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## MORBIDITY AND MORTALITY WEEKLY REPORT

### Epidemiologic Notes and Reports

	<b>Epidemiologic Notes and Reports</b>
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### Polybrominated Biphenyl Exposure — Michigan

In 1973 and 1974, more than 10,000 Michigan farm residents were exposed to polybrominated biphenyls (PBB), a group of fat-soluble, biologically persistent brominated hydrocarbon compounds employed until recently as flame retardants. Exposure was the result of a shipping accident in the summer of 1973 in which several hundred pounds of PBB were substituted for magnesium oxide, a dairy nutritional supplement, and introduced into animal feed (1). Anorexia, skin changes, weight loss, decreased milk production, and death resulted in exposed cattle (2), and an increased incidence of stillborn and malformed calves was noted. Human contact with PBB-contaminated feed and consumption of contaminated dairy food products began shortly after the episode of contamination and continued undetected for almost a year until quarantine of affected herds was established in May 1974. While human contact with PBB was most intense on quarantined farms (3), low-level exposure was widespread throughout the state, and in October 1976 a survey of randomly selected samples of human breast milk showed that 51 (96.2%) of 53 samples obtained in the lower peninsula of Michigan contained detectable quantities of PBB (4).

To determine whether or not exposure to PBB had caused illness in Michigan residents, the Michigan Department of Public Health (MDPH) in collaboration with CDC, the Food and Drug Administration, the National Institutes of Health, and the Environmental Protection Agency undertook a prospective cohort study of the most heavily exposed persons in the state. Three groups were invited to participate: (1) all persons who had been identified by MDPH as living on PBB-contaminated farms at the time of quarantine\*; (2) persons who had received food products directly from such farms; and (3) workers (and their families) who had been exposed occupationally to PBB in a chemical manufacturing plant. Participation rates in these 3 groups were 95.6%, 95.1%, and 78.0%, respectively. In addition, 57 persons with low-level PBB exposure who had participated in a 1974 MDPH pilot survey (3), 331 persons

from farms with low-level PBB contamination, and 337 unsolicited volunteers were enrolled in the cohort.\*\*

All subjects were visited by MDPH staff during 1976 and 1977. A standard questionnaire was administered and information obtained on PBB exposure as well as on the occurrence in the years before and since 1973 of 17 symptoms and conditions potentially related to PBB. Venous blood samples were obtained on 3,639 subjects and analyzed for PBB concentrations by gas chromatography at the MDPH Laboratory; laboratory quality control was exercised jointly by MDPH and CDC.

Analysis of symptom-prevalence data showed that symptoms had occurred most frequently in volunteers and in persons from non-quarantined farms with low-level PBB contamination; symptoms were least prevalent in quarantined farm families and in chemical workers.

Highest serum PBB levels (mean, 43.0 parts per billion; median, 4.5 ppb) were found in the chemical workers. Among the other groups, highest levels were found in the members of quarantined farm families (mean, 26.9 ppb; median, 4.0 ppb), followed by farm product recipients (17.1 ppb; 3.0 ppb), residents of non-quarantined farms (3.5 ppb; 2.0 ppb), pilot-study participants (3.5 ppb; 2.0 ppb), and volunteers (3.2 ppb; 1.0 ppb). PBB levels showed no significant gradient by age ( $F=1.81$ ,  $p=0.11$ ). Levels were significantly higher in males than in females ( $X^2=256.5$ ,  $p=10^{-10}$ ).

An evaluation of dose-response relationships was undertaken by dividing the cohort into 7 segments on the basis of serum PBB levels. No positive associations were found between serum concentrations of PBB and reported symptom frequencies (Table 1, page 116). Symptom-prevalence rates (excluding volunteers) were slightly higher in persons with no detectable PBB in serum than in those with measurable quantities.

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\*A farm was quarantined if a single sample of meat or milk was found to contain PBB in levels above minimum permissible limits.

\*\*A group of approximately 2,000 Iowa dairy farm residents with no known exposure to PBB will be enrolled in the cohort during 1978 for comparison purposes.

*Polybrominated Biphenyl Exposure — continued*

atories, and Special Studies Br, Chronic Diseases Div, Bur of Epidemiology, CDC.

TABLE 1. Percent incidence of reported symptoms and conditions\* since 1973 by serum PBB\*\* level, Michigan, 1976-77

Symptoms and conditions	Serum PBB concentrations							Mean
	0	1	2-3	4-9	10-19	20-99	100+	
Fatigue	46.5	40.1	40.7	38.1	37.8	28.7	27.4	38.3
Rashes	9.0	8.5	8.4	7.2	8.3	6.3	4.1	7.8
Joint pains	42.9	32.7	29.8	26.4	28.4	21.6	17.1	28.6
Hepatitis	4.5	1.4	1.8	1.4	1.3	0.0	0.0	1.4
Diabetes	4.7	2.9	2.4	1.8	1.9	3.3	0.0	2.4
Benign tumors	0.0	0.9	0.5	0.5	1.0	0.4	1.8	0.6
Cancer-all sites	2.7	7.5	5.6	4.3	5.3	3.8	2.6	5.3
Number of subjects**	89	716	941	892	316	276	126	3356

\*Excludes volunteer subjects

\*\*PBB concentrations in parts per billion (ppb)

**Editorial Note:** The finding of elevated serum PBB levels in families from quarantined farms and in Michigan chemical workers confirms earlier reports of increased PBB absorption in these groups (3-5). Although a number of the exposed individuals reported symptoms, it was noteworthy that symptom prevalence bore no relationship to serum PBB levels. Symptom frequency was much more closely related to mode of recruitment into the cohort, with highest frequencies occurring in volunteers and in persons

from farms that were contaminated by PBB but at levels insufficient to result in quarantine. A similar lack of dose-response has been noted in 2 previous studies of exposure to PBB in Michigan (3,6). These observations suggest that factors other than PBB absorption were responsible for the production of symptoms and that selection factors may have played an important role in the observed distribution of complaints.

