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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

December 1–28, 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 December 28, 1940, the number reported for the corresponding period in 1939, and the median number for the years 1935–39.

DISEASES ABOVE MEDIAN PREVALENCE

Influenza.—For the 4 weeks ended December 28 there were 126,111 cases of influenza reported, the weekly incidence rising from 9,663 to 38,056 during this period. These figures may be compared with reports of from 4,000 to 7,000 cases per week during the corresponding period in 1939, and from 1,000 to 2,000 cases per week during preceding nonepidemic years.

The current epidemic started in the Mountain and Pacific regions, with a peak in reported cases in California during the week ended December 14 (13,133 cases). Other States in those regions followed with peaks in Washington, Oregon, Wyoming, and Nevada during the week ended December 21. By the end of the period (week ended December 28) the disease had spread into the South Central regions and practically every State reported the maximum weekly incidence up to that time. This was also the case in a few States in the South Atlantic and North Central regions. The epidemic had apparently not reached the New England and Middle Atlantic regions. In its place of origin and its travel from west to east the present epidemic resembles those of 1932–33 and 1928–29. The major epidemic of 1918–19 began in the Northeast and traveled generally to the west and south, as have several of the succeeding minor epidemics.

Later reports (week ended January 4, 1941) show a still further decline in the number of cases in the Mountain and Pacific regions, but each State in the South Central regions except Louisiana reported the highest weekly incidence up to that date; of approximately 56,500 cases reported from those regions, Texas reported 32,983, Kentucky, 9,601, and Arkansas, 6,516 cases. Virginia and South Carolina, in the South Atlantic region, continued to report an increase in the weekly incidence. The total number of cases reported for the week was 77,144.

Mortality records indicate that the cases have been of a mild type. A rise in the mortality rate from all causes in 92 large cities began in the latter part of November and while the weekly rates were slightly higher than those for the corresponding weeks in 1939 they compared very favorably with the preceding 3-year average rates. During the week ended December 21 when there were approximately 42,500 cases of influenza reported, the death rate for large cities was 12.2, as compared with 11.7, 12.0, and 12.0 for the corresponding week in 1939, 1938, and 1937, respectively; for the following week, when approximately 38,000 cases of influenza were reported, the death rate was 12.5 as compared with 12.4, 12.8, and 13.2 in the three preceding years.

Measles.—The number of cases of measles rose from approximately 13,000 during the preceding 4-week period to approximately 24,000 for the 4 weeks ended December 28. The number of cases was more than twice the number reported for the corresponding period in 1939, which figure (11,035) represented the 1935–39 median incidence for this period. The disease was unusually prevalent in the Middle Atlantic and North Central regions, only slightly above normal in the South Central regions, and comparatively low in all other regions. In the Pacific region the incidence of measles was unusually high during the years 1938 and 1939, but during the current year the number of cases has compared more favorably with the average of preceding normal years.

Poliomyelitis.—For the 4 weeks ended December 28 there were 260 cases of poliomyelitis reported, as compared with 265, 76, and 134 cases for the corresponding period in 1939, 1938, and 1937, respectively. While the incidence of this disease declined rapidly during the current period in all sections of the country, in the East North Central and South Atlantic regions, where the disease has been unusually prevalent, the incidence is still considerably above the normal seasonal expectancy. Each of the States in the East North Central region reported a relatively high incidence, while Virginia and West Virginia seemed mostly responsible for the excess in the South Atlantic region.

Number of reported cases of 8 communicable diseases in the United States during the 4-week period, Dec. 1–28, 1940, the number for the corresponding period in 1939, and the median number of cases reported for the corresponding period 1935–39

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 [1]			Measles [2]			Meningococcus meningitis		
United States	1,369	2,355	2,788	126,111	23,874	7,736	23,776	11,035	11,035	115	132	317
New England	17	28	52	50	21	26	1,435	1,900	1,900	9	5	12
Middle Atlantic	173	271	349	115	113	113	9,735	1,936	2,849	14	40	54
East North Central	205	378	477	1,854	337	494	7,626	1,492	1,492	16	15	42
West North Central	82	135	206	2,309	542	316	1,409	876	876	11	6	18
South Atlantic	321	658	658	3,981	10,659	2,097	922	869	962	21	25	57
East South Central	146	298	298	2,318	2,950	823	858	264	264	18	17	37
West South Central	304	384	406	33,612	2,546	2,554	535	274	369	15	7	31
Mountain	46	88	88	30,401	5,978	441	733	629	812		8	8
Pacific	75	115	156	51,471	728	301	523	2,795	2,795	11	9	13
	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
United States	260	265	201	11,519	14,672	17,630	220	414	711	426	473	516
New England	1	10	2	858	717	1,022	0	0	0	16	18	18
Middle Atlantic	12	35	9	2,525	3,393	3,393	0	0	0	74	69	89
East North Central	110	23	23	3,722	4,702	5,623	79	48	79	45	68	78
West North Central	39	50	19	1,352	1,852	2,955	107	165	233	26	22	55
South Atlantic	39	24	22	1,148	1,364	1,246	1	4	4	87	89	92
East South Central	12	18	18	730	766	588	0	3	2	48	25	39
West South Central	14	21	21	362	442	725	13	57	32	84	115	121
Mountain	9	40	5	332	551	735	9	117	117	26	33	38
Pacific	24	44	34	490	885	1,194	11	20	145	20	34	46

[1] Mississippi, New York, and Pennsylvania excluded; New York City included.
[2] Mississippi excluded.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—Diphtheria again registered a record low level. The 1,369 cases reported for the 4 weeks ended December 28 was the lowest recorded number for this period in the 12 years for which these data are available. The current incidence compares with a total of 2,355 cases for the corresponding period in 1939 and 2,788 cases for the same period in 1938. Each section of the country reported the lowest incidence in recent years.

Meningococcus meningitis.—The relatively low incidence of meningococcus meningitis which has prevailed throughout the year was maintained during the current 4-week period. The number of reported cases (115) was less than 90 percent of the number recorded for the corresponding period in 1939 and slightly more than one-third of the 1935–39 median figure for the period. The incidence was relatively low in all sections of the country; in the Middle Atlantic and South Atlantic regions the incidence was the lowest reported during this period in 10 years.

Scarlet fever.—The incidence of scarlet fever was the lowest recorded for this period in the 12 years for which these data are available. The

number of cases (11,519) reported for the current 4-week period was less than 80 percent of last year's figure for the corresponding period and about 65 percent of the 1935–39 median incidence for the period. In the East South Central region the number of cases was slightly above the seasonal expectancy, but in all other regions the incidence was comparatively low.

Smallpox.—The incidence of smallpox was also relatively low. The total of 220 cases reported for the current 4-week period compared with 414, 711, and 1,338 cases reported during the corresponding period in 1939, 1938, and 1937, respectively. The situation was favorable in all sections of the country. While the number of cases reported in the East North Central section was considerably above that of last year, it stood at the 1935–39 median level.

Typhoid fever.—Typhoid fever also reached a new low level. The number of cases (426) reported for the 4 weeks ended December 28 was 10 percent less than the comparatively low incidence in 1939 and about 20 percent below the preceding 5-year median for this period. The only exception to the favorable situation was in the East South Central region, where an increase of approximately 25 percent over the seasonal expectancy was shown.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended December 28, based on data received from the Bureau of the Census, was 12.3 per 1,000 inhabitants (annual basis). The average rate for the corresponding period in 1937–39 was 12.2. Apparently the reported cases of influenza have been mild, for the death rate has been affected very little, if any, by the current epidemic.

A STUDY OF CERTAIN FACTORS WHICH INFLUENCE THE DETERMINATION OF THE MOUSE PROTECTIVE ACTION OF MENINGOCOCCUS ANTISERUM [1]

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Following Miller's (*1*) introduction of mucin to increase the lethal action of *Neisseria meningitidis* for mice there have been a number of reports which demonstrate the mouse protective activity of antimeningococcus serum. Reference to these reports was made in a previous paper (*2*). Furthermore, it has been shown that the mouse protective activity of the serum is associated with the specific antibody. In 1937,

[1] From the Division of Biologics Control, National Institute of Health.

Rake (*3*) reported that the Group I [2] protective power of antimeningococcus serum probably parallels the homologous specific antibody nitrogen content. Pittman, Branham, and Sockrider (*4*) showed by means of the "plate precipitation" reaction a close correlation between the amount of precipitation and the protective power of the antiserum. Subsequently, Rake and Scherp (*5*), using sera the precipitin content of which had been measured quantitatively by Scherp (*6*), demonstrated further the relation between the specific immune nitrogen content of the serum and the mouse protective capacity of the serum. Complete absorption of the sera with specific polysaccharide removed 90 to 99 percent of the protective antibodies. In addition, Alexander (*7*) has presented findings which suggest that there is a broad correlation between the mouse protective activity and the therapeutic value of meningococcus antiserum. Recently, McLeod (*8a*) and Branham (*8b*) presented evidence that the recovery of several patients suffering from Group II infections was influenced by treatment with serum containing homologous specific antibodies.

At present it seems that the best method available for evaluation of meningococcus antiserum is the mouse protection test. It is evident that the agglutinin titer (56°C.), which is now the criterion for approval, bears little relation to the protective action, excepting the fact that high protective action is not found when the agglutinin titer is low. The quantitative measurement of the specific immune nitrogen (*6, 9*) offers certain possibilities but there are two objections to this method. One is that carefully purified and standardized precipitinogens, which are necessary for the measurements, are not readily available; and the other is that an occasional horse serum contains a greater amount of precipitable immune nitrogen than mouse protective antibodies (*4*). The same objections are applicable to the turbidimetric method recommended by Little (*10*). The second objection is also applicable to the "plate precipitation" reaction.

In the performance of the mouse protection test, there has been lack of uniformity of techniques employed in the various laboratories. Consequently, the results obtained have not always been comparable. It therefore seemed desirable before adopting this method to make a detailed study of the different variables in order that the best procedures might be selected for the standard method. The results of the study are reported in this paper. It includes (*a*) the selection of a medium suitable for the maintenance of the virulence of the culture, (*b*) a comparison of the susceptibility of different cultural strains to antiserum, preparatory to the selection of a test culture, (*c*) a study of the susceptibility of mice as influenced by breed, sex, and weight,

[2] In this paper the word "Group" is used to designate immunological subdivisions of meningococci on the basis of soluble specific substances (probably capsular substances). In Group I are included those strains known as Type I and Type III in the Gordon-Murray classification, and in Group II only those strains known as Type II in the same classification.

(*d*) a comparison of different solutions for suspension of the culture, (*e*) a study of mucin in relation to variability of different lots and methods of preparation, and (*f*) the selection of the time interval between inoculation of serum and culture.

Material and methods.—The general procedures for the plate precipitation test, for the mouse protection test, and for the Reed-Muench method (*11*) of calculating results of the protection test have been described in a previous paper (*4*). Certain changes which were made in these procedures are as follows: In the precipitation test, 0.8, 0.4, and 0.2 cc. amounts of serum were each added to 16 cc. of melted agar in place of 1.0, 0.5, and 0.2 cc. amounts. Neopeptone solution was used for the first suspension of the culture instead of Ringer's solution.

Mice were inoculated with 0.5 cc. of the dilutions of serum; hence the actual amount which a mouse received was one-half of the amount in 1 cc. of the designated dilution.

