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PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES

February 23–March 22, 1941

The accompanying table summarizes the prevalence of nine 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 March 22, 1941, the number reported for the corresponding period in 1940, and the median number for the years 1936–40.

DISEASES ABOVE MEDIAN PREVALENCE

Measles.—All sections of the country showed a continued increase of measles during the current period. For the country as a whole the cases rose from approximately 73,000 cases for the preceding 4-week period to approximately 156,000 cases for the 4 weeks ended March 22. The number of cases is more than 5 times that reported for the corresponding period in 1940 and more than three and one-half times the 1936–40 median figure for this period. The incidence is the highest since the epidemic of 1937–38 when approximately 173,000 cases were recorded for this period.

A comparison of geographic regions shows that the greatest excesses over the normal seasonal incidence were reported from the Middle Atlantic, East North Central, South Atlantic, and East South Central regions. A minor excess was reported from the West South Central region, and in the New England, Mountain, and Pacific regions the incidence was considerably below the normal expectancy.

Whooping cough.—The incidence of whooping cough was also relatively high. For the current period there were 17,791 cases reported, an excess of about 40 percent over 1940 and more than 10 percent over the 1938–40 average incidence for this period. The Middle Atlantic region alone reported a decline from the average incidence of preceding years; all other regions reported excesses ranging from 10 percent in the South Atlantic region to more than 3 times the average incidence in the West North Central region.

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Number of reported cases of 9 communicable diseases in the United States during the 4-week period February 23–March 22, 1941, the number for the corresponding period in 1940, and the median number of cases reported for the corresponding period 1936–40

Division	Current period	1940	5-year median	Current period	1940	5-year median	Current period	1940	5-year median
	Diphtheria			Influenza [1]			Measles [2]		
United States	1,110	1,273	1,776	32,019	33,101	41,476	156,391	30,322	44,183
New England	9	26	37	159	48	155	3,890	4,041	6,313
Middle Atlantic	180	176	374	584	245	319	55,408	3,164	13,320
East North Central	211	199	354	1,940	2,797	1,506	56,218	2,671	5,135
West North Central	76	141	149	1,393	518	1,301	4,320	4,500	4,500
South Atlantic	205	256	291	11,085	11,834	11,970	19,509	2,037	5,469
East South Central	74	105	147	3,421	2,777	10,134	6,829	1,255	1,255
West South Central	209	192	276	10,377	12,158	12,109	4,502	2,964	2,768
Mountain	76	71	76	1,257	1,185	1,185	2,491	2,725	2,725
Pacific	70	107	141	1,803	1,539	1,539	3,224	6,965	6,965
	Meningococcus meningitis			Poliomyelitis			Scarlet fever		
United States	195	172	329	64	74	78	16,284	20,341	25,538
New England	12	12	12	1	1	1	935	978	1,891
Middle Atlantic	34	42	57	2	8	8	4,726	7,013	7,013
East North Central	25	33	40	5	19	13	5,362	7,254	8,020
West North Central	12	4	31	8	2	4	1,450	1,441	3,711
South Atlantic	43	33	58	15	7	10	999	1,031	1,031
East South Central	32	19	73	10	7	9	1,249	768	634
West South Central	18	15	27	10	12	11	429	357	587
Mountain	6	7	17	4	5	4	432	541	826
Pacific	13	7	15	9	13	11	702	958	1,294
	Smallpox			Typhoid and paratyphoid fever			Whooping cough [2]		
United States	183	309	1,290	337	299	423	17,791	12,645	[3] 16,456
New England	0	0	0	12	11	11	1,465	1,153	1,297
Middle Atlantic	0	0	0	44	41	48	3,230	3,241	3,632
East North Central	58	54	199	37	47	67	3,555	2,237	2,587
West North Central	77	89	597	14	26	26	1,548	452	489
South Atlantic	2	10	10	68	47	51	2,912	1,961	2,661
East South Central	8	8	8	51	34	31	645	434	434
West South Central	13	98	98	47	47	93	1,434	907	907
Mountain	7	35	100	37	19	19	926	1,043	795
Pacific	18	15	193	27	27	26	2,076	1,217	1,217

[1] Mississippi, New York, and Pennsylvania excluded; New York City included.
[2] Mississippi excluded.
[3] Three-year (1938–40) median.

DISEASES BELOW MEDIAN PREVALENCE

Diphtheria.—The incidence of diphtheria continued at a relatively low level. For the 4 weeks ended March 22 there were 1,110 cases reported, approximately 90 percent of the number reported for the corresponding period in 1940 and less than 65 percent of the 1936–40 median figure for the period.

Influenza.—The number of cases of influenza dropped from approximately 146,000 cases for the 4 weeks ended February 22 to approximately 32,000 for the current 4-week period. The number of cases was slightly lower than that recorded for this period in 1940 and only about 75 percent of the median incidence for the years 1936–40. The incidence was considerably below the normal seasonal

expectancy in the South Central regions, and while all other regions showed increases over the 1936–40 median, in some regions the excesses were very slight.

Mortality from all causes for 88 cities reporting dropped from a rate of 13.6 per 1,000 for the preceding 4-week period to 12.7 for the 4 weeks ended March 22; this rate was slightly below the average rate (12.9) for the years 1938–40.

Meningococcus meningitis.—For the current period there were 195 cases of meningococcus meningitis reported, as compared with 172, 201, and 329 for the corresponding period in 1940, 1939, and 1938, respectively. Increases over last year were reported from the West North Central, South Atlantic, South Central, and Pacific regions, but in each region except the New England the current incidence was lower than the 1936–40 median incidence for this period.

Poliomyelitis.—The incidence of poliomyelitis was also relatively low; 64 cases were reported during the 4-week period, as compared with 74 cases for the corresponding period in 1940, and a median of 78 cases for the years 1936–40. A few more cases than might normally be expected were reported from the West North Central and South Atlantic regions, but in all other regions the situation was quite favorable.

Scarlet fever.—The number of cases (16,284) of scarlet fever was only about 80 percent of last year's figure for the corresponding period and less than 65 percent of the expected seasonal incidence. In the East South Central region the number of cases was almost twice the average incidence in that region, but in all other regions the incidence was relatively low.

Smallpox.—The incidence of smallpox reached a new low level for this period. The number of reported cases (183) was only about 60 percent of last year's figure for the corresponding period, which figure (309 cases) was the lowest preceding incidence for the period. A comparison with the 1936–40 median of 1,290 cases and a 1933–36 (more "normal" smallpox years) median of 700 cases further emphasizes the current low incidence of this disease.

Typhoid fever.—For the current period there were 337 cases of typhoid fever reported as compared with 299, 515, and 452 cases for the corresponding period in 1940, 1939, and 1938, respectively. While the number of cases was slightly higher than that recorded for this period in 1940, it was only about 80 percent of the preceding 5-year median figure (423 cases). The disease was somewhat above the seasonal expectancy in the East South Central, South Atlantic, and Mountain regions, about normal in the North Atlantic and Pacific regions, and relatively low in the North Central and West South Central regions.

MORTALITY, ALL CAUSES

The average mortality rate from all causes in large cities for the 4 weeks ended March 22, based on data received from the Bureau of the Census, was 12.7 per 1,000 inhabitants (annual basis). The rate was slightly lower than the average rate for the years 1938–40, which was 12.9. The decline in the death rate from 13.6 for the preceding 4-week period to the current rate was no doubt due in part, at least, to the rapid decline in influenza cases that occurred during the 4 weeks under consideration.

MOBILE LABORATORY UNITS OF THE OHIO RIVER POLLUTION SURVEY

By F. E. DeMartini, *Passed Assistant Sanitary Engineer, United States Public Health Service*

In undertaking laboratory operations connected with stream pollution surveys of large or widely separated watershed areas, the use of a central laboratory may be impracticable because of its inaccessibility to the more distant sampling points. Under these circumstances it is necessary to consider either the equipment and maintenance of several fixed laboratories, entailing a multiplied expense, or the use of mobile laboratories which can be moved over the entire area at will. The latter of these alternative procedures has many points in its favor, including greater flexibility and economy.

In 1939 a problem of this kind was faced by engineers of the Public Health Service in undertaking a comprehensive laboratory survey of the sanitary condition of the Ohio River and its tributary streams over an area of some 203,000 square miles. This work is being carried on by the Stream Pollution Investigations Station at Cincinnati, in connection with the Ohio River Pollution Survey, a joint undertaking with the U. S. Engineer Corps under the provisions of the River and Harbor Act of August 1937.

The laboratory study of the tributaries of the Ohio River involved the examination of many large streams several hundred miles in length and in many cases so distant from the base laboratories on the main Ohio River that samples could not be transported to them and still be representative of the stream water.

Three possibilities presented themselves for carrying on the tributary examinations: (1) Subsidizing a considerable number of laboratories throughout the area to carry on the work; (2) training a large personnel and obtaining the cooperation of local laboratories to the extent of providing equipment and working space; (3) using some type of mobile laboratory unit which could be moved from place to place in the area without too much difficulty. It was concluded

that use of mobile laboratories would be the most satisfactory and economical solution to the problem.

Several State health departments have utilized mobile laboratories in recent years. In most cases they were built into bus type vehicles with their own motive power. Such units, if used also for collection of samples, have a limited usefulness owing to the time required for the collections. A better unit seemed to be of the type developed by the Dental Service of the U. S. Public Health Service for use at Coast Guard Stations throughout the country. These units consist of a trailer containing all of the equipment for dental work, and a tow car to move the unit from place to place.

In its application to laboratory examination of stream samples, the laboratory unit or trailer is stationed for a considerable period (2 weeks or more) at a central point. The tow car is used during this period for collection of samples in a radius of about 50 miles, delivering samples to the laboratory unit. The mobile units described were designed on this basis and equipped for making the following tests:

1. Dissolved oxygen.
2. 5-Day biochemical oxygen demand.
3. Temperature.
4. pH.
5. Alkalinity.
6. Soap hardness.
7. Turbidity.
8. Total agar count at 37° C.
9. Coliform index (by dilution method).
10. Nitrites.
11. Acidity.
12. Iron (ferrous and ferric).

Provision of space for the necessary incubators and equipment together with adequate bench space to allow working room for two technicians governed the actual design and layout of the units. It had been decided that a three-man crew would be necessary—one junior chemist, one laboratory attendant, and one sample collector and chauffeur. Various layouts and sizes for the trailer unit were considered; the one shown in figure 4 was finally adopted as the best of those studied. Some of the main points brought out during the design were: (1) The advisability of providing as much working bench space as possible; (2) space and load limitations would not allow provision of equipment for gas heat or electric power generation; (3) a standard type of trailer shell and chassis could be used but the interior benches and furnishing would have to be specially built for the purpose.

Early in 1939 plans and specifications for the mobile unit were prepared, bids were obtained, and the contract was awarded to one of the commercial concerns building house-trailer units.

Figure 1 shows a trailer unit and tow car. The trailer is supported by jacks to steady it against movements as it would be "on location."

Two units were in the field from September 12, 1939, to the end of the year, representing 27 trailer weeks of field service, in an area of

27,000 square miles. Total number of collections was 841, representing 3,364 samples, as 4 samples were taken at each collection.

During 1940 four additional units were obtained, differing only slightly from the first two. The 1940 operations represent 161 trailer weeks of field service in an area of 103,000 square miles. Total number of collections in 1940 was 5,068, which represents 20,272 samples.