PBB is a highly lipotropic compound and is extremely persistent in the human body (7). Persons exposed to PBB may be at potentially increased risk of developing delayed sequelae of exposure, such as cancer, since PBB given in a single high dose to rats, has produced neoplastic liver nodules (8). Because of the possibility of delayed illness, MDPH and the federal agencies are following the Michigan cohort for at least another 10-15 years.

*References*

1. Carter LJ: Michigan's PBB incident: Chemical mix-up leads to disaster. *Science* 192:240-243, 1976
2. Jackson TF, Halbert FL: A toxic syndrome associated with the feeding of polybrominated biphenyl-contaminated protein concentrate to dairy cattle. *J Am Vet Med Assoc* 165:437-439, 1974
3. Humphrey HEB, Hayner NS: Polybrominated biphenyls: An agricultural incident and its consequences, an epidemiological investigation of human exposure. Presented at the Ninth Annual Conference on Trace Substances in Environmental Health, Columbia, Missouri, Jun 1975
4. Wilcox KR Jr: Mothers' milk as a chemical transport medium.

(continued on page 121)

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 1973-1977 ††	CUMULATIVE, FIRST 13 WEEKS		
	April 1, 1978	April 2, 1977 †		April 1, 1978	April 2, 1977 †	MEDIAN 1973-1977 ††
Aseptic meningitis	21	43	40	447	467	461
Brucellosis	-	4	3	31	43	35
Chickenpox	3,899	6,897	5,727	50,530	79,653	70,940
Diphtheria	-	4	4	21	20	60
Encephalitis						
Primary	8	13	16	129	157	196
Post-Infectious	2	2	6	30	27	50
Hepatitis, Viral						
Type B	242	297	201	3,586	3,932	2,623
Type A	456	644	678	6,701	8,337	9,028
Type unspecified	172	193		2,131	2,352	
Malaria	12	6	4	107	82	68
Measles (rubeola)	788	2,407	1,229	6,852	19,108	9,191
Meningococcal infections, total	51	37	41	695	595	448
Civilian	51	37	41	686	593	435
Military	-	-	1	9	2	9
Mumps	313	669	1,573	5,236	7,814	19,593
Pertussis	22	10	---	536	182	---
Rubella (German measles)	452	974	619	3,199	7,288	4,574
Tetanus	1	1	1	10	10	14
Tuberculosis	643	569	684	6,814	7,137	7,241
Tularemia	-	-	2	16	19	19
Typhoid fever	12	5	6	104	82	85
Typhus, tick-borne (Rky. Mt. spotted fever)	1	5	1	11	22	12
Venereal Diseases:						
Gonorrhea						
Civilian	16,534	15,879	17,454	225,187	231,266	231,266
Military	542	537	537	5,528	6,645	7,349
Syphilis, primary and secondary						
Civilian	369	338	462	5,014	5,449	6,480
Military	5	6	6	78	72	86
Rabies in animals	56	62	71	596	604	604

Table II. Notifiable Diseases of Low Frequency: United States

	CUM.		CUM.
Anthrax:	-	Poliomyelitis, total:	-
Botulism:	4	Paralytic:	-
Congenital rubella syndrome:	7	Psittacosis: Minn. 2, Va. 1, Ga. 1, Ark. 1, Okla. 1, Utah 4, Calif. 2	28
Leprosy: NYC 1, Tex. 3, Calif. 1, Hawaii 3	23	Rabies in man:	-
Leptospirosis:	7	Trichinosis: Pa. 1, Calif. 1	11
Plague:	-	Typhus, murine: Tex. 1	8

†Delayed reports received for calendar year 1977 are used to update last year's weekly and cumulative totals.

††Medians for Gonorrhea and Syphilis are based on data for 1975-1977

Table III  
Cases of Specified Notifiable Diseases: United States  
Weeks Ending April 1, 1978 and April 2, 1977 - 13th Week

