reported (*6*).

Concerns about the hazards of unipolar electrocoagulation led to the development in

FIGURE 1. Unipolar laparoscopy



Female Sterilization — Continued

the mid-1970s of several instruments for laparoscopic sterilization that reduce the risk of electrical injury, including a bipolar coagulation instrument in which the jaws of the grasping forceps serve as both the active and return electrodes so that current only coagulates tissue grasped by the forceps (*7*). Only 1 bowel burn has been reported with use of the bipolar system (*8*). Mechanical techniques which use a spring clip (*9*) or a silastic band (*10*) completely eliminate the risk of electrical accidents.

Studies conducted by CDC and others indicate that all methods of laparoscopic sterilization, including unipolar electrocoagulation, have low complication rates and that deaths from these operations are rare. Unipolar electrocoagulation, however, carries a greater risk for electrical accidents than the alternative laparoscopic techniques (bipolar electrocoagulation, spring clip, silastic band) without demonstrably greater efficacy. Thus, the need for its continued use in female sterilization should be questioned.

CDC's Family Planning Evaluation Division is interested in learning about deaths from tubal sterilization. Any such deaths may be reported to state health departments and to CDC at the following address: Family Planning Evaluation Division, Centers for Disease Control, Attention: Sterilization Mortality, Atlanta, Georgia 30333.

References

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Deaths Associated with Liquid-Manure Systems — United States

Since August 1979, CDC has received reports of 8 deaths and 2 cases of near-fatal illness associated with liquid-manure disposal systems on swine and dairy farms. These deaths and illnesses were the result of 3 similar but separate accidents in Iowa, South Dakota, and Utah.

More than 1 death was associated with each accident reported. Characteristically, 1 person entered a disposal tank (to retrieve a fallen object in 2 accidents, and to fix a broken pump in the other) and was overcome by fumes within about 30 seconds to 2 minutes. Coworkers attempting rescue without respiratory equipment were also promptly overcome. In each case, survivors and the bodies of persons who died were retrieved from the tanks by local firemen wearing oxygen packs. All the persons involved in these

Liquid-Manure Systems — Continued

accidents were otherwise healthy; they ranged in age from 18-57 years.

Within a few days of the incident in Utah, state health authorities performed air analyses in an attempt to determine whether toxic gases had caused the problem. Using the same liquid-manure tank in which the accident had occurred, but allowing much less time for the manure to ferment, they measured a hydrogen sulfide (H_2S) concentration of 76 parts per million (ppm). On the basis of this finding, the H_2S concentration at the time of the accident was estimated to have been >570 ppm. (The National Institute for Occupational Safety and Health [NIOSH] recommends that an average measured concentration of no more than 10 ppm be present during a 10-hour work shift and that areas with levels of >47 ppm be evacuated immediately [*1*]). During the simulation, the measured oxygen level was somewhat reduced (to 18%), and the carbon dioxide (CO_2) level was slightly elevated (to 2%). Measured levels of ammonia and carbon monoxide were not thought to be high enough to cause sudden collapse. Nitrogen dioxide was not detected.

Reported by RM Perkins, MD, Office of Medical Examiner, Scott County, Iowa; LA Wintermeyer, MD, State Epidemiologist, Iowa State Dept of Health; B Thorpe, Grant County Sheriff's Dept, South Dakota; JD Corning, BA, State Epidemiologist, South Dakota State Dept of Health; MD Atwood, Bur of Radiation and Occupational Health, RE Johns, Jr, MD, State Epidemiologist, Utah State Dept of Health; K Dally, JP Davis, MD, State Epidemiologist, Wisconsin State Dept of Health and Social Services; JM Smucker, Milk Safety Br, Food and Drug Administration; Div of Surveillance, Hazard

(Continued on page 157)

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

[Cumulative totals include revised and delayed reports through previous weeks.]

DISEASE	13th WEEK ENDING		MEDIAN	CUMULATIVE, FIRST 13 WEEKS		
	April 4 1981	March 28 1980	1976-1980	April 4 1981	March 28 1980	MEDIAN 1976-1980
Aseptic meningitis	52	77	43	817	835	472
Brucellosis	4	3	1	21	42	42
Chickenpox	7,463	6,884	6,884	76,164	69,337	74,183
Diphtheria	–	–	–	3	1	20
Encephalitis: Primary (arthropod-borne & unspec.)	10	12	12	185	149	146
Post-infectious	4	3	3	19	39	39
Hepatitis, Viral: Type B	342	347	298	4,560	3,970	3,734
Type A	444	533	537	6,153	6,807	7,396
Type unspecified	190	201	185	2,778	2,677	2,298
Malaria	18	49	8	294	360	101
Measles (rubeola)	88	522	817	696	3,294	6,889
Meningococcal infections: Total	74	78	55	1,250	850	699
Civilian	73	78	55	1,247	841	692
Military	1	–	–	3	9	6
Mumps	105	285	484	1,406	3,656	5,507
Pertussis	20	20	21	248	262	275
Rubella (German measles)	84	113	475	682	1,196	3,487
Tetanus	2	2	1	12	11	10
Tuberculosis	482	583	616	6,210	6,098	6,612
Tularemia	–	2	1	22	23	23
Typhoid fever	15	9	9	113	76	89
Typhus fever, tick-borne (Rky. Mt. spotted)	1	1	1	14	10	11
Venereal diseases:						
Gonorrhea: Civilian	19,593	18,588	17,308	239,627	237,254	231,732
Military	340	384	469	6,903	6,810	6,810
Syphilis, primary & secondary: Civilian	452	585	477	7,435	6,600	6,100
Military	4	7	7	94	96	81
Rabies in animals	167	165	71	1,490	1,282	618