Group I meningococci have been largely used throughout the study. In mouse protection tests, Strain No. 1027 was used unless otherwise indicated.

The media, cultures, mice, and mucin are described below under the respective headings.

CULTURE MEDIA

Many media have been used by different workers in the cultivation of meningococcus. In the majority of instances, however, the selection has been made largely on the basis of multiplication and longevity of the bacteria and not maintenance of virulence. In the performance of the mouse protection test it is essential that the cultural inocula contain uniformly highly virulent bacteria. We have studied the influence of eight media on the virulence of meningococci. Observations were made also for any change in agglutinability and in precipitation of immune serum in agar plates. Other media might well have been included in the study. The purpose was not, however, to determine how many media are suitable for maintenance of virulence but to select one which could be relied upon with some degree of certainty. The media which were employed are listed in table 1.

The cultures grown on these media had not previously been subjected to artificial cultivation. They were started on the different media either directly from spinal fluid or from a primary culture grown from spinal fluid. There were eight strains, all of Group I. No strains of Group II meningococcus in spinal fluid were available at the time for study. As quickly as possible after isolation, subcultures of each strain were stored in the ice box in the lyophile state. Cultures so preserved apparently retain their original characteristics. The dried cultures were used as controls in observing the changes in the bacteria after they had been maintained on the different media. The examinations were made after about 6 months and again after another 6 months.

The virulence of a culture was determined by inoculating mice with dilutions of the culture, in mucin, ranging from 10^{-5} to 10^{-9}. The highest dilution which killed more than half of the mice was considered the measurement of the virulence

of the culture. The original virulence of all eight cultures was 10^{-8} or 10^{-9}; cultures which killed in dilutions between 10^{-5} and 10^{-7} will be reported as decreased in virulence; and cultures which failed to kill in the 10^{-5} dilution will be reported as avirulent.

The agglutinability of a culture was tested with Types I and III and polyvalent (M17) antisera. The test tubes were incubated at 56° C. for 20 hours. The ability to precipitate immune serum was tested on agar plates containing 5 percent of serum M17.

The results of the study are summarized in table 1. On all eight media, the majority of the cultures remained highly virulent for 6 months. In this respect, however, the solid media were superior to the semisolid. Blood agar was the only one on which the same cultures showed no loss in virulence during this period. Yet on each of the other solid media, serum glucose, EDB (*12*), and egg, there was only one culture which showed any decrease in virulence. Furthermore, on each of these three media the meningococci remained alive longer between transfers than on blood agar. The egg slant was most favorable in this respect as the transfers were made only every 21 days. Although EDB is quite favorable for maintaining virulence, the difficulty of preparation makes it impractical for routine use.

Of the solid media, serum glucose was the only one on which maintenance was continued for 12 months. During the second 6-month period five cultures which had shown no change in virulence were carried. All decreased in virulence but none became avirulent. In the use of serum glucose agar we had been previously somewhat prejudiced owing to an immunological change in a Type IV culture when it was grown on this medium (*15*). With these eight Group I strains, however, there were no apparent immunological changes.

Of the whole, semisolid media were much better than the solid for maintaining the longevity of the cultures but they were inferior in maintaining virulence. The loss in virulence, however, was not rapid. More than half of the cultures after a year on the semisolid media killed mice in a dilution of 10^{-5} or higher. Five were as virulent as when originally isolated. The latter had been grown on Hitchens' medium. One had been transferred every 21 days and the other four had been transferred every 2 or 3 days. Three of the four, however, had lost their ability to remain in suspension in saline.

From the work of others it appears that the rapidity with which a culture loses certain of its characteristics may be influenced by whether or not it has been previously subjected to artificial cultivation. Kirkbride and Cohen (*16*) compared the influence of serum glucose and Hitchens' media on the precipitative activity of cultures on immune serum agar plates. If stock cultures, routinely maintained on serum glucose, were grown on Hitchens' medium, there was a rapid loss in ability to precipitate immune serum. On the other hand, if recently isolated cultures were grown on Hitchens' medium,

TABLE 1.—*Changes in 8 strains of meningococcus after being maintained on 8 media*

Medium	Transfer interval	6 months			12 months		
		Virulence	Agglutination	Precipitation	Virulence	Agglutination	Precipitation
5 percent rabbit blood agar slant	24 or 48 hours	6 unch. (2 dead)	6 unch.	6 unch.	Discontinued		
5 percent horse serum 0.5 percent glucose agar slant	do	6 unch. 1 avir. (1 dead)	6 unch. 1 sp.	7 unch.	5 decr. 3 discontinued	5 unch.	5 unch.
Dorset's egg slant	21 days	6 unch. 1 avir. (1 dead)	6 unch. 1 sp.	5 unch. 1 negative	Discontinued		
EDB (4 percent extract) agar slant (*12*)	24 or 48 hours	6 unch. 1 decr. (1 dead)	7 unch.	7 unch.	Discontinued		
EDB (4 percent extract) 0.15 percent agar	21 days	5 unch. 1 decr. 2 avir.	8 unch.	8 unch.	Discontinued		
Hitchens' (beef infusion 0.12 percent agar, 0.1 percent glucose, 0.5 percent NaCl) (*13*).	48 or 72 hours	6 unch. 1 decr. 1 avir.	2 unch. 6 sp.	8 unch.	4 unch. 2 decr. 2 avir.	2 unch. 6 sp.	8 unch.
	21 days	7 unch. 1 decr.	7 unch. 1 sp.	8 unch.	1 unch. 6 decr. 1 avir.	6 unch. 2 sp.	8 unch.
Special 0.15 percent agar (beef infusion, 0.15 percent agar, 0.5 percent NaCl, 0.02 percent KCl and 0.01 percent $CaCl_2$) (*14*).	do	5 unch. 2 decr. 1 avir.	6 unch. 2 sp.	8 unch.	3 decr. 5 avir.	6 unch. 2 sp.	8 unch.
Plain 0.15 percent agar (beef infusion, 0.15 percent agar, 0.5 percent NaCl).	do	5 unch. 1 decr. 2 avir.	7 unch. 1 sp.	8 unch.	1 decr. 3 avir. (1 dead)	5 unch. 2 sp.	7 unch.

Unch.=Unchanged—Dilution of 10^{-8} or 10^{-9} killed more than half of mice.
Decr.=Decreased—Highest dilution which killed more than half of mice was between 10^{-5} and 10^{-7}.
Avir.=Avirulent—Dilution of 10^{-5} failed to kill mice.
Sp.=Spontaneous.

there was less change in this activity. Cohen (*17*) extended the study and reported that the virulence of a stock culture, routinely maintained on serum glucose, was definitely decreased when grown on Hitchens' medium.

It is of interest to note, under the conditions of our experiments, that there was no correlation between spontaneous agglutination and virulence of a culture. At the time of the first testing of the cultures, 12 were agglutinated spontaneously; 9 of these were highly virulent, 1 was moderately virulent, and only 2 were avirulent. At the time of the second testing, the same number were agglutinated spontaneously; 5 of these were highly virulent, 4 were moderately virulent, and 3 were avirulent. On the other hand, 12 cultures which were avirulent showed no spontaneous agglutination.

There was also no correlation between virulence and precipitation of immune serum in agar with the exception of one culture from the egg medium which was avirulent and caused no precipitation. Cultures which killed mice in dilutions of 10^{-9} produced no better halos than cultures which failed to kill mice in dilutions of 10^{-5}. No doubt, if the cultures had been completely avirulent, a difference would have been observed.

From the viewpoint of simplicity of preparation and preservation of virulence, our results indicate that, of the media studied, the rabbit blood agar and the serum glucose agar are the most satisfactory for the routine maintenance of cultures for the mouse protection test. We have chosen the blood agar. Transfers are made daily or every 2 days. In order to be absolutely certain that the cultures are kept at maximum virulence, they are passed through mice about every 2 weeks. The bacteria are recovered from the peritoneal exudate. In case a culture is to be used only occasionally, it is preserved in the lyophile state. Before using this culture, which has been resting, several daily or twice daily transfers are made on blood agar in order to restore its original vigor.

THE TEST CULTURE

In order to select a suitable strain of Group I meningococcus for measuring the mouse protective potency of antiserum, a number of strains were studied. It was found that, although of comparable virulence, the strains varied considerably in their susceptibility to antiserum. In some instances more than twice as much serum was required to protect mice against certain cultures as against others. This finding is in accord with data recently published by Branham (*18*).

TABLE 2.—*The determination of the protective value of 3 sera with 2 strains of meningococci of unequal susceptibility to antiserum*

No. of culture	Dilution of culture (1.0 cc.)	Calculated dilution of serum which protected 50 percent of mice		Potency—percentage of control, M19
		No. 1	*M19*	
1027	2.5×10^{-4}	1:128	1:75	170
1041	2.5×10^{-4}	1:200	1:107	187
		No. 2		
1027	2.5×10^{-4}	1:335	1:135	174
1041	4×10^{-4}	1:460	1:240	191
		No. 3		
1027	2.5×10^{-4}	1:124	1:154	80
1041	3×10^{-4}	1:170	1:215	79

Although our cultures were not equally susceptible, each usually reacted similarly to all antisera, so that when the potency of the unknown serum was expressed in the percentage value of the control, comparable values were obtained for the serum. These findings are illustrated in table 2. In the experiments two cultures, 1027 and 1041, were used in determining the potency of three antisera.

In each instance more of the unknown serum was required to protect against 1027 than against 1041. Likewise, corresponding amounts of the control serum M19 were required to protect against the respective strains. Hence, comparable values for the potency of each serum were obtained with both cultures. Similar results were obtained with several other cultures; dissimilar results were obtained with only one culture.

Our results indicate that a number of strains of Group I could be used with equal success in evaluating the mouse protective action of antisera. It is essential, however, that the culture be of highest virulence. Cultures only moderately virulent induce irregular results.

The culture selected for the mouse protection test.—Culture 1027 was selected for determining the potency of the antisera against Group I meningococcus. This culture grows well on artificial media, its virulence is such that less than 10 organisms in mucin are lethal for a mouse, and mice are protected against many lethal doses of it with Group I specific immune serum. Furthermore, the protective value of a serum obtained by the use of this culture, in almost every instance, is definitely correlated with the amount of specific antibody as measured by the plate precipitation reaction. In 1938, Pittman, Branham, and Sockrider (*4*), using this strain, reported a correlation between mouse protection and precipitins. This study has been continued and at present more than 100 different sera have been tested. Only a few have shown a discrepancy.

MICE

The results of the study of influence of breed, sex, and weight of mice on the determination of the mouse protective action of antimeningococcus serum are given below.

Breed.—Mice of different strains and from different colonies of one strain were employed in the study. The most important factor seemed to be that the mice came from a pure, closely inbred line. Mice of different strains did vary in susceptibility to meningococci but mice from different colonies of the same strain likewise varied. This difference in mice from the same strain is illustrated in table 3. The mice were from two colonies bred at the National Institute of Health (NIH) and from a dealer; all were of Swiss origin, the stock of each line originally coming from the same source. It may be seen that about 35 percent less serum was required to protect the mice from the dealer than those from the NIH colony No. 1; and about 40 percent less to protect mice from the NIH colony No. 1 than those from the NIH colony No. 1.