AREA REPORTING	ASEPTIC MENIN- GITIS	BRUCEL- LOSIS	CHICKEN- POX	DIPHTHERIA		ENCEPHALITIS			HEPATITIS, VIRAL			MALARIA	
						Primary: Arthropod- borne and Unspecified		Post In- fectious	Type B	Type A	Type Unspecified		
						1978	1977†	1978	1978	1978	1978		
UNITED STATES .....	21	-	3,899	-	21	8	13	2	242	456	172	12	107
NEW ENGLAND .....	-	-	371	-	-	-	1	-	6	10	9	1	6
Maine .....	-	-	92	-	-	-	-	-	-	-	-	-	1
New Hampshire * .....	-	-	1	-	-	-	-	-	-	1	2	-	1
Vermont .....	-	-	-	-	-	-	-	-	-	1	-	-	-
Massachusetts .....	-	-	146	-	-	-	1	-	1	5	7	-	1
Rhode Island .....	-	-	74	-	-	-	-	-	2	1	-	-	-
Connecticut * .....	-	-	58	-	-	-	-	-	3	2	-	1	3
MIDDLE ATLANTIC .....	2	-	333	-	-	1	5	-	34	41	27	3	29
Upstate New York .....	1	-	212	-	-	1	1	-	10	18	8	1	4
New York City .....	1	-	76	-	-	-	1	-	7	8	9	1	14
New Jersey * .....	-	-	NN	-	-	-	-	-	17	15	10	1	4
Pennsylvania * .....	-	-	45	-	-	-	3	-	NA	NA	NA	-	7
EAST NORTH CENTRAL ..	3	-	1,470	-	-	1	2	-	42	55	12	-	3
Ohio * .....	-	-	321	-	-	1	-	-	8	12	-	-	-
Indiana .....	1	-	112	-	-	-	-	-	-	5	7	-	-
Illinois .....	-	-	120	-	-	-	2	-	21	22	2	-	2
Michigan .....	2	-	550	-	-	-	-	-	7	13	3	-	1
Wisconsin * .....	-	-	367	-	-	-	-	-	6	3	-	-	-
WEST NORTH CENTRAL ..	-	-	645	-	-	-	2	-	12	37	17	-	8
Minnesota .....	-	-	-	-	-	-	-	-	2	7	-	-	2
Iowa * .....	-	-	286	-	-	-	2	-	-	2	2	-	-
Missouri * .....	-	-	5	-	-	-	-	-	6	13	14	-	4
North Dakota .....	-	-	4	-	-	-	-	-	-	6	-	-	-
South Dakota .....	-	-	13	-	-	-	-	-	-	-	-	-	-
Nebraska .....	-	-	23	-	-	-	-	-	2	4	1	-	1
Kansas .....	-	-	314	-	-	-	-	-	2	5	-	-	1
SOUTH ATLANTIC .....	6	-	455	-	-	2	-	1	33	66	12	1	19
Delaware .....	-	-	5	-	-	-	-	-	-	-	-	-	1
Maryland .....	-	-	26	-	-	-	-	-	-	11	-	-	6
District of Columbia ..	-	-	3	-	-	-	-	-	-	-	-	-	3
Virginia .....	2	-	11	-	-	-	-	1	4	8	1	1	3
West Virginia .....	-	-	149	-	-	-	-	-	-	2	1	-	1
North Carolina .....	1	-	NN	-	-	2	-	-	3	6	2	-	-
South Carolina .....	-	-	24	-	-	-	-	-	1	4	1	-	1
Georgia .....	-	-	-	-	-	-	-	-	1	7	-	-	1
Florida .....	3	-	237	-	-	-	-	-	24	28	7	-	6
EAST SOUTH CENTRAL ..	-	-	130	-	-	-	2	-	3	22	-	-	1
Kentucky .....	-	-	36	-	-	-	1	-	-	-	-	-	-
Tennessee .....	-	-	NN	-	-	-	-	-	2	16	-	-	1
Alabama .....	-	-	82	-	-	-	-	-	1	-	-	-	-
Mississippi .....	-	-	12	-	-	-	1	-	-	6	-	-	-
WEST SOUTH CENTRAL ..	4	-	182	-	1	1	-	1	21	66	29	1	7
Arkansas .....	-	-	-	-	1	-	-	-	4	7	1	-	-
Louisiana .....	-	-	NN	-	-	-	-	-	5	6	4	-	3
Oklahoma .....	2	-	-	-	-	1	-	1	2	16	3	-	-
Texas * .....	2	-	182	-	-	-	-	-	10	37	21	1	4
MOUNTAIN .....	1	-	135	-	1	-	-	-	9	39	16	-	2
Montana .....	-	-	37	-	-	-	-	-	1	2	2	-	-
Idaho * .....	-	-	4	-	-	-	-	-	-	2	-	-	-
Wyoming .....	-	-	-	-	-	-	-	-	-	2	1	-	-
Colorado .....	-	-	48	-	-	-	-	-	4	7	5	-	1
New Mexico .....	-	-	-	-	-	-	-	-	2	7	1	-	-
Arizona .....	-	-	NN	-	-	-	-	-	2	10	3	-	1
Utah .....	1	-	41	-	-	-	-	-	-	9	4	-	-
Nevada .....	-	-	5	-	1	-	-	-	-	-	-	-	-
PACIFIC .....	5	-	178	-	19	3	1	-	82	120	50	6	32
Washington .....	2	-	151	-	19	-	1	-	6	22	8	-	1
Oregon .....	-	-	1	-	-	-	-	-	9	19	9	-	2
California * .....	2	-	-	-	-	2	-	-	65	73	33	5	27
Alaska .....	-	-	2	-	-	1	-	-	1	3	-	-	-
Hawaii .....	1	-	24	-	-	-	-	-	1	3	-	1	2
Guam .....	NA	NA	NA	NA	-	NA	-	-	NA	NA	NA	NA	-
Puerto Rico .....	2	1	6	-	-	-	-	-	1	6	7	-	2
Virgin Islands * .....	NA	NA	NA	NA	-	NA	-	-	NA	NA	NA	NA	-

NN: Not notifiable  
 NA: Not available  
 †Delayed reports received for 1977 are not shown below but are used to update last year's weekly and cumulative totals.  
 \*The following delayed reports will be reflected in next week's issue: Asep. menq.: Pa. +1, Bruc. Iowa +1; Chickenpox: N.H. +12, Mo. +2, Calif. +82; Enceph.: Mo. -1; Hep. B: N.J. -1, Pa. +26, Ohio -1, Wis. -1; Hep. A: Conn. -1, N.J. -1, Pa. +24, Ohio -1, Wis. -1, Idaho -1; Hep. unsp.: Pa. +1, Mo. -2, Tex. -1, V.I. +6

Table III-Continued  
Cases of Specified Notifiable Diseases: United States  
Weeks Ending April 1, 1978 and April 2, 1977 - 13th Week