TABLE II. Notifiable diseases of low frequency, United States

	CUM. 1981		CUM. 1981
Anthrax	–	Poliomyelitis: Total	–
Botulism	13	Paralytic	–
Cholera	–	Psittacosis	18
Congenital rubella syndrome	2	Rabies in man	–
Leprosy (Calif. 1)	47	Trichinosis (Conn. 1, N.J. 2)	56
Leptospirosis	13	Typhus fever, flea-borne (endemic, murine) (Va. 1, Tex. 1)	2
Plague	1		

All delayed reports and corrections will be included in the following week's cumulative totals.

TABLE III. Cases of specified notifiable diseases, United States, weeks ending April 4, 1981 and March 29, 1980 (13th week)

REPORTING AREA	ASEPTIC MENINGITIS	BRUCELLOSIS	CHICKEN-POX	DIPHTHERIA		ENCEPHALITIS			HEPATITIS (VIRAL), BY TYPE			MALARIA	
						Primary		Post-infectious	B	A	Unspecified		
	1981	1981	1981	1981	CUM. 1981	1981	1980	1981	1981	1981	1981	1981	CUM. 1981
UNITED STATES	52	4	7,463	-	3	10	12	4	342	444	190	18	294
NEW ENGLAND	2	-	890	-	-	3	2	-	12	20	2	6	19
Maine	1	-	208	-	-	-	-	-	-	2	-	-	1
N.H.	-	-	144	-	-	2	-	-	-	1	1	-	2
Vt.	-	-	91	-	-	-	-	-	-	1	-	1	1
Mass.	-	-	234	-	-	-	-	-	6	12	1	3	11
R.I.	1	-	65	-	-	-	-	-	1	3	-	-	1
Conn.	-	-	148	-	-	1	2	-	5	1	-	2	3
MID. ATLANTIC	9	-	267	-	-	-	1	-	44	40	17	1	23
Upstate N.Y.	-	-	55	-	-	-	-	-	2	17	10	-	7
N.Y. City	1	-	160	-	-	-	-	-	28	16	5	-	12
N.J.	4	-	NN	-	-	-	1	-	NA	NA	NA	1	3
Pa.	4	-	52	-	-	-	-	-	14	7	2	-	1
E.N. CENTRAL	4	-	2,907	-	-	1	2	-	46	59	22	1	6
Ohio	4	-	134	-	-	1	1	-	11	11	3	1	1
Ind.	-	-	557	-	-	-	-	-	6	15	10	-	1
Ill.	-	-	871	-	-	-	-	-	17	22	6	-	1
Mich.	-	-	673	-	-	-	1	-	9	7	3	-	3
Wis.	-	-	672	-	-	-	-	-	3	4	-	-	-
W.N. CENTRAL	-	1	883	-	-	-	-	-	9	20	4	-	10
Minn.	-	1	5	-	-	-	-	-	3	3	-	-	2
Iowa	-	-	327	-	-	-	-	-	1	6	1	-	2
Mo.	-	-	9	-	-	-	-	-	4	7	2	-	1
N. Dak.	-	-	60	-	-	-	-	-	-	-	-	-	1
S. Dak.	-	-	39	-	-	-	-	-	1	-	-	-	1
Nebr.	-	-	36	-	-	-	-	-	-	1	-	-	-
Kans.	-	-	407	-	-	-	-	-	-	3	1	-	3
S. ATLANTIC	10	1	1,235	-	1	3	1	2	92	56	28	2	31
Del.	-	-	9	-	-	-	-	-	-	1	1	-	-
Md.	1	-	70	-	-	1	-	-	12	3	9	1	6
D.C.	-	-	1	-	-	-	-	-	-	-	-	-	1
Va.	-	1	173	-	-	1	-	-	7	5	4	-	9
W. Va.	1	-	252	-	-	-	-	-	2	3	-	-	-
N.C.	3	-	NN	-	-	1	-	-	6	7	3	-	2
S.C.	1	-	12	-	-	-	1	-	10	7	3	-	-
Ga.	-	-	12	-	-	-	-	-	14	9	-	-	4
Fla.	4	-	706	-	1	-	-	2	41	21	8	1	9
E.S. CENTRAL	5	1	466	-	-	-	1	-	13	14	4	-	1
Ky.	4	-	154	-	-	-	1	-	-	-	-	-	-
Tenn.	1	1	NN	-	-	-	-	-	7	7	-	-	-
Ala.	-	-	39	-	-	-	-	-	4	2	4	-	-
Miss.	-	-	273	-	-	-	-	-	2	5	-	-	1
W.S. CENTRAL	4	1	557	-	-	-	1	1	29	42	45	3	21
Ark.	-	1	13	-	-	-	-	-	5	3	2	-	2
La.	-	-	NN	-	-	-	-	-	3	2	8	-	2
Okla.	-	-	-	-	-	-	1	1	6	5	4	-	2
Tex.	4	-	544	-	-	-	-	-	15	32	31	3	15
MOUNTAIN	4	-	141	-	1	1	-	1	21	55	25	-	6
Mont.	-	-	-	-	1	-	-	-	-	4	-	-	-
Idaho	-	-	-	-	-	-	-	-	-	7	-	-	-
Wyo.	-	-	-	-	-	-	-	-	1	-	-	-	-
Colo.	-	-	136	-	-	1	-	-	6	17	10	-	2
N. Mex.	-	-	-	-	-	-	-	-	4	12	-	-	-
Ariz.	4	-	NN	-	-	-	-	-	3	10	12	-	2
Utah	-	-	1	-	-	-	-	1	1	1	2	-	-
Nev.	-	-	4	-	-	-	-	-	6	4	1	-	2
PACIFIC	14	-	117	-	1	2	4	-	76	138	43	5	177
Wash.	2	-	90	-	-	-	-	-	-	5	2	-	11
Oreg.	1	-	3	-	-	-	1	-	7	8	-	-	5
Calif.	10	-	-	-	-	2	3	-	63	120	39	5	160
Alaska	-	-	5	-	1	-	-	-	2	1	-	-	-
Hawaii	1	-	19	-	-	-	-	-	4	4	2	-	1
Guam	NA	NA	NA	NA	-	NA	-	-	NA	NA	NA	NA	-
P.R.	1	-	34	-	-	-	-	-	5	6	1	-	3
V.I.	-	-	-	-	-	-	-	-	-	-	-	-	1
Pac. Trust Terr.	NA	NA	NA	NA	-	NA	-	-	NA	NA	NA	NA	-