In addition one unit made several hundred odor threshold observations in 1939–40 on a special taste and odor problem, during the winter months of December to March inclusive. This study will again be carried on this winter (1940–41) to compare results of last season with present conditions. A second unit is carrying on a similar study in another area where, in addition to odor tests and routine observations, phenol determinations are being made.

With this brief statement of accomplishments as the background upon which our experience with mobile units is based, the following comments seem justified.

In stream pollution surveys or laboratory operations involving a large field of activity, the mobile trailer laboratory has a definite place. The units described here have been successfully used to carry out the problem for which they were designed. There have been no serious difficulties with the units during this survey, but certain improvements would be made in additional units. Briefly, these are:

1. Use of a heavier tow car than the type in use at present.
2. Installation of a heavy-duty clutch and special transmission, having an extra low gear, on the tow car.
3. Limitation of the total weight of trailer unit, exclusive of payload, in order to make vertical load on drawbar a reasonable value, when axle is properly located on chassis.

DETAILED DESCRIPTION OF MOBILE UNITS AND THEIR OPERATIONS

Some of the features provided in these units will be briefly mentioned:

1. Trailer shell of the commercial type with heavy frame, tires, and axle; walls insulated with glass wool and all window glass of the safety type.
2. Work bench 37 inches in height around the entire periphery of the unit except at the door. No space is occupied above bench top level by incubators or fixed equipment.
3. An acid and alkali resistant "karcite" sink and lead lined bench-top around this sink. (A second small porcelain sink is provided at center of side bench.)
4. A 30-gallon water tank supplying double-action pumps at each sink; a second faucet at the karcite sink connected by hose line to a pressure water supply.
5. Small house trailer type of built-in ice box.

6. Ventilating fan in roof vent.

7. Electrical wiring in trailer with ample capacity to supply current for incubators, hot plates, electric muffle, etc., controlled by a load center box. An insulated copper wire cable 150 feet long for transmitting electric current from an outside source to the trailer unit.

8. Auxiliary trailer brakes, and stop and turn signals on trailer, all operated by switches from tow car.

9. Four jacks for leveling trailer floor and to relieve springs from trailer load during a stop at one "location."

10. Fire extinguishers and gasoline stove for laboratory use supplied as part of the trailer contract.

After delivery of the units at Cincinnati, 2 weeks were spent in preparing them for field operations. These preparations were principally:

1. Treatment of bench tops with acid-proof stain.

2. Installation of 20° C. incubator, 37° C. incubator, and hot air sterilizer.

3. Construction of "egg-crate" type boxes and trays for storing bottles and various items of glassware.

4. Preparation of chemical reagents and bacteriological media for beginning of field work.

5. Loading of all equipment and supplies in lockers and cupboards.

It may be of interest to mention that the 37° C. incubator is water jacketed. This is believed to be the best type for field use under varying climatic conditions and heavy loading of the incubator itself. The one selected has proven to be very satisfactory and to hold its temperature uniformly in spite of adverse conditions.

The 20° C. incubator was built to specifications. An electrically operated unit was designed to fit under the working bench. The contractor used a standard refrigerator box with compressor unit located in the bottom section. By cutting off the lower section of the box, and placing the compressor unit in a cupboard adjacent to the incubator, a full-sized incubator was provided which could fit in the space available beneath the bench level.

Figures 2 and 3 are views of the interior of the trailer laboratory.

The first two units started work on September 12, 1939. Arrangements were made in advance with some waterworks or sewage treatment plant in the area to be covered, including a parking space for the trailer unit where water, power, and waste disposal facilities were convenient. Upon arrival the trailer was moved into place, tow car uncoupled, trailer stabilized by means of a jack at each corner so as to level it and steady it against movements, rear sink faucet connected to a water supply by means of a 50-foot garden hose, and the 150-foot cable plugged into the trailer at one end and to a source of electrical energy at the other. Within a few hours incubators attained their

proper temperatures and the unit was ready to operate for any desired period.

Upon moving to a new location the 20° and 37° C. incubators vary from these temperatures depending upon the time involved in the move. However, if this is only a matter of a few hours the variations are not great as the 37° C. incubator has a 2-inch water jacket and the heat differential between the inside and outside of the 20° incubator is low except under extreme weather conditions.

Average duration of work at a given location was 2 weeks, but in some cases stops were as long as 3 months. Local authorities and waterworks officials have been most cooperative and no difficulty has been experienced in obtaining quarters, water, and electric power for the units.

The following tabulation indicates the average volume of work carried on per month by one mobile unit:

Number of samples collected	475
Number of bacteriological tests made	250
Number of physical and chemical tests made	850

Each collection at a station represented four samples—one for bacteriological tests, one for chemical tests, one for dissolved oxygen, and one for 5-day B. O. D. Each determination is considered to be a "test." These tests include dissolved oxygen, 5-day B. O. D., turbidity, pH, alkalinity, acidity, soap hardness, iron, nitrites, *B. coli*, and total agar count.

COSTS OF MOBILE LABORATORY UNITS

Costs have been estimated for obtaining laboratory results in the mobile units as compared with the Kiski (the floating laboratory on the Ohio River) and the Cincinnati laboratory. These estimates are based on a 4-year life for expendible equipment such as glassware, trailer, and tow car, and 8-year life for incubators, furniture, etc. This represents a depreciation of approximately 2 percent and 1 percent, respectively, per month. Salaries, operating costs, travel, clerical, and engineering costs were also included. The comparative costs were found to be:

	Trailer laboratory	*Kiski laboratory*	*Cincinnati laboratory*
Cost per sample	$2.78	$2.26	$1.79
Cost per test	1.22	1.13	1.09

Costs of trailers, tow cars, and equipment are tabulated below. A plan of the trailer units is also shown (fig. 4), as revised in 1940 when the second group of four units was ordered. The revisions consisted of additional interior lights, provision of a ventilation opening for the compressor unit of the 20° C. incubator, extension of the lead-lined portion of the bench, and an increase of 4 inches in ceiling height to 6 feet 6 inches instead of 6 feet 2 inches.

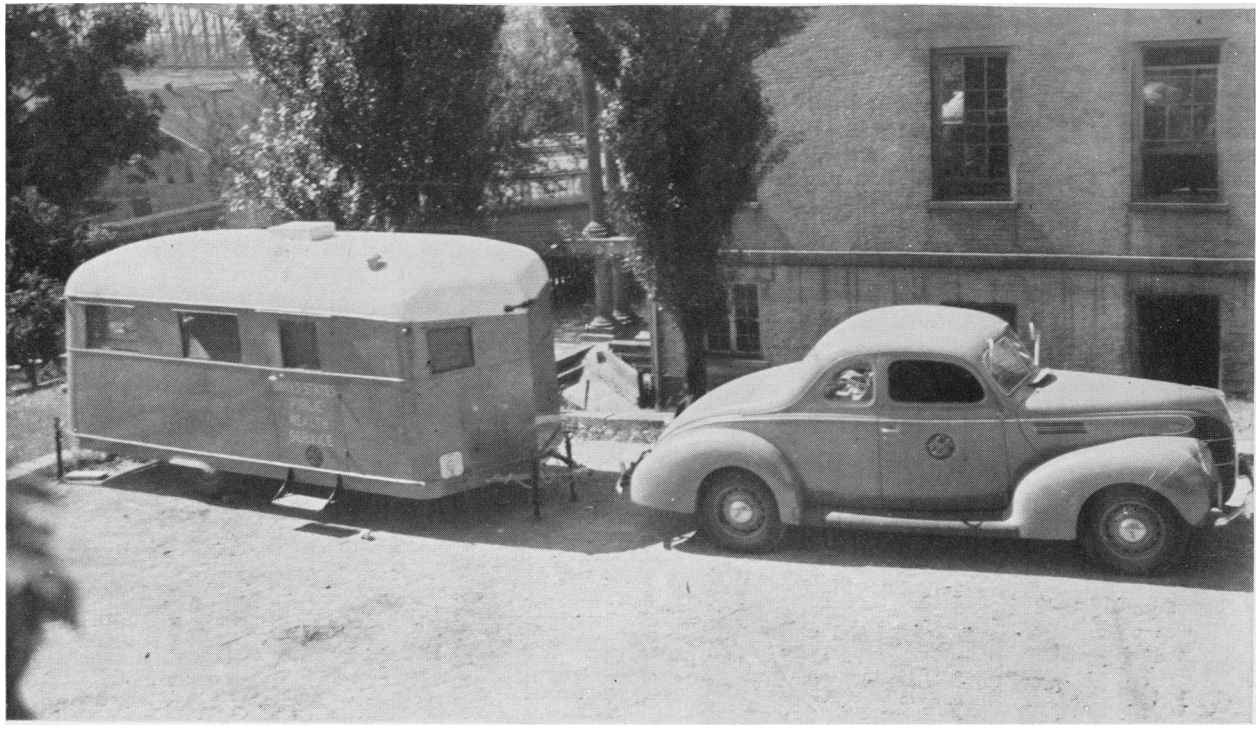

FIGURE 1.—Trailer unit and tow car.

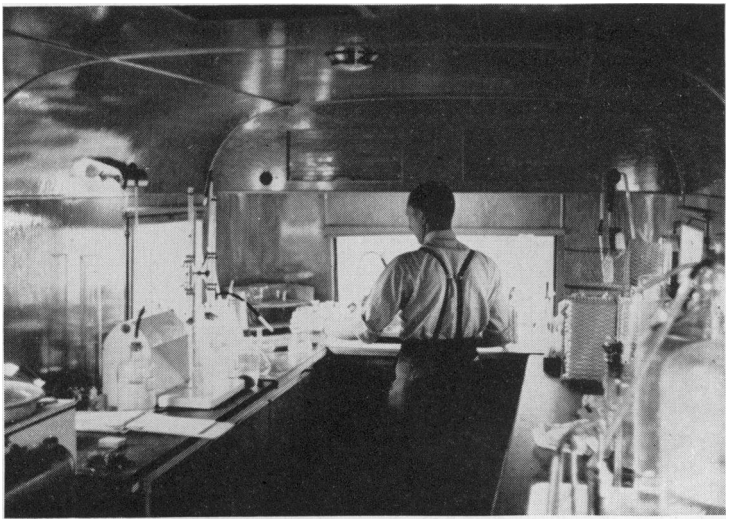

FIGURE 2.—Looking toward rear of trailer unit.

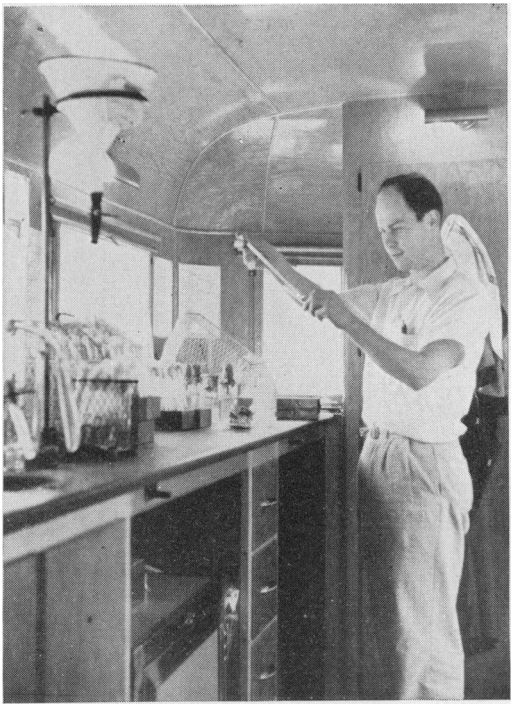

FIGURE 3.—Looking toward front of trailer unit.