REPORTING AREA	MEASLES (Rubeola)			MENINGOCOCCAL INFECTIONS TOTAL			MUMPS		PERTUSSIS	RUBELLA		TETANUS
	1978	CUMULATIVE		1978	CUMULATIVE		1978	CUM. 1978	1978	1978	CUM. 1978	CUM. 1978
		1978	1977 †		1978	1977 †						
UNITED STATES .....	788	6,852	19,108	51	695	595	313	5,236	22	452	3,199	10
NEW ENGLAND .....	138	568	912	3	37	31	37	302	-	33	139	-
Maine .....	79	328	3	-	4	2	28	206	-	18	71	-
New Hampshire* .....	1	8	277	-	5	3	-	5	-	11	15	-
Vermont .....	-	5	207	-	1	2	1	3	-	-	-	-
Massachusetts .....	8	85	179	1	7	8	5	34	-	4	40	-
Rhode Island .....	-	4	6	1	9	-	-	9	-	-	1	-
Connecticut .....	50	138	240	1	11	16	3	45	-	-	12	-
MIDDLE ATLANTIC .....	74	529	2,216	6	94	76	19	235	1	106	581	-
Upstate New York .....	58	371	600	3	35	19	3	76	-	6	66	-
New York City .....	9	83	98	1	25	15	9	69	1	4	20	-
New Jersey* .....	6	7	55	2	17	22	1	49	-	72	388	-
Pennsylvania* .....	1	68	1,463	-	17	20	6	41	-	24	107	-
EAST NORTH CENTRAL ..	274	2,554	4,673	6	63	59	134	1,867	1	143	1,138	1
Ohio* .....	48	150	273	2	16	24	22	213	-	6	65	-
Indiana .....	3	46	2,327	1	12	3	4	101	-	5	62	1
Illinois .....	23	310	462	1	4	13	13	594	-	13	80	-
Michigan .....	164	1,644	489	2	27	13	23	604	-	77	653	-
Wisconsin* .....	36	434	1,122	-	4	6	42	355	1	42	278	-
WEST NORTH CENTRAL ..	8	67	3,566	2	26	36	31	1,075	-	6	102	1
Minnesota .....	-	12	530	1	4	15	-	11	-	-	8	-
Iowa .....	-	10	2,017	-	1	4	3	66	-	2	14	-
Missouri* .....	-	2	348	-	14	12	12	635	-	3	25	-
North Dakota .....	7	16	5	-	-	1	-	4	-	-	2	-
South Dakota .....	-	-	10	-	2	4	-	4	-	-	16	-
Nebraska* .....	-	-	85	-	-	-	-	6	-	-	-	-
Kansas* .....	1	27	571	1	5	-	16	349	-	1	37	1
SOUTH ATLANTIC .....	121	1,742	1,057	16	202	124	13	281	4	72	332	2
Delaware .....	-	4	18	-	-	1	-	19	-	1	2	-
Maryland .....	-	1	121	-	8	9	1	38	-	-	1	1
District of Columbia ..	-	-	2	-	1	-	-	-	-	-	1	-
Virginia* .....	69	1,216	594	3	29	6	-	49	-	16	121	-
West Virginia .....	19	268	44	-	5	7	5	51	1	9	119	-
North Carolina .....	-	40	17	2	43	34	1	31	1	42	62	-
South Carolina .....	11	126	74	1	15	10	1	10	-	1	5	-
Georgia .....	-	5	178	3	27	23	-	8	2	-	1	-
Florida .....	22	82	9	7	74	34	5	75	-	3	20	1
EAST SOUTH CENTRAL ..	51	524	348	5	58	61	15	428	2	9	107	1
Kentucky .....	2	52	98	-	11	17	4	78	1	1	33	1
Tennessee .....	49	384	235	1	19	15	5	219	1	8	55	-
Alabama .....	-	1	4	1	15	20	5	116	-	-	4	-
Mississippi .....	-	87	11	3	13	9	1	15	-	-	15	-
WEST SOUTH CENTRAL ..	69	496	1,031	6	94	125	55	615	-	44	308	5
Arkansas .....	-	1	11	-	10	7	32	104	-	-	4	1
Louisiana .....	15	249	55	3	27	60	-	30	-	30	175	1
Oklahoma .....	-	8	41	-	8	2	-	4	-	-	3	-
Texas* .....	54	238	924	3	49	56	23	477	-	14	126	3
MOUNTAIN .....	30	81	1,407	-	11	12	12	94	6	4	56	-
Montana .....	26	55	672	-	1	2	-	7	2	-	7	-
Idaho .....	-	1	27	-	1	1	1	16	-	-	3	-
Wyoming .....	-	-	1	-	-	-	-	-	-	-	-	-
Colorado .....	4	11	314	-	2	1	1	28	-	1	10	-
New Mexico .....	-	-	193	-	2	2	-	7	4	-	2	-
Arizona* .....	-	9	154	-	3	5	-	2	-	2	19	-
Utah .....	-	1	3	-	1	-	10	32	-	1	14	-
Nevada .....	-	4	43	-	1	1	-	2	-	-	1	-
PACIFIC .....	23	291	3,898	7	110	71	27	339	8	35	436	-
Washington .....	-	32	228	-	17	11	6	102	1	1	56	-
Oregon .....	12	77	84	-	4	6	3	35	3	4	35	-
California .....	11	176	3,530	7	85	40	17	191	4	30	343	-
Alaska .....	-	1	55	-	3	13	-	4	-	-	1	-
Hawaii .....	-	5	1	-	1	1	1	7	-	-	1	-
Guam .....	NA	1	3	-	-	-	NA	1	NA	NA	-	-
Puerto Rico .....	9	63	249	-	-	-	64	347	-	1	4	1
Virgin Islands* .....	NA	5	6	-	-	-	NA	-	NA	NA	-	-

NA: Not available

†Delayed reports received for 1977 are not shown below but are used to update last year's weekly and cumulative totals.

\*The following delayed reports will be reflected in next week's issue: Measles: N.H. +2, Pa. +1, Ohio -1, Wis. -1, Nebr. +1, Kans. -1, Va. -1, Tex. +1, Ariz. -4, V.I. +1; Men. inf.: N.H. +1, N.J. +1, Ohio -1, Mo. -1, Va. -1; Mumps: Pa. +1; Pertussis: Va. -1; Rubella: N.H. +17, N.J. -2, Tex. -1, V.I. +1

Table III-Continued  
Cases of Specified Notifiable Diseases: United States  
Weeks Ending April 1, 1978 and April 2, 1977 - 13th Week

