Recent Trends in Meningococcal Disease

By ARTHUR W. HEDRICH, Sc.D

The incidence and mortality of meningococcal disease have been slowly rising after a 5-year decline from the 1943–44 epidemic.

Another trend observed in the civilian population is the appreciable rise in the apparent case fatality. Since modern therapy should have reduced the ratio of deaths to recorded cases, indications are that case reporting has deteriorated in recent years.

Data are given here to support these observations, to aid in gauging epidemic potential, and particularly to indicate population segments which appear to be at especial risk.

General Epidemiological Characteristics

The term "meningococcal disease," used at times in this report, includes various clinical forms of the infection, such as meningitis, meningococcemia, and milder forms of invasion.

Bacteriological Types

The bacteriology of the meningococcus is complex, and classifications and viewpoints have changed considerably. The many different strains of the organism are now commonly classed into three major groups. Type I apparently predominates during heavy epidemics, and types II and IIA, endemically (*3a*, *16*). This raises the question whether publication of current national summaries of types found in State and local diagnostic laboratories might be of value to epidemiologists during the present rising phase of the disease.

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Perry (*15*) advises that in Maryland too few specimens are offered nowadays for diagnostic purposes. However, all of the 14 positives received from 1942–46 (including the epidemic) were type I; of the 7 positives received subsequently (1947–51), only 1 was type I; 3 were type II, and 3 were type IIA.

Clinical Types and Carriers

Three clinical stages of the disease are: (*a*) nasopharyngeal infection, which is normally asymptomatic and extremely difficult to detect; (*b*) invasion of the blood stream (septicemia); and (*c*) meningitis. The nasopharyngeal infections, although unquestionably the major source of new cases, are rarely recorded. Practically all of the reported cases are septicemias and meningitis.

Nasopharyngeal infections are extremely common during epidemics. In Army camps, prevalence of asymptomatic carriers may run from 30 to 50 percent or more of the strength (*2*, *3*, *6*); and even in civilian communities prevalence of meningococcal carriers has been found to be as high as 30 percent. This means that meningococcal infection during epidemics may be about as prevalent as the common cold. Hence, it has been said that "the recognized cases constitute merely the visible foam on top a huge carrier wave" (*6*). Even during endemic periods in the civilian population, meningococci may be found in the rhinopharynx in about 2 percent of the healthy persons.

It has been estimated that possibly as few as 1 per 1,000 subclinical infections develop into frank cases with septicemia or meningitis (*1, 7b*).

Fulminating Cases

Although the sulfa drugs and antibiotics have been effective therapeutic agents, the following recent incidents among others (*3, 14*) illustrate the problem of obtaining prompt diagnosis and treatment in fulminating cases.

1. Dr. A. L. Gray, Mississippi State Board of Health, recently reported (*12a*) four deaths from meningococcal disease within about a month among Negroes in a rural neighborhood. Duration of illness was 8 to 16 hours. One death certificate gave "bronchial pneumonia" as the cause of death, but on autopsy this was changed to meningococcal septicemia. A second death certificate reported "no doctor."

2. Dr. James Strain advises the writer that during his 2-year residency in Cleveland hospitals in 1948–49, some 8 to 10 children with previous diagnoses of measles, then heavily prevalent in the city, arrived at the emergency wards in moribund condition or dead. Postmortem blood cultures in these cases revealed meningococci.

Age, Race, and Sex

The reported case rate for infants is four or more times higher than for school children and adults (table 1 and fig. 1). In measles the opposite is true, the attack rate at ages 6 and 7 being fully four times higher than in infancy (*8*).

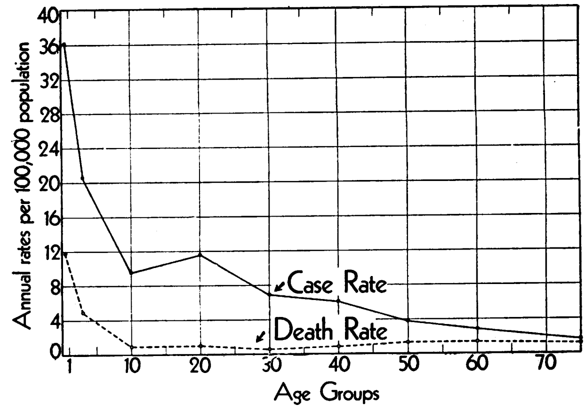

Figure 1. Reported case and death rates for meningococcal meningitis by age, Maryland 1940–49.

Obviously, some form of immunity to effective meningococcal invasion is commonly developed early in life.