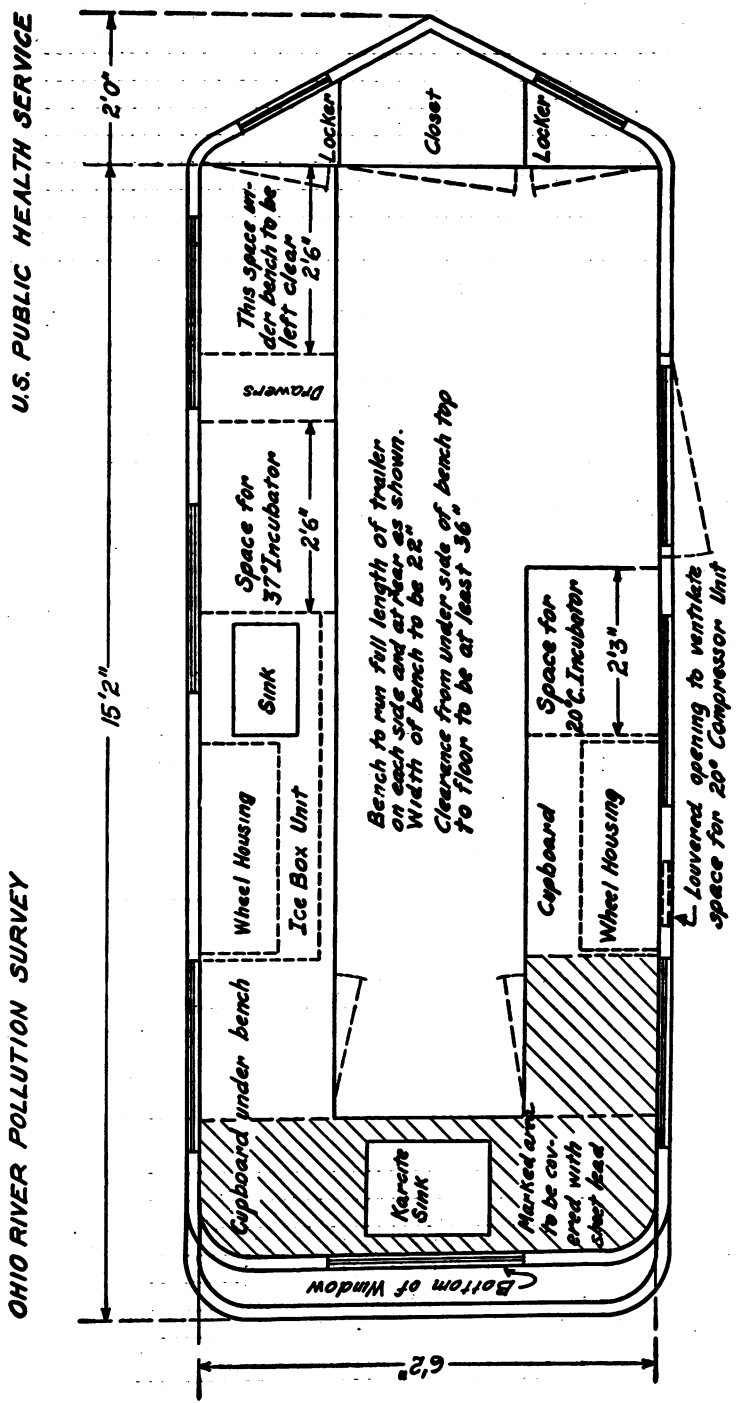
PLAN OF MOBILE LABORATORY UNIT
OHIO RIVER POLLUTION SURVEY
U.S. PUBLIC HEALTH SERVICE
15'2"
2'0"
6'2"
Locker
Closet
Locker
This space under bench to be left clear
2'6"
Drawers
Space for 37°C. Incubator
2'6"
Sink
Wheel Housing
Ice Box Unit
Cupboard under bench
Bench to run full length of trailer on each side and at rear as shown. Width of bench to be 22"
Clearance from under side of bench top to floor to be at least 36"
Space for 20°C. Incubator
2'3"
Cupboard
Wheel Housing
Louvered opening to ventilate space for 20° Compressor Unit
Karsite Sink
Marked area to be covered with sheet lead
Bottom of Window

FIGURE 4.

Cost figures for mobile field laboratory, tow car, equipment, and 6 months' supplies [1]

Item	Cost
A. Trailer [2]	$1,850.00
B. Tow car	649.13
C. Laboratory equipment	711.72
D. Glassware	231.90
E. Sampling equipment	47.00
F. Chemicals and supplies for 6 months	80.00
G. Miscellaneous	45.75
Total	3,615.50

DETAILED COST DATA

Item A.—Trailer unit includes benches, lockers, 2 sinks, water tank and plumbing, 1 spare tire, 150 feet of 60-ampere capacity wire cable, ventilating fan, two 1-quart fire extinguishers, 4 hydraulic jacks, and a 2-burner gasoline stove. Also includes installation of helper springs and tow iron on a coupe tow car		$1,850.00
Item B.—Tow car, standard 85-horsepower coupe		649.13
Item C.—Laboratory equipment:		
1 20° C. incubator (specially built)	$230.00	
1 37° C. water jacketed incubator	173.04	
1 pH kit, Sanitary District Chicago	53.56	
1 Electric hot air sterilizer	45.32	
1 Quebec colony counter	30.90	
1 22-quart pressure cooker	18.22	
1 Chemical balance and set of weights	12.61	
1 Artificial daylight lamp	10.00	
1 Electric heater (1,000 watts)	8.75	
1 8-inch electric hot plate	7.26	
All other equipment such as wire baskets, pots, pipette cans, burette holders, alcohol lamps, etc	122.06	
		711.72
Item D.—Glassware. Includes all bottles, burettes, cylinders, test tubes, flasks, pipettes, funnels, petri dishes, etc		231.90
Item E.—Sampling equipment:		
Sampling can and rope	$32.00	
1 pair rubber hip boots	5.00	
1 sampling kit for shallow streams	10.00	
		47.00
Item F.—Chemicals and supplies. Includes chemical supplies, dehydrated media, alcohol, gasoline for stove, towels, soap, brushes, rubber stoppers, filter paper, etc		80.00
Item G.—Miscellaneous:		
50 feet of garden hose	$5.77	
1 first-aid kit	2.11	
2 laboratory stools	9.89	
1 copy Standard Methods of Water Analysis	2.58	
Lumber for trays, test tube blocks, etc	17.90	
Screen, bolts, nails, etc., for installing equipment	2.00	
Car wax, chamois, sponge, rear-view mirror, etc	5.50	45.75
Total		$3,615.50

[1] Last four trailers cost $1,256.70 each.

[2] Three percent was added to this cost by the Procurement Division, U. S. Treasury Department, for handling contract. Total cost to Ohio River Pollution Survey was $1,905.50 for each of the first two trailers.

DOMESTIC WATER AND DENTAL CARIES

II. A Study of 2,832 White Children, Aged 12–14 Years, of 8 Suburban Chicago Communities, Including *Lactobacillus Acidophilus* Studies of 1,761 Children [1]

By H. TRENDLEY DEAN, *Dental Surgeon*, PHILIP JAY,[2] *Consultant*, FRANCIS A. ARNOLD, Jr., *Passed Assistant Dental Surgeon*, and ELIAS ELVOVE, *Senior Chemist, United States Public Health Service*

(Clinical Examinations by Assistant Dental Surgeons (R) David C. Johnston and Edwin M. Short)

Recent studies (*1*, *2*) have disclosed marked differences in the amount of dental caries among communities often in close proximity to one another. Considering the apparent similarity of the population groups, especially those in Galesburg, Monmouth, Macomb, and Quincy (Ill.), and the method followed in the selection of the samples, it is difficult from an epidemiological standpoint to ascribe these differences to any cause other than the mineral composition of the common water supply. At the present time both epidemiological and experimental evidence points to fluoride as the factor partially inhibiting dental caries, but the possibility that other constituents of the water may likewise play some role cannot at present be entirely ruled out on the basis of the epidemiological evidence available.

A marked difference in the amount of dental caries was particularly noticeable in the Galesburg-Quincy study. In the latter city the children, using a public water supply practically free of fluorides (0.2 p. p. m.),[3] had experienced more than three times as much dental caries as had a comparable age group living in the nearby city of Galesburg where the common water supply contains 1.8 p. p. m. of fluorides (F). The continued use of this water, somewhat in excess of the minimal threshold of endemic dental fluorosis (1.0 p. p. m.), was found to be associated not only with a low dental caries rate but also with unusually low oral lactobacilli counts.

A domestic water containing 1.8 p. p. m. of fluorides produces the mildest types of mottled enamel in about 45 to 50 percent of those continuously using it during the period of susceptibility, the remainder showing no macroscopic evidence of the affection. A percentage incidence of affection of this approximate order makes possible a comparison of the amount of dental caries in a group of children having the mildest forms of mottled enamel with a comparable group free of mottled enamel. No significant difference in the amount of dental caries between the two groups was apparent and it appeared that the factor responsible for the low amount of dental caries in that city was

[1] From the Division of Infectious Diseases with the cooperation of the Division of Chemistry, National Institute of Health.

[2] Assistant Professor, University of Michigan School of Dentistry.

[3] This figure was obtained only in one sample; a few recent determinations indicated about 0.1 part per million (p. p. m. = parts per million).

operative irrespective of whether the child showed macroscopic evidence of mottled enamel or not.

It is obvious that whatever effect the waters with relatively high fluoride content (over 2.0 p. p. m. of F) have on dental caries is largely one of academic interest; the resultant permanent disfigurement of many of the users far outweighs any advantage that might accrue from the standpoint of partial control of dental caries. On the other hand, the demonstration of such marked dental caries differences as were observed at Galesburg and Quincy made advisable a quantitative study of the influence on dental caries of waters with lower ranges of fluoride concentration. If marked inhibitory influences were operative at concentration levels as low as the minimal threshold of endemic dental fluorosis (1.0 p. p. m.), the findings would be of considerable import.

PRESENT STUDY

The basic objective of this study was to determine how low a fluoride concentration in a public water supply would be found associated with relatively low dental caries rates. The study closely followed that made at Galesburg and Quincy (*2*) excepting that only children with continuous exposure to the public water supply of their respective communities were examined. All examinations were limited to 12–14-year-old white public school children, age being defined by last birthday. Selection of this segment of the school population permits the examination of a group in whom a high percentage of the permanent teeth have erupted. The results of an examination of school children of higher age groups introduces the question of representativeness of the sample because of the increasing percentage of children in the higher age groups not attending school.

The communities selected for study necessarily had to possess the dual requisites of (*a*) a population sufficient in size to permit the selection of an adequate sample of children continuously exposed to the influence of the variable under investigation, and (*b*) a public water supply of the desired fluorine concentration with no serious interfering relevant variables in either its physical set-up or its source during the period concomitant with the life of the group examined.

The selection of cities meeting these requirements would have been difficult but for the extensive studies carried on in 1936 by the Illinois Department of Public Health. In 1937 Weart and Klassen (*3*) reported on the fluoride content of many Illinois common water supplies, 78 communities being listed as having 0.9 part per million or more of fluoride (F) in their public water supplies. This work proved of value in selecting the areas to be studied.