REPORTING AREA	TUBERCULOSIS		TULA- REMIA	TYPHOID FEVER		TYPHUS-FEVER TICK-BORNE (RMSF)		VENEREAL DISEASES (Civilian Cases Only)						RABIES IN ANIMALS
	1978	CUM. 1978	CUM. 1978	1978	CUM. 1978	1978	CUM. 1978	GONORRHEA		SYPHILIS (Pri. & Sec.)			CUM. 1978	
								CUMULATIVE		1978	CUMULATIVE			
								1978	1977†		1978	1977†		
UNITED STATES	643	6,814	16	12	104	1	11	16,534	225,187	231,266	369	5,014	5,449	596
NEW ENGLAND	22	214	-	7	31	-	-	346	5,357	5,979	13	155	194	29
Maine	5	14	-	-	-	-	-	24	410	510	1	3	7	28
New Hampshire	-	7	-	-	5	-	-	23	276	229	-	1	-	-
Vermont	1	10	-	-	-	-	-	18	146	154	-	-	3	-
Massachusetts*	13	118	-	7	17	-	-	123	2,190	2,581	6	98	143	1
Rhode Island	-	15	-	-	4	-	-	33	377	444	1	4	2	-
Connecticut*	3	50	-	-	5	-	-	125	1,958	2,061	5	49	39	-
MIDDLE ATLANTIC	152	1,167	1	1	13	1	4	1,837	25,142	25,894	63	655	796	12
Upstate New York	-	148	1	-	3	1	2	411	3,905	3,654	8	42	65	12
New York City	38	486	-	1	7	-	-	781	10,087	11,864	35	456	496	-
New Jersey	33	293	-	-	1	-	-	199	4,536	3,778	10	77	111	-
Pennsylvania*	81	240	-	-	2	-	2	446	6,614	6,598	10	80	124	-
EAST NORTH CENTRAL	97	985	-	-	5	-	-	2,343	31,234	34,278	18	507	613	21
Ohio*	7	184	-	-	1	-	-	696	8,316	9,134	10	94	160	-
Indiana	12	141	-	-	-	-	-	NA	3,320	2,786	NA	28	38	3
Illinois	46	354	-	-	1	-	-	781	8,960	11,363	3	326	329	1
Michigan	28	261	-	-	3	-	-	569	7,596	7,733	5	45	62	-
Wisconsin*	4	45	-	-	-	-	-	297	3,042	3,262	-	14	24	17
WEST NORTH CENTRAL	25	218	7	-	4	-	-	794	11,205	12,076	11	118	126	172
Minnesota	2	48	-	-	-	-	-	166	2,143	2,118	6	47	40	63
Iowa*	5	27	-	-	2	-	-	99	1,361	1,473	2	11	9	35
Missouri	4	73	6	-	2	-	-	236	4,263	5,000	-	31	41	19
North Dakota	2	14	-	-	-	-	-	15	268	193	2	2	2	28
South Dakota	9	27	-	-	-	-	-	33	430	318	-	1	1	18
Nebraska	1	3	-	-	-	-	-	73	875	1,017	-	3	15	-
Kansas	2	26	1	-	-	-	-	172	1,865	1,957	1	23	18	9
SOUTH ATLANTIC	127	1,540	2	-	6	-	4	3,747	53,997	55,799	114	1,367	1,549	63
Delaware	-	8	-	-	-	-	-	65	902	681	-	3	12	-
Maryland	18	278	1	-	-	-	-	216	7,216	6,896	4	97	104	-
District of Columbia	11	85	-	-	-	-	1	277	3,525	3,679	7	117	164	-
Virginia	19	169	-	-	1	-	-	452	5,020	5,789	11	124	151	1
West Virginia	2	64	-	-	-	-	-	59	830	758	-	4	1	1
North Carolina*	21	249	-	-	-	2	325	7,126	8,594	5	109	218	-	
South Carolina	11	124	-	-	-	-	349	5,035	5,078	5	63	76	5	
Georgia	11	184	-	-	-	1	1,007	10,453	10,714	28	324	284	46	
Florida*	34	379	1	-	5	-	997	13,890	13,610	54	526	539	10	
EAST SOUTH CENTRAL	33	672	3	-	1	-	1	950	18,987	19,662	18	232	187	28
Kentucky	17	149	-	-	1	-	199	2,183	2,753	3	25	19	19	
Tennessee	4	193	3	-	-	-	1	483	7,162	7,778	5	85	54	5
Alabama	5	156	-	-	-	-	-	-	5,434	5,483	-	29	37	4
Mississippi	7	174	-	-	-	-	-	268	4,208	3,648	10	93	77	-
WEST SOUTH CENTRAL	66	762	2	1	4	-	1	2,603	32,040	29,721	42	787	679	166
Arkansas*	8	78	2	-	-	-	-	291	2,452	2,321	-	41	18	26
Louisiana	6	158	-	-	-	-	-	487	5,193	4,027	12	164	141	3
Oklahoma*	9	96	-	-	-	-	-	206	2,832	2,695	3	28	18	43
Texas*	43	430	-	1	4	-	1	1,619	21,563	20,678	27	554	502	94
MOUNTAIN	21	188	-	2	9	-	-	697	8,490	9,403	14	109	113	4
Montana	-	17	-	-	-	-	-	40	516	488	-	6	-	-
Idaho	2	10	-	-	5	-	-	28	292	474	-	-	2	-
Wyoming	-	4	-	-	-	-	-	18	195	278	-	3	2	-
Colorado	5	5	-	2	2	-	-	196	2,327	2,435	2	33	34	-
New Mexico	3	35	-	-	-	-	-	71	1,166	1,427	9	31	24	3
Arizona	4	93	-	-	-	-	-	166	2,174	2,585	1	23	45	1
Utah	2	9	-	-	1	-	-	62	522	539	-	3	4	-
Nevada	5	15	-	-	1	-	-	116	1,298	1,177	2	10	2	-
PACIFIC	100	1,068	1	1	31	-	1	3,217	38,735	38,454	76	1,084	1,192	101
Washington	15	34	-	-	1	-	-	167	2,629	2,816	NA	26	49	-
Oregon	3	46	-	-	1	-	-	179	2,711	2,757	2	32	43	-
California	72	831	1	1	29	-	1	2,671	31,408	30,851	68	1,009	1,083	99
Alaska	-	16	-	-	-	-	-	104	1,237	1,231	1	5	6	2
Hawaii	10	141	-	-	-	-	-	96	750	799	5	12	11	-
Guam	NA	14	-	NA	-	NA	-	NA	36	80	NA	-	1	-
Puerto Rico*	7	114	-	-	-	-	-	68	667	762	14	106	146	4
Virgin Islands*	NA	-	-	NA	-	NA	-	NA	44	35	NA	4	1	-

NA: Not available

† Delayed reports received for 1977 are not shown below but are used to update last year's weekly and cumulative totals.

\* The following delayed reports will be reflected in next week's issue: TB: Pa. +22, Ohio -1, Iowa +1, N.C. -1, Fla. -1, V. I. +1; Typhoid fever: Mass. -2; GC: Mass. +376 civ., Conn. -17 civ. +17 mil., Wis. -1 civ., Okla. +80 mil., V.I. +11 civ.; Syphilis: Mass. +11, Ark. -13, Tex. -1.