NN: Not notifiable. NA: Not available.
All delayed reports and corrections will be included in the following week's cumulative totals.

TABLE III (Cont.'d). Cases of specified notifiable diseases, United States, weeks ending April 4, 1981 and March 29, 1980 (13th week)

REPORTING AREA	MEASLES (RUBEOLA)			MENINGOCOCCAL INFECTIONS TOTAL			MUMPS		PERTUSSIS	RUBELLA		TETANUS
	1981	CUM. 1981	CUM. 1980	1981	CUM. 1981	CUM. 1980	1981	CUM. 1981	1981	1981	CUM. 1981	CUM. 1981
UNITED STATES	88	696	3,294	74	1,250	850	105	1,406	20	84	682	12
NEW ENGLAND	1	26	279	2	82	49	5	65	-	7	65	-
Maine	-	2	4	-	12	2	-	14	-	-	31	-
N.H.	1	3	148	-	6	4	1	9	-	3	14	-
Vt.	-	1	115	-	2	6	-	2	-	-	-	-
Mass.	-	16	8	1	21	16	2	22	-	2	16	-
R.I.	-	-	2	-	7	3	1	9	-	-	-	-
Conn.	-	4	2	1	34	18	1	9	-	2	4	-
MID. ATLANTIC	35	233	788	8	142	133	32	173	2	22	92	1
Upstate N.Y.	5	153	203	1	47	50	1	31	1	2	32	-
N.Y. City	6	23	227	2	15	39	1	25	-	3	17	1
N.J.	3	18	151	-	41	29	23	52	-	7	30	-
Pa.	21	39	207	5	39	15	7	65	1	10	13	-
E.N. CENTRAL	4	44	390	7	144	96	26	401	5	19	150	1
Ohio	-	13	52	2	50	37	4	54	1	-	-	-
Ind.	-	3	20	1	18	16	5	53	-	4	50	-
Ill.	-	6	95	3	40	14	10	74	-	10	42	-
Mich.	4	22	97	1	32	22	5	167	3	-	20	1
Wis.	-	-	126	-	4	7	2	53	1	5	38	-
W.N. CENTRAL	-	4	424	4	50	37	6	118	-	1	33	2
Minn.	-	1	282	1	21	11	-	2	-	-	5	1
Iowa	-	1	-	2	11	3	-	28	-	-	-	-
Mo.	-	-	47	1	12	16	1	21	-	-	1	1
N. Dak.	-	-	-	-	1	1	-	-	-	-	-	-
S. Dak.	-	-	-	-	1	2	-	1	-	-	-	-
Nebr.	-	1	50	-	-	-	3	3	-	-	1	-
Kans.	-	1	45	-	4	4	2	63	-	1	26	-
S. ATLANTIC	11	195	734	27	331	207	8	197	1	4	69	1
Del.	-	-	1	-	4	2	-	3	-	-	-	-
Md.	-	1	19	2	14	18	-	36	-	-	-	-
D.C.	-	-	-	-	1	-	-	-	-	-	-	-
Va.	-	2	144	6	40	17	1	50	-	1	8	-
W. Va.	-	6	3	-	15	6	4	35	-	-	12	-
N.C.	-	-	36	3	47	39	-	4	-	1	3	-
S.C.	-	-	91	3	44	25	1	5	-	-	4	1
Ga.	4	74	295	8	56	47	1	18	1	-	18	-
Fla.	7	112	145	5	110	53	1	46	-	2	24	-
E.S. CENTRAL	-	1	102	3	93	82	5	45	2	1	17	1
Ky.	-	-	31	2	30	24	2	17	-	1	10	-
Tenn.	-	1	5	1	27	19	1	16	2	-	7	-
Ala.	-	-	15	-	26	23	2	11	-	-	-	1
Miss.	-	-	51	-	10	16	-	1	-	-	-	-
W.S. CENTRAL	21	57	259	15	228	87	9	80	1	6	47	2
Ark.	-	-	6	-	17	5	-	-	-	-	-	1
La.	-	-	7	5	49	26	-	3	1	2	6	-
Okla.	-	3	177	2	18	8	-	-	-	-	-	-
Tex.	21	54	69	8	144	48	9	77	-	4	41	1
MOUNTAIN	6	14	63	4	43	35	4	43	1	3	23	1
Mont.	-	-	1	-	2	1	-	3	-	-	1	-
Idaho	-	-	-	-	2	3	-	2	-	-	-	-
Wyo.	-	-	-	-	-	1	-	-	-	-	1	-
Colo.	3	3	2	1	19	9	4	21	-	2	16	-
N. Mex.	-	-	2	-	4	6	-	-	-	-	-	-
Ariz.	-	1	27	3	11	5	-	7	-	-	1	1
Utah	-	-	29	-	3	1	-	5	1	1	3	-
Nev.	3	10	2	-	2	9	-	5	-	-	1	-
PACIFIC	10	122	255	4	137	124	10	284	8	21	186	3
Wash.	-	-	99	1	30	17	3	85	2	2	44	-
Oreg.	-	-	-	-	13	26	2	35	-	-	4	-
Calif.	10	122	148	3	87	79	5	152	6	19	138	3
Alaska	-	-	5	-	3	2	-	3	-	-	-	-
Hawaii	-	-	3	-	4	-	-	9	-	-	-	-
Guam	NA	1	2	-	-	-	NA	1	NA	NA	-	-
P.R.	11	88	28	1	3	5	3	35	-	1	1	-
V.I.	-	2	4	-	-	1	-	1	-	-	-	-
Pac. Trust Terr.	NA	-	3	-	-	-	NA	1	NA	NA	1	-