The disclosure of a number of suburban Chicago communities with small amounts of fluorides in their domestic water supplies presented

the unusual epidemiological opportunity of comparing their dental caries experience rates with those of their neighbors using the fluoride-free Lake Michigan water.

The communities selected for study, the findings of which form the basis of this report, were Elmhurst, Maywood, Aurora, Joliet, Elgin, Evanston, Oak Park, and Waukegan.

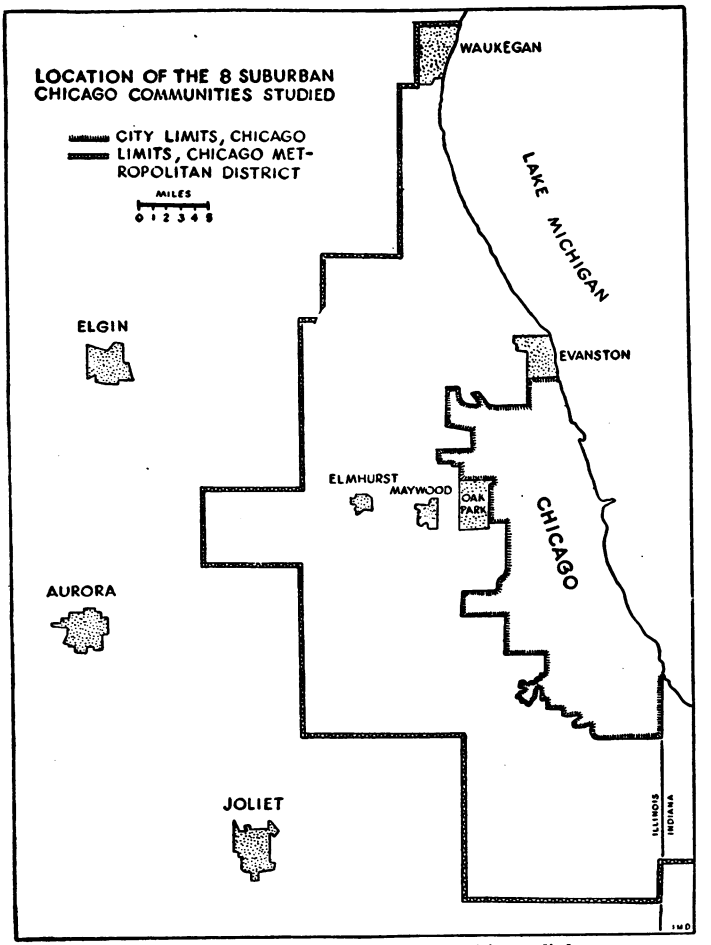

FIGURE 1.—Location of the eight communities studied.

Their location with respect to the city of Chicago and the Chicago Metropolitan District[4] is shown in figure 1.

Population of cities studied.—Population statistics with respect to the eight cities or villages studied are given in table 1. Inasmuch as the study was limited to white school children, the percentage of native white was computed on the basis of the total white population, not the total population. At Elmhurst, Maywood, Aurora, Joliet,

[4] Limits of the Chicago Metropolitan District as shown in the Fifteenth Census of the United States, 1930, Metropolitan Districts, Population and Area.

Elgin, Evanston, Oak Park, and Waukegan the percentage of native white of the white population was 86.4, 84.0, 86.8, 82.8, 84.6, 83.5, 86.8, and 79.7 percent, respectively.

TABLE 1.—*Composition of the population of the 8 suburban Chicago communities studied (census of 1930)*

City	Total	White	Negro	Other races [1]	Total	White	Negro	Other races [1]	Native white of white population
	Number				Percent				
Elmhurst	14,055	14,023	13	19	100.0	99.77	0.09	0.14	86.4
Maywood	25,829	25,087	722	20	100.0	97.13	2.79	0.08	84.0
Aurora	46,589	45,348	936	305	100.0	97.34	2.01	0.65	86.8
Joliet	42,993	40,797	1,309	887	100.0	94.89	3.05	2.06	82.8
Elgin	35,929	35,539	310	80	100.0	98.92	0.86	0.22	84.6
Evanston	63,338	58,338	4,938	62	100.0	92.10	7.80	0.10	83.5
Oak Park	63,982	63,798	143	41	100.0	99.71	0.22	0.07	86.8
Waukegan	33,499	31,925	1,017	557	100.0	95.30	3.04	1.66	79.7

[1] While the Negro was excluded from this study because of the possibility of a racial difference in attack by dental caries, no attempt was made to eliminate children of "other races." This segment of the population was of such a relatively small percentage of the general population (0.6 percent) of the 8 communities studied that it seemed unnecessary to eliminate the occasional child who may have belonged in this classification. They are, accordingly, included with the white children in the tables that follow in this paper. Persons of Mexican birth or parentage who were not definitely reported as white or Indian were designated "Mexican" in the 1930 Census and included in the general class of "other races." In prior censuses most of the Mexicans have been classified as white. Of the 1,952 persons listed in this column, Elmhurst excluded, 1,755, or approximately 90 percent, were Mexicans.

Climatological data.—Weather Bureau reports list the number of clear, partly cloudy, and cloudy days as recorded for a number of stations in northern Illinois. Reporting stations are located at three of the cities included in this study, viz, Aurora, Joliet, and Waukegan. No station is located at Oak Park but it is assumed that the recordings of the Cicero Station probably reflect this type of climatological data

TABLE 2.—*A 5-year summary of available data concerning number of clear, partly cloudy, and cloudy days recorded for cities included in this study, or from communities in their immediate vicinity*

[From Weather Bureau, Department of Agriculture]

Station	Number of days														
	Clear					Partly cloudy					Cloudy				
	1935	1936	1937	1938	1939	1935	1936	1937	1938	1939	1935	1936	1937	1938	1939
Aurora	175	179	182	176	199	54	92	74	53	59	136	95	109	136	107
Chicago (University)	85	101	114	112	132	98	92	109	90	105	182	143	142	163	128
Cicero	81	119	99	100	116	104	96	129	108	110	180	151	137	157	139
Joliet	135	174	159	166	167	75	83	87	74	80	155	109	119	125	118
Waukegan	146	153	164	205	195	122	145	155	75	82	97	68	46	85	88
Average, Northern Division (Illinois)	137	184	168	157	173	89	87	86	93	89	139	95	111	115	103

N. B.: A day is classified clear, partly cloudy, or cloudy, on the basis of hourly estimations, sunrise to sunset, as follows:

Clear	Sky averages 3/10 or less obscured.
Partly cloudy	Sky averages 4/10 to 7/10, inclusive, obscured.
Cloudy	Sky averages more than 7/10 obscured.

for Oak Park inasmuch as the corporate limits of Cicero and Oak Park adjoin. These same conditions might also be considered as probably applicable to Maywood, which is about one and one-half miles west of Oak Park. The number of clear, partly cloudy, and cloudy days was not recorded at the Elgin Station and no stations are listed for Evanston and Elmhurst. Available data on this subject are shown in table 2.

Sampling method.—The group examined was selected in the following manner. The classroom or assembly hall was visited and the purposes of the survey explained to the teacher and the pupils. Those children who stated that they had lived in the city continuously since birth and had always used the common water supply for domestic purposes (drinking and cooking) were assembled in a separate group. This group was then further questioned to determine whether there had been any breaks in the continuity of their residence and water consumption. If questioning elicited information which disclosed breaks in the continuity of exposure (30 days in any calendar year excepted), the child was eliminated from further study. Those remaining constituted the group classified as continuously exposed since birth to the effects of the local water supply. Immediately after the selection of the group to be studied, the name, address, age, grade, continuity of residence, and other pertinent data were recorded on a sampling card, one being made out for each child. Each child was again carefully questioned several days later at the time of the clinical examination regarding his or her water history. This second cross-questioning at times revealed discontinuities in water history not brought out in the first questioning; the number further eliminated by this second questioning was in the neighborhood of 10 percent of the group for whom sampling cards had been made out previously.

All sampling was done by one individual (H. T. D.). With the exception of Evanston and the ninth grades (Freshman High School) at Oak Park, Maywood, Elmhurst, Joliet, Waukegan, and at the West Side High School at Aurora, each classroom or assembly hall was visited and the sampling done at that time. Excepting Aurora all communities included in this study have one large community high school and relatively large enrollments. To meet this particular condition a method of "home room" sampling was developed and carried out by each home room teacher, after instruction in the method to be followed. At Evanston all seventh, eighth, and ninth grade pupils attend one of three large schools. In this city it was necessary to utilize the home room method of sampling through the medium of the home room teacher for the entire group. Each of the three schools has a school physician, and the sampling was supervised by the school physician in collaboration with the one of us (H. T. D.) conducting the sampling aspects of the study.

This method of preliminary sampling by the home room teacher was necessary in 9 of the 67 schools included in the study, and the results obtained were quite satisfactory. All children selected by the home room teacher were subsequently questioned individually by the dental examiner when the water history was recorded prior to the clinical examination.

The samples examined generally represent all white public school children in the community with the requisites of continuity of exposure defined. All public schools in the community having a seventh, eighth, or ninth grade were included in the study, but no effort was made to locate 12–14-year-old children in grades other than those specified, with the exception of those instances where an appreciable number of children of the age group studied were in the sixth grade.

The percentage of continuous histories is unusually low at Evanston, Oak Park, and Maywood. This may be due to (*a*) the common practice of children of these three communities going away for summer vacations considerably in excess of 30 days, and (*b*) to the movement in and out of Chicago or between the highly urbanized communities adjacent to the corporate limits of Chicago.

It might be well to digress for a moment and touch upon certain basic constants and pertinent interfering variables, particularly as they relate to the problem of sampling. As dental caries is a non-healing lesion, a single clinical dental examination of 12–14-year-old children can merely record the amount of dental caries experienced by that group during the post-eruptive life of the teeth examined. The observed lesion may have developed at any time during the post-eruptive life of the tooth examined. At what particular time during the post-eruptive tooth life the observed lesion developed cannot be determined on the basis of a single examination in this age group.

The movement of populations, especially in the densely populated urbanized areas contiguous to the city of Chicago, is quite marked. The water supplies of these numerous communities show considerable variation, some purchasing Lake Michigan water from the city of Chicago, others depending wholly upon the municipal ground water supply. As single clinical examinations in this age group can disclose only the amount of dental caries experienced and not when it occurred, the corollary that naturally follows demands that all observations be confined to children with continuous exposure to the variable under study (the communal water supply). Otherwise, dental caries developed several years previously in an area with a high rate might be erroneously charged to an area with a low rate, or vice versa. In order, therefore, that differences in dental caries experience might be effectively studied with respect to their relationship to the mineral composition of the public water supply, all groups

compared were placed on a comparable basis of exposure to risk, namely, age, sex, color, and continuous use of the water supply being studied.

Table 3 shows the number of public schools in which examinations were held, the number of 12–14-year-old pupils in attendance on the day of sampling, and the number and percentage of these whose histories on repeated questioning indicated continuity of exposure and who were examined. Attention might be called to the difference in the percentages of those with continuous histories between those communities contiguous to the city of Chicago (Evanston, Oak Park, and Maywood) and the more outlying suburbs such as Waukegan, Elgin, Aurora, and Joliet.

