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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

October 6–November 2, 1940

The accompanying table summarizes the prevalence of eight important communicable diseases, based on weekly telegraphic reports from State health departments. The reports from each State are published in the Public Health Reports under the section "Prevalence of disease." The table gives the number of cases of these diseases for the 4-week period ended November 2, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.—The number of cases of influenza rose from approximately 1,300 during the preceding 4-week period to approximately 3,300 for the 4 weeks ended November 2. The current incidence was slightly lower than that for the corresponding period in 1939, but more than 10 percent above the 1935–39 median incidence for this period. In the South Atlantic, West South Central, and Mountain regions the number of cases was higher than the seasonal expectancy, but in all other regions the disease appeared to be less prevalent than in preceding years.

Measles.—The incidence of measles in relation to that for the same period in 1939, and also to the 1935–39 median incidence, was considerably higher in the New England, Middle Atlantic, and East North Central regions and slightly higher in the East South Central region, but all other regions showed decreases. For the country as a whole, the number of cases reported (6,083) represented an increase of approximately 35 percent over the normal seasonal expectancy.

Poliomyelitis.—The number of cases of poliomyelitis dropped from 2,859 during the 4-week period ended October 5 to 1,789 during the current period. Each geographic region, and each State in which the disease was unusually prevalent, shared in the decline. The incidence was, however, considerably in excess of that for recent years, the number of cases being 1.5 times the number reported for the same

period in 1939 and almost twice the 1935–39 median figure for the period.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period Oct. 6–Nov. 2, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period 1935–39 [1]

Division	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median	Current period	1939	5-year median
	Diphtheria			Influenza [2]			Measles [3]			Meningococcus meningitis		
United States [1]	1,850	3,219	3,943	3,285	3,361	2,832	6,083	4,506	4,513	106	135	243
New England	27	31	42	4	6	13	851	583	456	8	7	10
Middle Atlantic	138	215	256	31	50	73	2,307	568	740	9	27	43
East North Central	194	410	592	224	188	261	1,681	418	570	24	25	44
West North Central	128	131	302	39	46	157	265	381	381	11	12	16
South Atlantic	610	1,473	1,391	1,144	1,456	768	191	412	412	18	20	52
East South Central	256	439	656	136	241	268	190	53	155	19	20	28
West South Central	338	355	509	1,127	1,005	830	82	128	90	3	11	13
Mountain	53	95	118	456	272	200	258	516	476	7	3	9
Pacific	106	70	152	124	97	158	258	1,447	1,078	7	10	10
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States [1]	1,789	1,163	902	7,928	9,382	11,116	77	119	225	888	1,096	1,388
New England	13	29	29	403	372	575	0	0	0	25	28	28
Middle Atlantic	92	309	122	1,265	1,545	1,753	0	0	0	99	132	177
East North Central	742	215	190	2,355	2,866	3,915	36	24	45	109	186	190
West North Central	463	170	78	963	1,147	1,430	20	29	89	59	67	107
South Atlantic	204	69	64	1,211	1,390	1,301	0	1	2	190	212	286
East South Central	58	64	56	663	729	725	4	6	6	134	120	157
West South Central	49	43	40	350	301	423	9	21	12	164	195	271
Mountain	65	125	18	232	377	523	4	19	52	56	70	115
Pacific	103	139	95	486	655	803	4	19	35	52	86	69

[1] 48 States. Nevada is excluded and the District of Columbia is counted as a State in these reports.
[2] 44 States and New York City.
[3] 47 States. Mississippi is not included.

From a comparison of the recent reports of poliomyelitis with the incidence in recent years, it is evident that the present outbreak has been largely confined to the North Central and South Atlantic regions, with very little rise in the South Central and far western regions, and none in the North Atlantic regions. In the regions where the disease has been most prevalent the incidence is still more than three times the normal seasonal incidence, and in the Mountain region, while the number of cases (65) is not large, it also is more than three times the 1935–39 median figure for this period. It is not unusual that the present outbreak has been confined to certain areas for, with the exception of the outbreak in 1939, which was quite widespread, previous epidemics have been confined more or less to certain geographic areas. The minor outbreaks of 1936 and 1937 occurred mostly in States in the South Central regions, while in 1934 California and other

western States experienced a more severe outbreak. In 1931, 1933, and 1935 the disease was epidemic in States along the Atlantic Coast; there was no epidemic of this disease in 1938, and 1932 was also a non-epidemic year.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria continued at a relatively low level. For the 4 weeks ended November 2 there were 1,850 cases reported, as compared with 3,219 for the corresponding period in 1939, and a median of 3,943 cases for the years 1935–39. The incidence for the country as a whole was the lowest on record for this period.

Meningococcus meningitis.—For this disease the incidence continued very favorable during the current period. The total number of reported cases was 106, as compared with 135, 168, and 246 cases for the corresponding period in 1939, 1938, and 1937, respectively. The situation was favorable in all sections of the country.

Scarlet fever.—The reported current incidence of scarlet fever (7,928 cases) was about 85 percent of the incidence for the corresponding period in 1939, and about 70 percent of the 1935–39 median incidence for this period. In the New England region the number of cases was slightly above the number reported last year, but all regions participated in a decline from the median figures for this period, the decreases ranging from less than 7 percent to more than 45 percent in the various regions.

Smallpox.—While the number of cases of smallpox increased about 75 percent over the incidence during the preceding 4-week period, the total of 77 cases was the lowest number on record for this period. No cases were reported from the Atlantic coast regions and very appreciable declines from the preceding 5-year averages were reported from other regions.

Typhoid and paratyphoid fever.—The incidence of typhoid and paratyphoid fever was also relatively low in all sections of the country. The number of cases reported for the 4 weeks ended November 2 was 888, which was the lowest number on record for this period.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended November 2, based on data received from the Bureau of the Census, was 11.0 per 1,000 inhabitants (annual basis). The rate for the corresponding period in 1939 was 10.9, as was also the average rate for the years 1935–39.

A COMPREHENSIVE STUDY OF INFLUENZA IN A RURAL COMMUNITY[1]

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NOMENCLATURE

The nomenclature which has come into general use among students of clinical influenza has become unwieldy, confusing, and not as specific as could be desired. The need for a more exact terminology has been recognized by many investigators. The desirability of using precisely defined terms in this field has become even more apparent as additional evidence has been acquired indicating that the symptom-complex historically called influenza is not a single etiological entity. Large epidemics of the clinical disease have been described by Francis (*1*) and by Stuart-Harris, Smith, and Andrewes (*2*) in which no evidence was obtained that the ferret pathogenic virus originally discovered by Smith, Andrewes, and Laidlaw (*3*) was concerned. Recently those associated with influenza research in the laboratories of the International Health Division of the Rockefeller Foundation, New York, and in the National Institute for Medical Research, London, agreed to use in the future a nomenclature (*4*) which was considered to be sufficiently exact to be consistent with present knowledge and which also would permit of logical expansion as additional information was acquired. The cooperation of other workers in this field of investigation was invited.

Since the statement issued jointly by the workers in the two institutions mentioned above suggesting this nomenclature was at the time of this writing in press and inasmuch as it will be used throughout this paper, it is reprinted here in summary form.

Clinical influenza.—An etiologically indefinite symptom-complex long recognized by physicians and characterized by the presence of the clinical manifestations which in recent years have been enumerated and described by Stuart-Harris, Andrewes, and Smith (*2*, *5*), Francis (*6*), Francis, Magill, Beck, and Rickard (*7*), and Horsfall, Hahn, and Rickard (*8*). The term includes the symptom complexes referred to by Stuart-Harris et al. (*2*, *5*) as "febrile catarrhs"; a sharp separation of these on clinical or epidemiological grounds has proved exceedingly difficult to establish.

Influenza A.—A specific disease entity caused by infection with any one of the various strains of the virus discovered by Smith, Andrewes, and Laidlaw (*3*), which will hereinafter be termed influenza A virus.

[1] From the Laboratories of the International Health Division of the Rockefeller Foundation and the Westchester County Department of Health, New York.

The separation of influenza A leaves a disease or group of diseases clinically resembling it but as yet of unknown etiology. (If and when hitherto undescribed viruses are isolated from this group and are shown to be of etiological significance, other specific diseases in the group could be labeled influenza B, C, etc., as they are found to be caused by the as yet hypothetical agents, influenza B virus, C virus, etc.; if agents other than viruses are implicated, the diseases in question should be given appropriate names which cannot be confused with those of the virus diseases.)

Influenza A virus.—The virus discovered by Smith, Andrewes, and Laidlaw (*3*) was originally termed "influenza virus," or "human influenza virus," and more recently "epidemic influenza virus." If and when other "influenza viruses" are isolated from patients they could be labeled influenza B virus, C virus, etc., to correspond with the diseases, influenza B, C, etc."

For the purposes of conciseness it has been useful in the present report to assign the term "influenza X" to that disease or group of diseases of unknown etiology which, though clinically indistinguishable from influenza A, can readily be differentiated from it by appropriate laboratory tests.

INTRODUCTION

The discovery of influenza A virus (*3*) has led to the development of neutralization (*9*, *10*) and complement fixation (*11*, *12*, *13*) tests for the presence of specific antibodies against the virus in the serum of human beings. In epidemics in which influenza A virus has been isolated from patients with the disease, marked increases in antibody titers have been demonstrated by means of both tests, when sera taken during the first 2 or 3 days of illness were compared with sera taken during the first few weeks of convalescence (*2*, *8*, *13*). The diagnostic value of these tests may, therefore, be considered definitely established. Relatively little is known, however, as to the distribution of antibody titers in the sera of a normal population during nonepidemic periods, or as to the persistence of individual antibody levels in the absence of manifest infection by the virus. Moreover, the relationship of antibody titer to immunity or susceptibility to the disease and the importance of subclinical infections in the determination of antibody levels have only been suggested on the basis of evidence obtained by certain investigators (*13*, *14*).

To permit a comprehensive investigation of these and other questions, a long-term study of clinical influenza and related respiratory diseases was begun during January 1938 in Yorktown, Westchester County, N. Y. This locality was chosen because of the impression that the stable, representative character of the population would

allow the greatest generalization in the interpretation of the results obtained from the investigation.

ORGANIZATION OF THE PROGRAM IN THE RESPIRATORY DISEASE OBSERVATION AREA

The town of Yorktown is a rural district suburban to New York City. Forty-five square miles of the area of the town were taken as the sphere of the study. Within this area were some 2,000 permanent residents of whom 800 lived in the unincorporated village of Yorktown Heights. In the village was located a consolidated school which served a district coinciding almost exactly with the area of the influenza study.

The program was begun by a house-to-house canvass during which the people were informed of the nature of the project, and registry cards were made out for all persons who expressed willingness to cooperate in the study. Data in regard to age, sex, length of residence in the locality, amount of travel, and past history of clinical influenza were recorded for each individual, a total of 1,336 persons distributed in 387 families being so registered. Beginning in March 1938, following a period of 1 year in which no known epidemics of influenza A had occurred throughout the world, blood specimens were obtained from more than 1,100 individuals from 4 to 85 years of age who were registered for the study. Constant contact with the population during the several months required to obtain the original blood specimens gave assurance of the continued absence of influenza A in the area during that interval.

NEUTRALIZATION AND COMPLEMENT FIXATION TESTS UPON 1938 SERA

The neutralization titers of the 1938 sera were determined against the PR8 strain (*15*) of influenza A virus propagated in mouse lung. Sera were regularly examined in final dilutions of 1:4, 1:16, and 1:64. Additional tests with dilutions to as high as 1:256 or 1:1024 were done when necessary. Generally from 50 to 100 sera were included in each test. Four mice were inoculated with each serum dilution-virus mixture and six mice with each dilution of the virus, which was titrated in every test. The mice were observed for a period of 10 days. All mice which survived the observation period were killed and their lungs examined for pulmonary consolidation. Both the serum dilution end points and the virus titration end points were calculated by the 50 percent mortality method of Reed and Muench (*16*). The serum dilution end points were then adjusted so that they could be expressed in terms of the neutralization of a constant amount of virus. This was accomplished by means of the linear relationship between the quantity of serum and the quantity

of virus neutralized, as described by Horsfall (*17*). That dilution of serum which was capable of neutralizing 3,100 fifty percent mortality doses of virus was designated as the "standard neutralization titer." All serum neutralization titers to be presented have this value.

TABLE 1.—*Frequency distribution of standard neutralizing antibody titers according to age*

Standard titer range	Individuals classified according to age group (years)														Total, all ages	
	4-9		10-19		20-29		30-39		40-49		50-59		60+			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<1:4	60	53	59	27	65	36	93	42	63	42	64	63	87	74	491	45
1:4 to 1:15	33	28	85	39	74	41	71	32	50	33	20	19	23	19	356	32
1:16 to 1:63	18	16	58	27	35	20	51	23	33	22	15	14	8	7	218	20
1:64 to 1:255	3	3	14	7	5	3	6	3	4	3	4	4	0	0	36	3
Total in groups	114	100	216	100	179	100	221	100	150	100	103	100	118	100	1, 101	100
Mean titers	1:13.4		1:25.0		1:16.4		1:16.8		1:16.4		1:14.0		1:4.7		1:16.4	

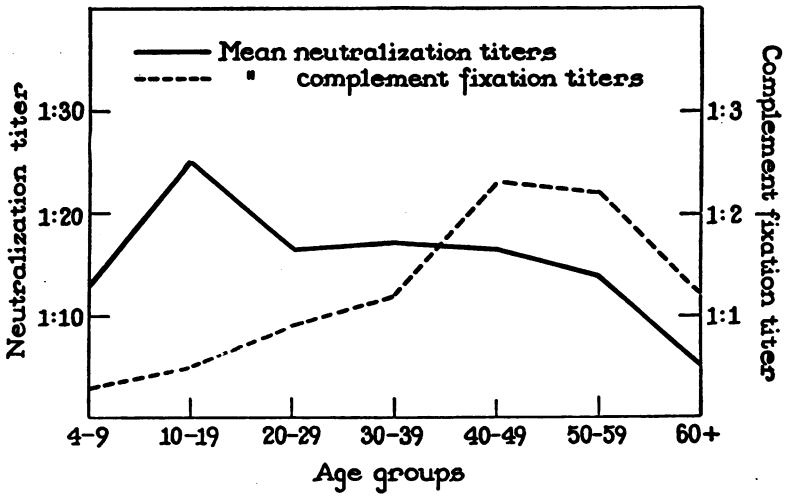

FIGURE 1.—Comparison of variation of mean antibody titers by neutralization and complement fixation tests in different age groups.