**Table IV**  
**Deaths in 121 United States Cities\***  
*Week Ending April 1, 1978 - 13th Week*

REPORTING AREA	ALL CAUSES					Pneumonia and Influenza ALL AGES	REPORTING AREA	ALL CAUSES					Pneumonia and Influenza ALL AGES
	ALL AGES	65 Years and Over	45-64 Years	25-44 Years	Under 1 Year			ALL AGES	65 Years and Over	45-64 Years	25-44 Years	Under 1 Year	
<b>NEW ENGLAND</b>	683	453	158	35	18	39	<b>SOUTH ATLANTIC</b>	1,244	748	319	84	54	63
Boston, Mass.	163	101	37	11	9	10	Atlanta, Ga.	131	77	38	10	4	7
Bridgeport, Conn.	38	27	9	2	-	2	Baltimore, Md.	240	150	62	11	6	3
Cambridge, Mass.	23	17	6	-	-	2	Charlotte, N. C.	48	29	11	4	3	3
Fall River, Mass.	29	22	6	-	-	1	Jacksonville, Fla.	103	59	27	9	-	7
Hartford, Conn.	63	39	19	2	1	3	Miami, Fla.	121	76	30	8	5	8
Lowell, Mass.	33	25	4	4	-	2	Norfolk, Va.	54	25	17	5	6	1
Lynn, Mass.	17	10	5	1	-	-	Richmond, Va.	77	43	24	5	2	7
New Bedford, Mass.	30	21	9	-	-	1	Savannah, Ga.	45	27	11	2	3	3
New Haven, Conn.	65	42	13	3	5	2	St. Petersburg, Fla.	95	84	11	-	-	8
Providence, R.I.	67	45	13	3	2	6	Tampa, Fla.	80	50	19	6	2	5
Somerville, Mass.	8	5	3	-	-	1	Washington, D. C.	204	97	60	20	21	10
Springfield, Mass.	48	31	13	3	-	3	Wilmington, Del.	46	31	9	4	2	1
Waterbury, Conn.	42	29	11	1	-	6							
Worcester, Mass.	57	39	10	5	1	-	<b>EAST SOUTH CENTRAL</b>	766	465	189	63	25	45
<b>MIDDLE ATLANTIC</b>	2,890	1,865	697	173	81	135	Birmingham, Ala.	101	62	24	10	3	2
Albany, N. Y.	53	35	8	1	7	-	Chattanooga, Tenn.	68	46	17	3	2	6
Allentown, Pa.	21	12	2	6	-	-	Knoxville, Tenn.	46	30	13	1	-	1
Buffalo, N. Y.	120	74	29	10	4	9	Louisville, Ky.	111	66	25	9	8	13
Camden, N. J.	31	15	11	3	-	2	Memphis, Tenn.	211	122	61	16	1	3
Elizabeth, N. J.	34	26	6	-	1	-	Mobile, Ala.	73	48	11	8	3	8
Erie, Pa.	43	29	9	3	1	3	Montgomery, Ala.	44	32	4	4	3	4
Jersey City, N. J.	57	36	17	-	2	1	Nashville, Tenn.	112	59	34	12	5	8
Newark, N. J.	66	27	21	8	6	7							
New York City, N. Y.	1,358	878	317	94	34	53	<b>WEST SOUTH CENTRAL</b>	1,295	758	326	93	59	36
Paterson, N. J.	34	22	9	2	1	-	Austin, Tex.	40	20	13	2	1	2
Philadelphia, Pa.	493	305	134	31	11	28	Baton Rouge, La.	49	29	12	6	1	-
Pittsburgh, Pa.	168	122	38	1	4	4	Corpus Christi, Tex.	43	20	10	3	5	-
Reading, Pa.	38	28	9	1	-	1	Dallas, Tex.	192	122	36	17	9	8
Rochester, N. Y.	114	83	23	1	4	8	El Paso, Tex.	71	31	16	12	7	5
Schenectady, N. Y.	27	21	4	2	-	3	Fort Worth, Tex.	91	52	27	5	5	3
Scranton, Pa.	49	31	15	2	-	-	Houston, Tex.	293	155	87	21	15	3
Syracuse, N. Y.	100	64	22	5	5	4	Little Rock, Ark.	61	35	19	2	4	1
Trenton, N. J.	37	23	12	1	1	5	New Orleans, La.	131	83	33	9	-	-
Utica, N. Y.	21	17	2	2	-	4	San Antonio, Tex.	162	96	43	11	4	3
Yonkers, N. Y.	26	17	9	-	-	3	Shreveport, La.	62	46	11	2	2	3
							Tulsa, Okla.	100	69	19	3	6	8
<b>EAST NORTH CENTRAL</b>	2,352	1,404	611	160	96	75	<b>MOUNTAIN</b>	564	316	150	48	21	21
Akron, Ohio	82	49	25	3	3	-	Albuquerque, N. Mex.	82	50	16	12	1	2
Canton, Ohio	45	30	12	2	-	2	Colorado Springs, Colo.	38	20	9	5	1	6
Chicago, Ill.	579	323	155	51	27	12	Denver, Colo.	110	62	33	7	5	2
Cincinnati, Ohio	175	103	51	13	4	5	Las Vegas, Nev.	31	17	11	1	-	3
Cleveland, Ohio	187	111	57	13	4	4	Ogden, Utah	24	14	5	4	-	2
Columbus, Ohio	130	83	33	5	6	10	Phoenix, Ariz.	123	67	35	12	3	3
Dayton, Ohio	100	50	37	7	3	5	Pueblo, Colo.	22	11	5	1	2	3
Detroit, Mich.	258	148	61	21	14	8	Salt Lake City, Utah	52	32	6	2	8	-
Evansville, Ind.	33	24	8	1	-	3	Tucson, Ariz.	82	43	30	4	1	-
Fort Wayne, Ind.	52	31	12	3	6	1							
Gary, Ind.	20	7	7	1	1	-	<b>PACIFIC</b>	1,691	1,091	383	98	60	42
Grand Rapids, Mich.	45	37	4	-	1	2	Berkeley, Calif.	24	16	6	2	-	-
Indianapolis, Ind.	170	97	41	16	8	1	Fresno, Calif.	66	42	12	4	4	1
Madison, Wis.	35	23	5	3	3	5	Glendale, Calif.	17	17	-	-	-	1
Milwaukee, Wis.	122	83	31	2	4	4	Honolulu, Hawaii	78	47	20	6	3	-
Peoria, Ill.	41	27	4	2	7	1	Long Beach, Calif.	89	48	31	3	5	2
Rockford, Ill.	37	29	5	1	2	4	Los Angeles, Calif.	540	359	110	37	14	16
South Bend, Ind.	46	31	11	2	-	5	Oakland, Calif.	69	47	15	2	3	-
Toledo, Ohio	128	74	33	13	2	2	Pasadena, Calif.	37	27	5	1	4	-
Youngstown, Ohio	67	44	19	1	1	1	Portland, Oreg.	140	94	31	3	5	6
							Sacramento, Calif.	66	37	21	4	4	1
<b>WEST NORTH CENTRAL</b>	782	513	185	38	26	46	San Diego, Calif.	141	86	35	10	4	3
Des Moines, Iowa	50	38	7	2	-	1	San Francisco, Calif.	133	79	31	14	4	3
Duluth, Minn.	30	21	5	2	2	5	San Jose, Calif.	50	30	12	3	2	1
Kansas City, Kans.	43	26	12	1	2	2	Seattle, Wash.	149	99	34	7	5	4
Kansas City, Mo.	137	81	48	2	3	7	Spokane, Wash.	50	35	9	1	2	4
Lincoln, Nebr.	35	25	8	2	-	3	Tacoma, Wash.	42	28	11	1	1	-
Minneapolis, Minn.	100	69	17	6	5	6							
Omaha, Nebr.	78	49	14	7	7	1	<b>TOTAL</b>	12,267	7,613	3,018	792	440	502
St. Louis, Mo.	149	89	41	10	5	4	Expected Number	11,676	7,202	3,000	699	420	484
St. Paul, Minn.	83	67	15	-	-	9							
Wichita, Kans.	77	48	18	6	2	8							