TABLE 3.—*Summary of data with relation to continuity of exposure to the public water supply of 2,832 white 12–14-year-old children residing in 8 suburban Chicago communities*

Place	Number of public schools in which examinations were held	Number of 12–14-year-old children in attendance on day of sampling	Number of 12–14-year-old white children whose histories on repeated questioning [1] indicated continuity of exposure and who were examined	Percentage of the total present who were examined
Elmhurst	7	633	170	26.9
Maywood	6	873	171	19.6
Aurora	13	1,625	633	39.0
Joliet	6	1,412	447	31.7
Elgin	10	1,030	403	39.1
Evanston	3	2,125	[2] 256	12.0
Oak Park	12	1,662	329	19.8
Waukegan	10	1,354	423	31.2
Total	67	10,714	2,832	26.4

[1] About 20 percent of the group for whom sampling cards were originally made out were not examined. The detailed subsequent questioning which disclosed breaks in the continuity of exposure warranting elimination from the study accounted for about half of the cases excluded and these, together with those absent on the day of examination and the colored, comprised the 20 percent referred to.

[2] In addition there were 53 other children with a history of continuous exposure whose parents did not give their consent to making the clinical examination.

Clinical examinations.—All examinations were made by a dentist using a mouth mirror and explorer with the child seated facing a window. Explorers used throughout the study were double end No. 3. New explorers were provided at intervals throughout the study and Arkansas stones were furnished the examiners in order that the explorer points might be kept sharp at all times. In all instances the instruments used in the examinations were taken from the sterilizer and placed in a common pool from which the examiner selected the instrument to be used. Failure in coalescence of enamel lobes (pits and fissures) in which the end of the explorer caught but which showed no evidence of dental caries was not counted as caries. Pits or fissures showing one or more of the following criteria were counted as caries irrespective of how small the cavitation: Slight opacity around the

edges, underlying dark stain suggestive of caries, or a perceptible soft feeling when the explorer was inserted in the pit or fissure. Examination of each child took approximately 10 minutes.

The personal interpretation in diagnosis is subject to some variation between examiners. This is especially noticeable in communities

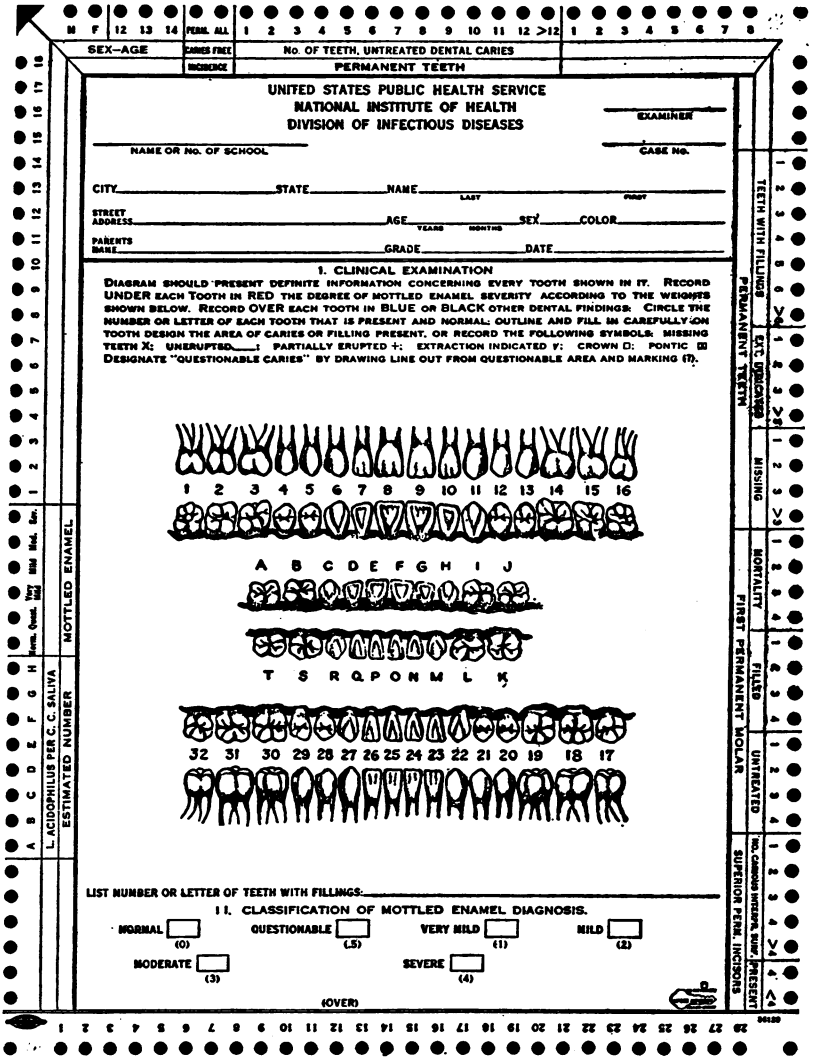

FIGURE 2.—Form used in dental caries study (front).

characterized by low dental caries experience rates where oftentimes pits and fissures introduce an important problem of subjective assessment. The inherent variation associated with subjective assessment results in varying degrees of differences between examiners in dental caries diagnosis. Attempts to equalize variation between the examiners (Assistant Dental Surgeons (R) David C. Johnston and

Edwin M. Short), or at least to make such variations compensatory insofar as group differences in dental caries rates were concerned, were made as follows:

1. With respect to previous training both examiners had completed a year's post-graduate study in children's dentistry at the Forsyth

III. WATER HISTORY ENUMERATOR:

RESIDENCE FROM BIRTH IN CHRONOLOGICAL ORDER *	DURATION (YRS.)	SOURCE OF DRINKING WATER					
		MUNICIPAL	DEEP WELL	SHALLOW WELL	CISTERN	SPRING	OTHER
BIRTH PLACE							
2.							
3.							
4.							
5.							
6.							
7.							

*IGNORE CHANGES IN A DURATION OF RESIDENCE LESS THAN THIRTY DAYS IN ONE CALENDAR YEAR.

WAS ABOVE HISTORY CONFIRMED BY INTERVIEW WITH CHILD'S PARENTS? YES ☐ NO ☐

BROTHERS AND/OR SISTERS IN SCHOOL NONE ( ) NAME GRADE SCHOOL

NAME GRADE SCHOOL

NAME GRADE SCHOOL

REMARKS:

IV. BACTERIOLOGICAL FINDINGS

DATE	ACID AGAR (COLONIES PER C. C. SALIVA)							ACID BROTH	
	DIL.	L. A. (S)	L. A. (R)	PIN POINT	YEAST	STAPH	STREP.	SALIVA	FECES

FIGURE 2.—Form used in dental caries study (back).

Dental Infirmary, Boston, Mass., about a month prior to the beginning of this study. This one year of specialized training in the same class in a subject pertinent to this study, dental caries in children, should have a tendency to bring the examiners into closer diagnostic accord than if the study had been made by two examiners of dissimilar training.

2. At the beginning of the study, the diagnostic criteria of the two examiners were calibrated for several weeks by one of us (F. A. A., Jr.) in both an area with a high dental caries rate (Waukegan) and in one with a low dental caries rate (Maywood).

3. The examiners worked together as a team, visiting each school included in the study, and each examined approximately an equal number of children in each school. The examination schedules were numbered serially, and throughout the entire study all odd-numbered cases were examined by one examiner, all even-numbered by the other.

The clinical findings [5] were recorded on a schedule form designed for combined dental caries and mottled enamel studies (fig. 2). The several communities were studied in this order: Waukegan, Maywood, Oak Park, Elmhurst, Elgin, Evanston, Aurora, and Joliet, the purpose being to have examiners alternate between areas which, on the basis of the fluoride content of the public water supply, might be expected to show high and low dental caries experience rates.

CLINICAL FINDINGS

In the eight communities studied, 2,832 children were examined; they were distributed according to age and sex as shown in table 4.

TABLE 4.—*Distribution of the 2,832 children examined, according to age and sex*

City	Total	Age in years, last birthday								
		12			13			14		
		M	F	Both sexes	M	F	Both sexes	M	F	Both sexes
	Number									
Elmhurst	170	36	28	64	31	29	60	22	24	46
Maywood	171	34	20	54	31	33	64	27	26	53
Aurora	633	120	88	208	121	104	225	105	95	200
Joliet	447	67	60	127	66	90	156	63	101	164
Elgin	403	72	90	162	52	55	107	75	59	134
Evanston	256	30	52	82	48	54	102	33	39	72
Oak Park	329	55	66	121	49	54	103	54	51	105
Waukegan	423	60	70	130	62	90	152	68	73	141
	Percent									
Elmhurst	100.0	21.2	16.5	37.7	18.2	17.1	35.3	12.9	14.1	27.0
Maywood	100.0	19.9	11.7	31.6	18.1	19.3	37.4	15.8	15.2	31.0
Aurora	100.0	19.0	13.9	32.9	19.1	16.4	35.5	16.6	15.0	31.6
Joliet	100.0	15.0	13.4	28.4	14.8	20.1	34.9	14.1	22.6	36.7
Elgin	100.0	17.9	22.3	40.2	12.9	13.7	26.6	18.6	14.6	33.2
Evanston	100.0	11.7	20.3	32.0	18.8	21.1	39.9	12.9	15.2	28.1
Oak Park	100.0	16.7	20.1	36.8	14.9	16.4	31.3	16.4	15.5	31.9
Waukegan	100.0	14.2	16.6	30.8	14.6	21.3	35.9	16.1	17.2	33.3

[5] The clinical examinations were made during September, October, November, and December 1939.

In table 5 are shown the number of children examined, the number and percentage of children showing dental caries experience (permanent teeth),[6] the number and percentage of children with no dental caries experience (permanent teeth), and the dental caries experience (permanent teeth) by single age groupings. In computing an index for showing the amount of dental caries in these population groups it was decided to express the amount of dental caries in terms of the dental caries experience of the group. Dental caries experience (permanent teeth) is determined by totaling the number of times the following items were recorded on the clinical examination form: Filled teeth (past dental caries), untreated dental caries, extraction indicated, and missing teeth.[7] In computing this index no single tooth is counted more than once even though one surface may show a carious lesion and another surface a filling.[8] When it is desired to express the dental caries experience in terms of a rate per 100 children, the sum of the 4 aggregates referred to is divided by the number of children examined and the quotient multiplied by 100.

TABLE 5.—*Summary of the percentage incidence and dental caries experience, permanent teeth, in selected 12–14-year-old white school children of 8 suburban Chicago communities*

City	Number of children examined	Children with dental caries experience	Children showing no dental caries experience	Dental caries experience, permanent teeth			
				Age in years, last birthday			Total
				12	13	14	
		Number					
Elmhurst	170	127	43	138	135	156	429
Maywood	171	120	51	112	154	176	442
Aurora	633	484	149	474	620	684	1,778
Joliet	447	365	82	363	500	580	1,443
Elgin	403	357	46	600	480	709	1,789
Evanston	256	246	10	462	690	571	1,723
Oak Park	329	315	14	705	717	952	2,374
Waukegan	423	410	13	890	1,249	1,288	3,427
		Percent		Number per 100 children			
Elmhurst		74.7	25.3	216	225	339	252
Maywood		70.2	29.8	207	241	332	258
Aurora		76.5	23.5	228	276	342	281
Joliet		81.7	18.3	286	321	354	323
Elgin		88.6	11.4	370	449	529	444
Evanston		96.1	3.9	563	676	793	673
Oak Park		95.7	4.3	583	696	907	722
Waukegan		96.9	3.1	685	822	913	810

[6] All data in the tables to follow refer to permanent teeth only.