NA: Not available.

All delayed reports and corrections will be included in the following week's cumulative totals.

TABLE III (Cont.'d). Cases of specified notifiable diseases, United States, weeks ending April 4, 1981 and March 29, 1980 (13th week)

REPORTING AREA	TUBERCULOSIS		TULAREMIA	TYPHOID FEVER		TYPHUS FEVER (Tick-borne) (RMSF)		VENEREAL DISEASES (Civilian)						RABIES (in Animals)
								GONORRHEA			SYPHILIS (Pri. & Sec.)			
	1981	CUM. 1981	CUM. 1981	1981	CUM. 1981	1981	CUM. 1981	1981	CUM. 1981	CUM. 1980	1981	CUM. 1981	CUM. 1980	CUM. 1981
UNITED STATES	482	6,210	22	15	113	1	14	19,593	239,627	237,254	452	7,435	6,600	1,490
NEW ENGLAND	10	170	–	–	7	–	–	397	5,995	6,173	11	172	148	6
Maine	–	18	–	–	–	–	–	11	291	391	–	1	1	5
N.H.	–	2	–	–	–	–	–	8	221	225	1	7	–	–
Vt.	–	7	–	–	–	–	–	5	100	173	1	6	1	–
Mass.	8	95	–	–	6	–	–	175	2,439	2,496	7	102	82	–
R.I.	1	9	–	–	–	–	–	22	284	362	1	12	8	–
Conn.	1	39	–	–	1	–	–	176	2,660	2,526	1	44	56	1
MID. ATLANTIC	52	1,058	–	5	24	–	3	2,530	27,890	25,756	77	1,140	926	2
Upstate N.Y.	2	160	–	–	4	–	1	425	4,404	4,409	–	99	73	1
N.Y. City	23	464	–	5	16	–	2	950	11,025	10,437	55	719	603	–
N.J.	1	184	–	–	2	–	–	574	5,726	4,444	7	129	118	–
Pa.	26	250	–	–	2	–	–	581	6,735	6,466	15	193	132	1
E.N. CENTRAL	62	812	1	–	5	–	1	1,633	36,682	38,174	34	451	626	192
Ohio	9	148	–	–	–	–	1	511	14,146	9,982	3	72	97	13
Ind.	NA	35	–	–	–	–	–	181	3,091	3,819	2	32	62	8
Ill.	29	353	–	–	4	–	–	107	7,980	12,149	–	216	332	146
Mich.	19	236	1	–	–	–	–	586	8,169	8,260	27	103	106	–
Wis.	5	40	–	–	1	–	–	248	3,296	3,964	2	28	29	25
W.N. CENTRAL	24	206	3	–	2	–	1	798	11,464	10,380	4	130	72	605
Minn.	3	34	–	–	1	–	–	172	1,881	1,778	3	47	25	111
Iowa	–	30	–	–	–	–	–	68	1,135	1,130	–	8	4	220
Mo.	15	83	3	–	–	–	1	380	5,186	4,320	1	64	41	49
N. Dak.	–	8	–	–	–	–	–	14	150	148	–	1	–	89
S. Dak.	2	17	–	–	1	–	–	14	305	330	–	–	–	52
Nebr.	–	7	–	–	–	–	–	15	835	891	–	3	1	41
Kans.	4	27	–	–	–	–	–	135	1,972	1,783	–	7	1	43
S. ATLANTIC	134	1,397	5	3	14	–	4	4,789	60,208	57,294	139	1,957	1,589	98
Del.	4	16	1	–	–	–	–	37	900	838	–	3	5	–
Md.	21	137	–	3	5	–	–	583	6,425	5,940	16	155	112	1
D.C.	2	80	–	–	1	–	–	350	3,994	4,254	15	173	111	–
Va.	23	159	–	–	1	–	–	426	5,640	4,771	11	186	134	16
W. Va.	4	49	–	–	3	–	–	70	866	791	–	4	4	3
N.C.	23	263	1	–	1	–	4	593	9,743	9,051	20	153	123	–
S.C.	7	121	2	–	–	–	–	421	5,396	5,446	4	134	82	4
Ga.	17	216	1	–	–	–	–	1,228	12,063	10,229	29	508	460	48
Fla.	33	356	–	–	3	–	–	1,081	15,181	15,974	44	641	558	16
E.S. CENTRAL	54	552	2	–	4	–	3	1,982	20,066	19,078	29	508	543	104
Ky.	18	142	2	–	–	–	1	180	2,557	2,821	1	21	33	31
Tenn.	15	184	–	–	1	–	1	499	7,257	6,801	12	201	216	59
Ala.	13	164	–	–	2	–	–	911	6,659	5,440	9	143	107	14
Miss.	8	62	–	–	1	–	1	392	3,593	4,016	7	143	187	–
W.S. CENTRAL	56	564	4	2	10	1	2	2,991	33,398	30,511	71	1,772	1,251	304
Ark.	7	54	–	–	–	1	1	216	2,065	2,290	3	36	47	50
La.	6	117	2	–	–	–	–	595	5,258	4,828	5	378	295	12
Okla.	–	72	1	–	3	–	–	191	3,318	3,068	–	44	18	51
Tex.	43	321	1	2	7	–	1	1,989	22,757	20,325	63	1,314	891	191
MOUNTAIN	8	173	6	–	6	–	–	859	9,825	8,974	3	210	162	27
Mont.	–	17	1	–	4	–	–	28	354	326	–	4	–	25
Idaho	–	5	2	–	–	–	–	63	391	458	–	2	5	–
Wyo.	–	2	–	–	–	–	–	9	209	261	–	2	7	2
Colo.	–	11	2	–	2	–	–	210	2,537	2,280	3	65	41	–
N. Mex.	3	41	–	–	–	–	–	92	1,155	1,180	–	40	25	–
Ariz.	4	70	–	–	–	–	–	294	3,235	2,469	–	44	62	–
Utah	1	9	1	–	–	–	–	25	450	441	–	3	5	–
Nev.	–	18	–	–	–	–	–	138	1,494	1,559	–	50	17	–
PACIFIC	82	1,278	1	5	41	–	–	3,614	34,099	40,914	84	1,095	1,283	162
Wash.	12	100	–	–	–	–	–	239	3,013	3,280	–	23	73	–
Oreg.	2	44	–	–	2	–	–	216	2,613	2,903	3	27	30	1
Calif.	65	1,098	1	5	37	–	–	3,011	26,767	32,977	81	1,017	1,146	149
Alaska	–	12	–	–	–	–	–	83	947	923	–	4	1	12
Hawaii	3	24	–	–	2	–	–	65	759	831	–	24	33	–
Guam	NA	–	–	NA	–	NA	–	NA	14	29	NA	–	–	–
P.R.	–	4	–	1	3	–	–	89	851	659	19	183	145	20
V.I.	–	–	–	–	1	–	–	10	17	40	–	–	7	–
Pac. Trust Terr.	NA	16	–	NA	–	NA	–	NA	82	113	NA	–	–	–