In table 1 the frequency distribution of the standard neutralization titers of 1,101 sera obtained during 1938 is summarized according to age groups. In the distribution of titers among persons of all ages it was revealed that 45 percent of the population possessed low titers of less than 1: 4 serum dilution, 32 percent had medium titers of from 1: 4 to 1: 15, 20 percent had high titers of from 1: 16 to 1: 63, and only 3 percent were found with very high titers of from 1: 64 to 1: 255. The mean titers of the various age groups, as illustrated in figure 1,

indicated that the incidence of sera with high titers was greatest in the adolescent group of from 10 to 19 years, while during adult life there was a remarkable constancy of mean neutralizing antibody levels. In late adult life a slight fall in mean titer occurred, and in advanced age, beyond 60 years, this decrease became very marked.

Complement fixation tests were done upon 807 of the original 1,101 sera collected during 1938. PR8 mouse lung antigen standardized against a pool of convalescent human serum as described by Eaton and Rickard (*18*) was used throughout; otherwise the test did not differ materially from that used by Francis, Magill, Rickard, and Beck (*13*). Original serum dilutions of 1: 4 and 1: 16 were regularly employed. Additional tests with serum dilutions to as high as 1: 256 were done when necessary. The use of 1: 2 dilutions of serum was not practicable because it was found that at this dilution a large proportion of the sera either were anticomplementary or gave positive reactions with normal mouse lung antigen. Dilutions higher than 1: 16 were not considered to be regularly necessary because of the almost universal absence of fixation by normal sera at greater dilutions (*18*).

The frequency distribution of the complement fixation titers according to age groups is summarized in table 2. Among persons of all ages there were 78 percent whose sera did not fix complement at a dilution of 1: 4, 20 percent whose sera did fix complement at that dilution but not above, and only 2 percent whose sera fixed complement at a dilution of 1: 16. The mean titers of the different age groups are illustrated in figure 1 where the differences in mean titers obtained by the complement fixation tests may be compared to those obtained by the neutralization tests. It is readily apparent that a higher titer of complement-fixing antibodies is characteristic of late adult life, in contrast to the higher titer of neutralizing antibodies found in adolescence. Advanced age is marked by a reduction of the mean titers of both antibodies.

TABLE 2.—*Frequency distribution of complement fixing antibody titers according to age*

Titer of fixation	Individuals classified according to age group (years)												Total all ages	
	4–9		10–19		20–29		30–39		40–49		50–59		60+			
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
No fixation 1:4	88	97	150	88	82	78	125	75	66	63	51	66	68	76	630	78
Fixation 1:4	2	2	19	11	23	22	38	23	33	30	23	28	20	22	158	20
Fixation 1:16	1	1	1	1	0	0	3	2	7	7	5	6	2	2	19	2
Total in groups	91	100	170	100	105	100	166	100	106	100	79	100	90	100	807	100
Mean titers	1:0.3		1:0.5		1:0.9		1:1.2		1:2.3		1:2.2		1:1.2		1:1.2	

An analysis of both the neutralization and complement fixation titers in relation to sex, amount of travel, length of residence in the locality and history of clinical influenza of the persons from whom sera were obtained in no case revealed any differences in antibody levels attributable to these factors.

In table 3 the frequency distribution of individual sera in different neutralization titer ranges is compared with the distribution of the same sera according to complement fixation titers. In spite of the different trends of the neutralization and complement fixation titers with age, as shown in figure 1, there is some correlation between these two titers for individual sera. The amount of this correlation is small ($r=+0.259$) but real ($P<0.01$).

TABLE 3.—*Comparison between neutralization and complement fixation titers of the same individuals' 1938 sera*

Complement fixation titers	Neutralization titer ranges										Mean neutralization titers
	1:4		1:4–1:15		1:16–1:63		1:64–1:255		Total		
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
No fixation 1:4	300	88.2	201	77	110	64	16	57	627	78	1:14
Fixation 1:4	39	11.5	56	21	53	31	9	32	157	20	1:26
Fixation 1:16	1	.3	6	2	9	5	3	11	19	2	1:47
Total	340	100.0	263	100	172	100	28	100	803	100	1:17
Mean complement fixation titers	1:0.5		1:1.1		1:2.1		1:3.0		1:1.2		

INCIDENCE OF ACUTE UPPER RESPIRATORY DISEASE IN THE OBSERVATION AREA DURING THE 1938–39 SEASON

From the beginning of October 1938 to the end of May 1939 a systematic search for cases of acute upper respiratory disease was carried out among the population under observation. In cooperation with the local school nurse the cause of absences from school due to illness was verified by a nurse trained in epidemiological procedure. In addition, periodic calls were made by telephone or by personal visits to responsible members of the families under observation. The frequency of these calls is summarized by months in table 4.

TABLE 4.—*Summary of calls made to determine the presence of acute upper respiratory disease among members of families registered in the observation area, October 1938 to May 1939, inclusive*

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Number of families receiving 3 or more calls	13	3	13	8	190	34	32	56
Number of families receiving 2 calls	108	17	73	78	79	139	82	83
Number of families receiving 1 call	187	157	237	195	68	110	200	136
Total number of families registered for the study	387	382	357	340	342	343	346	346
Number of persons in these families	1,336	1,324	1,386	1,348	1,345	1,347	1,343	1,342

In order to simplify the possible clinical classifications, all cases of acute upper respiratory disease were classified under the two headings, "common colds" and "clinical influenza." No attempt was made to classify so-called "febrile catarrhs" (*5*) or "sporadic grippe" (*8*). Persons presenting signs of coryza, occasionally accompanied by vague or indefinite symptoms such as slight achiness or mild malaise, with oral temperatures of 99° F. or less, and sometimes even with such complications as laryngitis or tracheo-bronchitis, were classified as cases of "common cold." The clinical manifestations described by previous authors (*2, 5, 6, 7, 8*) were followed and persons whose illness had a relatively sudden onset with temperatures of more than 99° F., together with definite constitutional symptoms such as headache, body pains, and malaise, and with upper respiratory symptoms either slight or pronounced were considered as having "clinical influenza." Sinusitis, tonsillitis, and chronic "nasal catarrh" were not considered as acute upper respiratory diseases for the purpose of this study.

The prevalence of these two broad clinical types of acute upper respiratory disease among persons in the observation area during the 1938–39 season is shown in table 5. The cases classified as "clinical influenza" have been subdivided according to the results of laboratory tests on sera and throat washings obtained from them.

TABLE 5.—*Incidence of acute upper respiratory disease among members of families registered in the observation area, October 1938 to May 1939, inclusive*

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total	Percent
Clinical diagnosis:										
"Common colds"	102	75	155	192	165	70	48	53	860	85
Clinical influenza	2	2	4	16	94	16	6	7	147	15
Total	104	77	159	208	259	86	54	60	1,007	100
Laboratory diagnosis:										
Influenza A	0	0	0	9	47	3	0	0	59	40
Influenza X	2	0	1	1	17	9	5	0	35	24
Not tested	0	2	3	6	30	4	1	7	53	36
Total	2	2	4	16	94	16	6	7	147	100

Under "influenza A" are classified those persons who were ill and whose serum taken during the first few weeks of convalescence showed more than a fourfold increase in neutralization titer as compared to the neutralization titer of the same individual's preepidemic serum. Influenza A virus was demonstrated in throat washings from 11 of these persons during the acute stage of illness (*8*).

Under "influenza X" are grouped those patients whose preepidemic and convalescent antibody titers showed no significant increases either by the neutralization or the complement fixation tests. At-

tempts to demonstrate influenza virus in throat washings taken from eight of these patients were unsuccessful.

The section "not tested" includes cases from which either pre-epidemic or convalescent blood specimens were not available. No attempt was made to isolate influenza A virus in throat washings from this group.

The symptoms presented by the patients in these three subdivisions did not differ materially; and on clinical evidence alone the differentiation of the cases of influenza A would have been impossible. The symptoms and clinical signs which were observed have been described in another publication (*8*).

It may be noted that "common colds" were prevalent throughout the entire period of observation, but that the greatest number occurred in the months of December, January, and February. Although the highest incidence of the "common colds" fell in January about 1 month before the peak of "clinical influenza," "colds" were still very prevalent during February when 64 percent of all clinical influenza and 80 percent of influenza A occurred.

NEUTRALIZATION TESTS UPON SERA TAKEN AFTER THE EPIDEMIC

In March 1939, blood specimens were obtained from the majority of the persons who had suffered from clinical influenza during the 2 previous months. In April, May, and June a second general bleeding program was carried out and specimens were obtained from 819 of the same individuals who had furnished sera in 1938. At the time of the bleeding each person was questioned by a physician as to the occurrence of symptoms suggestive of influenza during the previous winter months in order to discover whether any clinical cases had been missed.

Neutralization tests were performed upon all of the 1939 sera according to the same technique used for the examination of sera taken during 1938. In addition to the significant antibody increases already noted in the sera of persons who were ill, significant increases in neutralization titers were observed in the sera of 63 individuals who gave no history of illness suggestive of influenza. Thirty-six of these individuals gave histories of the "common cold" in the interval between the taking of the first and second blood specimens. The incidence of the "common cold" in this group was no greater, however, than among the 691 individuals whose sera showed no antibody increase during the same interval.

In spite of frequent contact which had been maintained, as shown in table 4, no history could be elicited of an influenzalike illness sufficiently severe to impress the memory of any of these 63 individuals. It therefore seemed likely that symptoms of infection by influenza

A virus were absent entirely, or so mild as to justify the application of the term "subclinical infections" to these cases. Seventeen, or 27 percent of these individuals were in close personal association with cases of influenza A during the acute phase of illness.

In table 6 under the section "preepidemic sera" is shown the distribution of neutralization titers of sera taken during 1938 from individuals who likewise furnished sera in 1939. It is obvious that knowledge concerning the general distribution of antibody titers before an epidemic must be available, if the significance of clinical cases or of subclinical infections occurring among persons possessing various antibody levels is to be evaluated properly. In the second section of the table the incidence of frank cases of influenza A proved by significant increases in antibodies, as well as the incidence of subclinical infections in relation to the different levels of neutralization titer, is demonstrated. In both instances it will be noted that the attack rates were highest in the group of persons possessing the lowest levels, and became progressively lower in the two succeeding groups. The number of individuals found with neutralization titers of from 1:64 to 1:255 was too small to allow statistically significant attack rates. Nevertheless, the occurrence of one case of influenza A and one subclinical infection in this group demonstrated that the possession of even very high neutralization titer was not an absolute indication of immunity. The highest attack rate of frank cases in the <1:4 antibody range together with the higher rate for subclinical infections than for frank cases in the 1:4 to 1:15 range suggested that the titer of neutralizing antibodies may have been one factor in determining the severity of the disease caused by infection with influenza A virus. These differences were not large, however, and the number of cases in either series did not allow great statistical significance for the differences noted. Taken as a whole, the trends displayed in the attack rates of cases and subclinical infections were remarkably similar. The mean titers of the preepidemic sera of the two groups were identical.

TABLE 6.—*Comparison between standard neutralization titers of sera obtained during 1938 and incidence of clinical and subclinical influenza A during 1939 in the same individuals*

Preepidemic 1938 sera			1939 influenza A			
Standard titer ranges	Individuals		Clinical cases		Subclinical infections	
	Number	Percent	Number	Attack rate, percent	Number	Attack rate, percent
<1:4	352	43	48	13.6	39	11.1
1:4 to 1:15	263	32	7	2.7	21	8.0
1:16 to 1:63	176	22	3	1.7	2	1.1
1:64 to 1:255	29	3	1	3.4	1	3.4
Total	820	100	59	7.2	63	7.7
Mean titers of 1938 sera	1:17		1:5		1:5	

It might be thought that individuals with low titer sera would respond to an attack of influenza A with a greater increase in antibodies against the virus than would persons with higher titers. An analysis of the antibody increases observed in this laboratory during the 1939 epidemic has revealed that this was not the case. The mean increase in antibodies observed in the serum of patients in the $<1:4$ range was not significantly higher than in the 1:4 to 1:15 range and was only twice as great as in the 1:16 to 1:63 range. On this basis, the observed attack rates in the different titer ranges become increasingly significant and suggest that a low titer of neutralizing antibodies against influenza A virus and susceptibility to influenza A are related.

The increases in neutralization titers of convalescent sera as compared to preepidemic sera of persons ill with confirmed influenza A varied markedly in different individuals. The maximum increase in titer was 185 times, while the minimum increase was 4.5 times. In 12 cases, or 20 percent of the series, the neutralization titer of the sera taken during convalescence was less than 1:16, a titer lower than that of the preepidemic sera of certain other individuals who contracted influenza A. With the sera from persons affected by subclinical infections similar results were obtained. The maximum increase in titer was 157 times and the minimum increase just over 4 times. The titers of the sera of 5 individuals, or 8 percent of the series, did not increase to 1:16. Observations similar to these in regard to cases of influenza A already have been recorded by other workers (*13*).