[7] In this study third molars are excluded from consideration; the occasional instance of teeth lost by accident or extracted because of malposition is also excluded.

[8] In this study a tooth showing both an untreated lesion and a filling was counted as a "filled tooth."

An analysis of the data in table 5 shows a remarkable difference in the amount of dental caries in these selected groups, both with respect to the percentage incidence of affection and to the dental caries experience. For instance, the combined dental caries experience rate for the 1,421 children of those communities (Elmhurst, Maywood, Aurora, and Joliet) whose public water supplies contain fluorides (F) in excess of 1.0 p. p. m. is 288 per 100 children in contrast to a rate of 746 per 100 children in the 1,008 children of communities (Evanston, Oak Park, and Waukegan) using water with a fluoride content of 0.0 p. p. m.[9] In other words, there is 2.6 times as much dental caries in the latter communities as in the former.

With respect to the data on permanent teeth shown in table 5 it also seems desirable to list how much each of the following items contributed to the rates shown: Filled teeth (past dental caries), untreated dental caries, extraction indicated, and missing teeth (teeth lost because of accident, or extracted because of malposition excluded). These data are shown in table 6 and figure 3.

TABLE 6.—*Summary of the dental caries experience in the permanent teeth of 2,832 white school children, aged 12–14 years, of 8 suburban Chicago communities classified on the basis of filled teeth (past dental caries), untreated dental caries, extraction indicated, and missing teeth (presumably because of dental caries)*

City	Number of children examined	Dental caries experience, permanent teeth				
		Filled teeth (past dental caries) (a)	Untreated dental caries (b)	Extraction indicated (c)	Missing teeth (d)	Total (a+b+c+d)
		(A) Number				
Elmhurst	170	234	173	12	10	429
Maywood	171	216	202	3	21	442
Aurora	633	629	1,055	22	72	1,778
Joliet	447	468	879	18	78	1,443
Elgin	403	781	918	24	66	1,789
Evanston	256	985	614	24	100	1,723
Oak Park	329	1,546	715	18	95	2,374
Waukegan	423	1,527	1,536	70	294	3,427
		(B) Number per 100 children				
Elmhurst		137.6	101.8	7.1	5.9	252
Maywood		126.3	118.1	1.8	12.3	258
Aurora		99.4	166.7	3.5	11.4	281
Joliet		104.7	196.6	4.0	17.4	323
Elgin		193.8	227.8	6.0	16.4	444
Evanston		384.8	239.8	9.4	39.1	673
Oak Park		469.9	217.3	5.5	28.9	722
Waukegan		361.0	363.1	16.5	69.5	810

Proximal dental caries.—An unusual difference in the amount of dental caries in the proximal surfaces of the four superior permanent incisors was noted in the four Illinois cities previously studied (*2*).

[9] The limit of the sensitivity of the procedure used for the fluoride determinations may be considered as about 0.1 part per million.

At Macomb and Quincy there was about 16 times as much of this type of dental caries as was observed in the children of Galesburg and Monmouth.

The dental caries experience of the eight proximal surfaces of the four superior permanent incisors in the children of the eight communities included in this report is shown in table 7.

Differences of approximately the same order of magnitude as previously reported were found in the communities included in this study. For example, in the cities using a fluoride-free water (Evanston, Oak Park, and Waukegan) dental caries experience was evidenced in

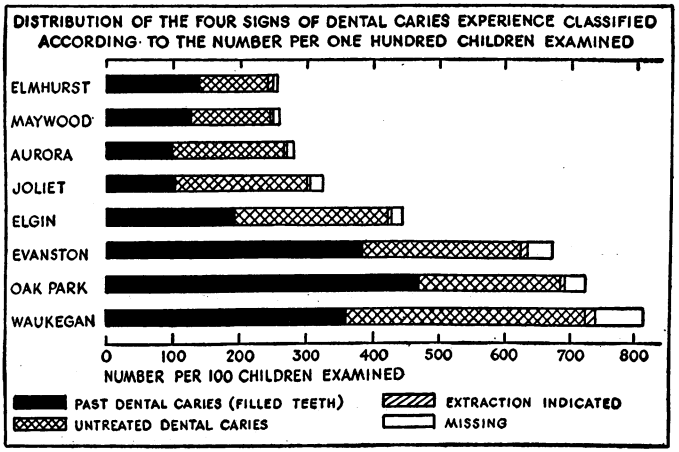

FIGURE 3.

1,043 out of 7,968 surfaces, or a rate of 13.1 per 100 surfaces. In the 11,256 proximal surfaces in the children exposed to waters with a fluoride (F) content in excess of 1.0 p. p. m. (Elmhurst, Maywood, Aurora, and Joliet) evidence of dental caries was discernible in only 103, or a rate of 0.9 per 100 surfaces. Or, to summarize, there was 14.3 times as much of this type of caries in the former group as in the latter group.

TABLE 7.—*Dental caries experience of the proximal surfaces of the four superior permanent incisors of selected children of 8 suburban Chicago communities*

City	Number of children examined	Number of proximal surfaces [1]	Number of proximal surfaces with dental caries experience	Dental caries experience per 100 surfaces
Elmhurst	170	1,342	8	0.60
Maywood	171	1,358	8	.59
Aurora	633	5,000	39	.78
Joliet	447	3,556	48	1.3
Elgin	403	3,170	130	4.1
Evanston	256	2,030	218	10.7
Oak Park	329	2,584	232	9.0
Waukegan	423	3,354	593	17.7

[1] Teeth lost by accident, unerupted, extracted because of malposition, and proximal surfaces restored by prosthesis (inlays, ¾ crowns, etc.) because of traumatic injury, excluded. The maximum possible number of surfaces in a population of this size (2,832) is 22,656. The number of surfaces excluded for the reasons stated was 262, or approximately 1.2 percent.

First permanent molar mortality.—An index of value for measuring certain aspects of the dental caries problem is the first permanent molar mortality rate. Knutson and Klein (*4*) define tooth mortality as referring to "not only extracted permanent teeth but also those which are indicated for extraction and still present in the mouth"; molar mortality rates reported in table 8 were computed in accordance with this definition. In order to determine how closely this index might reflect differences in the dental caries experience of the eight surveyed communities, the first permanent molar mortality rate for each community was computed. Furthermore, as tooth mortality may be influenced by the amount of remedial treatment received, data with respect to the number and percent of filled permanent molars are furnished for a fuller interpretation of the molar mortality rates reported.

TABLE 8.—*Summary of data respecting first permanent molar mortality rates, including number and percent of filled teeth, in selected 12–14-year-old children of 8 suburban Chicago communities*

[All teeth referred to in this table are first permanent molars]

City or village	Elmhurst	Maywood	Aurora	Joliet	Elgin	Evanston	Oak Park	Waukegan
Number of children examined	170	171	633	447	403	256	329	423
Molar population—estimated (number of children examined × 4)	680	684	2,532	1,788	1,612	1,024	1,316	1,692
Percent of children with 1 or more missing teeth (extraction indicated included)	7.6	8.2	10.4	12.8	13.9	23.4	17.9	40.9
Number of teeth showing dental caries experience:								
(a) Filled teeth	197	159	464	339	559	593	883	724
(b) Untreated dental caries	88	99	533	441	428	164	148	372
(c+d) Extraction indicated and missing	20	20	92	87	82	109	102	338
(a+b+c+d) Total	305	278	1,089	867	1,069	866	1,133	1,434
Percent of teeth showing dental caries experience	44.9	40.6	43.0	48.5	66.3	84.6	86.1	84.8
First permanent molar mortality, number per 100 children	11.8	11.7	14.5	19.5	20.3	42.6	31.0	79.9
Percent of dental caries experience with fillings, $\frac{a}{a+b+c+d}$	64.6	57.2	42.6	39.1	52.3	68.5	77.9	50.5

Incidence of endemic dental fluorosis (mottled enamel).—The incidence and degree of mottled enamel observed in the groups studied is shown in table 9.

In accordance with a previously described method of computing a community mottled enamel index (*5*) on the basis of the percentage distribution of clinical severity, the approximate mottled enamel index of Elmhurst is "slight"; that of Maywood, Aurora, and Joliet, "border-line"; and that of Elgin, Evanston, Oak Park, and Waukegan, "negative."

TABLE 9.—*Incidence and distribution of endemic dental fluorosis (mottled enamel) according to the degree of affection*

Macroscopic signs of mottled enamel	Elmhurst	Maywood	Aurora	Joliet	Elgin	Evanston	Oak Park	Waukegan
	(A) Number							
Total examined	170	171	633	447	403	256	329	423
Absent:								
Normal	48	67	337	181	244	235	298	414
Questionable	54	47	201	153	142	17	29	8
Present:								
Very mild	51	50	88	99	14	4	2	1
Mild	15	7	7	14	3	0	0	0
Moderate	2	0	0	0	0	0	0	0
Severe	0	0	0	0	0	0	0	0
	(B) Percent							
Total examined	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Absent:								
Normal	28.2	39.2	53.2	40.5	60.5	91.8	90.6	97.9
Questionable	31.8	27.5	31.8	34.2	35.3	6.6	8.8	1.9
Present:								
Very mild	30.0	29.2	13.9	22.2	3.5	1.6	.6	.2
Mild	8.8	4.1	1.1	3.1	.7	0	0	0
Moderate	1.2	0	0	0	0	0	0	0
Severe	0	0	0	0	0	0	0	0
Incidence of affection	40.0	33.3	15.0	25.3	4.2	1.6	.6	.2

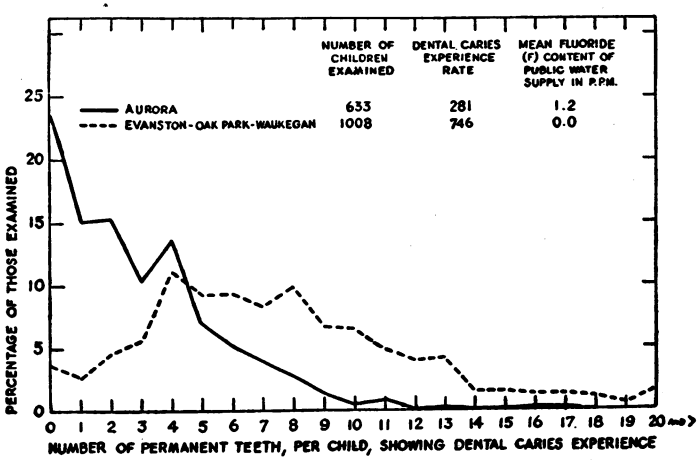

FIGURE 4.—Differences in the severity of dental caries attack.

Gradations in the amount of dental caries.—A study of the differences in the amount of dental caries between, for instance, Aurora, whose public water supply contains 1.2 p. p. m. of fluoride (F), and the communities using fluoride-free water (Evanston, Oak Park, and Waukegan) indicates that the vigor or force of the dental caries impact upon the selected populations studied varies widely. The 633 Aurora children showed a dental caries experience rate (permanent teeth) of 281 per 100 children; the 1,008 children at Evanston, Oak Park, and Waukegan, a rate of 746 per 100 children. The differences in the intensity of dental caries attack in Aurora and in the three other communities are shown in table 10 and figure 4.