At ages 15–24, the hump seen in the case rate curve of figure 1 is probably attributable mainly to the excess of cases reported from Maryland induction camps during World War II. Other data (*14*), however, indicate that during epidemics the attack rate among adults in Maryland is generally stepped up from 3 to 10 times more sharply than the rate for infants. In other words, although infants are always the most vulnerable group, in epidemic periods adults have the highest increase in reported case rates.

The apparent case fatality (ratio of deaths to reported cases) during a 10-year period is

Table 1. Age distribution of morbidity, mortality, and apparent case fatality for meningococcal meningitis, Maryland 1940–49

Age group (years)	Numbers			Annual rates per 100,000 population		Apparent case fatality [1] (percent)
	Reported cases	Deaths	Mean population	Reported cases	Deaths	
All ages	1, 787	310	2, 082, 622	8. 6	1. 5	17. 3
Under 1	160	52	44, 180	36. 2	11. 8	32. 5
1–4	317	76	153, 755	20. 6	4. 9	24. 0
5–14	320	32	332, 259	9. 6	1. 0	10. 0
15–24	393	34	337, 849	11. 6	1. 0	8. 7
25–34	250	23	360, 102	6. 9	. 6	9. 2
35–44	187	27	306, 917	6. 1	. 9	14. 4
45–54	91	32	240, 001	3. 8	1. 3	35. 2
55–64	46	18	164, 007	2. 8	1. 3	39. 1
65 and over	23	16	143, 552	1. 6	1. 1	69. 6

[1] Apparent case fatality is the ratio of deaths to reported cases.

relatively high in infancy and in late life, and lowest in the second and third decades of life (fig. 2 and table 1).

Data from an unpublished thesis of J. H. Fan (*10*, *14*) indicated that during 1930–41: (*a*) males had about double the attack rate of females, the excess being slightly greater in Baltimore City than in the counties; and (*b*) the attack rate among Negroes in Baltimore City was about 3.7 times as high as the rate for white persons. In the counties of Maryland, it was only about 2.1 times as high. The correlation of high attack rates with crowding suggests that congested living conditions may be primarily responsible for the high attack rate among the Negroes.

Role of Population Crowding

It has long been recognized that meningitis spreads most rapidly at times and places of population congestion, where contact rates are high, as in war camps and institutions. Military authorities found in World War I that increasing the space between beds in barracks decreased the meningitis attack rate (*6*).

In Baltimore City, attack rates in the most crowded areas averaged about seven times the rates in the least crowded during two epidemics (fig. 3 and table 2). In fact, during the 1935–37 epidemic, this ratio of attack rates of crowded/uncrowded was 12.5.

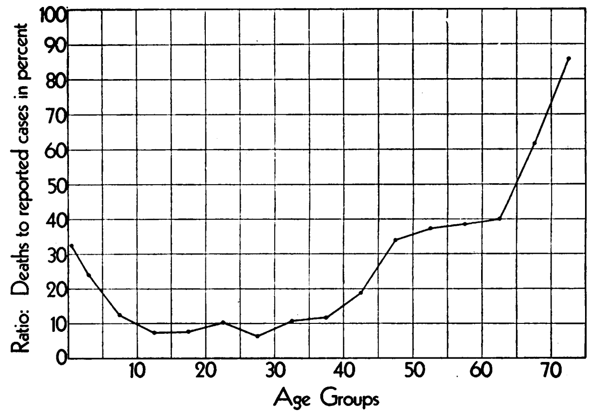

Figure 2. Apparent case fatality for meningococcal meningitis by age, Maryland 1940–49.

Rural areas also showed low rates. In 1942, the latest epidemic year Fan (*10*) could include in his study, the incidence rate for meningitis was only 5.0 per 100,000 population in the 9 counties with less than 60 persons per square mile, compared with a rate of 12.7 for suburban districts of Baltimore, and 23.1 for "Old Baltimore City" which has 26,000 persons per square mile.