In the spring of 1940, approximately 1 year after the influenza A epidemic, blood specimens were obtained from 49 of the 59 persons who had suffered from proved influenza A and from 44 of the 63 who had had subclinical infections. All the individuals from whom sera were obtained in 1940 had remained resident in the community and during the interval the same type of observation for the presence of acute upper respiratory disease had been maintained. No influenza epidemic occurred during the winter of 1939–40 and such sporadic cases of clinical influenza as did occur in the community during this period were shown not to be due to influenza A virus since no significant increases were found in circulating antibodies of sera taken during convalescence. Neutralization tests done upon the 1940 sera revealed that, as was the case with the antibody response to infection by influenza A virus, there was a great variation among different individuals in the decline of neutralization titers after a period of 1 year following infection. These variations are summarized in table 7. It will be noted that in 19 percent of instances the individuals' neutralizing antibodies returned to their preepidemic levels. In 23 percent, however, no decline in the convalescent antibody level resulting from infection was demonstrable after 1 year; and in the remaining in-

stances, although decline of neutralizing antibody had taken place after the same interval, there was still a definite residual humoral immunity as measured by the neutralization test.

TABLE 7.—*Comparison between neutralization titers of sera taken 1 year after the epidemic of influenza A and titers of preepidemic sera from the same individuals*

Changes in titers of 1-year postepidemic sera as compared to titers of preepidemic sera	Clinical cases, number of individuals	Subclinical infections, number of individuals	Total clinical cases and subclinical infections	
			Number of individuals	Percent
Decreased to original titer ranges	10	8	18	19
Decreased to titer ranges 4 times above ranges of preepidemic sera	21	18	39	42
Decreased to titer ranges 16 times above ranges of preepidemic sera	3	10	13	14
Decreased to titer ranges 64 times above ranges of preepidemic sera	1	1	2	2
Remained in same titer ranges as convalescent sera	14	7	21	23
Total	49	44	93	100

Data in regard to rise and fall of titers of neutralizing antibodies are concisely summarized in table 8 where the similarity of antibody response to infection by influenza A virus, with or without clinical manifestations, is quite apparent. In both cases the mean neutralization titers of the 1-year postepidemic sera of persons who had been infected were approximately double the mean titer of the general population under study, and were five times greater than the mean titer of the preepidemic sera of the individuals who had been infected. These facts may aid somewhat in effecting a better understanding of the apparent 2-year periodicity of epidemics of influenza A.

TABLE 8.—*Comparison of mean neutralization titers of preepidemic and convalescent sera and of sera taken 1 year after the epidemic from the same individuals*

	Clinical cases		Subclinical infections	
	Number of individuals	Mean titers	Number of individuals	Mean titers
Titers of preepidemic sera	59	1:5	63	1:5
Titers of convalescent sera	59	1:126	63	1:77
Increase in titers of convalescent over preepidemic sera	59	25X	63	15X
Titers of 1-year postepidemic sera	49	1:23	44	1:26
Increase in titers of postepidemic over preepidemic sera	49	5X	44	5X

A comparison between the neutralization titers of the 1938 and 1939 sera of 691 individuals whose sera had shown no significant increase in neutralizing antibodies revealed, rather surprisingly, that a particular neutralizing titer was almost a personal characteristic. The results of titrations of two sera obtained from each of the 691 individuals 1 year apart are shown in table 9 where it will be seen that, irrespective of the 1938 level of neutralization titer of a particular

person's serum, there was a definite tendency for that titer to remain constant for at least 1 year. It will be noted that 64 percent of the titers did not change, 28 percent increased less than four times, and 8 percent decreased less than four times. These minor alterations in titer were not sufficiently great to exceed the experimental error inherent in the test. The neutralization titers of the sera of only four persons, or less than 1 percent of the series, decreased more than four times.

TABLE 9.—*Comparison between standard neutralization titers of 2 sera taken 1 year apart from each of 691 individuals*

1938 sera		1939 sera		Comparison between individuals' 1938 and 1939 sera		
Standard titer range	Number of individuals	Standard titer range	Number of individuals	No change	Less than 4 times increase	Less than 4 times decrease
				Percent	*Percent*	*Percent*
<1:4	262	*<1:4*	175	67		0
		1:4 to 1:15	87		33	
		1:16 to 1:63	0			
		1:64 to 1:255	0			
		<1:4	11			5
1:4 to 1:15	232	*1:4 to 1:15*	146	63		
		1:16 to 1:63	75		32	
		1:64 to 1:255	0			
		<1:4	2			
		1:4 to 1:15	36			21
1:16 to 1:63	170	*1:16 to 1:63*	103	61		
		1:64 to 1:255	29		16	
		<1:4	0			
		1:4 to 1:15	2			
		1:16 to 1:63	9			33
1:64 to 1:255	27	*1:64 to 1:255*	16	59	0	
Total	691			64	28	8

Quite obviously, this analysis would have been facilitated had it been possible to consider the entire group from whom two serum specimens were available. The occurrence of an epidemic of influenza A in the interval, however, and the well-established fact that infection by influenza A virus causes an increase in specific neutralizing antibodies made it necessary to withdraw the group proved to have been infected by the virus from the population under consideration. Under these circumstances significant decreases in titer were the only alterations which could be observed. As is shown in table 9, a total of 429 individuals possessed, in 1938, sera with titers sufficiently high so that significant decreases could have been demonstrated in 1939 had they occurred. Since only four individuals showed a significant decrease, it seems evident that very little alteration in individual titers occurred in 1 year.

In order to determine if the constancy of individual titers would be maintained for a longer interval, during the spring of 1940 blood specimens were obtained from 124 of the same persons whose sera

had been examined in 1938 and 1939. The results of the neutralization tests done upon the 1940 specimens are summarized in table 10, where titers of 1940 sera are compared to the 1938 titers of the same individuals. It may be noted that in the two lower ranges of titer the same constancy of neutralizing antibody was maintained for 2 years. In the higher ranges, however, although a large proportion of persons still maintained their original titers, there was a definite tendency for the neutralizing antibodies of other individuals to decrease. A change of less than four times in the titer of any one individual's serum may be considered as within the experimental error of the test. Nevertheless, when the sera of 35 percent of the group showed a decrease in titer of less than four times and still another 5 percent, a decrease of more than four times, while only 5 percent increased less than four times, it would appear that there had been some waning of neutralizing antibodies. In consideration of the age distribution of mean neutralization titers as illustrated in table 1 and figure 1, the loss of antibodies by certain individuals over a long period of time should be expected.

TABLE 10.—*Comparison between standard neutralization titers of 2 sera taken 2 years apart from each of 124 individuals*

1938 sera		1940 sera		Comparison beween individuals' 1938 and 1940 sera			
Standard titer range	Number of individuals	Standard titer range	Number of individuals	No change	Less than 4 times increase	Less than 4 times decrease	More than 4 times decrease
				Percent	*Percent*	*Percent*	*Percent*
<1:4	19	<1:4	19	100		0	0
		1:4 to 1:15			0		
		1:16 to 1:63					
		1:64 to 1:255					
1:4 to 1:15	46	<1:4	12			26	0
		1:4 to 1:15	28	61			
		1:16 to 1:63	6		13		
		1:64 to 1:255					
1:16 to 1:63	49	<1:4	5				9
		1:4 to 1:15	24			49	
		1:16 to 1:63	19	39			
		1:64 to 1:255	1		2		
1:64 to 1:255	10	<1:4					
		1:4 to 1:15	2				20
		1:16 to 1:63	7			70	
		1:64 to 1:255	1	10	0		
Total	124		124	54	5	35	5

COMPLEMENT FIXATION TESTS

Complement fixation tests were done upon the majority of the 1938 and 1939 sera. In all instances the same individual's two sera were examined in one test in order to exclude as many extraneous variants as possible in the interpretation of differences in titer. Fixation was

recorded according to the usual system of + to ++++ in degrees of lack of hemolysis. Plus one fixation was not considered significant and an increase of ++ or more degrees of fixation from the pre-epidemic to the convalescent serum specimen was considered as a significant increase in titer. In the sera of all but five persons significant increases in neutralizing antibodies were confirmed by significant increases in complement-fixing antibodies. The sera of three of these individuals in 1:2 dilutions showed suggestive increases but in the sera of the two remaining persons no complement fixing antibody increase whatever could be demonstrated. In four other instances, however, confirmation of the increase in neutralizing antibodies could only be demonstrated by the use of 1:2 dilutions. The increase in neutralization titers noted in the sera of the nine persons showing little or no increase in fixation of complement did not differ materially from those noted in sera in which definite complement fixation increases had been observed.

In table 11 the relationship of complement-fixing antibody titers to the incidence of cases of proved influenza A and of subclinical infections by influenza A virus as established by significant neutralization titer increases is shown. This table is comparable to table 4 which demonstrates the same data for the neutralization tests. As in the case of the neutralization tests attack rates for frank cases and subclinical infections are very similar at the different antibody levels. Although in both instances the attack rates were more than two times higher in the group showing no fixation at a serum dilution of 1:4 than in the group with fixation at that dilution, the complement fixation titers gave only partially as clear an indication of susceptibility to infection by influenza A virus as did the neutralization titers. The small number of individuals whose sera showed positive fixation at a dilution of 1:16 gave very little statistical significance to the attack rates for that group, but it is evident that a high titer of complement-fixing antibodies, like a high titer of neutralizing antibodies, did not absolutely preclude the possibility of infection by the virus.

TABLE 11.—*Comparison between complement fixation titers of sera obtained during 1938 and incidence of clinical and subclinical influenza A during 1939 in the same individuals*

Preepidemic 1938 sera			1939 influenza A			
Titer range	Individuals		Clinical cases		Subclinical infections	
	Number	Percent	Number	Attack rate, percent	Number	Attack rate, percent
No fixation 1:4	621	78	53	8.5	57	9.2
Fixation 1:4	158	20	5	3.2	6	3.8
Fixation 1:16	19	2	1	5.3	0	0
Total	798	100	59	7.4	63	7.9
Mean titers, preepidemic sera	1:1.2		1:0.6		1:0.4	

Increase in complement fixation titers of the convalescent sera as compared with the preepidemic sera varied considerably among different individuals. The maximum increase in the clinical cases was from no fixation at a serum dilution of 1:4 to ++++ fixation at 1:256; among the subclinical infections the maximum increase was from no fixation at 1:4 to ++++ fixation at 1:64. Of the sera of the total of 94 individuals classified as proved cases of influenza A or subclinical infections, 52 percent showed increases in fixation of complement of from zero at 1:4 serum dilution to ++++ at 1:16 and another 17 percent from zero at 1:4 to ++++ at 1:64. Increases in titer of complement-fixing substances tended to be considerably more uniform, therefore, than the increase in neutralization titers found in the sera of these same individuals. Nevertheless, as in the case of the increases in neutralization titers it was observed that the convalescent complement fixation titers of certain individuals' sera were not as high as the preepidemic titers of the sera of other persons who contracted influenza A.

TABLE 12.—*Comparison between complement fixation titers of sera taken 1 year after the epidemic of influenza A and titers of preepidemic sera from the same individuals*

Change in titers of 1-year postepidemic sera as compared to titers of preepidemic sera	Clinical cases, number of individuals	Subclinical infections, number of individuals	Total clinical cases and subclinical infections	
			Number of individuals	Percent
Decreased to original titer ranges	28	34	62	66
Decreased to titer ranges 4 times above ranges of preepidemic sera	12	6	18	19
Decreased to titer ranges 16 times above ranges of preepidemic sera	6	3	9	10
Remained in same titer ranges as convalescent sera	1	4	5	5
Total	47	47	94	100

TABLE 13.—*Comparison of mean complement fixation titers of preepidemic sera, convalescent sera, and sera taken 1 year after the epidemic from the same individuals*

	Clinical cases		Subclinical infections	
	Number of individuals	Mean titers	Number of individuals	Mean titers
Titers of preepidemic sera	59	1:0.6	63	1:0.4
Titers of convalescent sera	59	1:34	63	1:10
Increase in titers of convalescent over preepidemic sera	59	56X	63	25X
Titers of 1-year postepidemic sera	47	1:6	47	1:3
Increase in titers of postepidemic over preepidemic sera	47	10X	47	7X

Data in regard to the rise and fall of complement fixation titers, analogous to those presented in tables 7 and 8 pertaining to the neutralization tests, are summarized in tables 12 and 13. In table 12 it may be noted that, although there was a greater tendency for com-

plement fixation titers to return to their original levels than was observed in the case of the neutralization titers, there still was considerable residual immunity as measured by the complement fixation tests at one year after infection.

A comparison of mean complement fixation titers of the preepidemic, convalescent, and 1-year postepidemic sera as given in table 13 revealed that the mean titers of clinical cases and subclinical infections were essentially the same.

The complement fixation titers of the 1938 and 1939 sera of each of the 668 individuals whose sera showed no significant increase in neutralizing antibodies are compared in table 14. It will be observed that in 95 percent of instances there was no change in complement fixation titer after an interval of one year. In 5 percent of instances the titer declined to the next lower dilution. In considering these percentages, however, it is obvious that a very large number of the sera did not fix complement at a dilution of 1:4 and, therefore, no decrease in titer was demonstrable. Among sera which fixed complement at dilutions of 1:4 and 1:16 the percentages in which decreases were observed were quite large.