TABLE 10.—*Differences in the severity of dental caries attack in selected school children at Aurora (Ill.), whose public water supply contains 1.2 p. p. m. of fluoride (F), and three communities (Evanston, Oak Park, and Waukegan) using fluoride-free water*

Number of permanent teeth showing dental caries experience in amounts as specified per child	Aurora			Evanston, Oak Park, Waukegan		
	Number of children	Percentage of total examined	Percentage of total (cumulative)	Number of children	Percentage of total examined	Percentage of total (cumulative)
0	149	23.5	23.5	37	3.7	3.7
1	95	15.0	38.5	27	2.7	6.4
2	97	15.3	53.8	46	4.6	11.0
3	66	10.4	64.2	57	5.6	16.6
4	87	13.7	77.9	113	11.2	27.8
5	44	7.0	84.9	94	9.3	37.1
6	33	5.2	90.1	95	9.4	46.5
7	25	3.9	94.0	84	8.3	54.8
8	17	2.7	96.7	101	10.0	64.8
9	8	1.3	98.0	68	6.7	71.5
10	3	.5	98.5	67	6.6	78.1
11	6	.9	99.4	49	4.9	83.0
12	0			40	4.0	87.0
13	1	.2	99.6	42	4.2	91.2
14	0			15	1.5	92.7
15	0			15	1.5	94.2
16	1	.2	99.8	13	1.3	95.5
17	1	.2	100.0	13	1.3	96.8
18				11	1.1	97.9
19				6	.6	98.5
20 and over				15	1.5	100.0
Total	633			1,008		

Dental caries experience, number per 100 children examined: Aurora—281; Evanston, Oak Park, Waukegan—746.

Bacteriological studies.—In order to learn whether or not group differences in oral lactobacilli counts existed in the eight communities studied, *L. acidophilus* counts were made on saliva samples from 1,761 of the 2,832 children examined. In each community a specimen of saliva was collected from a representative sample of children selected at random from the total of those who were examined clinically. The bacteriological studies were conducted by two of the authors (P. J. and F. A. A. Jr.).

All saliva samples were collected in a similar manner at the same time of day (between 10 a. m. and 11:30 a. m.). Paraffin was used to stimulate the flow of saliva; all children were instructed to chew in such a manner as to touch all the teeth in the mouth. The time required to collect the saliva was approximately 5 minutes in all cases. The dilution used for all specimens was 1 cc. of saliva to 4 cc. of broth; 0.1 cc. of this mixture was plated on tomato juice agar of pH 5. Plates were incubated for 4 days and the counts of the *L. acidophilus* colonies were made by one of the authors (P. J.).

For a more detailed analysis of the relationship between the clinical findings and the bacteriological results, a separate tabulation was made of the dental caries experience of those children included in the bacteriological studies. It is shown in table 11.

TABLE 11.—*Summary of the percentage incidence and dental caries experience, permanent teeth, in the 1,761 children for whom a single L. acidophilus count was made*

City	Number of children examined	Children showing dental caries experience	Children showing no dental caries experience	Dental caries experience, permanent teeth				
				Filled teeth (past dental caries) (a)	Untreated dental caries (b)	Extraction indicated (c)	Missing (d)	Total (a+b+c+d)
				(A) Number				
Elmhurst	154	112	42	220	147	7	7	381
Maywood	139	100	39	174	164	1	13	352
Aurora	340	255	85	360	556	7	34	957
Joliet	233	191	42	265	469	10	41	785
Elgin	250	223	27	529	536	7	41	1,113
Evanston	208	200	8	802	485	23	89	1,399
Oak Park	208	202	6	1,010	424	13	61	1,508
Waukegan	229	223	6	884	816	31	160	1,891
	Percent of total [1] examined clinically			(B) Number per 100 children				
Elmhurst	90.6	72.7	27.3	143	95	4.5	4.5	247
Maywood	81.3	71.9	28.1	125	118	.7	9.4	253
Aurora	53.7	75.0	25.0	106	164	2.1	10.0	281
Joliet	52.1	82.0	18.0	114	201	4.3	17.6	337
Elgin	62.0	89.2	10.8	212	214	2.8	16.4	445
Evanston	81.3	96.2	3.8	386	233	11.1	42.8	673
Oak Park	63.2	97.1	2.9	486	204	6.3	29.3	725
Waukegan	54.1	97.4	2.6	386	356	13.5	69.9	826

[1] Percentage of total children examined clinically (tables 5 and 6) who were examined bacteriologically.

TABLE 12.—*Summary of the percentage distribution of oral L. acidophilus in salivas from 1,761 school children in 8 suburban Chicago communities*

City	Distribution of children according to the number of *L. acidophilus* per cc. of saliva								
	Negative	Less than 100	100 to 1,000	1,000 to 3,000	3,000 to 12,000	12,000 to 21,000	21,000 to 30,000	30,000 and over	Total
	(A) Number								
Elmhurst	39	16	13	9	16	13	10	38	154
Maywood	35	20	14	10	17	8	6	29	139
Aurora	86	44	24	10	43	34	12	87	340
Joliet	61	22	20	6	24	26	12	62	233
Elgin	40	13	24	14	40	22	14	83	250
Evanston	19	13	19	2	28	29	11	87	208
Oak Park	24	14	13	14	27	19	6	91	208
Waukegan	21	13	13	6	27	15	9	125	229
	(B) Percent								
Elmhurst	25.3	10.4	8.4	5.9	10.4	8.4	6.5	24.7	100
Maywood	25.2	14.4	10.1	7.2	12.2	5.7	4.3	20.9	100
Aurora	25.3	12.9	7.1	2.9	12.7	10.0	3.5	25.6	100
Joliet	26.2	9.4	8.6	2.6	10.3	11.2	5.1	26.6	100
Elgin	16.0	5.2	9.6	5.6	16.0	8.8	5.6	33.2	100
Evanston	9.1	6.3	9.1	1.0	13.5	13.9	5.3	41.8	100
Oak Park	11.5	6.7	6.3	6.7	13.0	9.1	2.9	43.8	100
Waukegan	9.2	5.7	5.7	2.6	11.8	6.5	3.9	54.6	100

The quantitative distribution of the lactobacilli counts are shown in table 12.

In order to demonstrate graphically the quantitative distribution of the *L. acidophilus* counts the entire group was divided into three classes: Those children using a water supply containing more than 1 p. p. m. F (Elmhurst, Maywood, Aurora, and Joliet); children whose water supply contained 0.5 p. p. m. F (Elgin); and children using

PERCENTAGE DISTRIBUTION OF LACTOBACILLI IN THE SALIVA OF 1,761 CHILDREN EXAMINED IN EIGHT SUBURBAN CHICAGO COMMUNITIES GROUPED ACCORDING TO THE FLUORIDE (F) CONTENT OF THE PUBLIC WATER SUPPLY AND CLASSIFIED ACCORDING TO THE ESTIMATED NUMBER OF LACTOBACILLI PER CC. OF SALIVA

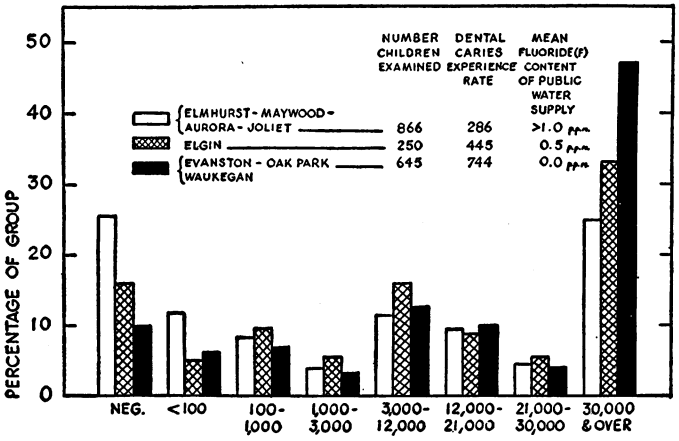

FIGURE 5.

water free of fluorine (Evanston, Oak Park, and Waukegan). This graphic presentation is shown in figure 5.

PUBLIC WATER SUPPLIES

Description of public water supplies.[10]—Description and data concerning these municipal water supplies were obtained from Mr. C. W. Klassen, chief sanitary engineer, State Department of Public Health, from the District Sanitary Engineers in whose districts the cities are located, from Bulletin No. 21, including Supplement No. 1 thereto, of the State Water Survey Division, and by interview with the local water superintendent. Description of these supplies follows.

Elmhurst.—The public water supply of Elmhurst is obtained from four drilled wells. Wells Nos. 1, 2, and 3 are located in the north central part of the city, No. 4 near the western city limits.

Well No. 1 was drilled in 1916 to a depth of 957 feet. Well No. 2 is located about 100 feet from well No. 1 and was drilled in 1919 to a depth of 1,398 feet. It enters the Eau Claire formation of the Cambrian system. In 1926–27 well No. 2 was deepened to 2,222 feet.

[10] For a proper evaluation of the reported clinical findings and their relation to the fluorine-dental caries hypothesis, detailed data regarding the common water supplies are included for the period of time concomitant with the life of the group examined.

Well No. 3 is located about two blocks from wells Nos. 1 and 2 and was drilled in 1925–26 to a depth of 2,077 feet, this level being designated in the log as the Mount Simon sandstone. In 1933 this well was deepened to 2,221 feet.

Well No. 4 was drilled in 1928, originally to a depth of 2,205 feet into the Mount Simon formation. In 1937 the lower part of this well was plugged in order to reduce the high sodium chloride content and the water is now being obtained from a depth of about 1,450 feet which is in the Eau Claire formation. Well No. 4 is used only sporadically, generally during the summer months.

At the time of the survey well No. 1 was emptying into a 150,000 gallon reservoir which has two leads, one to a large 1,000,000 gallon reservoir, the other direct to the mains. Well No. 1 is generally pumped between midnight and 6 a. m.; the water from this well is pumped directly into the mains during this period. Wells Nos. 2 and 3 supply most of the water used by the city between 6 a. m. and mid-

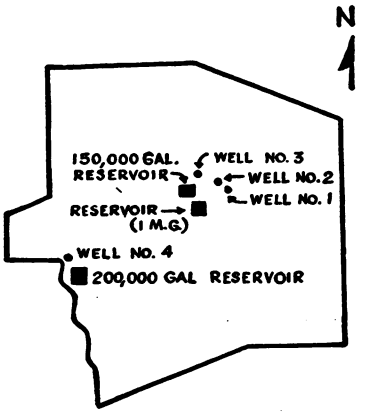

FIGURE 6.—Location of the wells in the city of Elmhurst.

night. A sample of water from each of these two wells, collected in December 1939, showed a fluoride (F) content of 1.3 and 2.2 parts per million, respectively. Another sample collected in September 1939, from a tap located at the City Hall showed a fluoride content of 1.8 parts per million.

Maywood.—The present Maywood supply is obtained from four drilled wells, designated as wells Nos. 3, 4, 5, and 6. Wells Nos. 1 and 2 were drilled about 1895; well No. 1 was abandoned about 1919, No. 2 about 1923.