It is important to recognize that in Maryland, at least, the excess risk for the city applied especially to epidemic periods. Table 3 shows that although, during recent epidemic periods, the death rates in Baltimore averaged 2.6 times more than the rates for the rest of Maryland,

Table 2. Relation of population congestion to reported meningococcal meningitis morbidity in Baltimore, Md., 1935–37 and 1941–42 epidemics [1]

Percent of overcrowded [1] dwelling units within area	Number of census tracts	1935–37 epidemic [2]			1941–42 epidemic [2 3]			Average of case rates of 2 epidemics
		Estimated population July 1, 1936	Number of reported cases	Average annual case rate [4]	Estimated population Jan. 1, 1942	Number of reported cases	Average annual case rate [4]	
All areas	155	838, 766	572	22. 7	899, 000	271	15. 1	18. 9
Under 1	37	156, 368	20	4. 3	167, 596	22	6. 6	5. 5
1.00–2.49	40	224, 868	51	7. 6	241, 017	49	10. 2	8. 9
2.50–4.99	39	220, 972	155	23. 4	236, 841	80	16. 9	20. 1
5.00–7.49	25	150, 116	205	45. 5	160, 896	76	23. 6	34. 5
Over 7.50	14	86, 442	141	54. 4	92, 650	44	23. 7	39. 0

[1] "Overcrowded dwelling units" defined as those with more than 1.5 persons per room.
[2] U. S. census tract data for persons per room in Baltimore dwellings and related meningitis data were obtained by Dr. Fan through the courtesy of Dr. W. Thurber Fales, Department of Health, Baltimore, Md.
[3] Dr. Fan was unable to include in his thesis data for 1943, an epidemic year.
[4] Case rates are per 100,000 population, annual basis.

Table 3. Ratio of death rates, Baltimore City to Maryland counties, during epidemic and low-incidence periods, for meningococcal meningitis

Periods covered	Baltimore City			Maryland counties			Ratio: City rate to counties
	Total population (person-years)	Deaths	Death rate [1]	Total population (person-years)	Deaths	Death rate [1]	
3 epidemic periods	7, 781, 752	375	4. 82	8, 385, 654	156	1. 86	2. 6
1929–31	2, 417, 558	61	2. 52	2, 492, 171	20	. 80	3. 2
1935–37	2, 516, 296	187	7. 43	2, 734, 002	70	2. 56	2. 9
1942–44	2, 847, 898	127	4. 46	3, 159, 481	66	2. 09	2. 1
3 low-incidence periods	7, 905, 591	49	0. 62	9, 014, 986	65	0. 72	0. 86
1932–34	2, 467, 492	21	. 85	2, 612, 061	20	. 77	1. 1
1938–40	2, 565, 099	18	. 70	2, 855, 946	16	. 56	1. 3
1947–49	2, 873, 000	10	. 35	3, 546, 979	29	. 82	. 4

[1] Death rates are per 100,000 person-years.

during recent low-incidence periods the city rates have averaged only 0.86 as high as the counties. A somewhat similar decline in the city/county ratio of death rates was noted in New York State (*11*).

Epidemic Cycles

The rise and fall of death rates from meningococcal disease in the United States since 1915 are shown in figure 4. The underlying annual data for the last two decades are shown in table 5; and data for the earlier years are from Gover and Jackson's tabulations of cerebrospinal meningitis (*5b*). Figure 4 indicates that:

1. Of the four epidemic crests, two came during war periods (1918 and 1942–43) and two came during periods of relatively high industrial activity during peacetime (1929 and 1935–36). In other words, all four epidemics came during periods of high travel rates and movement of population from rural to more congested areas, such as war camps and cities.

2. The inter-epidemic intervals have varied. Two were of 7 years' duration, and one was 12 years. Observations over a longer time (*5*, *7*) indicate that the interval between epidemic peaks, while varying from a few to as many as 20 years, has averaged about 8 years.

3. During the past 36 years, the national epidemic waves have had a marked continuity and orderliness. When the annual death rate began to rise, the wave continued rather smoothly to its peak with one minor exception (1933). The declines, likewise, tended to proceed systematically from peak to trough of the wave. For smaller areas or monthly time intervals, the numbers are smaller and the waves correspondingly less systematic (*5a*).

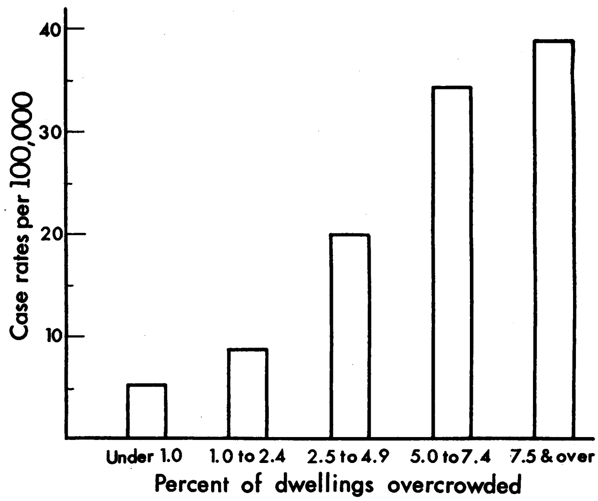

Figure 3. Relation of population congestion to reported meningococcal meningitis morbidity, Baltimore, Md. (epidemic periods 1935–37 and 1941–42).