TABLE 14.—*Comparison between complement fixation titers of 2 sera taken 1 year apart from each of 668 individuals*

1938 sera		1939 sera		Comparison between individual 1938 and 1939 sera	
Complement fixation titer	Number of individuals	Complement fixation titer	Number of individuals	No change	Decreased to next lower dilution
				Percent	*Percent*
No fixation 1:4	511	*No fixation 1:4*	511	100	0
		Fixation 1:4	0		
		Fixation 1:16	0		
		No fixation 1:4	28		20
Fixation 1:4	139	*Fixation 1:4*	111	80	
		Fixation 1:16	0		
		No fixation 1:4	0		
		Fixation 1:4	7		39
Fixation 1:16	18	*Fixation 1:16*	11	61	
Total	668			95	5

The results of the complement fixation tests done upon the sera taken in 1940 from 117 individuals whose 1938 serum complement fixation titers were determined are summarized in table 15. Here again the tendency of a certain proportion of individuals to lose their complement-fixing antibodies was demonstrated. It is apparent, therefore, that the relative constancy of the level of antibodies in a given individual's serum, as demonstrated by means of the neutralization test, was only partially demonstrable by means of the complement fixation test.

TABLE 15.—*Comparison between complement fixation titers of 2 sera taken 2 years apart from each of 117 individuals*

1938 sera		1940 sera		Comparison between individuals' 1938 and 1940 sera			
Complement fixation titer	Number of individuals	Complement fixation titer	Number of individuals	No change	Increased to next higher dilution	Decreased to next lower dilution	Decreased to second lower dilution
				Percent	*Percent*	*Percent*	*Percent*
No fixation 1:4	79	*No fixation 1:4*	75	95		0	0
		Fixation 1:4	4		5		
		Fixation 1:16					
		No fixation 1:4	23			70	0
Fixation 1:4	33	*Fixation 1:4*	10	30			
		Fixation 1:16	0		0		
		No fixation 1:4	3				60
		Fixation 1:4	0			0	
Fixation 1:16	5	*Fixation 1:16*	2	40	0		
Total	117		117	74	3	20	3

Among the sera obtained during 1940 there were four in which an increase in complement fixation was noted. In all four cases there was no fixation in the corresponding sera taken in 1938 and 1939, while the 1940 specimens gave only ++ degrees of fixation. These individuals had suffered no illness similar to influenza and there were no significant increases in neutralizing antibodies in the corresponding sera.

DISCUSSION

The results of the investigation which have been presented in this paper were obtained by the prolonged study of a large group of normal individuals. This study was sufficiently comprehensive to permit of certain generalizations regarding antibodies against influenza A virus in the serum of human beings. The evidence which has been obtained indicates that there are marked differences in the titer of neutralizing antibodies against influenza A virus in the sera of different normal individuals. Certain persons may possess neutralization titers 100 or more times higher than certain other individuals and between these two extremes are found human beings with almost any intermediate antibody level. Furthermore, these different individual titer levels remain relatively constant throughout a period of at least 1 year and appear to be quite characteristic for a given person. In the population under study it was found that this was true in the large majority of instances despite the occurrence of an epidemic of proved influenza A in the area during the observation period. The fact that normal human beings differ so widely as regards the titer of neutralizing antibodies against influenza A virus in their sera makes it impossible to establish any critical antibody level which, if exceeded, would have diagnostic significance. This fact also makes it necessary that accurate

and as nearly quantitative methods as possible be used in determining neutralization titers since otherwise erroneous conclusions may result. Finally, it is evident that no diagnostic interpretation can be made on the basis of a given neutralization titer, however high, in a single specimen and that at least two serum specimens, taken before and after an acute upper respiratory disease, are essential if accurate information is to be obtained regarding the presence of infection by influenza A virus.

The opportunity to obtain serum specimens from the population of this community before an epidemic of influenza A occurred made it possible to achieve an important and previously unattained objective. An analysis of the antibody titers of all the preepidemic sera and those obtained from individuals who subsequently contracted either proved influenza A or subclinical infection by influenza A virus indicated that there was a definite relationship between the possession of a low antibody titer and susceptibility to infection by the virus. Although it was found that the great majority of cases of influenza A occurred in individuals who had low levels of antibodies it was also found that a few cases occurred in persons with relatively high titers. Consequently there does not seem to be any critical antibody level which absolutely assures immunity to infection by influenza A virus. Hoyle and Fairbrother (*14*) have suggested that such a critical antibody level does exist. Francis, Magill, Rickard, and Beck (*13*), on the basis of studies on acute and convalescent phase sera from patients with influenza A, also suggested that a critical zone of antibody concentration could be defined. Horsfall, Hahn, and Rickard (*8*) found that the titers of acute phase sera from patients with influenza A were lower than similar sera from other patients with respiratory diseases not due to influenza A virus. Although the majority of persons who contract influenza A normally possess a low titer of antibodies against the virus, some persons are encountered with surprisingly high titers.

This information may prove helpful in the interpretation of the results of attempts to immunize human beings against influenza A virus infection. It has already been shown (*19*, *20*) that specific antibodies may be increased by the parenteral administration of influenza A virus vaccines in human beings. The fact that low antibody levels and susceptibility to infection by the virus are correlated should afford a stimulus for the continuation of studies to determine the actual value of immunization. Intensive studies of a vaccinated population exposed to an epidemic of proved influenza A will be required before the immunizing effectiveness of a vaccine can be accurately assessed.

It has been found that the marked increases in antibody levels which follow either influenza A or subclinical infection by influenza A virus are not permanent and that the increased titers rather rapidly

decrease. Francis, Magill, Rickard, and Beck (*13*) found that convalescent titers diminished by approximately 50 percent in 2½ to 5 months after influenza A. In the present study it was shown that 1 year after the disease antibody levels were only moderately though significantly higher than they were prior to the disease. This fact is also of considerable importance in relation to the possibility of prophylactic vaccination against influenza by influenza A virus since it is hardly to be expected that a vaccine will produce a more prolonged immune response than follows after actual infection by the virus.

The very close correlation which was obtained between significant increases in antibody titer as determined by the neutralization test and by the complement fixation test entirely confirms the results of previous comparative studies (*13*, *18*) on these two different techniques. The complement fixation test offers a number of practical advantages over the neutralization test since it requires much less time and fewer laboratory facilities. It can undoubtedly be carried out in almost any laboratory equipped to perform the Wassermann test and its application should make possible the accurate diagnosis of influenza A without which epidemiological investigations of clinical influenza will yield but little information. The results of a large series of complement fixation tests have been recently reported by Martin (*21*).

There appears to be a considerable body of evidence which indicates that the clinical syndrome generally termed influenza does not constitute a single disease entity. The studies of Francis (*1*), Horsfall, Hahn, and Rickard (*8*), and those of Stuart-Harris, Smith, and Andrewes (*2*) all indicate that an exact diagnosis cannot be made upon clinical grounds alone and that one or more etiologically unrelated diseases can simulate influenza A so closely as to be indistinguishable from it. Because of this fact the diagnosis of influenza A must rest upon laboratory evidence. An exact diagnosis should depend upon the isolation of the virus from typical cases and upon the demonstration of a significant increase in antibodies determined by the study of two serum specimens from each patient. It should be emphasized again, however, that an accurate clinical history is an invaluable adjunct to the laboratory studies, particularly since subclinical and entirely asymptomatic infections by the virus can result in increases in antibody titers equally as significant as those encountered in frank cases of the disease.

SUMMARY AND CONCLUSIONS

A comprehensive study of influenza in a representative rural population over a period of 2 years has revealed the following:

1. The proportion of individuals with different neutralizing antibody levels against influenza A virus was determined during a non-

epidemic interval among 1,101 persons from 4 to 85 years of age. Titers varied greatly from one individual to another. The highest mean titer was found in the adolescent age group, while during adult life mean titers remained at a constant level and dropped very considerably in old age. No relationship was demonstrated between neutralization titers and factors such as sex, length of residence in the locality, amount of travel, or past history of clinical influenza.

2. Neutralization titers of persons not infected with influenza A virus remained markedly constant for a period of 1 year. At the end of 2 years this same constancy was still demonstrable among the sera of many individuals but evidence was obtained of a decline in antibodies of some persons who possessed high or very high titers.

3. Complement fixation tests done upon 807 of the same 1,101 sera revealed considerable variation in titers among different individuals but this variation was not as marked as that noted by the neutralization tests. In contrast to the neutralization tests mean complement fixation titers were low in youth and progressively increased to reach their greatest height in late adult life, falling somewhat in old age. As in the case of the neutralization titers no relationship was demonstrated between complement fixing antibodies and sex, length of residence in the locality, amount of travel, or past history of clinical influenza.

4. The degree of constancy of individual complement fixing antibody levels was not as marked as was noted with the neutralization titers. Certain persons maintained the same complement fixing antibody level for a period of 2 years but a large proportion of individuals showed a considerable decline in titers at the end of that period.

5. Some correlation between the titers of neutralizing and complement fixing antibodies in the same sera was demonstrated but this correlation was small.

6. In an epidemic of influenza A occurring several months after the taking of the original blood specimens 59 persons were ill with influenza A, the diagnosis having been confirmed in all instances either by the isolation of influenza A virus or by a significant increase in neutralizing antibodies. A comparison of the neutralization titers of the preepidemic sera of these individuals to the preepidemic titers of the sera of the general population indicated that susceptibility to proved influenza A and the possession of a low titer of neutralizing antibodies were definitely correlated but that the possession of a high titer was not an absolute guarantee of immunity. The complement fixation titers were only partially as good an index of susceptibility to infection as were the neutralization titers.

7. Significant increases in neutralizing antibodies were found in the sera of 63 persons who had been present in the community during the epidemic but who gave no history of having been ill with symp-

toms suggestive of influenza. These cases were classified as "subclinical infections."

8. The titers of the preepidemic sera of the persons who had proved influenza A and of the persons sustaining subclinical infections were almost identical both by the neutralization and complement fixation tests, thus indicating that antibody titers did not alone determine the severity of symptoms caused by infection with influenza A virus.

9. A comparison of mean neutralizing titers of preepidemic, convalescent, and 1-year postepidemic sera revealed that the rise and fall of neutralizing antibodies among proved cases and subclinical infections were likewise almost identical. This in turn indicated that the neutralizing antibody response to infection had little relationship to the severity of symptoms caused by the infection.

10. Great variation among different individuals was noted both in the increase and in the subsequent decrease of neutralizing antibodies after infection. The titers of some persons' sera during convalescence were lower than the titers of the preepidemic sera of other individuals who contracted proved influenza A. After 1 year, the neutralization titers of 19 percent of the individuals in the series had returned to their preepidemic levels. In another 23 percent, however, the convalescent levels were maintained for 1 year and among the remaining individuals the titers fell to varying levels above those of the preepidemic sera. A comparison of the mean titers of the 1-year postepidemic sera of persons who had been infected to the mean titers of preepidemic sera from these same individuals and to the mean titer of the preepidemic sera of the general population demonstrated that at 1 year following an epidemic of influenza A there was a considerable increase in humoral immunity as measured by the neutralization test both among persons who had been ill and among persons who had suffered subclinical infections.

11. Data in regard to the rise and fall of complement fixation titers were very similar to those described for the neutralization titers with the exception that the tendency of individual titers to return to their preepidemic level after a period of 1 year following infection was considerably more pronounced in the case of the complement fixation titers than in the case of the neutralization titers. Nevertheless, a definite residual humoral immunity as measured by the complement fixation test was still demonstrable.

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A SANITARY LOG FOR AMERICAN SHIPS

Description and Plan of Operation

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A clean, rat-free ship is becoming increasingly important, not only for the health, comfort, and safety of passengers and crews but for the protection of visited ports against the importation of disease. In achieving these desirable results there has long been need for keeping a permanent, reliable, and official record of a vessel's sanitary condition. The present article sets forth a plan for a cumulative sanitary log, whereby public health officials, responsible ship's officers, and authorized representatives of owners and operators may obtain useful information.

Under present-day conditions few vessels maintain fixed itineraries for any considerable length of time, but alter their ports of call and trade routes to meet the everchanging conditions of trade and politics. Under these circumstances it is difficult for official agencies to accumulate a continued history of the sanitation, extent of rat infestation, and the special matters of interest essential in safeguarding the health of

passengers and crew and preventing the transmission of disease. The collection of sanitary data in a special log kept on the vessel would make this information available at all times and at all ports.

Sample pages of the proposed sanitary log are shown herewith. These pages face each other in the bound book and refer to the same inspection. It will be noted that the data included are simple in character, referring principally to rat infestation and sanitation, the two subjects of greatest importance from the standpoint of health on vessels.

Under the heading "rat infestation," there are spaces for inserting the estimated number and location of rats, the exterminative measures in effect, data relating to traps, and the recommendations for correcting undesirable conditions. There are also suggestive leads relating to sanitation and recommendations for improvements. Space is provided for the insertion of the important information pertaining to the exemption or deratization certificate, without which no vessel should engage in foreign trade. The remainder of the page is devoted to entries identifying the vessel, its chief officer, and the inspector who represents an official governmental agency.

On the page opposite the basic information just mentioned is a separate sheet on which the chief officer may record his understanding of the inspector's recommendations and the corrective measures to be employed. He may also make his own entries as to rat infestation and sanitation. It is expected that the master of the vessel will review the chief officer's remarks and maintain close contact with the conditions mentioned.

The log book would be approximately 9 inches by 12 inches in size, cloth bound, and would contain approximately 200 pages, 100 of each type. The pages would be numbered consecutively in order to discourage the removal, alteration, or destruction of reports. It is estimated that a log book of good quality can be supplied for $1.50, the cost to be borne by the vessels or shipping interests concerned. The record might easily serve for periods varying from 5 to 20 years, depending upon the extent to which the log book is used, this in turn depending upon the length of voyages, ports of call, and the frequency of inspections.

