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Donald R. Stern, M.D., M.P.H., Acting Commissioner
Grayson B. Miller, Jr., M.D., Epidemiologist

Editor: Elizabeth Eustis Turf, Ph.D.
Layout Editor: Vickie L. O'Dell

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The Epidemiology of Meningococcal Disease in Virginia

An increase nationally in serogroup C meningococcal disease over the last decade and an increase in outbreaks due to this serogroup have recently been reported (1,2). In addition, the public and the media have focused attention on cases of serogroup C meningococcal disease occurring in Virginia this year (see box on page 3). The following data are based on the analysis of cases of meningococcal disease reported in Virginia from 1986-1994. These years were selected because the data are contained in a computerized database and were thus readily available for analysis.

During the nine years analyzed, 506 cases of meningococcal disease were reported in Virginia, for an average of 56 cases per year. The annual number of cases ranged from 32 in 1991 to 82 in 1989 (Figure 1). Serogroup was not reported for 207 cases (40.9%). Of those for whom serogroup was determined, serogroup B was the most common (144 cases, 28.5%), followed by serogroup C (117 cases, 23.1%). Serogroups Y (21 cases), W135 (12 cases), A (3 cases), and Z (2 cases) were responsible for a total of only 7.5% of all cases.

No clear increase or decrease is discernible in cases of serogroup C infections during the nine year period. Between 1986 and 1989 an average of 16.3 serogroup C infections were reported per year. That number dropped to 8.0 per year during 1990-1993. In 1994, the total increased to 20 cases due to this serogroup (Figure 1).

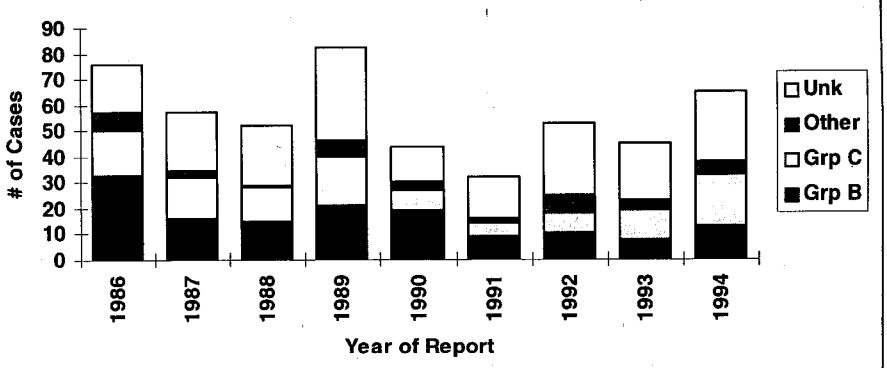
The predominant serogroup varied by age of the patient (Table 1). In infants (<1 year), serogroup B was by far the most commonly identified serogroup (47 cases, 43.9%), while serogroup C accounted for 13 cases (12.1%) and serogroups A and Y for 3 cases (2.8%) in the past nine years. In no other age group analyzed was the difference in the proportion of serogroup B to C infections so notable. School age children were equally likely to be infected with serogroups B or C meningococci.

Meningococcal infections resulted in meningococcemia in 216 cases (42.7%), meningitis in 183 (36.2%), and both meningococcemia and meningitis in 106 cases (20.9%) (Table 1). Cases ranged in age from less than one to 89 years, with a median of 10. The most commonly affected age group was infants, who accounted for 107 cases (21.2%). With all age groups combined, cases were evenly divided between males and females. More males than females were reported with meningococcal disease in the youngest three age groups; that ratio was reversed in adults.

February was the most often reported month of onset (73 cases, 14.7%), followed by March (63 cases, 12.7%). Quarter of the year in which onset of disease occurred is presented in Table 1. After infancy, onset in each age group was most common in the first quarter of the year.

A total of 48 persons died from meningococcal disease between 1986 and 1994 (Table 2). Half of these persons were younger than age 17.5. Patients from whom *N. meningitidis* was isolated from both the blood and the cerebrospinal fluid were at greatest risk of death (15/106, 14.1%), compared to those with septicemia (20/216, 9.3%) or meningitis (13/183, 7.1%) alone. Case fatality did not appear to vary by serogroup; 9.7% of serogroup B infections resulted in death compared to 8.5% of serogroup C and 7.9% of the remaining serogroups.