Earlier studies (*5*, *7*) have shown that the epidemics in the several regions of the United States tended to synchronize with the national curve, although there were frequent deviations in peaks of a year or two. This geographic

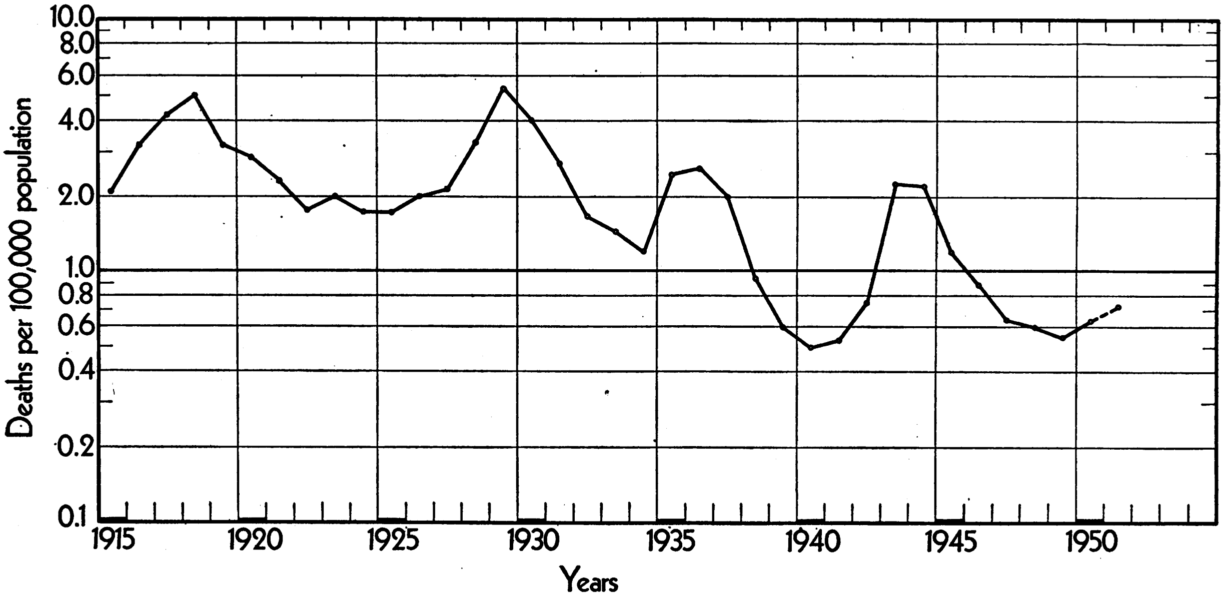

Figure 4. Annual death rates for meningococcal meningitis in the United States, 1915–51.

synchronism has been especially strong during the wartime epidemics, when large numbers of men went to military camps at about the same time. It has further been observed that regions which had very high rates in one epidemic tended to have lower than average rates in the next, and vice versa (*7a*).

4. In meningococcal disease, the rise to the epidemic peak is more deliberate than for most other communicable diseases, for example, influenza. Examination of regional data for the last 3 epidemics shows that of 27 ascending episodes within regions, the interval from trough to crest was about 3 years in 14 ascents, or slightly more than half. In seven ascents, the duration was about 2 years; in four, it was 4 years; and in two ascents, it was apparently 5 years (*5a*).

5. The most recent low point in mortality for the United States occurred in 1949; but there has been a rather flat trough during the last 4 years which resembles the wave bottom which terminated the recession from the World War I epidemic wave. The rise following that trough covered fully 4 years: from 1925 to 1929. If history should repeat itself in this regard, several years of increase would lie ahead.

Quarterly Index of Epidemicity Trend

To give a more detailed view of the recent rise and to facilitate projection into 1952, quarterly morbidity data are given in figure 5 and table 4. Like most communicable diseases, meningococcal infections show a seasonal cycle in which, from the low in about September to the high point in early spring, cases are multiplied on the average by about four—sometimes more during epidemics (*5c*). In order to cancel out this seasonal swing and to show an epidemic wave comparable with the annual data, an "epidemicity index" has been calculated for each quarter year. This index is the ratio of reported cases to the median of the corresponding quarters for the 10-year period 1940–49.