It is contemplated that the care and responsibility of the log book will rest with the chief officer, under the immediate supervision of the master. This delegation is made because many vessels are inspected at their docks, during a period when the masters are absent on business and records are not available. Then, too, it is a common practice of many shipping companies to charge the chief officers with the duty of maintaining vessels in a sanitary condition.

It is believed that both Federal health officials and shipping interests will derive substantial benefits from the application of this plan. Some of these benefits may be listed as follows:

1. In a comparatively short period of time following the inauguration of the plan each vessel would have on board an official and authentic record of its sanitary history readily accessible to quarantine officers and sanitary inspectors at each port of call. The sequence and continuity of the recorded data would greatly facilitate both quarantine and sanitary inspection.

2. The plan would afford a means through which a continuity of effort could be established between various quarantine stations in the matter of rat control and sanitation, and avoid conflicting recommendations as to the method of applying specific corrective measures.

3. The availability to owners and their representatives of the information contained in the sanitary log should be of considerable value in enabling them to determine and apply needed corrective measures, and afford a criterion as to the efficiency of those persons charged with the maintenance of proper sanitation.

4. Information as to the time, place, and date of issuing deratization or deratization exemption certificates will be recorded and made available to those concerned, thereby facilitating the application for renewal of certificates at the proper time.

5. During the quarantine inspection of vessels at ports where trained sanitary inspectors are not immediately available, the quarantine officer will be able to obtain a sanitary and rat-infestation history which will assist in determining what, if any, quarantine treatment is required.

6. The plan will stimulate interest, present a focal point of contact, and assist in coordinating the efforts of all persons and agencies concerned in promoting the proper sanitation of ships.

Arrangements have already been made in the port of New York to make a practical test of the sanitary log on the vessels of two large shipping lines. Moreover, the plan has been explained to a representative group of ships' operators without substantial objection to the principle or its details. Because of the obvious simplicity and low cost of the log book the rapid extension of the plan is contemplated to other American vessels. Thereafter it is hoped that the results will be sufficiently gratifying to justify the world-wide adoption of the plan through international conventions.

In conclusion, the writer desires to acknowledge his grateful appreciation to Dr. Robert Olesen, Chief Quarantine Officer at the port of New York, for his leadership in the presentation of the plan to the shipping interests at the port of New York and for many helpful suggestions given during the preparation of this article.

Sanitary Log

Page No. 1

_____ S/S _____ Chief Officer _____

Inspected at port of _____ Date _____

RAT INFESTATION: Number estimated _____ Location _____

_____

_____

Eliminative measures in force: _____

_____

_____

No. of traps set: _____ No. on board: _____ Kind: _____

RECOMMENDATIONS: _____

_____

_____

_____

SANITATION: General condition _____ Insanitary conditions _____

_____

_____

_____

RECOMMENDATIONS: _____

_____

_____

_____

_____

Place and date of last exemption or deratization certificate _____

_____

REMARKS: _____

_____

_____

_____

NOTE.—Entries to be made by Sanitary Inspectors only.

Inspector _____

Title _____

Chief Officer's Entries

Page No. 1a

This is to certify that I have read the above entries.

---,

MASTER.

NOTE.—Entries should be dated and signed by the Chief Officer.

PNEUMONIC PLAGUE IN ECUADOR DURING 1939

By JOHN R. MURDOCK, *Surgeon, United States Public Health Service, Traveling Representative, Pan American Sanitary Bureau*

During 1939, three outbreaks of pneumonic plague occurred in Ecuador, two in the Province of Chimborazo and one in the Province of Loja. The first outbreak occurred during the months of January and February in Riobamba, causing 17 deaths, the second during the month of April in Columbe, with 14 deaths, both in the Province of Chimborazo. The third outbreak, which occurred during the month of September, started in Cofradia, near Catacocha, and extended to the city of Loja in the Province of Loja. It caused at least 7 deaths.

In the first two outbreaks, no definite proof was available that patients with bubonic plague had developed secondary pneumonia, but in Loja the history was definite; there the first primary case of plague pneumonia was diagnosed and followed through. The author worked in the three outbreaks and assisted in their control.

Bubonic plague has been present in Ecuador since its introduction in 1908. It has spread from the ports to the mountain districts along the rivers, railroads, highways, and mule trails. The three common types of rats, Norway (*Rattus norvegicus*), Alexandrinus (*Rattus alexandrinus*), and *Rattus rattus*, have been the responsible hosts, and from them the disease has spread to the domestic guinea pigs, wild rats (ratas de campo), rabbits (conejos), squirrels (ardillas), and probably to other rodents. A few scattered cases of pneumonic plague have been recorded in Ecuador, but no outbreaks such as those reported here had previously been recorded.

RIOBAMBA OUTBREAK

During the early part of January 1939, a few cases of bubonic plague were reported from the endemic zone in the Province of Chimborazo. On January 17, a woman who had been transferred from Tixan to the hospital in Alausi died after 2 days' illness with a disease diagnosed as pneumonia. On January 20 the husband of this woman was transferred from Tixan to the hospital in Riobamba. He had a high fever and a generalized rash, and died on January 21 of what was diagnosed as typhoid fever. During the 2 days in the hospital, the patient had occupied a corner bed in a small 7-bed ward, all beds of which were occupied. The distance from the head of this patient's bed to the heads of the two nearest patients' beds were 10 and 12 feet, respectively. No other patients in the ward contracted the disease. The doctor and nurses also escaped, but a friend who visited the patient and sat on his bed for about 30 minutes during the last day of his illness became sick on January 24.

This friend had been confined to the hospital with an attack of malaria since January 16 and was to have been discharged on January 24. However, about 5 a. m. on January 24 he developed a chill followed by a fever of 39.4° C., marked prostration, and later a cough and expectoration which became blood stained before his death on January 26. The diagnosis was pneumonia.

This patient had occupied a bed in an overcrowded 17-bed ward, all beds of which were occupied. There were patients in the beds on each side of his bed not more than 4 feet away, but no other patients in the ward developed the disease. The doctor escaped, but the Sister who spent the last 4 hours in close contact with the patient became ill on January 29 with a chill followed by fever, headache, generalized pains, and a cough, which later became productive, with blood-stained sputum. She died on January 31, the diagnosis being pneumonia. This Sister occupied a room with two other Sisters and was treated by Dr. Alfonso Villagomez.

On February 3, two more Sisters in the Alausi hospital and the Mother Superior of the Children's Hospital in Riobamba became ill, all developing the same group of symptoms—chills followed by headache, fever, generalized pains, and prostration. After about 24 hours the characteristic, soft, easy cough commenced, with little expectoration, of a mucoid character at first, later flecked with pus, and finally blood stained. One of these Sisters died on February 5, the Mother Superior on the 6th in the Children's Hospital, and the other Sister died on the 7th.

Dr. Alfonso Villagomez, who was treating the Sisters, became suspicious of the disease, and, working with the health officer, made smears of the sputum of one of the Sisters, stained and examined them, and made a diagnosis of plague pneumonia. Another Sister had become ill on February 4, and still another with similar symptoms on February 5. Both died on February 7.

On February 8, the Chief of the Antiplague Service and the author arrived at Riobamba about 4 p. m. and the foregoing history was secured from the records of several of the hospital staff doctors who had cared for the patients. The smears stained with methylene blue were examined, and from them, and from the history of nine deaths in rapid succession, and epidemiological and clinical evidence, the diagnosis of plague pneumonia was made.

As there was no diagnostic material then available, and as the diagnosis had not been confirmed by guinea pig inoculation, on February 9 the cadaver of the last Sister to die was exhumed, and a section of the third rib removed. From the medullary portion smears were made and 3 guinea pigs were inoculated, two by scarification and one by the subcutaneous method.

It was learned that no precautions had been taken by the doctors, nurses, or helpers to protect them from the disease, that the sick Sisters had been treated in their quarters, and that no quarantine or isolation had been instituted. Arrangement was made for the isolation of the new cases and the handling of contacts. Head masks (made like sacks, which could be pulled down over the head and tied about the neck, and with holes for the eyes covered with isinglass), coveralls, and rubber gloves were obtained to protect the doctors, nurses, and orderlies. The hospital was placed under strict quarantine by armed police, and no one was permitted to enter or leave except the doctors.

From February 9 to 14, 9 other cases of pneumonic plague, with 8 deaths, occurred in Riobamba, one of the victims being Doctor Villagomez.

The sputums of the patients who became ill after February 8 were examined microscopically and found in most cases to be almost pure cultures of *Pasteurella pestis*. The guinea pig inoculated subcutaneously on February 9 died on the 12th, and the two inoculated by scarification died on the 13th, all with typical macroscopic and microscopic findings of plague.

Although 2 cases of plague pneumonia in Riobamba developed the disease outside of the hospital, no secondary cases occurred from contact with them. Doctor Villagomez, who became ill in his home, was transferred to the isolation ward in the hospital, where he was treated; and the Mother Superior of the Children's Hospital, who contracted her illness while living at the Children's Hospital, was treated until her death at the hospital. It was not suspected at the time that she had plague pneumonia.

COLUMBE OUTBREAK

Columbe is a small town on the railroad which connects Quito with Guayaquil, situated in the mountainous region of Chimborazo about 35 kilometers from Riobamba. Its elevation is 2,140 meters above sea level.

During the first 3 months of 1939, numerous outbreaks of bubonic plague had been reported in the towns surrounding Columbe. Dr. Santos Miranda had been sent to the region, with headquarters in Alausi, to investigate and take measures to control the disease.

About April 15, a number of Indians living and working on a hacienda 2 kilometers from Columbe, died. A young student of medicine spending his vacation in Columbe learned of the deaths and went out to the hacienda to investigate. He found two patients with symptoms of pneumonia, and, knowing the history of the Riobamba outbreak, he examined the lungs of the patients and made smears of the sputum for examination. The following day he was said to have found the plague

bacillus. Two days later he had a chill followed by fever, headache, generalized pains, cough, and blood-stained expectoration. He died on April 18 in the convent in Columbe.

Doctor Miranda examined the young medical student, made smears of and inoculated a guinea pig with the sputum. The smears contained *Pasteurella pestis* and the pig showed definite evidence of plague. With this confirmatory evidence of plague pneumonia, Doctor Miranda informed the Director of Health on April 24 that plague pneumonia had broken out in Columbe.

On April 25, the Assistant Director of Health, Dr. Anthony Donovan, Traveling Representative of the Pan American Sanitary Bureau, and the author arrived at Columbe about 2 p. m. Smears from the spleen of the guinea pig, which died following inoculation with the sputum of the student, were examined, and a confirmatory diagnosis of plague was made. Then smears made from the sputum of the medical student and from an Indian who had died were examined and found positive for the *Pasteurella pestis*.

All people living in the convent were found in good health, and as the room occupied by the student had been fumigated and cleaned, and as 7 days had elapsed since his death, it was believed that there was no further danger from that source.

Then the scattered Indian village was visited and 3 suspected cases were examined. One, an Indian male, was found to have symptoms of pneumonia, and the soft, easy cough and sputum, showing the cohesive stringy form and the rust color characteristic of plague pneumonia, provided a tentative diagnosis of pneumonic plague. Smears from the sputum were prepared for examination, and a guinea pig was inoculated with it by scarification. The patient had a temperature of 39.4° C. and a pulse rate of 132. The other two suspects, a woman and her small child in a nearby hut, were considered negative.

A large implement house of several rooms, located near the village, was converted into a hospital for isolating the patient from the mother and child and quarantining all other contacts.

As the huts previously occupied by Indian patients were found to be of cheap construction and difficult to fumigate, orders were issued for them to be burned by the local authorities.

The methods employed broke the chain of contact and the epidemic terminated. Altogether 14 patients contracted the disease, with 100 percent mortality.

THE LOJA OUTBREAK

From May to August 31, 1939, there were 139 known cases of bubonic plague in the mountainous Province of Loja in the southern part of Ecuador, bordering on Peru. One of the sections most

affected was the region around the 300-year-old city of Catacocha. This Province, which is noted for its fine climate, good crops, and mineral wealth, is backward in its means of communication with the outside world. There are no railroads. A few highways extend out from the city of Loja, but the most important method of transportation, which has been used since the founding of Loja in 1549, is by muleback. Some of the mule trails are fair in the summer months, while others are fit only for goats. Many become impassable during the winter months.

On September 6 a commission consisting of the new Chief of the Antiplague Service, a sanitary inspector, and the author arrived in the city of Loja. The streets of the old city were crowded with all types of people who live in the Province and who had gathered for the annual 3-day fair. People from all parts of Ecuador go to Loja for this occasion, some to sell their cattle or merchandise, others to purchase.

Loja and the adjacent region had been free from plague for several years; but with many cases occurring in the Province, the danger of the congregation of so many people was recognized by the commission. After a discussion of the entire plague problem with the Sanitary Delegate, a trip through the Province was made.

The commission arrived at Catacocha on September 8, accompanied on the latter part of the trip by the local health physician, who stated that many cases of bubonic plague had occurred in the Casanga Valley below Catacocha. Guided by the local physician the commission visited Cofradia and Colanga in the Casanga Valley on September 9.

The first house visited was one occupied by the widow and son of Ramon Pineda, who had died on September 5 after 3 days' illness. The unconfirmed diagnosis was given as bubonic plague. He had had a bubo in the right axillary region.

The mother was ill, with a fever of 39.6° C., a pulse rate of 120, and a respiratory rate of 64. She complained of headache and exhaustion. She stated that she had had a chill early on the morning of September 8, followed by fever and headache, but that she had no other pains. No buboes were found. The lungs and heart were examined. The soft, easy cough which resembled the cough of the pneumonic plague patients in Riobamba and Columbe aroused suspicion. A specimen of sputum obtained from the patient showed the adhesive, stringy characteristics of plague sputum. When the end of a match was placed in it and then withdrawn slowly, a fine filament about 6 inches long connected the match to the sputum in the cup. This sputum was not blood-tinged but was sprinkled with small flecks of pus. Smears were made, to be examined later by microscope.