NA: Not available.
All delayed reports and corrections will be included in the following week's cumulative totals.

TABLE IV. Deaths in 121 U.S. cities,* week ending April 4, 1981 (13th week)

REPORTING AREA	ALL CAUSES, BY AGE (YEARS)					P&I** TOTAL
	ALL AGES	≥65	45-64	25-44	<1	
NEW ENGLAND	658	462	135	29	22	59
Boston, Mass.	178	108	41	12	12	27
Bridgeport, Conn.	41	32	9	-	-	3
Cambridge, Mass.	31	25	6	-	-	3
Fall River, Mass.	41	28	11	1	1	1
Hartford, Conn.	48	27	10	6	3	-
Lowell, Mass.	34	28	3	2	-	2
Lynn, Mass.	21	17	4	-	-	-
New Bedford, Mass.	23	21	2	-	-	1
New Haven, Conn.	47	33	10	2	2	1
Providence, R.I.	59	42	12	2	2	6
Somerville, Mass.	9	8	1	-	-	2
Springfield, Mass.	39	24	11	2	1	5
Waterbury, Conn.	33	23	9	1	-	4
Worcester, Mass.	54	46	6	1	1	4
MID. ATLANTIC	2,538	1,636	627	158	59	111
Albany, N.Y.	43	27	9	2	3	1
Allentown, Pa.	24	18	6	-	-	-
Buffalo, N.Y.	116	80	22	6	6	10
Camden, N.J.	51	31	18	2	-	3
Elizabeth, N.J.	19	13	5	-	-	1
Erie, Pa.†	39	33	3	2	-	7
Jersey City, N.J.	51	33	10	5	2	3
Newark, N.J.	42	23	16	1	2	1
N.Y. City, N.Y.	1,351	854	327	107	27	46
Paterson, N.J.	24	14	9	-	1	1
Philadelphia, Pa.†	291	172	88	17	7	15
Pittsburgh, Pa.†	73	45	23	2	3	3
Reading, Pa.	31	23	5	2	-	2
Rochester, N.Y.	142	94	35	4	5	11
Schenectady, N.Y.	21	16	4	-	-	-
Scranton, Pa.†	33	26	5	2	-	-
Syracuse, N.Y.	92	61	25	2	2	4
Trenton, N.J.	36	24	8	3	1	-
Utica, N.Y.	28	26	2	-	-	2
Yonkers, N.Y.	31	23	7	1	-	1
E.N. CENTRAL	2,301	1,424	588	137	80	87
Akron, Ohio	90	50	32	2	4	5
Canton, Ohio	44	36	6	1	1	6
Chicago, Ill.	560	313	158	45	20	10
Cincinnati, Ohio	121	72	29	7	8	11
Cleveland, Ohio	167	90	51	16	2	2
Columbus, Ohio	134	81	36	8	6	4
Dayton, Ohio	119	76	32	4	3	4
Detroit, Mich.	237	141	65	19	7	6
Evansville, Ind.	43	32	10	1	-	3
Fort Wayne, Ind.	60	45	10	5	-	2
Gary, Ind.	19	12	4	1	1	2
Grand Rapids, Mich.	65	43	14	3	4	4
Indianapolis, Ind.	176	108	46	7	9	1
Madison, Wis.	44	29	8	2	2	4
Milwaukee, Wis.	139	100	28	7	1	1
Peoria, Ill.	52	32	13	1	4	9
Rockford, Ill.	34	26	4	2	1	4
South Bend, Ind.	37	29	7	-	-	2
Toledo, Ohio	108	74	25	4	3	5
Youngstown, Ohio	52	35	10	2	4	2
W.N. CENTRAL	743	484	173	37	30	36
Des Moines, Iowa	55	32	14	4	2	1
Duluth, Minn.	34	21	10	1	1	4
Kansas City, Kans.	31	14	8	3	5	1
Kansas City, Mo.	92	62	19	7	2	10
Lincoln, Nebr.	27	24	2	-	1	1
Minneapolis, Minn.	71	47	13	3	6	2
Omaha, Nebr.	92	58	28	1	5	2
St. Louis, Mo.	173	109	44	9	6	6