TABLE 3.—*The difference in susceptibility of Swiss mice from 3 colonies*

Experiment No.	Calculated 50 percent endpoint of antiserum (M19)		Percent variation	Experiment No.	Calculated 50 percent endpoint of antiserum (M19)		Percent variation
	NIH (No. 1) mice	*Dealer mice*			*NIH (No. 1) mice*	*NIH (No. 2) mice*	
1	1:160	1:215	34	3	1:84	1:117	39
2	1:100	1:135	35	4	[1] 1:50	[1] 1:72	44

[1] Serum No. 5.
Male mice, 16–18 grams, were used in experiments 1, 3, and 4; male and female mice, 18–19 grams, were used in experiment 2.
3.5 and 4.25 percent mucin suspensions were used in experiments 1 and 2, and 3 and 4, respectively.

These results show some of the variations in susceptibility that may arise in mice of the same strain. It is obvious that in order to obtain consistent results in mouse protection tests only mice from a pure, closely inbred line should be used.

Sex.—In table 4 are given the results of six protection tests in which the susceptibility of male and female mice was compared. Five tests were made with a Group I culture and one with a Group II culture. The mice were of comparable weights, between 16 and 18 grams. The males were about 5 weeks old and the females were approximately a week older.

It is shown that on an average about twice as much serum was required to protect the females as the males—in three instances twice as much was required, in one almost three times, and in another a little less than twice. It can be readily seen how irregular results may arise from the use of mice of both sexes if they are not equally distributed.

TABLE 4.—*The influence of sex on the protective action of meningococcus antiserum*

Group of culture	Dose of culture (1.0 cc.)	Concentration of mucin (percent)	Serum No.	Calculated 50 percent endpoint of serum with	
				Male mice	Female mice
I (1027)	$1x10^{-4}$	3.5	M19	1:160	1:80
			No. 6	1:103	<1:40
	$1x10^{-4}$	3.5	M19	1:144	1:91
			No. 7	1:120	1:43
	$2x10^{-4}$	4.25	M19	1:105	1:48
II (963)	$2x10^{-4}$	4.25	M19	1:13.5	1:6.5

Weight of mice 16–18 gm.
Mucin No. 35,689, plus 0.5 percent NaCl and 0.5 percent dextrose.

Weight.—The influence of the weight of mice on the determination of the protective action of antiserum is illustrated by two experiments, the results of which are recorded in table 5. In the first experiment, mice weighing 15 to 17 grams were compared with mice weighing 21 to 23 grams. The calculated dilutions of serum which protected 50 percent of the mice were 1:138 and 1:168, respectively. In the next experiment 15 to 16 gram mice were compared with 22 to 24 gram mice. In this instance with the wider variation in weight there was a corresponding variation in protection. The 50 percent protection endpoints of the serum were 1:156 and 1:308, respectively.

TABLE 5.—*The influence of weight on the protective action of meningococcus antiserum*

Weight of mice (grams)	Dilution of serum M19—0.5 cc. inoculum				Calculated 50 percent endpoint
	1:50	1:100	1:200	1:400	
15 to 17	6S	3S 3D	2S 4D	1S 5D	1:138
21 to 23	6S	6S	2S 4D	6D	1:168
15 to 16	4S 2D	5S 1D	2S 4D	2S 4D	1:156
22 to 24	6S	4S 2D	4S 2D	4S 2D	1:308

Equal number of males and females inoculated with each dilution of serum.
Test dose of culture = 1 cc. of 2.5×10^{-4} dilution:
Mucin No. 35,689, 3.5 percent concentration, plus 0.5 percent NaCl and 0.5 percent dextrose.

The results of the work with mice show that inherent susceptibility, sex, and weight are influential factors in determining the protective action of antiserum. Variations in any one of the factors may give rise to irregular results. By controlling these variables, however, we have found that it has been possible to duplicate the results of a mouse protection test with as few as 24 or 30 mice for a serum.

In the use of mice, one other factor should be mentioned. It is environmental temperature. We have noted that during the hot summer months in Washington mice are much less resistant to meningococci than during the winter. Dilutions of serum which will protect

half of the mice against a given dose of culture during the winter fail to protect any against the same dose during hot weather. Furthermore, the survival time after infection is also decreased. In order to obtain results in the summer comparable to those obtained in the winter, it is necessary to use a smaller test dose of culture or to decrease the concentration of mucin. Colvin and Mills (*19*), in work with controlled environmental temperatures, have demonstrated that mice kept at 90° F. are less resistant to hemolytic streptococci than mice kept at 65° F.

SOLUTION FOR SUSPENSION OF CULTURE

In preparing a culture for the mouse protection test it is the general practice to suspend it first in a clear solution in order that an estimate of the number of organisms can be made by comparing it with a turbidity standard. A number of solutions have been employed by different workers. The list includes distilled water, saline, Ringer's, Locke's (plus 0.1 percent gelatin), and meat infusion broth. We have compared the influence of each of these, with the exception of the broth, on the viability of meningococci. Solutions of proteose peptone and of neopeptone were also included. The latter solutions contained 1 percent peptone and 0.5 percent sodium chloride.

The procedure for the test was as follows: A suspension of a 5-hour-old blood agar culture was prepared in neopeptone solution. Its density corresponded to that of 500 parts per million of silica (*20*). One cubic centimeter of the suspension was added to 4 cc. of each of the solutions to be studied. These dilutions were designated as 1×10^{-1}. Serial dilutions $\times$ 10 were made as quickly as possible to 1×10^{-8} in the respective diluents. Beginning with the 1×10^{-5} dilution, 0.2 cc. of each was cultured in special 0.15 percent agar simultaneously with the making of the dilution. After an interval of 30 minutes and again after 2 hours subcultures were made from the dilutions. The growth which took place in the subcultures was read after 24 hours of incubation; the tubes were examined again after 72 hours in order to make sure that no growth had occurred in the tubes that had been negative on first reading.

After the last subcultures had been made from the different dilutions, all of the latter tubes were placed in the incubator for 24 hours, after which time 1 loopful was cultured on a blood agar plate.

The results of one experiment in which distilled water, saline, Ringer's, and neopeptone solutions were used are given in table 6.

From the dilutions in neopeptone solution, comparable amounts of growth were obtained in the subcultures made simultaneously with the dilution of the culture and 30 minutes and 2 hours after diluting. This solution was apparently in no way injurious to the bacteria. Moreover, multiplication took place in each of the original dilutions.

On the other hand, in the presence of each of the other three solutions, there was rapid dying of the bacteria. Distilled water was the most injurious, saline was less, and Ringer's was least. But even

in the presence of the latter there was marked reduction in the number of bacteria within 30 minutes. Furthermore, in certain other experiments the number of bacteria recovered in the subcultures from Ringer's solution made immediately after diluting were less than from corresponding dilutions in neopeptone solution.

TABLE 6.—*The survival of meningococci in distilled water, saline, Ringer's, and neopeptone solution*

Diluent	Time interval between diluting and subculturing	Growth of subcultures from dilutions							
		10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}
Distilled water	Simultaneous					++	(7)	(1)	−
	30 min		++++	++	(1)	−	−	−	−
	2 hrs	++++	+++	−	−	−	−	−	−
	24 hrs.*	±	−	−	−	−	−	−	−
0.85 percent NaCl	Simultaneous					+++	++	(4)	−
	30 min		++++	++++	+++	(11)	(10)	(1)	−
	2 hrs	++++	++++	++	(1)	−	−	−	−
	24 hrs.*	++++	−	−	−	−	−	−	−
Ringer's	Simultaneous					++++	++	+	(3)
	30 min		++++	++++	++	(10)	(3)	(1)	−
	2 hrs	++++	++++	++	+	−	−	−	−
	24 hrs.*	++++	+	−	−	−	−	−	−
Neopeptone	Simultaneous					++++	++	+	(7)
	30 min				++++	++++	++	+	(3)
	2 hrs			++++	++++	++++	++	+	(8)
	24 hrs.*	++++	++++	++++	++++	++++	++++	+++	+++

−, ±, +, ++, +++, ++++=None, very slight, slight, moderate, good, and heavy growth from 0.2 cc. in special 0.15 percent agar medium.
( )=Number in parentheses indicates actual number of colonies.
*=One loopful of a dilution cultured on blood agar plate.

In other experiments which included Locke's solution containing 0.1 percent gelatin and proteose peptone solution, it was observed that the survival of the meningococci in Locke's solution was similar to that in Ringer's solution, while in proteose peptone solution it was similar to that in neopeptone solution. In the original dilutions in proteose peptone solution the growth was more luxuriant than in the presence of neopeptone.

Our observations on the viability of meningococci in distilled water, saline, and Ringer's solution, in general, are in agreement with the findings of Flexner (*21*) which were reported in 1907. He found that meningococci suspended in distilled water fragmented more rapidly than in saline, that saline was directly injurious to the organism, and that viability was more prolonged in Ringer's solution than in saline.

On account of the rapidly injurious action of distilled water, saline, Ringer's, and Locke's solution on meningococci, it would seem advisable not to use any one of them for the suspension of meningococci for the mouse protection test.

On the other hand, neopeptone and proteose peptone apparently are not only not harmful to the bacteria but are favorable for multi-

plication. We have selected neopeptone for use in our routine mouse protection tests. It should be mentioned, however, that in freshly prepared solutions of neopeptone, growth is not always initiated in the higher dilutions of the culture. In this case, if the solution is permitted to stand at room temperature for a week or two, this inhibitory action disappears and inocula of less than 10 meningococci will promote multiplication.

MUCIN

Mucin has been one of the most troublesome variables in the performance of the mouse protection test. During the early work, investigators found that different lots of mucin prepared by the same manufacturer varied tremendously in their influence on the lethal action of meningococci in mice. At times the use of a mouse protection test as a means of evaluating antimeningococcus serum seemed almost hopeless. Recently, however, better preparations of granular mucin have been available, but even these may vary in influence on lethal action of meningococci and on primary toxicity for mice. The difference in the effect of two lots of mucin on the viability of meningococci will be demonstrated below.

Different methods of preparing suspensions of mucin for the mouse protection test have been employed by various workers. Some have used distilled water suspensions with or without the addition of dextrose, while others have added 0.5 percent sodium chloride. Both the autoclave and the Arnold sterilizer have been used in the sterilization of the suspensions. In the present work we have determined the viability of meningococci in suspensions of mucin prepared by the different methods. We have also observed the influence on the mouse protection test of distilled water and saline suspensions of mucin, and of suspensions sterilized in the autoclave and in the Arnold sterilizer. Data on the influence of viscosity of mucin and the proper concentration of mucin for the mouse protection test are given.

The viability of meningococci in suspensions of mucin.—Two lots of mucin, Nos. 31,111 and 35,689, were used. Suspensions of No. 31,111 were dark, slightly viscous, and contained many hard particles. Suspensions of No. 35,689 were creamy, very viscous, and contained practically no hard particles.

A 5 percent suspension of each lot was prepared in distilled water, sterilized in the autoclave, and adjusted to pH 7.4. Each solution was divided into four portions. To one nothing was added, to the second 1 percent dextrose, to the third 0.5 percent sodium chloride, and to the fourth both 1 percent dextrose and 0.5 percent sodium chloride.