Figure 1. Number of Cases of Meningococcal Disease by Year and Serogroup, Virginia, 1986-1994



In This Issue:

Over half of the deaths (26 deaths, 54.2%) occurred in cases with onset during the months of January through March for a case fatality rate of 13.7% in cases with onset during that quarter of the year. Case fatality was less than ten percent for cases with onset in the other three quarters of the year. Analysis of risk of death by age demonstrated that the fatality rate was highest in cases that experienced onset during the first quarter for infants and adults, but was greater for cases occurring later in the year for young and school age children.

Virginia's experience with serogroup C meningococcal disease does not follow the pattern reported elsewhere (1,2). However, any assessment of the effect of serogroup is complicated by the large percentage of cases for whom serogroup was not ascertained (see box). Improved serogroup identification is important to the descriptive epidemiology of this disease. In addition, and perhaps more importantly, proper serogroup identification is necessary to identify clusters of cases which may be related and may require more extensive use of chemoprophylaxis or meningococcal vaccine.

Table 1. Characteristics of Reported Cases of Meningococcal Disease by Age, Virginia, 1986-1994

	All Cases		Infants (<1)		Age 1-4		Age 5-19		Age 20+	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Number of Cases	506		107		118		131		147	
Ave. Cases/Yr	56.2		11.9		13.1		14.6		16.3	
Male/Female	1.0:1.0		1.3:1.0		1.2:1.0		1.2:1.0		0.6:1.0	
Serogroup										
B	144	*28.5*	47	*43.9*	28	*23.7*	40	*30.5*	28	*19.0*
C	117	*23.1*	13	*12.1*	34	*28.8*	39	*29.8*	30	*20.4*
A/W135/Y/Z	38	*7.5*	3	*2.8*	5	*4.2*	8	*6.1*	22	*15.0*
Unreported	207	*40.9*	44	*41.1*	51	*43.2*	44	*33.6*	67	*45.6*
Clinical Data										
Meningococcemia	216	*42.7*	47	*43.9*	55	*46.6*	49	*37.4*	63	*42.9*
Meningitis	183	*36.2*	38	*35.5*	40	*33.9*	53	*40.5*	51	*34.7*
Both	106	*20.9*	22	*20.6*	23	*19.5*	29	*22.1*	32	*21.8*
Time of Onset										
Jan-Mar	190	*37.5*	33	*30.8*	47	*39.8*	57	*43.5*	53	*36.1*
Apr-Jun	129	*25.5*	34	*31.8*	27	*22.9*	33	*25.2*	33	*22.4*
Jul-Sep	69	*13.6*	13	*12.1*	18	*15.3*	18	*13.7*	19	*12.9*
Oct-Dec	107	*21.1*	26	*24.3*	22	*18.6*	21	*16.0*	38	*25.9*

References:

1. Whalen CM, Hockin JC, Ryan A, and Ashton F. The Changing Epidemiology of Invasive Meningococcal Disease in Canada, 1985 Through 1992, JAMA, 273, Feb. 1, 1995, pp. 390-394.

2. Jackson LA, Schuchat A, Reeves MW, and Wenger JD, Serogroup C Meningococcal Outbreaks in the United States, JAMA, 273, Feb. 1, 1995, pp. 383-389.

Note to Laboratory Directors:

Forty percent of the cases of meningococcal disease reported in the last nine years have no serogroup identified. It is very important that isolates of *Neisseria meningitidis* be forwarded to the state laboratory (Division of Consolidated Laboratory Services, DCLS) for serogrouping. Public health recommendations to protect the community in which cases reside are frequently based on serogroup information. Please help by sending all *N. meningitidis* isolates to DCLS for serogroup identification.