The son stated that his father had developed a chill on September 2, followed by headache, fever, pains in the back, and a sore swelling under his right arm. He said the swelling became larger and more painful, and that his father became very weak. He stated that, on the afternoon of September 4, his father developed a cough like that of his mother and that his sputum was red before he died. This story confirmed the provisional diagnosis of plague pneumonia of the mother, and indicated that the father, during the course of a bubonic form of plague, had died with a complication of plague pneumonia and had infected his wife.

From the son a list of the persons who had visited the house during the illness and "wake" of the father was obtained. After the Pineda house had been cleaned and the walls, floors, and household furnishings washed with cresol solution, the homes of neighbors in Cofradia, and especially those who had been in contact with Pineda, were visited, and later other cases were discovered.

A total of 7 deaths attributable to pneumonic plague occurred up to September 18, in persons who had been in contact with Ramon Pineda or with cases originating in such contact. The diagnosis was confirmed by sputum examination and guinea pig inoculation.

Instructions were given regarding the prevention of further spread of the disease, and plans to combat the epidemic and to provide for future protection were instituted, supported financially by the Government at Quito. When the writer left Loja on September 20, it was believed that future cases arising from this outbreak were unlikely.

CONCLUSIONS

These three outbreaks again emphasize the fact that pneumonic plague is a highly contagious infection with a high mortality rate that may at times approximate 100 percent.

The best methods to control the outbreaks and break the chain of contact are:

1. To isolate rigidly the infected patients when the first suspicious symptoms are recognized.
2. To quarantine all persons who have been in direct contact with the infected person or persons (under armed guards, if necessary).
3. To protect nurses and doctors in attendance by suitable head masks, gowns, and rubber gloves.
4. The careful disinfection and fumigation of quarters previously occupied by pneumonic plague patients.
5. House-to-house inspection of infected sectors, with temperature taken twice daily and isolation of all who show temperature regardless of cause.

It is the author's opinion that outbreaks of pneumonic plague almost always result from cases of bubonic plague that develop a secondary pneumonia. This was the case in the Loja outbreak.

When pneumonic plague cases are discovered, it is not always possible to establish the connection between the first pneumonic infection and the bubonic cases that produced it.

The only way the author can explain the fact that no secondary cases occurred among the ward patients in Riobamba is that close intimate contact whereby the person breathes the exhaled air of the patient is necessary, and that when a sufficient distance separates the patient from other persons the soft, easy cough of the pneumonic plague patient is not sufficiently forceful to propel the infective *Pasteurella* more than a few feet.

Doctors and health officers in any endemic plague region should be on their guard and be suspicious of all patients with pneumonic symptoms and especially of those who die in less than 4 days. They should also remember that patients with pneumonic plague may cough very little, that the cough is soft and easy, that the sputum in the early stages may contain small flecks of pus and become blood stained only in the last stages of disease, but that at all times it is very cohesive and forms long, fine filaments when a portion of sputum is separated from the mass specimen.

PERIOD OF ANTIBODY DEVELOPMENT TO LYMPHOCYTIC CHORIOMENINGITIS IN MICE[1]

By Robert A. Lyon, M. D., *Washington, D. C.*

A considerable number of persons in many localities harbor the antibodies of lymphocytic choriomeningitis in their blood, which indicates that infection with the virus of this disease is not rare (*1, 2*). An incapacitating illness such as usually occurs in the meningeal type of the disease, however, is recalled by few of these immune individuals. Hence, the acquisition of this protection probably resulted from a somatic, nonmeningeal infection with this virus. The practical importance of the disease, however, results from central nervous system invasion by the virus which may be associated with marked symptoms and even neurological sequellae (*3*). In connection with the study of methods of experimental immunization of mice, it was considered of interest to determine the time necessary for development of immunity in this species.

The purpose of the investigation here reported is, therefore, to determine the duration of the immunization period of lymphocytic

[1] Work performed at National Institute of Health, Washington, D. C.

choriomeningitis virus in mice. (Daily observations on inoculated animals were made throughout the progress of the study.)

METHOD

Graded concentrations of virus-infected mouse brain emulsion diluted to 10^{-2}, 10^{-3}, and 10^{-4} were injected subcutaneously into groups of mice on successive days for a week; each group of mice received but one inoculation. One cubic centimeter quantities of emulsion were employed. Half of the animals of each group were inoculated in the morning and half in the afternoon, in order to determine the time of onset of the immunity with greater precision. Two separate experiments were carried out (see table 1).

Since preliminary tests indicated that immunization occurred within a week, on the seventh day after vaccination of the first group of mice in each of the two tests, all groups were tested for immunity by intracerebral inoculation with 0.03 cc. of a 10^{-2} dilution of lymphocytic choriomeningitis infected mouse brain emulsion. Normal mouse brain inoculated into mice induced no evidence of protection.

RESULTS

From table 1 it is apparent that immunity develops in mice prior to the fifth day following subcutaneous inoculation with the living choriomeningitis virus. There is a slight difference in the apparent rate at which immunization proceeded in the two experiments reported, possibly to be explained by variation in the quantity of virus employed for immunization or by variation in the intracerebrally inoculated test dose employed in the two experiments. In the initial trial an increase in survivors from 16 percent on the third to 98 percent on the fifth day is observed.

TABLE 1.—*Period of immunization*

Intracerebral inoculation, days after immunizing injection	Number inoculated intracerebrally (0.03 cc. 10^{-2} suspension)	Number of survivals (immunes)	Percent of survivals (immunes)	Intracerebral inoculation, days after immunizing injection	Number inoculated intracerebrally (0.03 cc. 10^{-2} suspension)	Number of survivals (immunes)	Percent of survivals (immunes)
Experiment 1:				Experiment 2:			
2	57	3	5	3	40	17	42
3	110	27	25	4	38	33	87
4	111	79	72	5	40	37	93
5	53	52	98	6	40	40	100
6	105	102	97	7	38	37	98
7	107	106	99				

However, in the second experiment the survivors increased from 42 percent on the third day through 87 percent on the fourth day to

93 percent on the fifth. In all instances full immunity was present after the fifth day.

DISCUSSION

In accord with other workers, it was found that subcutaneous administration of potent lymphocytic choriomeningitis virus in mice suffices to establish immunity such that the animal survives intracerebral inoculation of the same virus strain. Since so few animals died during the test period when vaccinated on the fifth, sixth, or seventh day prior to intracerebral inoculation and most are protected after the fourth day, it is evident that 96 to 120 hours are required to immunize mice to active lymphocytic choriomeningitis virus by subcutaneous inoculation, using the method described.

SUMMARY

A period of 5 days is required for the development in white mice of immunity by subcutaneous inoculation of lymphocytic choriomeningitis virus, as tested by intracerebral inoculation.

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LOBAR PNEUMONIA*

General Statement.

Although information concerning pneumonia has been rapidly and steadily accumulating, only recently (1938) has this disease dropped from third to fifth place among the principal causes of death in the United States. The prompt and correct employment of suitable methods of treatment has influenced favorably the outcome of this important and dreaded disease. The death rate from pneumonia has declined about one-third since 1936.

Such advances in the management and treatment of pneumonia, however, have had little effect upon reducing the number of cases developing each year. Preliminary reports of recent studies indicate that in the not too distant future preventive measures may be developed to combat this malady.

*This material is available in leaflet form and a limited number of copies may be obtained by addressing the Surgeon General, U. S. Public Health Service, Washington, D. C.

Occurrence.

The condition is observed at all ages, though more frequently in early and middle adult life. Males are attacked twice as commonly as females.

Pneumonia is chiefly a disease of the winter months. At this time of the year there is a greater prevalence of mild infections of the respiratory tract; there is more exposure and chilling of the body and a greater tendency to crowding of people in closed warm spaces. These factors are believed to influence the development of the illness.

Method of Spread.

Pneumonia is mildly contagious and may be acquired by contact with a patient suffering with the disease or with a healthy carrier. A carrier is a healthy person who harbors the pneumonia germs in the secretions of the nose and throat.

The germs are spread by the patient into the air in droplets of saliva or sputum while coughing or talking. They may also be transferred by eating utensils used by the sick.

Early Signs of Pneumonia.

The disease usually begins suddenly with a chill. Fever rises rapidly, often reaching 104° within a few hours. After 24 hours, cough develops and the patient takes short, jerky breaths because of pain associated with movement of the lungs.

Course of Disease.

In favorable cases a sudden striking improvement is noted after 4 to 10 days. This is called the "crisis," during which time the temperature drops rapidly, profuse sweating occurs, and the most distressing symptoms disappear. The early use of adequate doses of serum has shortened this period.

In some cases, the improvement is more gradual, in which case the term "lysis" is applied.

Diagnosis.

A competent physician usually has little difficulty in recognizing this disease clinically. It is necessary to determine the type of pneumonia present in order to secure favorable results with serum treatment. This is readily accomplished by an examination of the sputum.

The use of the X-ray film has been of great value in demonstrating the extent of involvement of the lung as well as its progress.

Treatment.

The importance of placing the patient promptly under the care of a competent physician cannot be overemphasized. When used early enough in the course of the disease, serum for type I pneumonia has reduced the death rate of this type to 5 or 6 percent as compared

to a control of 25 to 30 percent. Whereas the results obtained with serums of other types have not been as striking, nevertheless a significant reduction has been observed to justify their continued use.

In recent years the employment of sulfapyridine or sulfathiazole has affected favorably the outcome of pneumonia. The action of these drugs is more dramatic in the pneumonias caused by the streptococcus group of germs. With the use of both of these measures, singly or combined (serum and these sulfanilamide derivatives), a further reduction in the number of deaths from pneumonia is anticipated.

Prevention.

1. Isolate the patient in order to prevent the spread of germs to other members of the household. Investigations have demonstrated that the number of healthy carriers increases during the pneumonia season.
2. Maintain good general bodily health and resistance by—
   (a) Obtaining sufficient rest and sleep.
   (b) Eating adequate amounts of the proper foods.
   (c) Avoiding overcrowding.
   (d) Exercising regularly in the open air.
3. Avoid contact with cases of pneumonia.
4. Secure prompt medical attention for all respiratory infections.
5. Wear clothing suitable to weather conditions.

DO NOT INDULGE IN SELF-DIAGNOSIS OR SELF-TREATMENT. CONSULT YOUR DOCTOR

COUNTY HEALTH DEPARTMENT ESTABLISHES MENTAL HYGIENE UNIT

What is believed to be the first mental hygiene unit in a local health department was established October 30, 1940, when the Suffolk County, N. Y., Board of Supervisors placed $17,525 in the budget of the Suffolk County Department of Health for the establishment of a division of mental hygiene. It is hoped that this unit will be functioning by January 1, 1941.

The personnel will comprise one psychiatrist, one psychologist, two psychiatric social workers, and a clerk.

The division will in no wise replace the clinics carried on by the State department of mental hygiene, which are devoted chiefly to the problems of school children and to the follow-up of their own parole cases. It will supplement this program by concentrating on the mental problems arising out of physical conditions among those

families served by the health department, the probation department, the children's court, the department of public welfare, and the board of child welfare.

COURT DECISION ON PUBLIC HEALTH

State narcotic drug law construed.—(Louisiana Supreme Court; *State* v. *Martin*, 192 So.694; decided November 27, 1939.) The defendant appealed from a conviction of unlawfully possessing and having under his control a narcotic drug in violation of the State uniform narcotic drug act. One of his contentions before the Louisiana Supreme Court was that the verdict was not responsive to the provisions of the narcotic drug statute in that the statute affected only a designated class of persons in which he was not included. In other words he sought to limit the law's application to those persons who, by its terms, prescribe, dispense, deal in, and distribute narcotic drugs, under which limitation the defendant, as a mere possessor of a drug, would not be amenable to the law.

In sustaining the conviction the supreme court pointed out that, in addition to authorizing certain specified persons, such as persons in charge of a hospital or laboratory, manufacturers, wholesalers, physicians, etc., to possess or control narcotic drugs, the statute also made provision for the proper acquisition, and resultant legal possession, of a narcotic drug by an ordinary individual and penalized possession obtained in other than the prescribed manner. The defendant relied considerably upon a United States Supreme Court case, but the Louisiana court said "We find nothing in the opinion of the court interpreting the Federal act involved in the Jin Fuey Moy case requiring us to restrict the application of the State statute to the prescriber, seller, dispenser, dealer, or distributor of narcotic drugs."

DEATHS DURING WEEK ENDED NOVEMBER 9, 1940

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Nov. 9, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	7,984	7,707
Average for 3 prior years	7,745	
Total deaths, first 45 weeks of year	376,895	370,242
Deaths under 1 year of age	512	431
Average for 3 prior years	457	
Deaths under 1 year of age, first 45 weeks of year	22,582	22,339
Data from industrial insurance companies:		
Policies in force	64,863,128	66,569,616
Number of death claims	9,323	9,407
Death claims per 1,000 policies in force, annual rate	7.5	7.4
Death claims per 1,000 policies, first 45 weeks of year, annual rate	9.6	9.9

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED NOVEMBER 16, 1940

Summary

The incidence of each of the nine communicable diseases included in the weekly telegraphic reports, with the exception of meningococcus meningitis and poliomyelitis, increased during the current week, but no significantly unusual prevalence was recorded for any of these diseases. The figures for only three—measles, poliomyelitis, and whooping cough—were above the 1935–39 median expectancy, and the cumulative totals for this year to date (46 weeks) are above the 5-year medians for only influenza and poliomyelitis.