In each of the different preparations serial dilutions × 10 of a 5-hour-old blood agar culture suspended in neopeptone solution (density 500 p. p. m.) were made. Similar dilutions were made in neopeptone solution. After the dilutions had stood for 2 hours at room temperature, 0.1 cc. of each was cultured in special 0.15 percent

agar. Then the dilutions were placed in the incubator and after 48 hours 1 loopful of each was cultured on a blood agar plate.

The results of an experiment with the two lots of mucin prepared by the different methods are given in table 7.

In the presence of all preparations containing mucin No. 31,111 there was dying of the bacteria. It was most rapid in the distilled water suspension. In the presence of dextrose or sodium chloride the death was slower while in the presence of both dextrose and sodium chloride conditions were still more favorable for the bacteria. Although the time interval for the subculturing in this experiment was 2 hours, in preliminary tests it was found that even within 30 minutes in a suspension of this mucin containing dextrose there was a decided decrease in the number of bacteria.

In the presence of mucin No. 35,689 (table 7) there was less dying of the bacteria than in presence of the other lot of mucin but only when both dextrose and sodium chloride were added were the conditions most favorable. However, there was multiplication of the bacteria in all dilutions of each preparation of this lot of mucin except in the distilled water preparation.

TABLE 7.—*The influence of dextrose and sodium chloride on the viability of meningococcus in mucin*

Diluent	Growth in subcultures from culture dilutions in mucin								
	After 2 hours—0.1 cc.[1]				After 48 hours incubation—1 loopful[2]				
	5×10^{-6}	5×10^{-7}	5×10^{-8}	5×10^{-9}	5×10^{-5}	5×10^{-6}	5×10^{-7}	5×10^{-8}	5×10^{-9}
Neopeptone	++++	++++	+	±	.....	.....	++++	++++	++++
Mucin No. 31,111	++++	−	−	−	−	−	−	−	−
plus 1 percent dextrose	++++	++	−	−	−	−	−	−	−
plus 0.5 percent NaCl	++++	++++	−	−	±	−	−	−	−
plus 1 percent dextrose + 0.5 percent NaCl	++++	++++	++	−	+++	−	−	−	−
Mucin No. 35,689	++++	++++	−	−	±	−	−	−	−
plus 1 percent dextrose	++++	++++	−	−	++++	++++	++++	++	+
plus 0.5 percent NaCl	++++	++++	++++	−	++++	++++	++++	++++	++++
plus 1 percent dextrose + 0.5 percent NaCl	++++	++++	++++	++++	++++	++++	++++	++++	++++

[1] Subcultures were made in special 0.15 percent agar and incubated for 4 days.
[2] Subcultures were made on blood agar plates.

In other experiments 1 percent proteose peptone was added to water suspensions of each of the two lots of mucin. In the presence of each there was no injurious action on the bacteria. Even in the presence of mucin No. 31,111 there was multiplication of the bacteria in all dilutions.

Although the test-tube experiments with suspensions of mucin containing dextrose but not sodium chloride indicated that such suspensions were injurious to the bacteria, this action was further demonstrated in a mouse protection test. Two sets of mice were inoculated,

45 minutes apart, with the same dilutions of an antiserum. The mice of the first set were inoculated with a culture immediately after it had been suspended in the mucin solution (No. 31,111) containing 1 percent dextrose, and the mice of the other set were inoculated with the same cultural suspension after it had been held about 45 minutes. The dilution of serum which protected 50 percent of the first mice was 1:47, and in the second case it was 1:90; that is, only one-half as much serum was required to protect the mice against the bacteria that had been exposed to the injurious action of the suspension of mucin for 45 minutes. In a similar experiment in which the mucin suspension contained 0.5 percent sodium chloride, the dilutions of serum which protected the mice of each set were comparable.

Sterilization of mucin.—Whether the mucin is sterilized in the autoclave or in the Arnold sterilizer does not seem to make any particular difference in the results of the mouse protection test. The results of two experiments performed at different times are as follows: In the first, the calculated dilutions which protected 50 percent of the mice were 1:163 and 1:150, respectively. In the second, the dilutions were 1:147 and 1:168, respectively.

With autoclaved mucin, it has been noted that certain preparations are slightly toxic for mice. This toxicity, however, disappears if the preparation is allowed to stand for about 2 weeks before use. When sterilizing in the autoclave, great care is taken to prevent the pressure going over 15 pounds (121° C.). Thirty minutes is used for amounts of 1,000 cc., and 20 minutes for 500 cc. or less. For sterilization of the same amounts in the "Arnold," we have used, respectively, 1 hour and 30 minutes on 3 successive days. With "Arnold" mucin we have had some difficulty with lack of sterilization.

Viscosity of mucin.—It is interesting to note that although the suspensions of mucin sterilized differently induced similar results in the mouse protection test, they do differ in viscosity. Preparations of 3.5 percent mucin sterilized in the autoclave have been found to have an average viscosity of 9.0, while like preparations sterilized in the "Arnold" have a viscosity of about 12.0.

The fact that viscosity alone is not the determining factor of mucin which increases the lethal action of meningococci for mice was very strikingly demonstrated with a preparation that had been improperly sterilized in the "Arnold" due to escape of steam. (The stopper holding the thermometer in the top of the sterilizer had inadvertently been left out of place.) This mucin was used on the final day of sterilization in a mouse protection test. Although no contaminating organisms were seen in the peritoneal smears of the mice which died, 2 weeks later the mucin contained a toxigenic gram-positive spore-forming rod. The viscosity of this preparation was 18.6. In the

same experiment a preparation of autoclaved mucin of the same concentration with a viscosity of 8.7 was also used. With the "Arnold" mucin the 50 percent endpoint dilution of serum M19 was 1:159, and with the autoclaved mucin it was 1:177.

The comparable results obtained in the mouse protection tests with preparations of mucin which contain the same concentration of mucin but which differ in viscosity substantiate the conclusion of Anderson and Oag (*22*) that it is not viscosity *per se* which enables a substance to increase the lethal action of meningococcus for mice.

Concentration of mucin.—It has not been possible to use a fixed concentration of mucin for the mouse protection test. The amount has had to be adjusted for the particular lot of mucin, for the susceptibility of the mouse as influenced by breed and weather, and the immunological group of the test culture.

For Group I cultures, with mice from the open market and mucin lot No. 31,111, a 5 percent suspension of mucin was used with a 1×10^{-3} to 5×10^{-4} dilution of the culture. With mucin lot No. 35,689, it was necessary to decrease the dilution of the culture to about 1×10^{-4}, the other factors remaining constant. With the shift to inbred Swiss mice the concentration of mucin was reduced to 4 percent and later to 3.5 percent during the summer. With 3.5 percent mucin the dilution of culture has varied from 1 to 2.5×10^{-4}.

For Group II cultures it has been necessary to use a slightly higher concentration of mucin than with Group I cultures.

It is believed that the minimum concentration of mucin that will render at least 10 highly virulent meningococci lethal for more than half of the mice inoculated, should be used.

TIME INTERVAL BETWEEN INOCULATION OF SERUM AND OF CULTURE

In a study of the mouse protection test, Branham (*23*) reported in 1935 that, on the whole, the best protection was obtained when serum was given 4 hours preceding the culture. The other time intervals which she used were 1, 8, 12, and 24 hours preceding the culture. In her work relatively large doses of serum, at times as much as 0.5 cc. of undiluted serum, were used to protect against large numbers of meningococci which were not suspended in mucin. Other workers have given the serum 30 to 60 minutes before the culture, while still others have given it either simultaneously or mixed with the culture. In our more recent work a time interval of 1 hour has been used. This interval was selected after studying the influence of inoculating the serum 4 hours and 1 hour before and simultaneously with the culture.

It was found that the selection of the best time interval between inoculation of serum and culture was dependent on the size of the test dose of culture. With large amounts of culture and corresponding

amounts of serum the best protection was obtained when the serum was given 4 hours in advance. With a small number of bacteria and high dilutions of serum the best protection was obtained when the inoculations were made simultaneously. With intermediate-size inocula the greatest protection was obtained with the hour interval. These findings are illustrated in tables 8, 9, and 10.

TABLE 8.—*The influence of time interval between inoculations of a large amount of serum and varying amounts of culture*

Experiment No.	Serum [1]	Time interval (hours)	Dilution of culture—1 cc. inoculum						Calculated 50 percent endpoint of culture
			1:100		1:1,000		1:10,000		
			S	D	S	D	S	D	
1	M19	4	3	5	4	4	5	3	1:1,000
		(2)	0	8	2	6	7	1	1:2,500
2	No. 9 Concentrated	4	2	6	8	0	8	0	1:210
		1	0	8	3	5	7	1	1:1,900
		(2)	2	6	3	5	4	4	1:2,600

[1] Each serum diluted 1:5, 0.5 cc. inoculated.
[2] The serum and culture were inoculated simultaneously.
Male mice 18–20 gm.
Mucin No. 35,689, 3.5 percent concentration, plus 0.5 percent NaCl and 0.5 percent dextrose.

TABLE 9.—*The influence of time interval between inoculations of small amounts of serum and a constant amount of culture*

Time interval	Amount of culture	Dilution of serum [1]—0.5 cc. inoculum						Calculated 50 percent endpoint of serum
		1:200		1:400		1:800		
		S	D	S	D	S	D	
4 hours	1.0 cc. of 2×10^{-3}	5	3	4	4	0	8	1:310
1 hour		6	2	4	4	1	7	1:365
None [2]		6	2	5	3	4	4	1:540

[1] Serum No. 9 concentrated.
[2] Serum and culture injected simultaneously.

Equal distribution of male and female mice; weight: males 18–20 gm.; females 16–18 gm.

TABLE 10.—*The influence of time interval of inoculation of serum on the amount required to protect against approximately 100,000 m. f. d. of culture*

Time interval	Dilution of serum M19—0.5 cc. inoculum								50 percent endpoint of serum
	1:50		1:100		1:200		1:400		
	S	D	S	D	S	D	S	D	
4 hours	3	2	3	3	3	3	1	5	1:114
1 hour	4	2	5	1	4	2	0	6	1:175
None [1]	3	3	2	4	2	4	3	3	1:100

[1] Serum and culture inoculated simultaneously. Test dose of culture=1 cc. of 2.5×10^{-4} dilution. Equal number of male and female mice, 16–17 gm.

In table 8 are given the results of two experiments. The mice were inoculated with 0.1 cc. of serum and varying amounts of culture. In each instance the mice were protected against the largest amount of culture when the serum was given 4 hours in advance and against the least amount when serum and culture were given simultaneously.

In the next experiment recorded in table 9, a moderately high dilution of culture, 2.5×10^{-5} (approximately 10,000 m. f. d.) was inoculated with varying dilutions of serum. Under these conditions the best protection was obtained when the serum and culture were given simultaneously and least when serum was given 4 hours in advance.

In table 10 are given the results of an experiment with intermediate inocula. In this case the optimum protection was obtained when the serum was given 1 hour in advance, and poorest when given with culture. The test dose of culture contained approximately 100,000 m. f. d. This size inoculum has been advocated by several workers. It has not seemed advisable to use a larger dose because of the primary toxicity of meningococci for mice.

It may also be noted in table 10 that in case of the simultaneous inoculations, the protective action of varying dilutions of serum was not clearly differentiated. This finding has been observed in other experiments. Furthermore, with certain concentrated sera the occurrence of a marked prozone has been observed following simultaneous inoculation of serum and culture. The least occurrence of prozones has been noted when the serum was given 4 hours in advance.