Table 2. Risk of Death in Persons with Meningococcal Disease by Age, Serogroup, Clinical Manifestation, and Time of Onset, Virginia, 1986-1994

	All Cases		Infants (<1)		Age 1-4		Age 5-19		Age 20+	
	No.	Percent*	No.	Percent*	No.	Percent*	No.	Percent*	No.	Percent*
Deaths	48	*9.5*	9	*8.4*	9	*7.6*	7	*5.3*	23	*15.6*
Serogroup										
B	14	*9.7*	4	*8.5*	1	*3.6*	2	*5.0*	7	*25.0*
C	10	*8.5*	0	*0*	4	*11.8*	3	*7.7*	3	*10.0*
Clinical Data										
Meningococcemia	20	*9.3*	4	*8.5*	3	*5.5*	3	*6.1*	10	*15.9*
Meningitis	13	*7.1*	2	*5.3*	1	*2.5*	2	*3.8*	8	*15.7*
Both	15	*14.1*	3	*13.6*	5	*21.7*	2	*6.9*	5	*15.6*
Time of Onset										
Jan-Mar	26	*13.7*	5	*15.2*	4	*8.5*	4	*7.0*	13	*24.5*
Apr-Jun	8	*6.2*	2	*5.9*	1	*3.7*	1	*3.0*	4	*12.1*
Jul-Sep	4	*5.8*	0	*0*	1	*5.6*	2	*11.1*	1	*5.3*
Oct-Dec	10	*9.3*	2	*7.7*	3	*13.6*	0	*0.0*	5	*13.2*

*The denominator for these calculations is total number of cases in that age group with that characteristic. Thus percentages represent case-fatality rates per 100 cases.

Meningococcal Disease, 1995

The public and press have focused much attention on meningococcal infections this year, primarily because three teenage cases were linked together. Two cases competed in the same track meet and a third case occurred in a student who attended the same school as one of the athletes. The first two cases died. All three of these students were infected with serogroup C meningococcus. The last two isolates were further enzyme typed as ET-17 (enzyme typing is pending on the isolate from the first case).

Although the public and the health care community may be hearing more about meningococcal disease this year, no more cases have been reported to date in 1995 than are expected. During the first quarter of 1995, 21 cases were reported, compared to 19 in the first quarter of 1994. An average of 21 cases occurred between January and March in the years 1986-1994. As occurred this year, there were two deaths during the first quarter of last year.

The Virginia Department of Health recommends that close personal contacts of cases receive a two-day, four-dose schedule of rifampin (10 mg/kg every 12 hours) to eliminate nasopharyngeal carriage. Vaccine will be considered in situations in which two or more cases of the same serogroup of meningococcal bacteria arise from the same defined population in which there is ongoing contact for a considerable period of time each day, provided that the serogroup is one that is contained in the vaccine.

Rifampin and vaccine are not generally recommended for entire school populations except in outbreak situations. Anyone wanting advice on preventive measures for meningococcal disease should contact the local health department or the Office of Epidemiology.

Group A Streptococcal Disease Update

Group A streptococci (GAS) cause a variety of illnesses ranging from pharyngitis and impetigo to more serious conditions including cellulitis and invasive GAS infections. While the occurrence of pharyngitis and impetigo is common, the more severe invasive conditions are considered rare. Invasive GAS disease includes strep toxic shock syndrome (STSS), necrotizing fasciitis/myositis, or any infection where group A strep is identified from a normally sterile site, such as blood, joint or peritoneal fluid, or surgical wound.

On January 12, 1995, the epidemiologist with the Central Shenandoah Health District called the Office of Epidemiology regarding three cases of invasive GAS disease that occurred between December 15, 1994, and January 9, 1995. All three cases died within 24 hours of admission to the hospital. When two other hospitals in the district were contacted, three more cases of invasive GAS disease with onset between December 8 and December 28, 1994, were identified. One of these cases had died and two remained hospitalized.

There are no statewide statistics on expected incidence rates for Virginia. Nationally, the Centers for Disease Control and Prevention (CDC) in Atlanta estimate an annual incidence rate of 4 cases of invasive GAS disease / 100,000 persons, with 5-10% of invasive disease cases being necrotizing fasciitis. Using these suggested rates, Central Shenandoah health district (Augusta, Bath, Highland, Rockbridge, Rockingham counties; Staunton, Lexington, Buena Vista, Harrisonburg, Waynesboro; population 250,000) might expect 9-10 cases of invasive GAS per year, with possibly one case of necrotizing fasciitis. Retrospective searching of laboratory records from the three primary hospitals in the district identified the occurrence of six cases of invasive GAS during the 12 month period, December 1, 1993 to November 30, 1994 (Figure).