Comparison of the epidemicity index (fig. 5)

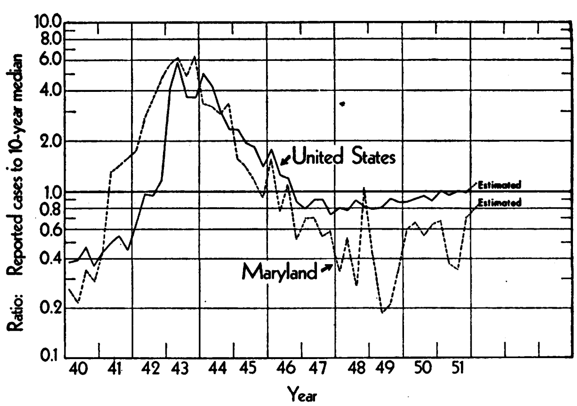

Figure 5. Epidemicity index for meningococcal meningitis (ratio of reported cases to 10-year median) United States and Maryland, quarterly, 1940–51.

Table 4. Quarterly reported cases, 10-year adjusted medians, and ratios of reported cases to median (epidemicity index) for meningococcal meningitis, United States, 1940–51

Year	Jan.–Mar.	Apr.–June	July–Sept.	Oct.–Dec.
	A. Reported cases [1]			
1940	528	432	324	347
1941	612	559	382	431
1942	911	1, 076	660	1, 111
1943	5, 577	6, 407	2, 506	3, 484
1944	7, 046	4, 706	2, 085	2, 257
1945	3, 231	2, 164	1, 283	1, 357
1946	2, 512	1, 407	829	849
1947	1, 091	985	622	701
1948	1, 115	856	618	787
1949	1, 106	898	632	837
1950	1, 201	998	651	849
1951	1, 401	1, 058	724	972
1952	**1, 685**	--------	--------	--------
	B. 10-year medians of cases [2]			
1940–49	1, 384	1, 105	689	958
	C. Ratios of reported cases to median (epidemicity index)			
1940	0. 38	0. 39	0. 47	0. 36
1941	. 44	. 51	. 55	. 45
1942	. 66	. 97	. 96	1. 16
1943	4. 03	5. 80	3. 64	3. 63
1944	5. 09	4. 26	3. 03	2. 35
1945	2. 33	1. 96	1. 86	1. 42
1946	1. 81	1. 27	1. 20	. 89
1947	. 79	. 89	. 90	. 73
1948	. 81	. 77	. 90	. 82
1949	. 80	. 81	. 92	. 87
1950	. 87	. 90	. 95	. 89
1951	1. 01	. 96	1. 05	1. 01
1952	1. 22	--------	--------	--------

[1] Quarterly reported cases received from National Office of Vital Statistics.

[2] The median is a mid-point above and below which half of the experience tends to fall. To reduce the effect of erratic fluctuations, medians were taken as the geometric mean of the four middle items in each quarterly array. (A geometric mean locates the median position more dependably than does an arithmetic mean in epidemic series.) A 10-year span (1940–49) was taken in calculating the quarterly medians instead of the more conventional 5-year span so as to include approximately one entire epidemic wave. For a disease with a long cycle, the 5-year span tends to give relatively high medians near epidemic peaks and low ones near the trough. This may distort the epidemicity index somewhat. The philosophy behind the ratio of current cases to median cases as an "epidemicity index" has been discussed previously (*9*).

with the corresponding wave of the annual mortality rates (fig. 4) shows that the two are nearly parallel, indicating that the quarterly index yielded about the same shape of epidemic wave as the annual data. The quarterly index as shown on the graph and in table 4 indicates that:

1. During the 1943 epidemic, reported cases rose to about six times the 10-year medians for corresponding quarters.

2. At the end of the subsequent 5-year decline, the national cases dropped to a low of 0.73 of the median in the fourth quarter of 1947, and since that time the cases have gradually risen to, or slightly above, the median values during most of 1951.

3. For Maryland, the epidemicity index showed about the same wave as the United States although, largely because of smaller numbers, the Maryland curve fluctuated more violently (*14*).

4. On the basis of reports (*12b*) to the week ending March 29, 1952, it is estimated that the reported cases for the United States during the first quarter of 1952 equalled 1,685. The median expectancy for the quarter being 1,384, there results for the first quarter an estimated index of epidemicity of 1.22, compared with 1.01 for the previous quarter. The index has, therefore, risen considerably higher in 1952 than is suggested by the conservative estimate shown in figure 5, prepared early in March.