The above results suggest that to obtain the maximum mouse protection with an antiserum, the choice of the time interval to be used between inoculation of serum and culture is dependent on the size of the test dose of culture. If a test dose of 100,000 m. f. d. is used the best results are apparently obtained when the serum is given 1 hour preceding the culture.

SUMMARY

The results of the comparative study of different variables or factors which influence the determination of the mouse protective action of antimeningococcus serum indicate that:

1. Five percent rabbit blood agar is a satisfactory medium for the maintenance of the virulence of meningococci. Serum glucose agar, EDB agar, and Dorset's egg medium are almost as favorable as the blood agar. On semisolid media the bacteria remain alive longer but there is a gradual loss in virulence.

2. Although different Group I strains of meningococcus differ in susceptibility to antiserum, it appears that comparable values in relation to control serum may be obtained with a number of strains.

3. Mice of different strains and from different colonies of the same strain may vary in susceptibility to meningococci. The important factor is that they come from a pure, closely inbred line. Furthermore, with closely inbred mice it has been demonstrated that about twice as much serum is required to protect females as males and that wide variations in weight cause irregular results.

4. In distilled water, saline, Ringer's or Locke's solution, meningococci die very rapidly and the use of either for the first suspension of the culture is contraindicated. Neopeptone or proteose peptone solutions are not injurious to the bacteria and may be used for the suspension fluid.

5. Different lots of mucin vary in influence on the viability of meningococci.

Preparations of mucin which contain both sodium chloride and dextrose appear to be the most favorable for the bacteria.

Comparable results are obtained with suspensions of mucin sterilized in the autoclave and in the Arnold sterilizer though they do differ in viscosity.

6. To obtain the maximum protection with antiserum, the time interval between inoculation of serum and culture is dependent on the size of the test dose of culture. With a test dose of 100,000 m. f. d., it appears that the best protection is obtained when the serum is inoculated 1 hour in advance of the culture.

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WHAT INDUSTRY HAS LEARNED ABOUT LEADERSHIP[1]

ITS APPLICATION TO PUBLIC HEALTH

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During the last quarter century industry has become increasingly concerned about the worker's job satisfaction. In order to promote a greater degree of satisfaction, it has fostered a number of programs to improve working conditions and help workers adjust themselves to their jobs. Among the developments toward this end are welfare departments, personnel departments, wage plans, annual income guarantees, and many other similar devices.

As recently as 1934, however, Dr. Robert Hoppock, in his illuminating study, "Job Satisfaction," pointed out that probably one out of every three workers is more or less dissatisfied with his job. Even though the dissatisfaction is frequently the result of the worker's own incapacity, industry continues its effort to remove it. But Schopen-

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Editorial Note.—A health officer's success as administrator of the public health program depends in large measure upon his ability as a leader. As the executive, responsible for the maintenance of staff morale and a high level of performance by his subordinates, the health officer requires the abilities, attitudes, and other traits that characterize good leaders.

Industry has found it profitable to study intensively the characteristics of its best leaders and to institute programs to improve the qualities of leadership possessed by its executives and subexecutives. Many of the principles found useful in industry can be practiced to advantage by health officers and other supervisory public health workers. Hence this paper, prepared by a man who has concentrated on the development of leaders in his own organization, is presented.

hauer taught, as you will recall, that every satisfaction leads to a new struggle, implying that continued satisfaction is impossible without annihilating desire. Experience has proved that the dissatisfactions of yesterday adjust to become routine operations today, and new dissatisfactions will appear tomorrow.

As a result, industry has been seeking some common factor upon which it could concentrate to secure a greater continuing satisfaction, and perhaps serve to "annihilate desire" in this particular. The most powerful common factor seems to be that of leadership. There is nothing new in this, except that in industry, as well as in other fields, it has heretofore been considered that leadership was a characteristic impossible to develop in those not born with it. But, just as it is no longer thought that salesmen are born and not made, it is now agreed that men may at least be trained to be better leaders. Given certain fundamental capacities, their ability as leaders may be improved through training.

You may all be thinking at this point, "What has this to do with me and public health?"—and well you might. I had much the same feeling when I was asked to prepare this paper. But reflection will show you, I am sure, that training for leadership has a very great deal to do with the men and women in public health work.

Let us consider for a moment the training that most public health officers have had. Throughout their training, their internship, and their clinical work, the whole emphasis has been on the relationship of the doctor to his patient—individual to individual. If most doctors are like the ones that I have known they have learned to impose their opinions upon their patients and have not found it necessary to "sell" their patients. It is, "Stop smoking or expect to have trouble,"—not a sales talk on the desirability of discontinuing smoking. This may be necessary, and I have no criticism of it. But when doctors become public health officers with staffs of people to handle, possibly this method of handling the human relationship problem may not be so successful. Frequently the energies of both the physician and his staff are vitiated by conflicting personalities.

Leadership has been defined by a very competent woman in the retail industry as the functioning of personality so as to secure immediate and spontaneous cooperation. I am sure that you will all agree that immediate and spontaneous cooperation in any field of human endeavor is a matter eagerly to be sought and greatly to be desired. Before discussing the qualities of good leadership, let us examine the idea of leadership as it has been recast under present social conditions. Too many of us think of leadership in terms of our school-day reading —the hero fighting on a battlement while his troops fall around him, Bismarck with his iron will and his iron fist welding a nation out of unrelated principalities, the Little Corporal from Corsica plunging

Europe into blood, captains of industry and finance building great empires of economic wealth, zealots leading important movements in the sweeping progress of civilization.

But the leadership we speak of here is warmer, more human. It is a quality that can be developed in any intelligent person willing to work patiently toward understanding and consideration. It is a persuasive and impelling force rather than an arbitrary and coercive one, and is motivated by deep-seated sincerity, integrity, kindliness, and tolerance. It cannot fail to make one who practices it a more valuable social being in the strife-torn world.

The purpose of this paper is to describe some of the characteristics of good leadership which industry has discovered in the process of training its own executives. Roughly, we can divide leadership into two parts, one, methods, and the other, relationships with subordinates. Two of the principal divisions under methods might be termed methods of praise and criticism and methods of direction.

Methods of praise and criticism are important because it is in this respect that supervisors most frequently fail in their handling of people. In your thinking about these problems, it is vitally important that you compare the way you like to be handled with the way in which you are handled. This will give you a desirable point of view in the handling of those you supervise. People, as a rule, respond to the same general sort of treatment, because the response engendered is usually emotional and not reasoned. The treatment that I dislike from my superiors is usually exactly the same as the treatment for which my subordinates criticize me. To put it more simply, it is nothing but the Golden Rule: "Do unto others as you would have them do unto you."

Upon reflection you will probably agree that there is more criticism given than praise. This situation tends to encourage a belief on the part of the worker that his supervisor is not fair. Constant criticism without the leaven of properly administered praise leads to discouragement. The worker says, "Is there anything I do right?" and answers his own question, "There are many things that I do right and do well, but my supervisor is not big enough to recognize them."

Well-merited praise should be given as freely as well-founded criticism. But criticism should never be given in the presence of others, nor should either praise or criticism be general. Praise should be given only for specific accomplishment. Criticism should be directed at a specific act. We have found by many surveys that workers frequently say, "A pat on the back is frequently worth more than money in the pay envelope."

It has been determined that criticizing attitude is a mistake. If one criticizes a person's attitude, it tends to disintegrate his person-

ality. Probably no one would argue the statement that most personalities are to some degree disintegrated and that individuals are always struggling, consciously or unconsciously, to achieve better integration. Everyone likes things that flatter him, that build up his good opinion of himself; and everyone is afraid of what hurts him. These feelings are both attempts at personality integration. Criticism of an act does not necessarily hinder integration or promote disintegration of a personality, but in making the criticism it is always advisable to mention something praiseworthy at the same time. In this way the criticism loses its sting but not its force. I know of no kind of situation in which this is not both profitable and desirable.

For example, you might say to a visiting nurse, who is not doing an entirely satisfactory piece of work, "Miss Jones, you have one of the best records in our department for the number of calls which you make each day and for the way in which you handle your patients. But much of this good work is offset by the fact that your reports are prepared in such a manner that it is almost impossible for us to make the proper use of them." From this point, you can develop your criticism more fully. The criticism should close with a word of encouragement and praise. This method will establish in the mind of the worker that you are being fair and have considered her good qualities as well as those about which you are concerned. If the interview is properly developed, she should leave your office more enthusiastic about her job than before, more determined to do a better job, and convinced that she must improve.

In this connection, let me quote you a statement which, I am told, hung in the office of a well-known department store for a long period of time. It is, perhaps, a little too sweeping in its statement; nevertheless the idea is an important one.

> Unless a reproof or criticism is given in such a way as to leave the employee more interested and enthusiastic than before, the exercise of authority has been detrimental to this Company and the person administering it has proven himself unfit to manage men.

In the criticism of conscientious people you must be extremely careful. Always try to put yourself in the other person's position. In the interview, if possible, develop an atmosphere of helpfulness and of the mutuality of the problem involved. For instance, to refer again to the case of the conscientious nurse who was careless about her reports, it would be in accord with this idea for you to say, "I know how much bother these reports are. This is one thing I have to keep constantly schooling myself on, because I do not like to make them out either. But you will agree that they are of great importance; so all of us must give them our best attention and make them out completely and fully."

Another question that has provoked much discussion in conferences considering leadership is, "What is the best time of day to give a subordinate a serious reprimand?" In speaking of "serious reprimand" we mean one that may lead eventually to dismissal of the employee, a final warning. The head of a Baltimore store which is doing a remarkable job on this type of leadership training became so much interested in the question that he asked Dr. Adolph Meyer, the eminent psychiatrist at Johns Hopkins University, this question. Dr. Meyer replied, after some consideration, that he felt the best time to give a criticism of this type was the first thing in the morning. At that time the person administering the reprimand as well as the person receiving it is fresher and more relaxed. This serious blow can then be received with the least permanent damaging effect. However, this is not always possible. This employer said, "I cannot run my store that way. There are too many pressing duties at that time." Dr. Meyer replied, "That is something else. You asked me the best time of day for the individual, and, in my opinion, it is the first thing in the morning."

Other things being equal, we are in agreement that the morning is the best time, but these are other points to be considered: How do you feel? How does the person to be criticized feel? Can the matter wait? What effect will it have on other people? When do you have the time?

In giving criticism it is not necessary to make the person admit his fault. It is not desirable to remind employees of their past errors except in the case of a final warning. Then it might be well to total up the score. It should never be given angrily or with any show of irritation. It should be calm and objective. I have dwelt at considerable length on this matter of criticism, but I think it is of the greatest importance in handling people.

How do you go about encouraging your people? Do you ever let them make errors? Most of the human race learn to some degree through trial and error. Although our best leaders think that this is a desirable situation, certainly no industry could afford to let an employee make a serious error that would cost a large sum of money. Neither could you afford to allow an employee to make an error that might cost lives. But in any job there are many details such that an occasional error in carrying them out is unimportant. Let the worker try his wings. After the error is made, point out how the thinking was faulty and encourage him to try again. Do not stifle the initiative of your people by too close supervision in every small detail. Insofar as possible, let them work in the manner that is the easiest for them so long as the results you require are obtained.