Since December 8, 1994, there have been 13 cases of severe or invasive group A Strep disease reported to the Central Shenandoah health district. The 13 cases of severe GAS included five cases of STSS, four cases of septicemia, three cases of septicemia accompanied by necrotizing fasciitis/myositis, one peritonitis, one hip abscess, and one deep wound with osteomyelitis. Neither the hip abscess nor the three cases of necrotizing fasciitis/myositis had any evidence of external wound (although one experienced a blunt trauma 12 hours prior to onset).

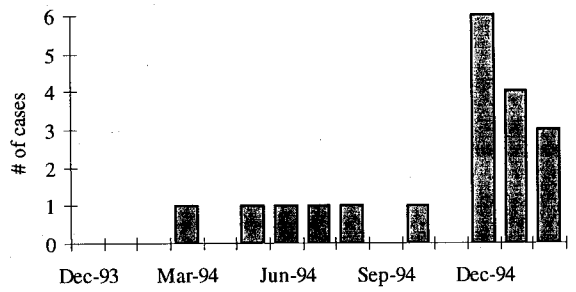
The age range of patients has been 5-83 years. Seven cases were males, six were female. Underlying medical conditions existed in eight of the 13 cases.

Organisms from 12 of the 13 reported cases were available for typing. Seven of the organisms serotyped as M-1, T-1, two were T-12 or T-11/12 (which may be the same strain), one was a T-3/13/B3264, one was a T-5/27/44 and one was non-typeable. The M-1, T-1 infections included three STSS (two with necrotizing fasciitis/myositis), one necrotizing fasciitis with septicemia, two cases of septicemia and one case of peritonitis. Five of the seven cases infected with the M-1,T-1 strain died (fatality rate = 71%). Evidence indicates that the M-1,T-1 strain has been increasing in incidence since 1970 and is associated with invasive infections.

To determine the prevalence of M-1,T-1 GAS carriage in Central Shenandoah, isolates from persons in the community diagnosed with strep throat and randomly selected community controls were T typed. Since the T-1 antigen migrates with the M-1 antigen, organisms that typed as T-1 were assumed to be M-1. Fifteen of 47 (31.9%) throat isolates from persons with pharyngitis subtyped as T-1. Only 7.9% of community controls had GAS in their throats and none were T-1.

During this outbreak, when a case in the surveillance area was identified, it was recommended that throat cultures be performed on all household / family members and any other close contacts. There is some evidence indicating that family members of a case of invasive disease are at a higher risk for invasive disease than the general population. Therefore, if GAS was identified in the throat of contacts, treatment was recommended.

Number of Cases of Invasive GAS, by Month, Central Shenandoah, 12/1993-2/1995



Information on Group A Streptococcus for Medical Care Providers

Disease Spectrum

Pharyngitis, impetigo, cellulitis and pyoderma are common manifestations of Group A Streptococcal (GAS) infections. Scarlet fever or scarlatina occurs less often. Serious invasive GAS, which occurs less commonly, is defined by isolation of the bacteria from usually sterile sites. Such infections include necrotizing fasciitis, streptococcal toxic shock syndrome (STSS), bacteremia, lymphangitis, and puerperal sepsis.

Nonsuppurative sequelae can occur 1 to 5 weeks after the initial infection, especially if antibiotic treatment was absent or inadequate. These complications include acute rheumatic fever and acute glomerulonephritis.

Incidence

Studies conducted in the late 1980s indicate that severe GAS infections are becoming more common. Based on surveillance data from 1990, the Centers for Disease Control and Prevention (CDC) estimates that 10,000 to 15,000 severe infections occur in the US each year, resulting in 2,000 to 3,000 deaths annually. Intensive surveillance in the U.S. for severe group A streptococcal infections has not been conducted since 1991.

The Maryland Department of Health and Mental Hygiene cooperated with Maryland hospitals in active surveillance for GAS bloodstream infections in 1989-1990. There were 155 cases reported, 20% of which were fatal; four cases of necrotizing fasciitis were reported. Ten of the 155 cases occurred in children.

Invasiveness/Virulence

Both the strain of streptococcal organism and host susceptibility likely play a role in determining the severity of GAS infection. Investigation of family clusters shows that the same strain of bacteria can cause severe infection in one family member and mild or asymptomatic disease in others.