Army vs. Civilian Morbidity and Mortality

From 1930 to 1951, the reported Army meningitis cases generally exceeded civilian cases considerably. The excess Army morbidity was highest at times of heavy induction or discharge of forces and lowest during periods of relatively stable strength. Sartwell and Smith (*4*), Thomas (*3a*), and others have reported that meningitis rates among recruits are highest within a few months after induction.

That the rise and fall of meningitis in the Army is strongly influenced by inductions and discharges is indicated in table 5 and figure 6:

1. The Army morbidity rate was below the civilian rate in but one year, 1933—a period when the armed forces were apparently stabilized at a fairly low level (table 5, last column).

2. Morbidity increased to epidemic peaks in 1935–37 and 1943, when Army rates were four to eight times the civilian rates. These increases in morbidity were approximately, though not exactly, coincident with heavy inductions into the armed forces. From mid-year 1940 to 1941, for example, Army strength was multiplied by 5.5.

3. The unexpected rise of Army rates in 1946 to about 10 times the civilian rates is associated with a period of rapid demobilization. June 30 Army strength declined from 8.2 million to 1.9 million in less than one year, with consequent congestion of travel facilities and separation centers.

4. The morbidity increase in 1951 was concurrent with mobilization for Korea.

In comparing military with civilian morbidity statistics, one must note the difference in reporting. Case diagnosis and reporting is usually more thorough in the military than in the civilian population. On the other hand, civilian statistics are expanded in the young adult ages by the more complete reporting to civil health authorities of cases from local Army camps.

Army mortality was about equal to the civilian mortality rate in the early 1930's, but it rose much higher during periods of appreciable induction or demobilization of personnel and declined toward the civilian rate during periods of strength stability. The effect of the newer therapies has been apparent during the past 8 or 10 years. The Army death rate nearly

Table 5. Annual mortality, reported morbidity, and apparent case fatality rates for meningococcal meningitis, United States, U. S. Army,[1] and U. S. Navy,[1] and U. S. Army strength, 1930–51

Year	Death rates per 100,000 [2]			Reported cases per 100,000 [2]			Apparent percent cases fatality [3]			U. S. Army strength in 1000's (June 30) [4]
	United States	U. S. Army	U. S. Navy	United States	U. S. Army	U. S. Navy	United States	U. S. Army	U. S. Navy	
1930	[5] 4.0	6.6	9.4	[5] 7.2	21.0	37.5	[5] 55.1	31.2	25.1	138.4
1931	2.7	1.5	3.6	4.7	16.	13.3	57.3	9.3	27.1	----------
1932	1.7	2.3	1.8	2.7	4.	8.1	61.6	56.7	22.2	----------
1933	1.4	.73	.9	2.4	2.	2.8	60.3	36.5	32.1	----------
1934	1.2	3.7	7.3	1.9	6.	22.9	61.9	61.8	31.9	----------
1935	2.5	3.6	7.0	4.9	14.	27.2	50.1	25.4	25.7	138.6
1936	2.6	4.3	9.6	5.5	19.	41.0	46.7	22.4	23.4	----------
1937	2.0	4.0	3.8	4.1	14.	18.1	48.2	28.5	21.0	----------
1938	.94	1.6	2.2	2.2	6.	5.0	42.9	27.3	44.0	----------
1939	.60	1.1	0	1.5	3.	1.3	40.8	35.0	0	----------
1940	.50	.89	1.0	1.3	3.	6.9	39.4	29.7	14.5	267.8
1941	.53	1.0	.9	1.5	12.	5.2	34.9	8.7	17.3	1,461.0
1942	.75	2.3	1.9	3.0	32.	29.5	25.3	7.0	6.4	3,074.2
1943	2.3	3.9	3.7	14.1	96.	78.0	16.0	4.1	4.7	6,993.1
1944	2.2	1.4	1.4	12.6	41.	34.3	17.3	3.4	4.1	7,992.9
1945	[6] 1.2	.81	.7	[7] 5.7	17.	13.3	21.4	4.8	5.3	8,266.4
1946	.89	1.47	.6	3.9	40.	12.1	22.5	3.7	5.0	1,889.7
1947	.64	.98	.5	2.4	21.	5.8	27.1	4.7	8.6	989.7
1948	.60	.52	.6	2.3	13.	6.3	26.0	4.0	9.5	552.2
1949	[8] .55	.35	.2	2.3	12.	5.4	23.4	2.9	3.7	658.7
1950	.64	.28	0	2.5	9.	2.8	25.9	3.1	0	591.5
1951	.72	.89	([9])	[10] 2.7	16.	4.7	26.7	5.6	([11])	1,529.7