When one of your subordinates comes to you with a suggestion or a plan, follow it as closely as possible. Give him full credit for the

suggestion. Do not be afraid that you will not get credit for your work. Give every credit possible to the subordinate and give it freely and openly. I have known executives who, presented with a plan by a subordinate, would change the plan in some nonessential way and then adopt it as theirs. This is not good leadership. If the plan is good in the main, let it go through as suggested. Later it may be necessary to make some small adjustment. Never be fearful that your subordinates will get credit that is rightfully yours. Be generous to a fault with them on this score. In the long run, you are judged by the results of your department, and you do get the larger and longer range credit.

Do your people ask questions, and do you answer them carefully, completely, exactly, and patiently? Industry has found that the worker asks too few questions, primarily because he does not realize his need for more complete instruction.

Let us discuss briefly the problems raised by the second part of our technique of good leadership, that of the relationship between you and the subordinate. Which type of error is usually more serious for an executive to make in his manner toward his subordinates, being too cold and brusque, or being too free and easy? We believe the more serious error is that of being too cold and brusque. Naturally, it is desirable that an executive maintain a manner of gracious friendliness toward his subordinates. It is better for him to err on the side of being free and easy, as coldness repels rather than attracts.

Above all, an executive must be honest with his subordinates. If you have unjustly criticized a subordinate, good leaders say it is desirable to admit that error. This does not weaken authority. Say frankly, "I did not understand all the problems involved, and find that you were quite right in what you did."

When a subordinate comes to you with a problem that seems serious to him, treat it just as seriously yourself, regardless of how petty or how small it may seem to you. It is advisable in such a case to admit the seriousness of the problem, and then you can point out with consideration those elements in the problem which indicate that it is not of the importance which the employee felt it to be.

Be sure, in laying down rules, that you give reasons for them. When you explain these reasons to your subordinates, show that their point of view has been taken into consideration and that the rule is desirable for other reasons which overbalance this consideration. When an employee understands the reasoning behind rules, he is much more likely to follow them carefully and with greater good will and cheerfulness. In taking over a new piece of work, do not let yourself fall into the error of making radical and rapid changes. Study a new job slowly and as you become familiar with all of its

elements and with people whom you are to supervise, make the necessary changes.

You should also keep in mind that only rarely will you become conscious of dissatisfaction on the part of your staff. The reasons for this are obvious. The only way in which you will know is by developing and practicing the art of good leadership so that your people may be frank and candid with you.

When a new member is added to your staff, take the time and trouble to see that he is well established and that he exactly and fully understands the duties of his job and knows what is expected of him. If duties, responsibilities, the amount of interest required, the exactitude necessary, are carefully described to a new employee, it makes a tremendous impression on him. He cannot help but feel that he is now associated with an organization headed by a sympathetic, understanding, and capable executive.

In industry, it is rarely advisable to mingle socially with one's subordinates outside of business hours. Joking and teasing of subordinates is never permissible. Such actions almost always tend to lower the respect of the individual for his superior. Uniform courtesy at all times is an emphatic rule of those who have executive responsibility, not the cold courtesy of lip service alone, but the courtesy that springs from a genuine interest and a genuine consideration for others.

I hope that the few suggestions I have made on what industry has learned about leadership will start you thinking on the subject. Industry has found leadership to be of great importance, and proficiency in it to be of great value. You will go far toward putting into practice the fundamental principles of good leadership if you will remember the admonitions expressed in these fragments of ancient sayings: "Wisdom is the principal thing; therefore get wisdom, and with all thy getting, get understanding" and "You may destroy a man's gold, his land, and his house, but yet be forgiven. But if you destroy his self-respect, you have destroyed what makes it possible for him to walk among men."

COURT DECISION ON PUBLIC HEALTH

State law for the control of contagious abortion in cattle held valid.—(Virginia Supreme Court of Appeals; *Stickley* v. *Givens, State Veterinarian,* 11 S.E.2d 631; decided November 25, 1940.) A suit was brought by a dairyman against the State Veterinarian of Virginia to enjoin the enforcement of a 1938 Virginia statute (ch. 439) providing for, among other things, the prevention, control, and eradication of Bang's disease. Some of the statute's provisions pertaining to Bang's disease related to the making of the agglutination test and to the condemnation, quarantine, appraisal, and slaughter of cattle found

infected. The plaintiff, as the result of the testing of his cattle for Bang's disease and the subsequent designation of a number of them as infected, challenged the validity of the statute. His contention was that the statute was in violation of the Federal and State constitutions in that it deprived him of his property without due process of law and denied to him the equal protection of the laws. The supreme court of appeals, however, took the view that the challenged act was a reasonable exercise of the police power of the State and that it was not violative of either the Federal or State constitution.

DEATHS DURING WEEK ENDED JANUARY 4, 1941

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

	Week ended Jan. 4, 1941	Corresponding week, 1940
Data from 88 large cities of the United States:		
Total deaths	9,251	9,250
Average for 3 prior years	9,280	10,027
Deaths under 1 year of age	585	566
Average for 3 prior years	560	607
Data from industrial insurance companies:		
Policies in force	64,796,540	66,416,327
Number of death claims	10,108	10,204
Death claims per 1,000 policies in force, annual rate	8.1	8.0

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 JANUARY 11, 1941

Summary

A total of 89,828 cases of influenza was reported for the current week, as compared with 77,144 for the preceding week. This represents an increase of 12,684 cases, or 16 percent, as against 31,669, or 70 percent, for the prior week. The number of cases for the current week is the largest number reported for any week since December 1932 and the largest number for the comparable week during the past 10 years, or since 1929, when approximately 140,000 cases were reported.

The peak week in the 1928–29 epidemic, with nearly 196,000 cases, was the week ended January 5, while in the 1932–33 epidemic the largest number of cases (90,102) was reported for the week of December 31, 1932.

For the current week, decreases were recorded only for the Mountain and Pacific States. Although all other areas showed increased incidence, the only significant changes were in the South Atlantic region, where the number of cases rose from 4,308 to 13,629, and in the New England States, with 2,563 cases as compared with 149 last week. Three States accounted for most of the increase in the South Atlantic group (Virginia, from 1,752 to 4,200; South Carolina, from 1,581 to 3,686; and Georgia, from 788 to 5,002), while increases in Maine (from 40 to 1,345) and New Hampshire (from 0 to 1,000) accounted principally for the rise in the New England area.

For the week ended January 13, 246 cases of influenza were reported in Alaska.

Of the other 8 communicable diseases reported weekly, measles, poliomyelitis, and whooping cough were above the 5-year (1936–40) median expectancy.

One case of Rocky Mountain spotted fever was reported in Oklahoma, 1 case of undulant fever each in Mississippi and Utah, 1 case of encephalitis each in Maryland and Oklahoma, 2 cases of tularemia in North Carolina and 25 cases of endemic typhus fever, all in the Southern States except 1 case in Ohio and 1 in California.

For the current week the Bureau of the Census reports 9,803 deaths in 88 major cities of the United States, as compared with 9,251 for the preceding week and with a 3-year (1938–40) average of 9,319.

Telegraphic morbidity reports from State health officers for the week ended January 11, 1941, and comparison with corresponding week of 1940 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 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940	
NEW ENG.												
Maine	0	4	4	1,345	32	7	70	73	73	0	0	0
New Hampshire	0	0	0	1,000	----	----	3	12	22	0	0	0
Vermont	0	0	0	76	----	----	76	3	11	0	0	0
Massachusetts	1	9	7	----	----	----	509	185	269	4	1	1
Rhode Island	0	0	0	31	----	----	0	226	74	0	1	0
Connecticut	0	0	4	111	3	6	11	161	161	0	1	1
MID. ATL.												
New York	17	25	37	[1] 94	[1] 13	[1] 17	2,135	369	389	2	1	10
New Jersey	3	7	15	30	18	18	876	23	41	2	0	3
Pennsylvania	14	28	39	----	----	----	2,129	50	135	1	9	6
E. NO. CEN.												
Ohio [2]	8	28	34	795	88	14	645	22	70	1	0	6
Indiana	16	14	25	176	25	25	63	7	11	1	1	3
Illinois	12	41	41	37	36	36	1,109	33	48	4	0	7
Michigan [3]	7	11	11	82	15	2	1,775	384	384	1	0	2
Wisconsin	1	2	2	61	48	48	404	221	221	0	0	1
W. NO. CEN.												
Minnesota	1	5	4	3	3	2	2	255	122	0	0	1
Iowa	14	11	6	470	11	5	138	49	34	0	0	1
Missouri	7	14	21	95	18	118	40	5	7	0	0	1
North Dakota	2	0	0	83	42	11	11	1	5	0	0	0
South Dakota	2	5	1	----	13	1	2	6	6	0	0	0
Nebraska	0	4	4	----	----	----	10	8	8	0	1	0
Kansas	2	11	11	3,163	99	32	148	141	18	0	0	1
SO. ATL.												
Delaware	0	0	2	19	----	----	26	1	2	0	0	0
Maryland [2] [3]	6	5	8	92	37	24	12	1	98	1	0	0
Dist. of Col	1	3	10	90	10	2	4	0	7	0	1	1
Virginia	10	25	25	4,200	869	----	198	25	71	5	2	3
West Virginia [3]	8	19	15	430	37	52	61	8	17	0	0	4
North Carolina [2]	22	41	33	40	211	26	94	67	98	2	2	3
South Carolina [2]	5	7	7	3,686	3,948	652	70	3	7	2	1	1
Georgia [2]	16	13	13	5,002	2,192	136	26	26	26	0	0	0
Florida [2]	3	5	9	70	28	11	6	11	11	0	0	2
E. SO. CEN.												
Kentucky	10	19	18	5,950	21	65	241	5	83	1	2	6
Tennessee	7	6	18	4,719	184	184	61	74	67	1	4	4
Alabama [2]	7	15	19	2,201	1,360	352	68	50	50	3	2	5
Mississippi [3]	9	9	8	----	----	----	----	----	----	1	0	1
W. SO. CEN.												
Arkansas	7	18	16	4,664	638	203	30	4	4	1	0	0
Louisiana [3]	4	13	13	4,983	32	36	1	2	23	0	0	1
Oklahoma [4]	6	17	15	2,550	263	183	11	9	13	1	0	0
Texas [2]	32	57	67	33,283	895	716	50	307	216	2	0	2
MOUNTAIN												
Montana	2	1	1	1,065	17	17	7	11	9	0	1	1
Idaho	0	1	2	29	3	3	1	48	48	0	0	0
Wyoming	0	1	1	1,207	24	----	5	9	4	0	0	0
Colorado	5	14	12	1,376	80	21	108	43	28	1	1	1
New Mexico	2	1	3	122	6	6	196	5	29	0	0	1
Arizona	4	2	6	1,118	242	117	101	10	3	0	0	0
Utah [3]	0	0	0	1,564	458	----	12	149	72	0	0	1
Nevada	0	----	----	153	----	----	0	----	----	0	----	----
PACIFIC												
Washington	0	7	1	260	----	1	50	999	141	2	1	0
Oregon	1	7	7	578	274	39	60	141	27	0	0	0
California [3]	10	18	32	2,725	223	86	62	326	326	1	1	3
Total	284	543	676	89,828	12,516	3,018	11,717	4,568	5,203	40	33	106
2 weeks	576	1,031	1,353	166,972	22,146	6,273	19,484	7,451	8,412	68	58	201