GAS strains

Data suggest that certain GAS strains are more likely to be associated with severe disease. Isolates of GAS can be serotyped and tested for the production of pyrogenic exotoxins and protease activity. Serotypes M-1 and M-3, and isolates that have protease activity and produce pyrogenic exotoxin are most commonly associated with invasive GAS disease in a susceptible host. Production of proteases is one factor that may be linked to necrotizing fasciitis.

Treatment

Penicillin remains the treatment of choice for GAS infections. No penicillin resistant organisms have been identified, although some strains are resistant to erythromycin (recommended as therapy in penicillin-allergic patients). Anecdotal reports suggest that the addition of clindamycin may be more effective than penicillin alone in toxin-mediated infection (CDC, personal communication). However, because of potential resistance to clindamycin, a beta-lactam antibiotic should be used in association with clindamycin. The Communicable Disease Surveillance Center, Public Health Laboratory Action Group in England (May 27, 1994) endorsed immediate treatment of all clinically suspected cases of invasive streptococcal disease with benzylpenicillin, (2.4 g at 4 hourly intervals). Clindamycin (0.6-1.2 g at 6 hourly intervals) should be considered as additional treatment in severe cases (with reductions in dosage for children and adherence to appropriate contraindications).

Recently, investigators in Canada have reported improved outcomes in GAS STSS patients when treated with intravenous immunoglobulin (IVIG). For more information, contact the Office of Epidemiology (804-786-6263).

Contacts of Invasive GAS Cases

Unpublished data indicate that the rate of invasive infection for family members of cases may be 200 times that of the general population. Throat cultures, as well as cultures of any lesions that might be present, may be considered in persons who are direct intimate or household contacts of invasive GAS cases, particularly if the contacts have severe underlying illness. Culture-positive persons should be treated. More data on risk of invasive disease in contacts are needed before further recommendations can be made.

The recommended therapy for contacts who are culture positive is penicillin for ten days. Several forms of penicillin are acceptable: benzathine penicillin G IM, a mixture of benzathine and procaine penicillin or oral penicillin V. Rifampin (20 mg/kg/day, maximum 600 mg/day) should be given concurrently for the last four days of therapy to eliminate carriage of the organism (J Pediatr 106:481,1985; CDC, personal communication). Other effective regimens include a 10-day course of clindamycin or a cephalosporin, such as cefadroxil or cefpodoxime. Neither rifampin alone, nor cefixime is adequate to eradicate the organism.

Infection Control

An invasive strain of GAS that is circulating in the community can easily be introduced into a hospital, nursing home, or other institutional population. To prevent transmission of such an organism, infection control procedures (contact isolation) should be strictly adhered to, including changing gloves between contacts with patients, meticulous attention to hand washing, and staying home from work when symptoms of respiratory or skin infection occur.

Cases of Selected Notifiable Diseases, Virginia, December 1 through December 31, 1994.*

Disease	Total Cases Reported This Month						Total Cases Reported to Date in Virginia		
		Regions							
	State	NW	N	SW	C	E	This Yr	Last Yr	5 Yr Avg
AIDS	180	6	23	17	38	96	1200	1634	828
Campylobacteriosis	82	21	16	17	20	8	825	706	658
Gonorrhea†	1289	-	-	-	-	-	13856	12144	16113
Hepatitis A	17	4	7	3	1	2	192	156	229
Hepatitis B	20	2	9	4	2	3	142	157	234
Hepatitis NANB	1	0	0	0	1	0	26	54	51
Influenza	40	0	1	39	0	0	923	1363	1190
Kawasaki Syndrome	1	0	1	0	0	0	23	31	26
Legionellosis	5	3	0	2	0	0	13	11	17
Lyme Disease	5	0	3	1	0	1	131	95	110
Measles	0	0	0	0	0	0	3	4	32
Meningitis, Aseptic	43	2	7	3	5	26	337	343	384
Meningitis, Bacterial‡	10	4	1	2	0	3	83	105	140
Meningococcal Infections	3	1	0	2	0	0	68	52	57
Mumps	7	1	0	2	0	4	48	40	80
Pertussis	0	0	0	0	0	0	36	75	36
Rabies in Animals	31	9	6	5	7	4	428	387	293
Reye Syndrome	0	0	0	0	0	0	1	3	2
Rocky Mountain Spotted Fever	2	0	0	0	1	1	21	14	21
Rubella	0	0	0	0	0	0	0	0	0
Salmonellosis	109	13	19	22	33	22	1138	1055	1253
Shigellosis	43	3	17	2	15	6	661	776	396
Syphilis,†	78	0	2	5	3	68	810	663	764
Tuberculosis	75	5	36	11	5	18	376	458	401