St. Paul, Minn.	73	49	19	4	-	3
Wichita, Kans.	95	68	16	5	2	6
S. ATLANTIC	1,401	890	340	84	51	52
Atlanta, Ga.	139	79	36	9	6	3
Baltimore, Md.	350	233	85	13	10	7
Charlotte, N.C.	63	34	18	8	3	2
Jacksonville, Fla.	100	65	28	7	-	4
Miami, Fla.	119	74	28	13	2	1
Norfolk, Va.	60	29	19	5	7	4
Richmond, Va.	69	45	14	1	6	8
Savannah, Ga.	46	27	11	2	5	6
St. Petersburg, Fla.	136	117	14	3	1	8
Tampa, Fla.	70	40	15	7	3	4
Washington, D.C.	204	118	59	15	6	5
Wilmington, Del.	45	29	13	1	2	-
E.S. CENTRAL	723	454	177	58	18	37
Birmingham, Ala.	112	71	32	5	2	4
Chattanooga, Tenn.	60	34	16	7	1	4
Knoxville, Tenn.	63	41	16	4	1	3
Louisville, Ky.	94	61	24	6	3	9
Memphis, Tenn.	197	114	51	21	5	9
Mobile, Ala.	30	23	5	1	1	2
Montgomery, Ala.	49	36	11	1	1	1
Nashville, Tenn.	118	74	22	13	4	5
W.S. CENTRAL	1,354	783	352	112	45	46
Austin, Tex.	47	32	10	3	1	2
Baton Rouge, La.	63	38	17	3	3	-
Corpus Christi, Tex.	54	27	14	7	1	1
Dallas, Tex.	196	114	41	19	8	1
El Paso, Tex.	59	31	16	10	2	8
Fort Worth, Tex.	76	44	25	2	3	5
Houston, Tex.	311	155	91	37	12	7
Little Rock, Ark.	52	34	11	4	2	2
New Orleans, La.	228	137	62	12	7	4
San Antonio, Tex.	144	85	40	8	3	4
Shreveport, La.	44	29	10	3	1	3
Tulsa, Okla.	80	57	15	4	2	9
MOUNTAIN	597	346	131	54	29	24
Albuquerque, N.Mex	87	41	28	10	1	3
Colo. Springs, Colo.	22	14	3	1	2	2
Denver, Colo.	128	67	26	13	14	4
Las Vegas, Nev.	68	45	14	6	1	3
Ogden, Utah	14	9	4	1	-	1
Phoenix, Ariz.	146	88	24	12	10	1
Pueblo, Colo.	19	13	4	1	-	-
Salt Lake City, Utah	39	23	10	3	-	-
Tucson, Ariz.	74	46	18	7	1	10
PACIFIC	1,661	1,108	342	106	50	86
Berkeley, Calif.	21	15	3	1	2	-
Fresno, Calif.	67	44	11	3	6	9
Glendale, Calif.	35	32	2	1	-	-
Honolulu, Hawaii	48	30	13	2	1	2
Long Beach, Calif.	98	64	21	6	4	4
Los Angeles, Calif.	416	283	90	23	7	13
Oakland, Calif.††	70	44	14	5	3	6
Pasadena, Calif.	24	20	4	-	-	1
Portland, Oreg.	116	83	26	4	2	-
Sacramento, Calif.	69	39	15	8	1	4
San Diego, Calif.	96	59	20	8	3	4
San Francisco, Calif.	152	109	24	11	5	10
San Jose, Calif.	148	94	32	11	4	12
Seattle, Wash.	176	109	41	16	6	7
Spokane, Wash.	74	50	15	2	4	7
Tacoma, Wash.	51	33	11	5	2	7
TOTAL	11,976	7,587	2,865	775	384	538

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

**Pneumonia and influenza

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

††Data not available this week. Figures are estimates based on average percent of regional totals.