A total of 1,180 cases of influenza was reported for the current week, as compared with 787 for the preceding week, the principal increases being in Virginia (from 74 to 148 cases), South Carolina (from 144 to 306 cases), and California (from 22 to 138 cases).

Of 39 cases of smallpox, 10 cases each were reported in Tennessee and Washington State, and 8 cases in Illinois. The highest incidence of whooping cough is apparently in the Middle Atlantic and East North Central States. Three cases of undulant fever were reported in Connecticut and 1 case each in Maryland and Mississippi. Of 51 cases of endemic typhus fever, 13 were reported in Georgia, 10 in Alabama, and 11 in Texas.

For the current week the Bureau of the Census reports 8,103 deaths in 88 major cities of the United States, as compared with 7,978 for the preceding week and with a 3-year (1937–39) average of 8,226 for the corresponding week.

Telegraphic morbidity reports from State health officers for the week ended November 16, 1940, and comparison with corresponding week of 1939 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939	
NEW ENG.												
Maine	1	2	2	-------	1	1	200	19	28	0	0	0
New Hampshire	0	0	0	-------	-------	-------	4	4	3	0	0	0
Vermont	0	0	0	-------	-------	-------	9	41	41	0	0	0
Massachusetts	5	9	8	-------	-------	-------	219	275	103	3	0	2
Rhode Island	0	0	0	-------	-------	-------	2	58	19	0	0	0
Connecticut	0	0	3	1	-------	3	2	45	45	0	0	0
MID. ATL.												
New York	17	19	24	[1] 11	[1] 11	[1] 11	357	149	149	2	0	3
New Jersey	12	27	17	-------	16	9	186	17	18	2	0	1
Pennsylvania	18	69	54	-------	-------	-------	812	39	66	0	4	3
E. NO. CEN.												
Ohio	18	48	48	18	34	32	38	27	27	1	0	4
Indiana	11	21	32	4	1	13	22	27	18	0	0	1
Illinois	18	39	44	8	10	19	251	28	28	0	4	4
Michigan [2]	9	6	29	11	-------	1	368	160	54	3	0	1
Wisconsin	1	0	2	26	28	33	248	35	42	0	0	0
W. NO. CEN.												
Minnesota	4	0	7	1	-------	1	28	87	45	0	0	1
Iowa	7	3	4	1	-------	3	41	17	5	0	0	1
Missouri	13	15	32	1	-------	41	2	9	9	2	1	1
North Dakota	3	1	1	-------	5	5	4	2	5	0	0	0
South Dakota	1	1	2	1	3	-------	1	5	4	0	0	0
Nebraska	0	2	5	-------	-------	-------	2	2	2	0	0	0
Kansas	5	4	14	3	4	5	9	68	11	0	0	0
SO. ATL.												
Delaware	0	1	1	-------	-------	-------	0	0	2	0	0	0
Maryland [2]	2	7	21	1	7	5	6	2	8	0	0	0
Dist. of Col.	1	2	11	-------	-------	-------	1	1	1	0	0	3
Virginia [2]	29	68	68	148	89	-------	55	11	26	2	2	3
West Virginia [2]	12	15	31	7	13	20	24	2	17	0	0	1
North Carolina [2]	49	117	117	3	5	7	24	103	103	0	2	2
South Carolina [2]	18	24	16	306	478	284	9	5	5	0	0	1
Georgia [2]	31	29	29	33	118	-------	12	9	0	0	0	0
Florida	11	8	12	2	3	3	3	4	4	0	1	1
E. SO. CEN.												
Kentucky	11	16	29	10	64	15	73	4	7	0	1	5
Tennessee [2]	13	34	40	39	38	38	25	9	6	0	0	3
Alabama [2]	27	54	44	43	185	55	23	4	6	4	2	4
Mississippi [2] [3]	23	18	14	-------	-------	-------	-------	-------	-------	0	0	0
W. SO. CEN.												
Arkansas	12	23	21	24	54	28	2	3	3	0	1	1
Louisiana [2]	10	9	18	9	10	6	1	1	8	0	1	1
Oklahoma	29	15	25	23	34	42	2	5	4	0	0	0
Texas [2]	36	46	61	229	247	220	41	14	14	0	1	1
MOUNTAIN												
Montana	6	1	1	-------	132	3	0	22	22	0	0	0
Idaho	0	0	0	-------	-------	1	0	1	7	0	2	0
Wyoming	1	1	0	-------	-------	-------	3	9	4	0	0	0
Colorado	5	5	9	4	13	-------	22	46	11	0	0	0
New Mexico	0	1	6	1	1	-------	11	7	7	0	1	0
Arizona	5	7	5	56	63	58	39	3	2	0	0	9
Utah [2]	0	0	0	6	5	-------	3	87	13	0	0	0
Nevada	0	-------	-------	-------	-------	-------	0	-------	-------	0	-------	-------
PACIFIC												
Washington	6	1	1	-------	-------	-------	6	263	30	0	1	0
Oregon	4	2	2	12	18	20	14	19	16	0	1	1
California [3]	18	32	49	138	21	33	27	162	140	0	3	1
Total	502	802	980	1,180	1,711	970	3,231	1,910	1,910	19	28	63
46 weeks	13,575	20,295	23,949	177,864	160,713	147,875	245,260	359,527	359,527	1,449	1,758	4,930

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended November 16, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939		Nov. 16, 1940	Nov. 18, 1939	
NEW ENG.												
Maine	0	0	0	3	8	12	0	0	0	0	2	1
New Hampshire	0	0	0	9	0	7	0	0	0	0	0	0
Vermont	0	0	0	2	0	7	0	0	0	0	0	1
Massachusetts	1	2	2	123	82	105	0	0	0	1	1	1
Rhode Island	0	0	0	2	3	12	0	0	0	1	0	1
Connecticut	0	0	0	15	35	38	0	0	0	0	2	2
MID. ATL.												
New York	6	18	7	187	236	271	0	0	0	22	5	8
New Jersey	0	5	2	76	103	85	0	0	0	4	2	4
Pennsylvania	8	15	4	189	408	340	0	0	0	15	10	19
E. NO. CEN.												
Ohio	23	7	0	210	325	270	0	2	1	11	10	11
Indiana	9	1	1	73	167	161	0	1	2	1	3	1
Illinois	21	5	4	250	300	300	8	1	2	2	8	13
Michigan [2]	21	6	5	156	287	287	3	10	4	3	2	4
Wisconsin	11	5	1	110	117	181	1	3	2	3	0	1
W. NO. CEN.												
Minnesota	11	4	2	64	101	121	2	13	4	1	0	1
Iowa	6	12	2	62	52	70	1	16	6	0	2	3
Missouri	3	0	2	62	68	114	0	2	4	1	12	5
North Dakota	0	0	0	8	35	43	1	0	10	1	0	2
South Dakota	0	1	1	13	20	34	0	2	2	0	0	1
Nebraska	2	3	1	17	17	33	0	0	0	0	2	1
Kansas	7	0	0	53	91	118	0	1	2	4	3	3
SO. ATL.												
Delaware	0	0	0	7	9	9	0	0	0	0	2	2
Maryland [2]	1	2	1	32	45	71	0	0	0	0	4	5
Dist. of Col	0	3	0	10	6	10	0	0	0	1	2	1
Virginia [2]	12	0	1	86	54	54	0	0	0	10	8	7
West Virginia [2]	19	7	0	49	81	86	0	0	0	3	7	7
North Carolina [2]	2	3	1	89	141	72	0	1	0	2	1	3
South Carolina [2]	0	1	1	23	31	12	0	0	0	0	14	3
Georgia [2]	1	0	1	43	42	38	0	1	0	9	10	10
Florida	1	0	1	2	16	11	0	0	0	8	3	3
E. SO. CEN.												
Kentucky	3	9	3	48	86	69	0	0	0	13	5	12
Tennessee [2]	4	1	1	117	71	71	10	0	1	8	1	5
Alabama [2]	0	3	2	42	54	27	0	1	0	7	2	5
Mississippi [2 3]	2	2	2	15	17	13	0	0	0	4	3	3
W. SO. CEN.												
Arkansas	0	2	2	13	21	20	1	0	0	7	10	10
Louisiana [2]	3	0	1	10	14	17	0	0	0	3	7	11
Oklahoma	3	1	1	29	23	23	1	2	2	5	3	10
Texas [2]	3	6	2	45	51	66	5	0	0	9	14	27
MOUNTAIN												
Montana	0	0	0	10	34	34	0	0	8	0	1	4
Idaho	2	2	0	7	6	21	0	1	1	0	2	2
Wyoming	6	0	0	8	5	11	0	1	1	0	0	0
Colorado	1	0	4	24	43	42	0	1	1	2	2	1
New Mexico	0	3	0	5	11	20	0	0	0	3	1	5
Arizona	0	0	0	6	9	9	1	0	0	0	2	1
Utah [2]	2	6	0	24	15	15	0	0	0	2	1	0
Nevada	0	------	------	0	------	------	0	------	------	0	------	------
PACIFIC												
Washington	7	1	1	30	36	43	0	1	1	1	3	3
Oregon	3	1	1	11	16	37	10	0	0	3	6	3
California [2]	1	26	12	99	179	209	0	1	1	6	18	9
Total	205	163	122	2,568	3,571	3,673	44	61	124	176	196	275
46 weeks	9,200	6,793	6,793	138,396	140,137	195,700	2,176	9,062	9,062	8,911	11,922	13,408

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended November 16, 1940, and comparison with corresponding week of 1939 and 5-year median—Continued

Division and State	Whooping cough	
	Week ended	
	Nov. 16, 1940	Nov. 18, 1939
NEW ENG.		
Maine	18	36
New Hampshire	0	4
Vermont	8	59
Massachusetts	165	134
Rhode Island	2	25
Connecticut	80	72
MID. ATL.		
New York	465	352
New Jersey	188	158
Pennsylvania	736	315
E. NO. CEN.		
Ohio	420	245
Indiana	20	43
Illinois	134	200
Michigan [2]	433	112
Wisconsin	188	136
W. NO. CEN.		
Minnesota	52	42
Iowa	21	6
Missouri	48	10
North Dakota	19	13
South Dakota	2	0
Nebraska	21	5
Kansas	49	17
SO. ATL.		
Delaware	46	18
Maryland [2]	83	48
Dist. of Col	3	11
Virginia [2]	91	23
West Virginia [2]	15	11
North Carolina [2]	107	78
South Carolina [2]	39	6
SO. ATL.—continued		
Georgia [2]	10	14
Florida	7	11
E. SO. CEN.		
Kentucky	68	58
Tennessee [2]	82	65
Alabama [2]	3	14
Mississippi [2 3]	----------	----------
W. SO. CEN.		
Arkansas	11	15
Louisiana [2]	4	5
Oklahoma	10	0
Texas [2]	89	55
MOUNTAIN		
Montana	1	2
Idaho	6	0
Wyoming	0	1
Colorado	38	23
New Mexico	9	32
Arizona	10	5
Utah [2]	25	62
Nevada	0	----------
PACIFIC		
Washington	57	27
Oregon	24	22
California [2]	285	112
Total	4,192	2,702
46 weeks	146,871	157,405

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Typhus fever, week ended Nov. 16, 1940, 51 cases as follows: Virginia, 1; North Carolina, 1; South Carolina, 2; Georgia, 13; Tennessee, 4; Alabama, 10; Mississippi, 6, Louisiana, 2; Texas, 11; California, 1.

WEEKLY REPORTS FROM CITIES

City reports for week ended November 2, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	195	88	31	408	461	823	4	323	39	931	----
Current week [1]	67	51	12	795	302	587	0	292	26	1,273	----
Maine:											
Portland	0	----	0	0	1	0	0	0	1	5	17
New Hampshire:											
Concord	0	----	0	0	0	2	0	0	0	0	7
Manchester	0	----	0	0	5	3	0	0	0	0	14
Nashua	0	----	0	0	0	1	0	0	0	0	7
Vermont:											
Barre	----	----	----	----	----	----	----	----	----	----	----
Burlington	0	----	0	0	0	0	0	0	0	0	11
Rutland	0	----	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	0	----	0	35	16	21	0	11	0	74	240
Fall River	1	----	1	2	2	0	0	5	0	5	45
Springfield	0	----	0	0	1	6	0	1	0	0	32
Worcester	0	----	0	81	7	0	0	2	2	2	76
Rhode Island:											
Pawtucket	0	----	0	0	1	0	0	0	0	0	18
Providence	0	----	0	2	1	2	0	0	0	16	59
Connecticut:											
Bridgeport	0	----	0	0	2	2	0	0	1	4	32
Hartford	0	----	0	0	0	0	0	0	0	3	32
New Haven	0	----	0	0	2	4	0	0	0	35	46
New York:											
Buffalo	0	----	0	2	11	8	0	8	0	17	167
New York	11	10	1	115	55	59	0	54	5	123	1,433
Rochester	0	----	0	0	1	4	0	1	1	21	55
Syracuse	0	----	0	0	0	0	0	3	0	9	50
New Jersey:											
Camden	1	----	0	41	1	3	0	1	0	2	21
Newark	0	----	0	3	3	1	0	7	0	21	82
Trenton	0	----	0	1	1	3	0	2	0	0	41
Pennsylvania:											
Philadelphia	1	1	1	151	14	34	0	18	2	127	413
Pittsburgh	2	1	0	0	13	13	0	4	0	43	149
Reading	0	----	0	5	1	6	0	3	0	0	21
Scranton	0	----	----	0	----	0	0	----	0	0	----
Ohio:											
Cincinnati	2	----	1	0	3	14	0	4	1	8	124
Cleveland	1	17	3	1	8	12	0	6	1	89	176
Columbus	1	----	0	0	3	5	0	1	0	14	80
Toledo	0	----	0	0	3	12	0	2	0	9	70
Indiana:											
Anderson	0	----	0	0	0	2	0	0	0	0	9
Fort Wayne	1	----	0	0	1	3	0	1	0	0	21
Indianapolis	1	----	0	1	8	14	0	2	1	2	95
Muncie	0	----	0	2	0	4	0	0	0	1	12
South Bend	0	----	0	0	0	0	0	0	0	0	14
Terre Haute	1	----	0	0	4	0	0	1	0	0	19
Illinois:											
Alton	0	----	0	0	0	2	0	0	0	0	9
Chicago	7	3	1	102	17	115	0	37	0	99	634
Elgin	0	----	0	0	0	0	0	0	0	6	7
Moline	0	----	0	0	0	0	0	0	0	0	7
Springfield	0	----	0	0	0	12	0	0	0	3	16
Michigan:											
Detroit	3	----	0	174	10	50	0	6	0	106	243
Flint	0	----	0	1	3	1	0	0	0	3	17
Grand Rapids	0	----	0	0	0	6	0	0	0	20	36
Wisconsin:											
Kenosha	0	----	0	1	0	0	0	0	0	0	11
Madison	0	----	0	2	0	0	0	0	0	3	28
Milwaukee	1	----	0	29	4	24	0	6	0	25	98
Racine	0	----	0	1	0	6	0	0	0	0	9
Superior	0	----	0	0	0	1	0	0	0	0	7

[1] Figures for Barre and Little Rock estimated; reports not received.