[1] U. S. Army and U. S. Navy Offices of the Surgeons General. [2] Army and Navy rates are per 100,000 mean strength per year. U. S. rates are per 100,000 population. [3] Apparent case fatalities are percentage ratios of death rates to reported case rates. [4] See reference *13*. [5] 1930–44 data are from tables 2, 3, and 4, in reference *5*. [6] 1945–48 deaths from Vital Statistics of the United States, Part II. Place of Residence (NOVS). [7] 1945–50 cases from *Public Health Reports* annual summaries. [8] 1949–51 deaths estimated from Current Mortality Analysis, 10 percent sample (NOVS). [9] Navy death rate (annual basis) for the last 6 months of 1951 was 0.4 per 100,000 mean strength. Data for the first 6 months not immediately available. [10] 1951 cases estimated from Weekly Morbidity Report (NOVS) 2:52 (Jan. 5, 1952). [11] Underlying data not available.

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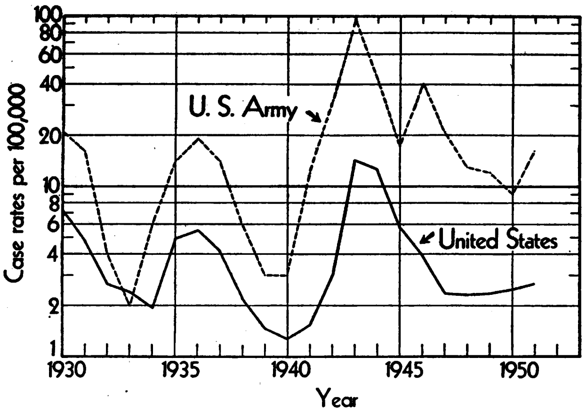

Figure 6. Reported case rates for meningococcal meningitis, United States and U. S. Army, 1930–51.

tripled, however, during the 1950–51 remobilization (fig. 7 and table 5).

Case Fatality and Case Reporting

The inference that case reporting in meningococcal disease has deteriorated was first made when it was observed in Maryland that the apparent case fatality (ratio of deaths to recorded cases) had increased from 15.3 percent in the 1943 epidemic year to 36.5 percent in 1950 (*14*). In other words, in 1943 more than six cases were reported per death; in 1950 reported cases per death were less than three. For the United States, likewise, the ratio of reported cases to deaths has declined from 6:1 to about 4:1 (*12*).

These observations threw suspicion on the statistics, for it did not seem reasonable that case fatality should increase when dramatically successful new therapeutic agents were coming increasingly into use. Figure 8 and table 5 do not indicate a similar rise in the case fatality ratio for the United States Army during the same 8 years. In fact, there was a decline of nearly 90 percent during 1940–44, and the Army case fatality ratio remained fairly steady at about 4 percent through 1950, against a "statistical" civilian fatality of about 25 percent.

A number of explanations for the rise in apparent case fatality in the civilian community suggest themselves. For example, age-adjusted calculations indicate that in Maryland approximately one-fifth of the rise in apparent case fatality in the State could be attributed to the growing proportion of infants and young children, who have a higher case fatality than adults (table 1). Possibly, part of the effect was produced by better case reporting during epidemics than between, although data prior to 1939 do not point to this as the major distorting factor (*14*).

A more plausible explanation of the rise in apparent case fatality is offered by Dr. Harold E. Harrison of Baltimore City hospitals. He stated that during recent years physicians have greatly increased their use of antibiotics and sulfa drugs in febrile cases; hence, they have probably cured many mild cases of meningococcal disease so promptly that case reports seemed unnecessary, if indeed this diagnosis was reached at all.

The declining trend of the ratio of civilian to Army case rates during the past 10 years or more, as suggested by figure 6, is consistent with the inference that civilian case reporting has been rather seriously incomplete in recent years.