\*By place of occurrence and week of filing certificate. Excludes fetal deaths.

The Morbidity and Mortality Weekly Report, circulation 78,000, is published by the Center for Disease Control, Atlanta, Georgia. The data in this report are provisional, based on weekly telegraphs to CDC by state health departments. The reporting week concludes at close of business on Friday; compiled data on a national basis are officially released to the public on the succeeding Friday.

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

Send mailing list additions, deletions, and address changes to: Center for Disease Control, Attn.: Distribution Services, GSO, 1-SB-36, Atlanta, Georgia 30333. When requesting changes be sure to give your former address, including zip code and mailing list code number, or send an old address label.

**Polybrominated Biphenyl Exposure — continued**

Presented at the Toxicology Forum, Washington, D.C., 21 Feb 1978

5. Selikoff IJ, Anderson HA, Wolff MS: Investigation of health effects of PBB exposure among Michigan Chemical Company Workers. Presented at a Workshop on Scientific Aspects of Polybrominated Biphenyls, East Lansing, Michigan, 24-25 Oct 1977

6. Selikoff IJ: Summary report on human health effects of exposure to polybrominated biphenyls. Presented at a Workshop on Scientific Aspects of Polybrominated Biphenyls, East Lansing, Michigan, 24-25 Oct 1977

7. Blum A, Ames BN: Flame-retardant additives as possible cancer hazards. *Science* 195:17-23, 1977

8. Kimbrough RD, Burse VW, Liddle JA: Toxicity of brominated biphenyls. Letter to editor. *Lancet* 2:602-603, 1977

**Antibiotic-Resistant *Neisseria gonorrhoeae* — United States**

During October through December 1977, CDC received 3 resistant gonococcal isolates from 2 patients in different geographical areas of the United States. All 3 isolates were found to be  $\beta$ -lactamase negative. However, they had exceptionally high values for the minimum inhibitory concentration (MIC) of both penicillin (1.0-2.0  $\mu\text{g/ml}$ ) and tetracycline (4.0  $\mu\text{g/ml}$ ) — a finding that prompted a study of isolates collected at CDC to see if high MICs to these drugs is becoming a trend (Table 2).

The first patient was a 19-year-old man with gonococcal urethral discharge who was treated in a local hospital with penicillin capsules on September 7, 1977. Ten days later he was seen in the local venereal disease clinic because of the same symptoms. A Gram stain of urethral discharge was positive for *Neisseria gonorrhoeae*, and he was treated with oral ampicillin, 3.5 gm, and probenecid, 1.0 gm. A culture taken at that time was positive for *N. gonorrhoeae*, and a disc diffusion test for penicillin resistance was positive (zone of inhibition < 20 mm). The patient was lost to follow-up.

The second patient, a 19-year-old women, was referred to a local clinic because she was a contact to a confirmed case of gonorrhea. She gave a history of vaginal discharge for 3 days. In addition she had been treated for 1 year with oral tetracycline, 250 mg per day, for acne. Throat and endocervical cultures were positive for *N. gonorrhoeae*. The

endocervical isolate was resistant on penicillin disc-testing. The patient was treated with spectinomycin, 2gm, and follow-up cultures were negative.

For 5 years (1972-1976), CDC has collected pre-treatment isolates from 10 venereal disease clinics participating in the National Gonorrhea Therapy Monitoring Study, a collaborative study of the efficacy of USPHS-recommended treatment regimens. The antibiotic-susceptibility patterns of these isolates were reviewed to discover how frequently  $\beta$ -lactamase negative, penicillin- and tetracycline-resistant strains of *N. gonorrhoeae* are found in the United States (Table 2). In the individual clinics the prevalence of these strains ranged from 0.06% to 0.67% of all isolates collected. The 5-year average for all the clinics was 0.26%. There has been no increase in the proportion of penicillin-/tetracycline-resistant organisms from 1972-1976.