Localities Reporting Animal Rabies: Accomack 3 raccoons; Amelia 1 raccoon, 1 skunk; Augusta 2 skunks; Bath 1 cat; Botetourt 1 skunk; Campbell 1 skunk; Charlotte 1 raccoon; Chesterfield 1 raccoon; Cumberland 1 raccoon; Fairfax 3 raccoons; Fauquier 2 skunks; Franklin County 1 raccoon; Giles 1 skunk; Gloucester 1 raccoon; Halifax 1 skunk; Loudoun 3 raccoons; Louisa 2 skunks; Madison 1 raccoon; Mecklenburg 1 skunk; Rockbridge 1 skunk; Wythe 1 cow.

Occupational Illnesses: Asbestosis 19; Carpal Tunnel Syndrome 55; Coal Workers' Pneumoconiosis 11; De Quervain's Syndrome 1; Lead Poisoning 1; Loss of Hearing 17.

*Data for 1994 are provisional.

†Total now includes military cases to make the data consistent with reports of the other diseases.

‡Other than meningococcal.

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Cases of Selected Notifiable Diseases, Virginia, January 1 through January 31, 1995.*

Disease	Total Cases Reported This Month						Total Cases Reported to Date in Virginia		
		Regions							
	State	NW	N	SW	C	E	This Yr	Last Yr	5 Yr Avg
AIDS	51	11	1	7	14	18	51	100	63
Campylobacteriosis	15	2	6	3	2	2	15	15	27
Gonorrhea	887	41	100	129	270	347	887	1272	1228
Hepatitis A	18	0	1	1	15	1	18	1	5
Hepatitis B	8	0	3	2	2	1	8	5	12
Hepatitis NANB	0	0	0	0	0	0	0	2	2
Influenza	40	15	3	16	5	1	40	445	267
Kawasaki Syndrome	0	0	0	0	0	0	0	0	1
Legionellosis	0	0	0	0	0	0	0	2	1
Lyme Disease	0	0	0	0	0	0	0	0	2
Measles	0	0	0	0	0	0	0	0	1
Meningitis, Aseptic	12	0	3	0	0	9	12	4	9
Meningitis, Bacterial†	9	2	2	1	0	4	9	1	5
Meningococcal Infections	1	1	0	0	0	0	1	4	3
Mumps	2	0	0	1	0	1	2	0	3
Pertussis	0	0	0	0	0	0	0	3	1
Rabies in Animals	19	3	3	4	9	0	19	19	16
Reye Syndrome	0	0	0	0	0	0	0	0	0
Rocky Mountain Spotted Fever	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0
Salmonellosis	70	7	20	8	17	18	70	40	65
Shigellosis	9	0	4	0	1	4	9	30	14
Syphilis,‡	91	0	2	12	9	68	91	50	56
Tuberculosis	0	0	0	0	0	0	0	0	18

Localities Reporting Animal Rabies: Augusta 1 cow, 1 raccoon; Bland 1 raccoon; Campbell 1 skunk; Chesterfield 2 raccoons; Dinwiddie 1 raccoon; Fairfax 2 raccoons, 1 skunk; Lunenburg 1 raccoon, 1 skunk; Mecklenburg 2 skunks; Pittsylvania 1 raccoon; Prince Edward 1 raccoon, 1 skunk; Pulaski 1 skunk; Rockbridge 1 skunk.

Occupational Illnesses: Asbestosis 31; Carpal Tunnel Syndrome 37; Coal Workers' Pneumoconiosis 17; Lead Poisoning 8; Loss of Hearing 15; Silicosis 1.

*Data for 1995 are provisional.

†Other than meningococcal.

‡Includes primary, secondary, and early latent.

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