Discussion and Summary

Likelihood of an epidemic. Information on the factors underlying epidemic potential are too scanty and crude to warrant categorical predictions. There are, however, the following indicators as to whether a continued rise is in prospect:

1. On a national scale, the cyclic movements of this disease have been exceptionally clear-cut and regular during more than three decades. Thus, when an epidemic wave started upward,

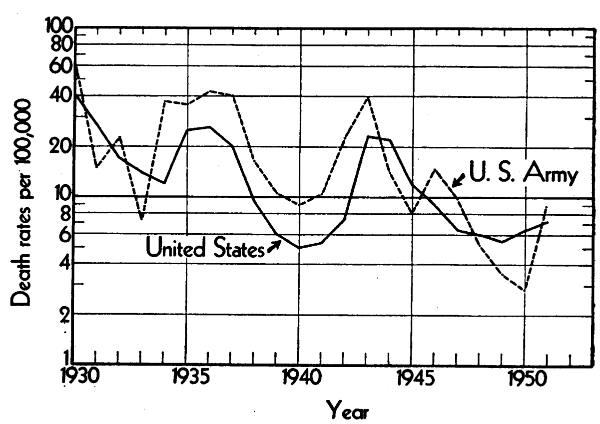

Figure 7. Death rates for meningococcal meningitis, United States and U. S. Army, 1930–51.

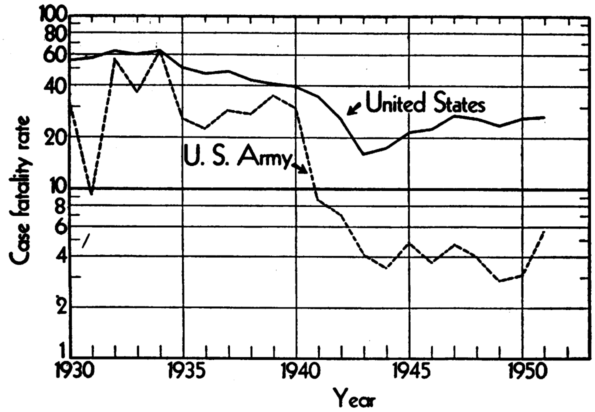

Figure 8. Apparent case fatality for meningococcal meningitis, United States and U. S. Army, 1930–51.

it tended to continue to an appreciable epidemic peak (fig. 4). Initial rises have been evident during the past year or two in the military and in the United States. (Table 5 and figs. 6 and 7.)

2. It has been approximately 9 years since the last epidemic peak in 1943; this is already somewhat longer than the average inter-epidemic interval.

3. The annual national birth rate since the last epidemic (23.0 per 1,000 population) has been about 50 percent higher than during the 9 years prior to the epidemic (15.6 births per 1,000). In other words, there has been an unusually heavy inflow of susceptible persons into the population.

4. The present unusually high industrial activity, high rates of travel, and build-up of the armed forces are conditions of high contact which in the past have been associated with epidemic development. Though conceivably the newer drugs might interfere with spread of the disease, figure 6 indicates that Army case rates could be high even with extensive use of the newer drugs. The major effect of the drugs in the Army was to reduce mortality rather than morbidity.

In the light of the stated potentials, the prudent assumption is that higher case and mortality rates may occur in the civil community during the next year or longer, although the normal seasonal declines may be expected from late spring to about September.

Current information. Since civilian case reports are clearly incomplete and could be influenced by publicity, it is believed that deaths will in the future yield a more trustworthy index of epidemicity than reported cases. If current information concerning the proportion of type I meningococci found in State and local diagnostic laboratories can be published, such information may be useful as a danger signal.

Magnitude of problem. Deaths from meningococcal meningitis in the United States during the latest two major epidemic years, 1943 and 1944, totaled 5,739. Although this number is not huge, it exceeds by a considerable margin the number of deaths during those 2 years from such diseases of public health interest as measles (3,224), acute rheumatic fever (2,972), poliomyelitis (2,512), diphtheria (2,341), typhoid and paratyphoid fever (1,234), and scarlet fever (873).

Preventive measures. Although the number of persons likely to be infected in an epidemic is enormous, the number of frank cases is relatively small, and the real danger comes from the risk of death after attack.

Prophylactic chemotherapy was employed during the last war in Army camps (*3b*, *4*) and was apparently successful in reducing the number of carriers and cases appreciably. However, Maxcy (*1*) gives reasons why this protective device should be regarded as experimental. Experimentation in the field of antigens for immunization and for testing susceptibles (*17*, *1*, *2*) will also be observed with interest.

For the present, apparently, major reliance must be placed upon prompt diagnosis and treatment. This is not easy because of the rapid course of the disease at times, and because of the sporadic distribution of recognized cases.

Obviously, for a disease like meningitis, best results are likely if the educational measures are particularly directed at the population in the areas in which the risk of attack is greatest: in the most congested parts of cities; in camps and institutions; among Negroes; and among the more susceptible rural groups migrating to congested areas such as industrial centers and military induction camps.

Finally, it is to be remembered that infants have the highest rate of attack and also that infants and the aged have a high case fatality (table 1).

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