Liquid-Manure Systems – Continued

Evaluations, and Field Studies, NIOSH, Special Studies Br, Chronic Diseases Div, Center for Environmental Health, CDC.

Editorial Note: The Utah incident was the basis for the second report to CDC of a liquid-manure-associated accident for which gas analyses indicated that H_2S was the most likely causative agent (*2*); the first was a report from Wisconsin in 1978 of a young male who collapsed and died while working near a liquid-manure system (*3*). This gas is extremely toxic and can rapidly cause coma, respiratory paralysis, and death. At low concentrations, the gas has a characteristic "rotten egg" odor. However, this odor may not signal persons to evacuate an area quickly enough to avoid ill effects because olfactory sensation is rapidly impaired by the presence of high concentrations of H_2S.

The levels of oxygen and CO_2 measured after the Utah accident would not be expected to cause otherwise-healthy persons to collapse suddenly. However, at the time of the accident, oxygen may have been even more depleted and CO_2 even more elevated than the later measurements indicated. Thus, hypoxia and hypercapnia may have been contributory causes of the observed acute health effects. Analyzing gases as soon as possible after such accidents would help to clarify which specific agents produce sudden death or illness.

Liquid-manure systems are an efficient and increasingly popular method for disposing of or recycling animal wastes. This series of accidents highlights the need for increased awareness on the part of farm personnel of the potential hazards posed by these systems. No one should enter liquid-manure tanks without wearing a self-contained breathing apparatus. Any person entering one of these tanks should also be tied to a cord or rope line, the other end of which is held by a "buddy" standing a safe distance away. Buildings housing liquid-manure tanks should be well ventilated.

The potential hazards of working in confined spaces are an increasingly recognized public health problem. Death or severe illness is not uncommon among persons who have occupational exposure to chemical agents in poorly ventilated areas. For example, a recent report describing 32 deaths indicates that toxic-gas mixtures found in the holds of ships are a common but previously unrecognized cause of death in the fishing industry (*4*). NIOSH has recently published criteria for recommended standards for work done in confined areas (*5*).

The increasingly widespread use of liquid-manure systems, their definite tendency to create toxic gases, and the common practice of locating liquid-manure storage tanks directly beneath dairy barns have caused the Food and Drug Administration to be concerned about possible adverse effects of fumes on milk quality. To date, milk from dairies using liquid-manure systems has not been shown to be unwholesome.

Reports of accidents involving liquid-manure systems may be sent through state health departments to the Special Studies Branch, Chronic Diseases Division, Center for Environmental Health, CDC, Atlanta, Georgia 30333.

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Current Trends

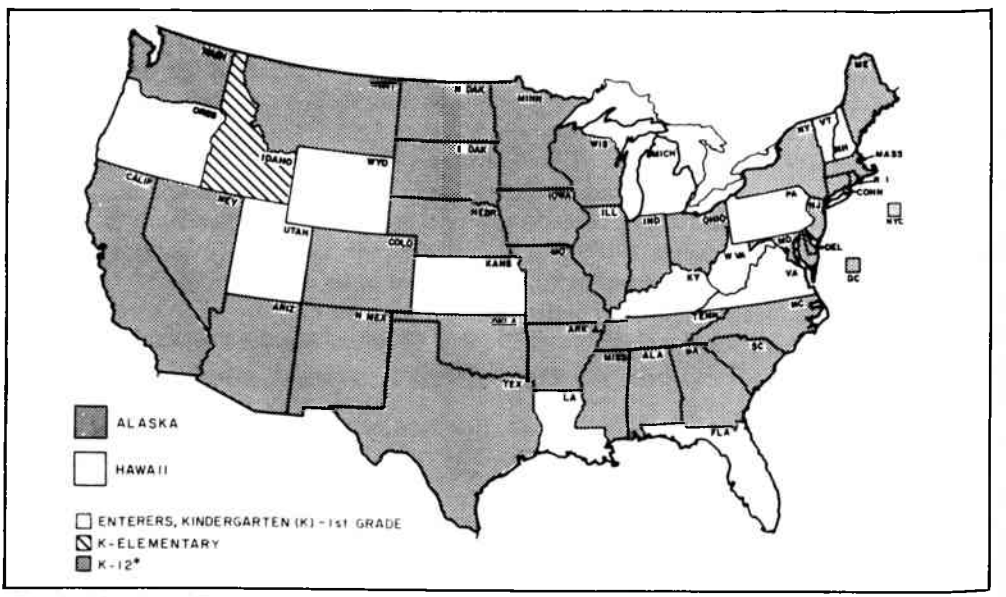
School Immunization Requirements for Measles — United States, 1981

Because schools are the major site of measles transmission in the United States, a major focus of the measles-elimination program has been to document that very high percentages of school-age children are immune to measles. The importance of schools as sites for measles transmission is reflected by the fact that the school-age population 5-19 years old accounted for almost three-fourths (72.4%) of the measles cases in 1979 (*1*), the most recent year for which age-specific data on measles cases are available.