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 11, 1941, and comparison with corresponding week of 1940 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40	Week ended		Median 1936–40
	Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940		Jan. 11, 1941	Jan. 13, 1940	
NEW ENG.												
Maine	0	0	0	5	26	16	0	0	0	1	0	0
New Hampshire	0	0	0	3	0	8	0	0	0	0	0	0
Vermont	0	0	0	15	5	6	0	0	0	0	0	0
Massachusetts	0	0	0	136	128	260	0	0	0	1	0	2
Rhode Island	0	0	0	4	4	26	0	0	0	0	0	0
Connecticut	0	0	0	27	72	77	0	0	0	2	0	0
MID. ATL.												
New York	4	1	0	316	419	564	0	0	0	9	9	8
New Jersey	0	1	0	173	224	164	0	0	0	1	2	3
Pennsylvania	1	0	0	268	308	536	0	0	0	4	1	13
E. NO. CEN.												
Ohio [3]	5	1	1	251	354	433	0	1	9	6	4	4
Indiana	3	0	0	101	150	174	5	4	5	2	1	1
Illinois	4	0	0	340	433	548	2	0	14	3	4	4
Michigan [3]	1	1	0	250	321	500	4	1	1	0	2	2
Wisconsin	1	1	1	129	133	288	12	6	6	0	0	0
W. NO. CEN.												
Minnesota	2	1	0	61	124	136	12	13	18	0	1	1
Iowa	0	2	0	54	91	156	4	31	18	1	0	0
Missouri	1	0	0	75	82	193	1	1	19	2	0	1
North Dakota	0	0	0	8	20	35	0	1	12	0	0	0
South Dakota	0	0	0	11	22	26	1	1	5	0	1	0
Nebraska	0	0	0	38	39	44	1	0	3	0	1	1
Kansas	1	0	0	92	135	160	2	1	20	0	0	2
SO. ATL.												
Delaware	0	0	0	13	17	15	0	0	0	0	0	0
Maryland [2 3]	0	1	0	50	66	66	0	0	0	1	3	2
Dist. of Col.	1	0	0	22	13	22	0	0	0	2	0	1
Virginia	0	2	0	59	54	54	0	1	0	4	2	2
West Virginia [3]	2	1	0	48	66	66	0	0	0	3	3	2
North Carolina [2]	0	3	1	76	84	63	0	0	0	6	3	3
South Carolina [2]	0	0	0	9	17	11	2	0	0	0	3	1
Georgia [2]	2	0	0	24	27	23	0	0	0	4	4	2
Florida [2]	1	0	0	5	11	8	0	0	0	2	0	1
E. SO. CEN.												
Kentucky	2	2	0	86	70	70	0	0	2	1	0	7
Tennessee	1	0	0	57	67	48	0	0	0	1	0	2
Alabama [2]	0	1	1	26	41	24	0	0	0	1	1	2
Mississippi [3]	0	0	0	10	13	10	0	0	0	1	1	2
W. SO. CEN.												
Arkansas	0	2	1	13	9	18	1	3	3	0	4	2
Louisiana [2]	0	0	0	8	19	18	0	0	1	2	7	7
Oklahoma [4]	2	0	0	39	35	36	0	5	3	2	2	2
Texas [2]	1	4	1	46	61	111	0	2	12	9	12	12
MOUNTAIN												
Montana	1	0	0	16	52	56	0	0	9	0	0	0
Idaho	0	1	1	25	12	19	0	0	14	0	0	0
Wyoming	1	0	0	2	5	10	0	0	1	0	1	0
Colorado	0	0	0	31	27	50	3	33	15	1	1	0
New Mexico	0	0	0	5	14	24	0	1	0	2	0	5
Arizona	0	0	0	2	7	11	0	1	0	2	2	1
Utah [3]	0	1	0	7	24	33	0	1	0	0	0	0
Nevada	0	----	----	1	----	----	0	----	----	1	----	----
PACIFIC												
Washington	0	0	0	38	49	56	2	0	8	1	1	2
Oregon	0	0	0	7	23	63	1	3	12	4	1	3
California [2]	0	16	3	129	161	218	0	0	12	7	1	2
Total	37	42	22	3,211	4,134	6,186	53	110	315	89	78	122
2 weeks	101	85	43	5,874	7,731	11,210	93	184	591	159	159	220

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended January 11, 1941, and comparison with corresponding week of 1940 and 5-year median—Con.

Division and State	Whooping cough	
	Week ended	
	Jan. 11, 1941	Jan. 13, 1940
NEW ENG.		
Maine	23	65
New Hampshire	0	21
Vermont	12	40
Massachusetts	269	152
Rhode Island	14	16
Connecticut	108	87
MID. ATL.		
New York	540	487
New Jersey	164	115
Pennsylvania	651	414
E. NO. CEN.		
Ohio [3]	320	149
Indiana	22	43
Illinois	121	119
Michigan [3]	448	101
Wisconsin	91	101
W. NO. CEN.		
Minnesota	82	72
Iowa	25	9
Missouri	40	3
North Dakota	14	13
South Dakota	2	4
Nebraska	2	1
Kansas	72	36
SO. ATL.		
Delaware	20	3
Maryland [2 3]	92	80
Dist. of Col	10	5
Virginia	151	29
West Virginia [3]	42	11
North Carolina [3]	327	39
South Carolina [3]	75	10
Georgia [3]	10	14
Florida [3]	11	7
E. SO. CEN.		
Kentucky	74	0
Tennessee	33	17
Alabama [3]	42	13
Mississippi [3]	----	----
W. SO. CEN.		
Arkansas	24	3
Louisiana [3]	8	2
Oklahoma [4]	12	0
Texas [3]	232	94
MOUNTAIN		
Montana	6	3
Idaho	8	6
Wyoming	9	6
Colorado	28	15
New Mexico	22	14
Arizona	26	37
Utah [3]	34	79
Nevada	0	----
PACIFIC		
Washington	45	49
Oregon	5	27
California [3]	410	183
Total	4,776	2,794
2 weeks	8,102	4,871

[1] New York City only.
[2] Typhus fever, week ended Jan. 11, 1941, 25 cases as follows: Ohio, 1; Maryland, 1; North Carolina, 3; South Carolina, 5; Georgia, 6; Florida, 2; Alabama, 1; Louisiana, 1; Texas, 4; California, 1.
[3] Period ended earlier than Saturday.
[4] Rocky Mountain spotted fever, week ended January 11, 1941, Oklahoma, 1 case.

WEEKLY REPORTS FROM CITIES

City reports for week ended December 28, 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	166	529	90	1,295	826	1,364	22	346	21	994	------
Current week [1]	57	4,869	99	2,689	513	890	11	278	18	967	------
Maine:											
Portland	0	1	0	0	5	2	0	0	0	8	32
New Hampshire:											
Concord	0	------	0	0	1	2	0	0	0	0	10
Manchester	0	------	0	0	3	14	0	0	0	0	23
Nashua	0	------	0	0	0	0	0	0	0	0	6
Vermont:											
Barre	0	------	0	0	0	0	0	0	0	0	2
Burlington	0	------	0	0	0	1	0	0	0	0	10
Rutland	0	------	0	0	0	0	0	1	0	0	2
Massachusetts:											
Boston	0	------	3	71	19	38	0	11	0	98	210
Fall River	0	------	0	0	0	9	0	1	0	7	38
Springfield	0	------	0	0	0	14	0	1	0	0	30
Worcester	0	------	0	64	6	29	0	4	0	0	60
Rhode Island:											
Pawtucket	0	------	0	0	3	1	0	0	0	0	15
Providence	0	------	0	0	4	1	0	0	0	5	66
Connecticut:											
Bridgeport	0	1	1	1	2	1	0	0	0	1	34
Hartford	0	------	0	1	0	1	0	1	0	5	45
New Haven	0	1	0	1	1	5	0	0	0	7	40
New York:											
Buffalo	0	------	1	40	6	20	0	3	0	25	138
New York	19	32	5	720	55	120	0	51	2	122	1,482
Rochester	0	------	0	2	2	2	0	1	0	12	50
Syracuse	0	------	0	0	2	3	0	1	0	8	43
New Jersey:											
Camden	0	1	0	67	5	4	0	0	0	0	31
Newark	0	------	0	54	5	21	0	4	0	8	119
Trenton	0	------	0	0	1	19	0	1	0	2	22
Pennsylvania:											
Philadelphia	2	7	0	354	13	58	0	17	1	82	465
Pittsburgh	0	------	0	2	18	15	0	9	1	47	175
Reading	0	------	0	74	1	0	0	0	0	5	21
Scranton	0	------	--------	1	-------	0	0	-------	0	0	--------
Ohio:											
Cincinnati	1	------	1	10	22	8	0	9	0	9	146
Cleveland	0	22	0	58	8	17	0	4	0	51	207
Columbus	2	3	3	9	7	6	0	2	0	3	79
Toledo	0	1	0	1	2	8	0	7	0	10	86
Indiana:											
Anderson	0	------	0	0	3	1	0	0	0	0	14
Fort Wayne	0	------	0	0	1	6	0	0	0	0	28
Indianapolis	3	------	3	1	7	17	0	1	0	8	122
Muncie	0	------	0	0	5	2	0	0	0	0	13
South Bend	0	------	0	0	6	0	0	0	0	0	26
Terre Haute	0	------	1	1	2	0	0	0	0	0	20
Illinois:											
Alton	0	------	0	0	2	8	0	0	0	0	6
Chicago	11	12	4	516	38	131	0	34	0	74	691
Elgin	0	------	0	1	0	1	0	0	0	0	8
Moline	0	------	0	0	0	1	0	0	0	0	12
Springfield	0	------	0	1	4	5	0	0	0	0	28
Michigan:											
Detroit	0	4	0	473	25	71	7	16	0	82	259
Flint	0	------	0	4	5	1	0	0	0	0	24
Grand Rapids	0	------	0	2	2	3	0	0	0	17	41
Wisconsin:											
Kenosha	0	------	0	0	0	0	0	0	0	0	3
Madison	0	------	0	0	1	5	0	0	0	2	4
Milwaukee	0	------	0	22	0	23	0	1	0	16	122
Racine	0	------	0	1	0	3	0	0	0	0	12
Superior	0	------	0	0	0	3	0	0	0	2	12

[1] Figures for Wilmington, N. C., and Boise estimated; reports not received.