*Reported by the City of St. Louis Venereal Disease Program; CT Caraway, DVM, State Epidemiologist, and the Communicable Disease Control Sect, Louisiana Dept of Health and Human Resources; Venereal Disease Control Div, Bur of State Services, and Bacteriology Div, Bur of Laboratories, CDC.*

**Editorial Note:** Although the data from the Therapy Monitoring Network indicate that these resistant isolates are extremely rare and that their incidence did not increase through 1976, increased detection can be anticipated because surveillance for penicillinase-producing *N. gonorrhoea* with the disc test on positive post-treatment isolates may also pick up these chromosomally resistant gonococci. Non- $\beta$ -lactamase-producing gonococcal isolates with an MIC to penicillin of  $\geq 1.0 \mu\text{g/ml}$  may have a zone of inhibition of  $\leq 20$  mm if the inoculum is greater than the suggested  $10^8$  CFU/ml.

TABLE 2. Number of isolates resistant to both penicillin (MIC  $\geq 2.0 \mu\text{g/ml}$ ) and tetracycline (MIC  $\geq 2.0 \mu\text{g/ml}$ ), United States, by year, 1972-1976

	1972	1973	1974	1975	1976	Total
Number resistant	3	15	12	1	0	31
Number examined	202	4,069	4,320	2,779	482	11,860
Percent resistant	1.4	0.4	0.3	0.03	0.0	0.26

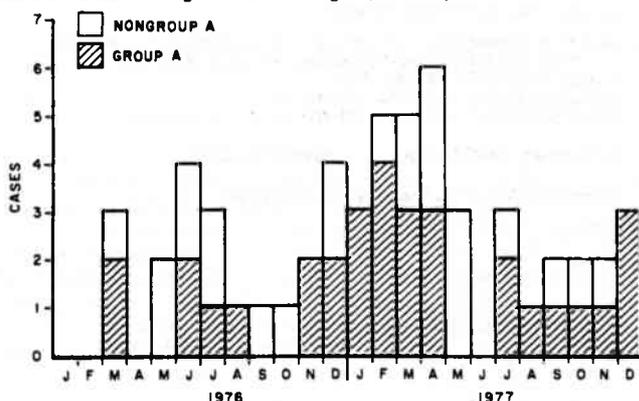
**Meningococcal Meningitis — Alaska, 1976-1977**

Fifty-six cases of meningococcal meningitis occurred in Alaska in 1976 and 1977 (Figure 1) as compared to the previous 5-year average of 6.2 cases per year. Thirty-two of the isolates from cases have been confirmed as group A; the remaining cases were due to groups B (7 cases), C(1), Y(1), W138 (1) and unknown serogroups (14).

Four of the patients died: an 18-month-old, a 2-year-old, a 53-year-old, and a 76-year-old. Two of the deaths were due to group A disease, 1 to group B, and 1 to an unknown serogroup. Only 1 secondary case of meningococcal meningitis (caused by group A meningococcus) occurred. It involved a 5-year-old Native Alaskan child who lived in a remote area and did not receive rifampin prophylactically.

Before March 1976, no cases of type A meningococcal disease had been reported in Alaska in 20 years. Of the 32

FIGURE 1. Meningococcal meningitis, Alaska, 1976-1977



***Meningococcal Meningitis — continued***

patients with group A disease, 23 have occurred in Native Alaskans and 9 in non-Natives. Two groups at increased risk of acquiring group A meningococcal meningitis are Native Alaskan children less than 10 years old (9 cases, 23/100,000/year) and adults with a history of excessive alcohol use (16 cases, 25/100,000/year). The highest attack rate occurred in adult Natives with excessive alcohol use (12 cases, 83/100,000/year). In any given population the normal yearly attack rate is considered to be 3/100,000/year.

In 1976 and 1977, type A meningococcal vaccine was administered in Anchorage and Fairbanks to about 400 members of the alcoholic community. Since that time, only 1 case has occurred in that population, in a 30-year-old Native male who received group A vaccine 1 year prior to the onset of illness with group A disease.

**International Notes****Quarantine Measures**

The following changes should be made in the "Supplement-Health Information for International Travel," MMWR Vol. 26, August 1977:

**MACAO**

Yellow fever — Delete all information. Insert none.

Smallpox — Delete all information. Insert code II >3 mos.

**MALAYSIA**

Yellow fever — Insert: A Certificate is required ALSO from travelers arriving from countries in the endemic zones (see page 60-61).

Smallpox — Delete all information. Insert code II >6 mos. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

**MARTINIQUE**

Smallpox — Delete all information. Insert code II. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

**MAURITIUS**

Smallpox — Delete all information. Insert code II. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

Reported by RI Fraser, MD, JP Middaugh, MD, Acting State Epidemiologist, F Pauls, PhD, Alaska Dept of Health and Social Services; Special Pathogens Br, Bacterial Diseases Div, Bur of Epidemiology, CDC.

**Editorial Note:** The proportion of meningococcal disease in the United States due to group A organisms was 2% in 1975 (1), and that proportion has not increased in the past 2 years. The predominance of group A disease in Alaska (57%) is in marked contrast to this trend but appears to be part of a local phenomenon along the Pacific coast (2,3).

**References**

1. Meningococcal Surveillance Group: Analysis of endemic meningococcal disease by serogroup and evaluation of chemoprophylaxis. J Infect Dis 134:201, 1976
2. MMWR 26:101-102, 1977
3. MMWR 26:225-226, 1977

**MEXICO**

Smallpox — Delete all information. Insert code II. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

**MONACO**

Smallpox — Delete all information. Insert code II. Delete note. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

**NIUE**

Yellow fever — Delete all information. Insert none.  
Smallpox — Under code delete >1 yr. Insert >3 mos.

**PAKISTAN**

Yellow fever — Delete the note. Insert: A Certificate is required ALSO from travelers (irrespective of age) arriving from countries in the endemic zones (see page 60-61).

**PERU**

Smallpox — Delete all information. Insert code II >6 mos. Insert: A Certificate is required ALSO from travelers who within the preceding 14 days have been in a country any part of which is infected.

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