In recent years, increasing attention has been paid to requiring documentation of measles disease or measles vaccination before allowing children of all ages to attend school. In March 1979, only 17 states and the District of Columbia had comprehensive laws requiring evidence of immunity to measles for all students from kindergarten through grade 12. By March 1981, the number of states with comprehensive laws covering all grades had more than doubled (35, plus the District of Columbia) (Figure 2). Fourteen states have only school-entry laws, that is, laws that cover only school entrance at kindergarten or first grade; 1 state's law covers only entrance to elementary school.

During the most recent school year (1979-1980), reporting areas whose laws cover only entry into kindergarten or first grade had higher incidences of measles than reporting areas with comprehensive laws covering all grades. Figure 3 shows the 15 reporting areas with the highest measles incidence during the 1979-1980 school year. The laws for 9 (60.0%) of these areas covered only entry into kindergarten or first grade (Florida, Minnesota, New Hampshire, Upstate New York, New York City, Pennsylvania, South Carolina, Vermont, and Virginia). Of the 37 reporting areas with low incidences, only 11

FIGURE 2. School immunization laws for measles, by state, March 31, 1981



*Rhode Island and Texas laws extend beyond 12th grade to include college. District of Columbia law includes students through age 25.

Immunization Requirements – Continued

(29.7%) had laws covering only entry into kindergarten or first grade. On the basis of this rank order, there is a statistically significant association between having a high measles incidence and having only a school-entry law ($X^2=4.1$, $p<.05$). Several of these states with high incidence—Minnesota, New York, and South Carolina—have since enacted comprehensive school immunization laws.

Day-care centers are becoming increasingly important as sites for measles transmission in the United States. In recent years, numerous outbreaks of measles have occurred in such centers (*2-6*). The percentage of measles cases affecting children <5 years of age has increased from 14.1% in 1977 to 20.7% in 1979.

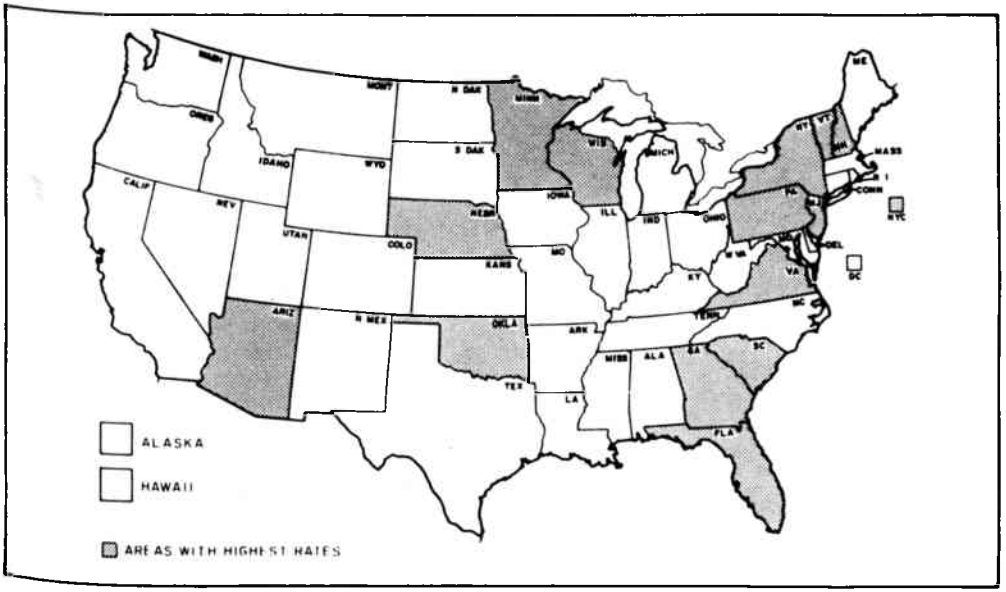
Reported by Surveillance and Assessment Br, Immunization Div, Center for Prevention Services, CDC.

Editorial Note: The existence of regulations requiring documented immunity to measles before children are allowed to enter kindergarten or first grade has been shown to correlate with reduced incidence of measles (*7,8*). The data reported above indicate that comprehensive laws covering all levels from kindergarten through grade 12 are associated with even lower incidence of measles.

Vigorous enforcement of school immunization laws is the key to their effectiveness. Excluding from school students who have not provided documented evidence of immunity to measles is the most effective means of enforcement. Experience with such enforcement programs indicates that necessary vaccinations are quickly obtained by most susceptible pupils and that exclusion from school for significant periods is uncommon (*9-11*).

The relationship of low measles incidence to comprehensive school immunization laws and to enforcement procedures has recently been emphasized in the report of a nationwide study (*12*). Of the 54 immunization project areas in the United States (all 50 states, New York City, District of Columbia, Puerto Rico, and Guam), 13 areas with

FIGURE 3. Reporting areas with highest incidence rates of measles, 1979-1980 school year



Immunization Requirements – Continued

low incidence of measles in 1977 and 1978 were compared with 10 areas with high incidence of measles. There were no statistically significant differences in demographic characteristics, vaccine utilization, or surveillance systems between low- and high-incidence areas. However, in low-incidence areas, school immunization laws were more comprehensive and more strictly enforced. Low- and high-incidence areas did not differ significantly in terms of having school-exclusion provisions in their immunization laws, indicating that such a provision has limited value unless it is rigorously enforced.

Continued progress toward eliminating measles from the United States will require that all states have comprehensive immunization laws covering schools and day-care centers. Enacting and strictly enforcing such comprehensive laws should receive high priority in all public health efforts to control or eliminate measles.

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