City reports for week ended November 2, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	0	0	1	0	1	0	5	19
Minneapolis	0	------	0	3	1	25	0	0	0	22	85
St. Paul	0	------	0	2	5	11	0	1	0	14	50
Iowa:											
Cedar Rapids	0	------	--------	0	-------	7	0	-------	0	0	--------
Davenport	0	------	--------	0	-------	5	1	-------	0	0	--------
Des Moines	0	------	0	0	0	11	0	0	0	3	21
Sioux City	0	------	--------	0	--------	1	0	0	--------	1	--------
Waterloo	0	------	--------	0	-------	2	0	0	-------	0	--------
Missouri:											
Kansas City	1	------	0	0	3	10	0	2	0	21	82
St. Joseph	1	------	0	0	3	0	0	0	0	0	23
St. Louis	2	------	0	5	8	20	0	6	2	24	214
North Dakota:											
Fargo	0	------	0	0	0	1	0	0	0	4	5
Grand Forks	0	------	--------	1	-------	1	0	-------	0	0	--------
Minot	0	------	0	0	0	1	0	0	0	2	12
South Dakota:											
Aberdeen	0	------	--------	1	-------	2	0	-------	0	5	--------
Sioux Falls	0	------	0	0	0	6	0	0	0	0	9
Nebraska:											
Lincoln	0	------	--------	1	-------	5	0	-------	0	0	--------
Omaha	0	------	0	0	4	2	0	0	0	6	43
Kansas:											
Lawrence	0	------	0	1	1	0	0	0	0	0	2
Topeka	0	------	0	0	0	1	0	0	1	2	--------
Wichita	0	------	0	0	0	1	0	1	0	14	23
Delaware:											
Wilmington	0	------	0	1	0	3	0	1	0	6	14
Maryland:											
Baltimore	1	1	1	5	7	9	0	8	0	66	218
Cumberland	0	------	0	0	0	0	0	0	1	1	10
Frederick	0	------	0	0	0	0	0	0	0	0	4
Dist. of Col.:											
Washington	2	------	0	3	10	8	0	9	1	11	152
Virginia:											
Lynchburg	0	------	0	0	0	1	0	1	0	0	8
Norfolk	0	9	0	0	2	3	0	0	0	0	38
Richmond	0	------	0	0	1	2	0	1	0	1	43
Roanoke	0	------	0	6	2	2	0	0	0	8	14
West Virginia:											
Charleston	1	------	0	0	2	0	0	0	0	0	12
Huntington	0	------	--------	1	-------	0	0	-------	1	0	--------
Wheeling	0	------	--------	1	-------	2	0	-------	0	3	--------
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	5	--------
Raleigh	0	------	0	0	1	1	0	0	0	2	13
Wilmington	0	------	0	0	2	0	0	1	0	0	12
Winston-Salem	0	2	0	1	0	3	0	1	0	24	19
South Carolina:											
Charleston	1	1	0	0	1	0	0	0	0	1	27
Florence	0	------	0	1	2	0	0	1	0	0	15
Greenville	1	------	0	0	1	1	0	1	0	1	6
Georgia:											
Atlanta	0	4	0	0	1	7	0	5	0	1	74
Brunswick	0	------	0	0	0	0	0	0	0	1	3
Savannah	2	2	0	0	0	0	0	3	0	0	32
Florida:											
Miami	0	1	0	0	1	0	0	1	1	0	34
Tampa	1	------	0	0	0	0	0	1	0	0	27
Kentucky:											
Ashland	0	------	0	0	0	2	0	0	0	0	4
Covington	0	------	0	1	2	0	0	3	0	0	19
Lexington	0	------	0	10	0	0	0	2	0	6	16
Tennessee:											
Knoxville	0	------	0	0	2	2	0	3	0	3	27
Memphis	2	------	0	4	2	11	0	4	1	1	69
Nashville	0	------	0	0	0	1	0	0	0	2	33
Alabama:											
Birmingham	0	------	0	3	6	3	0	3	0	4	69
Mobile	0	2	0	0	2	0	0	1	0	0	24
Montgomery	0	------	--------	1	-------	2	0	--------	2	1	--------

City reports for week ended November 2, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	1			0		1	0		0	0	
Little Rock											
Louisiana:											
Lake Charles	1		0	0	0	2	0	0	0	0	5
New Orleans	3		1	1	5	1	0	12	0	11	123
Shreveport	0		0	0	1	0	0	1	1	0	41
Oklahoma:											
Oklahoma City	0	1	0	1	3	5	0	0	0	0	41
Tulsa	1		0	0	0	4	0	0	0	7	19
Texas:											
Dallas	3		0	0	1	1	0	2	0	6	56
Fort Worth	0		0	4	3	1	0	1	0	0	40
Galveston	0		0	0	2	0	0	1	0	0	15
Houston	3		0	0	5	3	0	4	1	1	89
San Antonio	0	2	1	0	2	0	0	5	0	1	53
Montana:											
Billings	0		0	0	1	0	0	0	1	0	9
Great Falls	0		0	0	1	1	0	0	0	0	8
Helena	0		0	0	0	0	0	0	0	0	1
Missoula	0		0	0	1	0	0	0	0	0	4
Idaho:											
Boise	0		0	0	1	3	0	0	0	0	10
Colorado:											
Colorado Springs	0		0	1	0	1	0	1	0	1	12
Denver	2		0	4	7	4	0	4	1	20	75
Pueblo	0		0	0	3	3	0	0	0	0	14
New Mexico:											
Albuquerque	0		0	0	0	0	0	0	0	0	3
Utah:											
Salt Lake City	0		0	1	2	1	0	1	0	7	30
Washington:											
Seattle	3		0	2	4	3	0	1	0	19	112
Spokane	0		0	0	1	2	0	0	1	0	30
Tacoma	0		0	1	1	1	0	0	0	8	26
Oregon:											
Portland	2	3	0	2	1	1	0	2	0	14	83
Salem	0			0		0	0		0	2	
California:											
Los Angeles	0	4	1	4	4	12	0	17	0	33	340
Sacramento	4		0	0	1	3	0	0	0	1	29
San Francisco	1	1	0	0	4	5	0	9	0	46	195

City reports for week ended November 2, 1940—Continued

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New Hampshire:			
Nashua	0	0	1
Massachusetts:			
Springfield	1	1	0
Worcester	1	1	0
Rhode Island:			
Providence	1	0	0
New York:			
New York	2	1	3
Pennsylvania:			
Philadelphia	0	0	3
Reading	0	0	1
Ohio:			
Cincinnati	0	0	1
Cleveland	0	0	2
Columbus	0	0	2
Toledo	0	0	4
Illinois:			
Chicago	0	0	6
Michigan:			
Detroit	0	0	2
Flint	1	0	0
Grand Rapids	0	0	1
Wisconsin:			
Milwaukee	0	0	2
Minnesota:			
Duluth	1	0	1
Minneapolis	0	0	6
Iowa:			
Des Moines	0	0	1
Missouri:			
Kansas City	0	0	4
South Dakota:			
Aberdeen	0	0	1
Nebraska:			
Omaha	0	0	2
Kansas:			
Wichita	0	0	1
Virginia:			
Norfolk	0	0	1
Richmond	0	0	2
Roanoke	0	0	2
Florida:			
Miami	0	0	1
Alabama:			
Mobile	2	0	0
Louisiana:			
Shreveport	0	0	2
Texas:			
Fort Worth	0	0	1
Houston	0	0	1
San Antonio	1	1	0
Montana:			
Missoula	0	0	1
Colorado:			
Denver	0	0	1
Utah:			
Salt Lake City	0	0	1
Washington:			
Seattle	0	0	3
Spokane	0	1	3
Tacoma	0	0	1
California:			
Los Angeles	0	1	2

Encephalitis, epidemic or lethargic.—Cases: Tampa, 1.
Pellagra.—Cases: Savannah, 8; Montgomery, 1; San Antonio, 1; Los Angeles, 1.
Typhus fever.—Cases: New York, 1; Newark, 1; Atlanta, 1; Savannah, 5; Mobile, 1; Montgomery, 1; Lake Charles, 1; Houston, 1. Deaths: Mobile, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended October 19, 1940.—During the week ended October 19, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1		3	2		1			7
Chickenpox		3		110	163	42	23	53	62	456
Diphtheria		14	1	51	2	3	1	1		73
Dysentery				3	4				1	8
Influenza		5			9				26	40
Measles	12	26	1	114	89	29	32	62	25	390
Mumps				6	72	16		9	3	106
Pneumonia		4			12	1	3		13	33
Poliomyelitis			1	3	5					9
Scarlet fever		5	5	70	101	7	12	8	7	215
Trachoma									36	36
Tuberculosis		12	2	61	54	5		5		139
Typhoid and paratyphoid fever		1		42	13	4		3	5	68
Whooping cough				232	150	44	8	27	9	470

EGYPT

Infectious diseases—First quarter 1940.—During the first quarter of 1940, certain infectious diseases were reported in Egypt as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	1		Plague	246	119
Cerebrospinal meningitis	67	27	Poliomyelitis		3
Chickenpox	584	6	Puerperal septicemia	112	79
Dengue	1		Rabies	5	5
Diphtheria	349	147	Scarlet fever	45	
Dysentery	340	58	Smallpox	1	
Erysipelas	1,075	99	Tetanus	118	65
Influenza	1,877	38	Tuberculosis (all forms)	1,504	808
Leprosy	165	17	Typhoid fever	786	164
Lethargic encephalitis		2	Typhus fever	1,929	309
Malaria	664	8	Undulant fever	4	
Measles	4,181	511	Whooping cough	915	27
Mumps	863	7			

Vital statistics—First quarter 1940.—Following are vital statistics for the first quarter of 1940 for all places in Egypt having a health bureau:

Number of births	65,161	Deaths per 1,000 population	24.1
Live births per 1,000 population	51.2	Deaths under 2 years of age	7,483
Number of stillbirths	1,193	Deaths under 2 years of age per 1,000 live births	115
Total deaths	30,724		

FINLAND

Communicable diseases—4 weeks ended September 7, 1940.—During the 4 weeks ended September 7, 1940, cases of certain communicable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Diphtheria	206	Poliomyelitis	141
Dysentery	7	Scarlet fever	313
Influenza	755	Typhoid fever	29
Lethargic encephalitis	1	Undulant fever	4
Paratyphoid fever	285		

HAWAII

Influenza.—During the week ended November 8, 1,746 cases of influenza were reported in Hawaii, of which 485 cases, with 1 death, occurred on the island of Oahu.[1] During the week ended November 15, 1,115 cases, with no deaths, were reported. Of these, 186 cases were reported from the island of Oahu.

JAMAICA

Communicable diseases—4 weeks ended October 26, 1940.—During the 4 weeks ended October 26, 1940, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	1	9	Leprosy	1	3
Diphtheria	1	4	Puerperal sepsis		3
Dysentery	17	9	Tuberculosis	22	84
Erysipelas	1	2	Typhoid fever	4	46

SWEDEN

Notifiable diseases—August 1940.—During the month of August 1940, cases of certain notifiable diseases were reported in Sweden as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	3	Scarlet fever	1,101
Diphtheria	20	Syphilis	20
Dysentery	53	Typhoid fever	4
Gonorrhea	1,052	Undulant fever	7
Paratyphoid fever	116	Weil's disease	1
Poliomyelitis	73		

[1] For reports from September 28 to October 4, see Public Health Reports for November 8, 1940, p. 2097.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of October 25, 1940, pages 1973–1976. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Paauhau Area.—A rat found on October 17, 1940, about 2 miles from Paauhau Landing in the Paauhau Area, Hamakua District, Island of Hawaii, T. H., has been proved positive for plague.

Peru.—During the month of September 1940, plague was reported in Peru, by Departments, as follows: Lima, 3 cases, 3 deaths; Tumbes, 1 case, 1 death. Plague-infected rats were also reported in the city of Trujillo, Libertad Department.

Yellow Fever

Sudan (Anglo-Egyptian).—On November 7, 1940, the Nubia Mountain area of Anglo-Egyptian Sudan was declared by the Government to be infected with yellow fever. For the week ended November 9, 733 cases of yellow fever, with 75 deaths, were reported in Kordofan Province, Anglo-Egyptian Sudan.