City reports for week ended December 28, 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	1	1	3	0	0	6	24
Minneapolis	0	------	1	2	1	15	0	2	0	5	113
St. Paul	0	------	0	0	3	3	0	1	0	20	72
Iowa:											
Cedar Rapids	0	------	--------	0	-------	0	0	-------	0	0	--------
Davenport	0	------	--------	1	-------	1	0	-------	0	0	--------
Des Moines	0	------	0	2	0	5	0	0	0	0	31
Sioux City	0	------	--------	0	-------	11	0	-------	1	3	--------
Waterloo	0	------	--------	0	-------	3	0	-------	0	1	--------
Missouri:											
Kansas City	0	3	0	3	16	6	0	2	0	6	108
St. Joseph	0	------	0	0	11	3	0	0	0	0	23
St. Louis	4	5	0	0	20	26	0	7	1	5	274
North Dakota:											
Fargo	1	11	0	0	0	2	0	0	0	6	5
Grand Forks	0	------	--------	0	-------	0	0	-------	0	0	--------
Minot	0	------	0	0	0	0	0	0	0	0	7
South Dakota:											
Aberdeen	0	------	--------	0	-------	4	0	-------	0	1	--------
Sioux Falls	0	------	0	0	0	2	0	0	0	0	7
Nebraska:											
Lincoln	1	------	--------	1	-------	5	0	-------	0	2	--------
Omaha	0	------	0	0	2	2	0	0	0	2	47
Kansas:											
Lawrence	0	------	0	6	1	0	0	0	0	0	8
Topeka	0	2	0	2	3	2	0	0	0	2	25
Wichita	0	144	0	0	4	0	0	0	1	12	32
Delaware:											
Wilmington	0	------	0	4	6	0	0	0	0	2	30
Maryland:											
Baltimore	1	3	0	3	12	20	0	5	0	49	217
Cumberland	0	------	0	0	1	0	0	0	0	0	9
Frederick	0	------	0	0	0	0	0	0	0	0	9
Dist. of Col.:											
Washington	0	6	0	5	16	16	0	9	0	16	207
Virginia:											
Lynchburg	0	------	0	0	2	0	0	0	0	0	10
Norfolk	0	25	0	2	5	1	0	0	0	1	30
Richmond	1	------	1	1	2	6	0	3	1	0	61
Roanoke	0	------	0	19	2	4	0	2	0	5	22
West Virginia:											
Charleston	0	3	0	0	0	0	0	1	0	0	12
Huntington	0	------	--------	0	-------	1	0	-------	0	1	--------
Wheeling	0	------	0	0	2	0	0	0	0	7	16
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	-------	0	1	--------
Raleigh	0	------	0	0	0	2	0	0	0	4	1
Wilmington	------	------	--------	------	-------	------	------	-------	------	------	--------
Winston-Salem	1	------	0	0	2	0	0	0	0	10	31
South Carolina:											
Charleston	0	18	0	15	3	1	0	0	0	3	23
Florence	0	12	0	8	0	0	0	0	0	2	2
Greenville	0	------	0	1	3	1	0	0	0	0	22
Georgia:											
Atlanta	0	49	0	0	4	10	0	8	0	1	86
Brunswick	1	------	0	0	0	0	0	0	0	0	6
Savannah	0	18	2	4	2	2	0	0	0	1	29
Florida:											
Miami	2	5	2	0	1	0	0	1	1	0	35
Tampa	0	------	0	0	1	0	0	0	0	0	23
Kentucky:											
Ashland	0	7	0	0	0	0	0	0	0	1	4
Covington	0	------	0	3	2	1	0	0	0	0	12
Lexington	0	------	0	66	4	0	0	2	0	13	16
Tennessee:											
Knoxville	2	3	0	0	4	4	0	0	0	4	32
Memphis	0	29	0	13	3	6	0	2	0	7	63
Nashville	0	------	2	0	2	3	0	1	0	3	42
Alabama:											
Birmingham	0	3	0	15	3	2	0	2	0	0	52
Mobile	0	71	4	1	2	1	0	2	1	0	36
Montgomery	0	------	--------	0	-------	3	0	-------	0	0	--------
Arkansas:											
Fort Smith	0	304	--------	0	-------	1	0	-------	0	0	--------
Little Rock	0	56	0	1	2	0	0	0	0	3	16

City reports for week ended December 28, 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								
Louisiana:											
Lake Charles	0	------	1	0	1	0	0	1	0	0	------
New Orleans	1	45	3	0	20	1	0	10	0	1	155
Shreveport	0	645	0	0	2	0	0	3	2	0	20
Oklahoma:											
Oklahoma City	2	43	0	0	4	6	0	0	0	0	37
Tulsa	0	------	1	1	1	2	0	1	0	0	8
Texas:											
Dallas	4	15	3	0	5	0	0	0	0	0	86
Fort Worth	0	------	1	2	7	3	0	3	0	0	50
Galveston	0	------	0	1	4	0	0	3	0	0	21
Houston	1	691	0	0	5	3	0	4	1	0	83
San Antonio	1	181	14	1	14	0	0	6	0	0	110
Montana:											
Billings	0	------	0	0	3	1	0	0	0	0	10
Great Falls	0	11	0	0	2	1	0	0	0	0	13
Helena	0	80	0	0	0	0	0	0	0	0	7
Missoula	0	86	0	0	2	0	0	1	0	0	10
Idaho:											
Boise	------	------	------	------	------	------	------	------	------	------	------
Colorado:											
Colorado Springs	0	------	0	2	1	0	0	1	0	0	12
Denver	1	405	2	26	8	9	1	4	0	8	84
Pueblo	0	------	0	15	1	1	0	0	1	1	8
New Mexico:											
Albuquerque	0	11	0	0	2	0	0	1	0	0	11
Utah:											
Salt Lake City	0	------	4	1	4	0	0	1	0	3	59
Washington:											
Seattle	0	------	7	1	5	2	0	2	0	7	113
Spokane	0	219	7	0	4	3	0	0	0	0	71
Tacoma	0	------	7	2	2	0	0	1	0	4	58
Oregon:											
Portland	3	407	1	1	6	1	0	0	0	2	105
California:											
Los Angeles	1	1,519	13	2	16	14	0	14	1	26	372
Sacramento	1	96	3	0	9	2	0	2	0	0	46
San Francisco	0	371	4	1	7	1	0	8	0	13	187

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
Connecticut:			
Bridgeport	1	0	0
New York:			
New York	1	0	0
Pennsylvania:			
Philadelphia	1	0	0
Ohio:			
Cincinnati	0	0	1
Cleveland	0	0	1
Indiana:			
Indianapolis	0	0	1
Illinois:			
Springfield	0	0	1
Michigan:			
Detroit	1	0	0
Wisconsin:			
Milwaukee	0	0	1
North Dakota:			
Fargo	1	0	0
Maryland:			
Baltimore	1	1	0
District of Columbia:			
Washington	0	1	0
Virginia:			
Norfolk	1	0	0
Louisiana:			
Shreveport	0	1	0
Washington:			
Seattle	0	0	1

Encephalitis, epidemic or lethargic.—Cases: New York, 2.
Pellagra.—Cases: Charleston, S. C., 1; Atlanta, 2; Savannah, 1; Birmingham, 1.
Typhus fever.—Cases: Atlanta, 2; Savannah, 1; Miami, 1; Mobile, 2; Montgomery, 2; New Orleans, 1; Los Angeles, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 7, 1940.—During the week ended December 7, 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		2	1	1	7	1		2	2	16
Chickenpox		19		227	534	63	57	128	135	1,163
Diphtheria		34	2	69	3	9	3	2		122
Dysentery				4						4
Influenza		223			87	43			899	1,252
Measles		197	3	122	254	135	103	61	164	1,039
Mumps				87	100	13	6	7	5	218
Pneumonia		3			14	1	3	1	9	31
Poliomyelitis				2	3		2			7
Scarlet fever		21	5	114	102	10	10	15	32	309
Tuberculosis	1	9	9	34	43	2	8	5		111
Typhoid and paratyphoid fever			1	16	1				6	24
Whooping cough		3		166	156	19	24	13	15	396

Vital statistics—Second quarter 1940.—The Bureau of Statistics of Canada has published the following preliminary statistics for the second quarter of 1940. The rates are computed on an annual basis. There were 21.5 live births per 1,000 population during the second quarter of 1940 as compared with 21.3 during the second quarter of 1939. The death rate was 9.4 per 1,000 population for the second quarter of 1940 and 9.9 for the second quarter of 1939. The infant mortality rate was 56 per 1,000 live births in this quarter as compared with 60 for the same quarter of 1939. The maternal death rate was 3.7 per 1,000 live births for the second quarter of 1940 and 4.7 for the same quarter of 1939.

The accompanying tables give the numbers of births, deaths, and marriages, by Provinces, for the second quarter of 1940 and deaths by causes in Canada for the second quarter of 1940 and the corresponding quarter of 1939.

Number of births, deaths, and marriages, second quarter 1940

Province	Live births	Deaths (exclusive of still-births)	Deaths under 1 year of age	Maternal deaths	Marriages
Canada [1]	61,157	26,778	3,448	229	30,968
Prince Edward Island	544	253	34	3	128
Nova Scotia	3,164	1,367	176	6	1,530
New Brunswick	3,028	1,217	225	15	1,062
Quebec	21,467	8,132	1,530	88	9,510
Ontario	17,325	9,227	730	58	10,936
Manitoba	3,648	1,545	183	16	2,120
Saskatchewan	4,543	1,536	242	10	1,709
Alberta	4,024	1,544	206	21	1,631
British Columbia	3,414	1,957	122	12	2,312

[1] Exclusive of Yukon and the Northwest Territories.

Deaths, by cause, second quarter 1940

Cause of death	Canada [1] (second quarter)		Province								
	1939	1940	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Automobile accidents	314	331	1	17	23	83	148	15	14	10	20
Cancer	3,095	3,290	26	196	128	900	1,200	182	180	196	282
Cerebral hemorrhage, cerebral embolism, and thrombosis	525	549	12	37	44	111	214	33	35	31	32
Diarrhea and enteritis	454	387	2	7	15	228	68	19	25	16	7
Diphtheria	63	35			2	21	3	5		3	1
Diseases of the arteries	2,800	2,770	23	136	95	534	1,355	152	149	130	196
Diseases of the heart	4,747	4,858	36	199	180	1,169	2,035	303	255	259	422
Homicides	28	36				4	14	2	7	7	2
Influenza	1,209	534	9	33	12	205	115	35	54	55	16
Measles	75	42		2		18	11	8	1	2	
Nephritis	1,726	1,700	16	82	59	797	476	52	72	60	86
Pneumonia	1,596	1,452	15	90	96	423	453	89	104	99	83
Poliomyelitis	12	4	1				1	2			
Puerperal causes	280	229	3	6	15	88	58	16	10	21	12
Scarlet fever	41	31			1	19	8	1		2	
Suicides	297	298	2	4	6	46	117	16	29	27	51
Tuberculosis	1,682	1,527	13	100	85	676	271	102	61	81	138
Typhoid fever	47	58		1	7	30	5	8	7		
Other violent deaths	1,039	1,010	5	57	38	220	399	54	55	76	106
Other specified causes		7,350	86	377	366	2,451	2,246	433	461	438	492
Unspecified or ill-defined causes		163	3	14	31	56	20	7	6	19	7
Whooping cough	118	124		9	14	53	10	11	11	12	4

[1] Exclusive of Yukon and the Northwest Territories.

JAMAICA

Communicable diseases—4 weeks ended December 21, 1940.—During the 4 weeks ended December 21, 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	3	19	Leprosy		6
Diphtheria	3	1	Puerperal sepsis		5
Dysentery	14	10	Tuberculosis	22	77
Erysipelas	1	9	Typhoid fever	6	34

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 December 27, 1940, pages 2408-2412. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Union of South Africa—Orange Free State—Bothaville District.—During the week ended November 16, 1940, 6 deaths from pneumonic plague were reported in Bothaville District, Orange Free State, Union of South Africa.

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