Well No. 3 was drilled in 1910 and is 1,800 feet deep. Between 840 feet and 980 feet the St. Peter sandstone was penetrated and Cambrian sandstone entered at a depth of 1,400 feet. This well was repaired in 1931, the repair including the placing of 528 feet of 12-inch casing cemented in place for its entire length, and the reaming of the balance of the hole to 10 inches. Well No. 4 was completed in 1918 and is 2,048 feet deep. St. Peter sandstone was entered at a depth of 897 feet and the Cambrian sandstone at 1,400 feet. The well is cased 612 feet, about 50 feet into the Galena-Plattsville limestone. In 1937 the lower 30 feet was filled with cement. The discharges from wells Nos. 3 and 4 are softened (zeolite) and collected in the "north" reservoir.

Well No. 5 was drilled in 1922 and is 2,076 feet deep. This well is 17 inches in diameter at the top and is cased to a depth of 545 feet. A 10-inch liner is placed between depths 1,040 feet and 1,100 feet. This well is 10 inches in diameter at the bottom where it enters the Mount Simon of the Cambrian system. Apparently no changes have been made in this well since its original installation

except for a cleaning out in 1938. Well No. 6 was drilled in 1924 to an original depth of 2,090 feet but in 1937 this was filled back to a depth of 1,549 feet. The bottom of the original hole was filled with 40 feet of concrete, and after shooting the well at 1,440 to 1,470 feet about 455 feet of sand and clay was allowed to fill

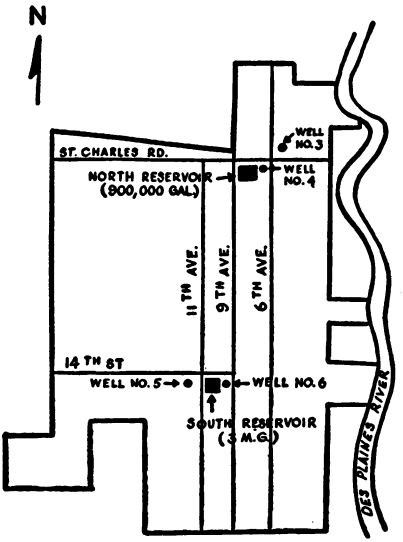

FIGURE 7.—Location of wells in the village of Maywood.

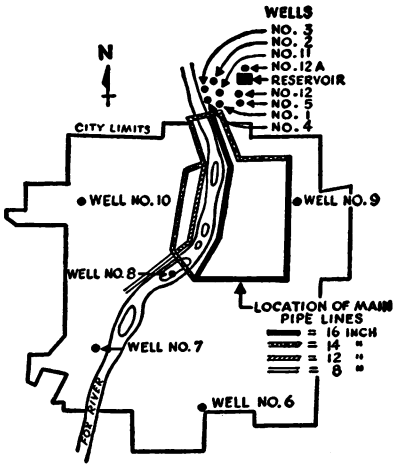

FIGURE 8.—Location of wells in the city of Aurora.

the well. Then more cement was added to seal the lower part of the well. The chloride content was reduced by this procedure from 1,500 to 250 parts per million. This well is cased to a depth of 556 feet. Wells Nos. 5 and 6 are located about a mile and a half from wells Nos. 3 and 4. The discharges from wells Nos. 5 and 6 are softened (zeolite) and collected in the "south" reservoir. The gravity open-type softening plant and chlorination was installed in 1938.

Aurora.—The common water supply of Aurora is obtained from nine wells, four of which (Nos. 5,[11] 11, 12, and 12A) pump into a collecting reservoir and thence to the distribution system. This reservoir and well field is located just outside the city limits, north of the city. The remaining wells (Nos. 6, 7, 8, 9, and 10) are located in different sections of the city. All pump directly into the distribution system with the exception of well No. 10, which pumps to the distribution system through a sand-collecting reservoir. Although there are several points in the distribution system where the water from several wells mix, these points are very indefinite as wells are not operated at the same time nor for the same length of time. From the pumping records of the Water Department, wells Nos. 11, 12, and 12A (distributed from the common reservoir) have furnished during 1935, 1936, 1937, 1938, and the first nine months of 1939, 56, 49, 68, 70, and 61 percent, respectively, of the water pumped (no water was pumped from the recently repaired well No. 5 during this period). Water from the main pumping station (wells Nos. 11, 12, and 12A) passes to the center of the city through main pipe lines lying east and west of the Fox River. Water from this source reaches all parts of the city, although in certain sections there is some mixture of waters from those wells pumping directly into the distribution system. The location of the wells, the reservoir, and the main pipe lines are shown in figure 8.

Wells Nos. 1 to 4, inclusive, drilled between 1891 and 1895, are now abandoned and plugged. Their site is close to the present location of wells Nos. 5, 11, 12, and 12A. Data with respect to these wells follow:

Well No.	Year drilled	Depth in feet	Remarks
1	1891	1,388	Deepened in 1898 to 2,230 feet. A report in city water department gives the depth as 2,250 feet.
2	1892	2,230	
3	1893	2,230	
4	1895	2,230	

The record with respect to the wells now in use follows:

Well No.	Year drilled	Depth in feet	Well No.	Year drilled	Depth in feet
5	1910	2,250	10	1923	2,290
6	1915	2,185	11	1928	2,253
7	1916	2,250	12	1929	2,260
8	1916	2,280	12A	1936	2,250
9	1923	2,259			

In the preliminary studies, samples were collected from the common reservoir (wells Nos. 11, 12, and 12A) and from each of the wells Nos. 6 to 10, inclusive. The monthly water samples for a year were collected from the main pumping station (wells Nos. 11, 12, and 12A). On the basis of the 12 months' pumping records for 1938, the percentages of water pumped were calculated and are shown with the fluoride (F) content of each supply in the following table (p. 782).

The Aurora water supply is not treated except for provisions for emergency chlorination.

From the standpoint of a population exposed for a long period of time to a public water supply containing small amounts of fluorides, Aurora appears to offer many advantages for epidemiological study. Since 1898 the public water supply has been obtained from wells into the Cambrian "Potsdam" sandstone.

[11] Well No. 5 was out of commission for a number of years. New pumping equipment was recently installed, and this well was put back into permanent operation August 19, 1940.

Well No.	Percent contributed by each well and main group of wells to the total amount of water used in Aurora during 1938	Fluoride (F) content in p. p. m. of samples collected in August 1939
11, 12, and 12A	70	1.2
10	1	1.1
9	7	1.3
8	8	1.3
7	9	.7
6	5	.5

Joliet.—At the time of the survey the Joliet water supply was being obtained from three wells, Washington Street wells Nos. 1 and 2, and from the Ottawa Street well. The water supply of this city has undergone a number of physical

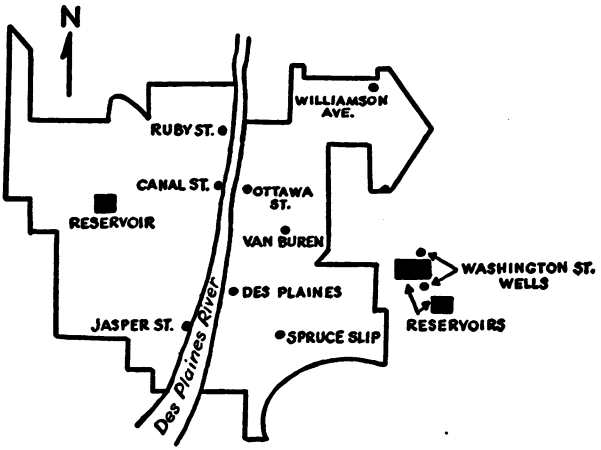

FIGURE 9.—Location of wells in the city of Joliet.

changes during the past 12 to 14 years, but an analysis of such information as is available does not indicate any marked change in the fluoride (F) content of the water used by the inhabitants. During this period the water supply of Joliet was largely obtained from wells into the Cambrian sandstone, an aquifer whose waters often contain small amounts of fluorides. Weart and Klassen (*3*) in 1937 reported, on the basis of seven samples collected in 1936, that the fluoride content of this public water supply was 1.4 p. p. m. The samples collected during the past year show a mean fluoride content of 1.3 p. p. m. The degree of mottled enamel observed in the 12–14-year-old children examined in this survey would reflect the fluoride concentration of the public water in use roughly 9 to 12 years ago. The percentage incidence of affection observed points to a concentration in the neighborhood of 1.3 to 1.4 p. p. m. Hence, with the exception of the summer of 1930, which will be discussed later, both chemical and epidemiological evidence would suggest that the fluoride (F) content of the water used in this community did not differ greatly from the range of concentration stated.

The following wells have contributed to the Joliet water supply:

Name of well	Depth in feet	Year drilled	Year last in use	Name of well	Depth in feet	Year drilled	Year last in use
Washington St.:							
Well No. 1	1,608	1937	(1)	Van Buren St	1,550	1913	1935
Well No. 2	1,704	1900	(1)	Des Plaines St	1,560	1913	1937
Ottawa St	1,627	1907	(1)	Ruby St	1,564	1915	1937
Canal St	1,570	1911	1931	Jasper St	1,565	1930	1938
Spruce Slip	1,530	1912	1931	Williamson St	1,588	1925	1938

[1] In use at present.

Washington Street well No. 2 and the Ottawa Street well were repaired in 1937. Water from Washington Street wells Nos. 1 and 2 pass through a common collecting reservoir. During the period 1925–39, certain wells now not in use were being pumped directly into the distribution system.

In May 1930, because of a break-down in the Williamson Avenue (Charlesworth Avenue) well, the public water supply was supplemented by water pumped from a quarry known as "Michigan Beach" and located on the south edge of the city. Up to the time of its use for drinking water it had been used for swimming-pool water. The quarry was of unknown depth and presumably was fed by springs. This water was chlorinated before being turned into the distribution system. According to the records of the State Department of Public Health about 1,000,000 gallons of water per day were used from the quarry and this continued for several months. The quarry water contributed about 25 percent of the water used by the inhabitants during this period. There is also a record of certain shallow wells, now abandoned, having constituted part of the city water supply.

At present the Washington Street wells supply a little over half of the water used in the city; the Ottawa Street well supplies the remainder. In the preliminary studies a sample of water from a tap in the Woodruff Hotel (southeastern section of the business district where water usage is high and located so that mixing of the two water supplies is obtained) showed on analysis a fluoride (F) content of 1.2 parts per million.

The present Joliet water supply is chlorinated.

Elgin.—Since 1905 Elgin has obtained its public water supply from ground water sources, previously from the Fox River. At present practically all of the water is obtained from six wells. Four of these wells are at the north end of the city (Main Station, Slade Avenue) and two in the southeastern section of the city (Lavoie Avenue well and the St. Charles Street well). In addition, the Creighton Avenue well and the Schuler Street well supply varying amounts, pumping directly into the distribution system.

Water from the four north wells passes through a softening plant to a reservoir and thence to the distribution system. In the southeastern part of town there is an aerator and settling reservoir at the site of the St. Charles Street well and the water from the Lavoie Avenue well, in addition to water from the St. Charles Street well, is regularly pumped over and through this aerator and reservoir before passing into the distribution system.

The major portion of the supply has been obtained for a number of years from the four north wells. For the years 1932, 1933, 1934, 1935, 1936, 1937, 1938, and 1939 the pumping records of the Water Department show that these four wells supplied 84, 78, 72, 71, 69, 65, 62, and 64 (estimated) percent, respectively, of the total amount of the water pumped.

When first installed these four wells ranged in depth from 1,300 to 2,000 feet. Between 1905 and 1917 certain changes were made by filling in the lower parts of the wells. In 1926 the wells were deepened and cleaned out to a depth of 1,960 feet and cased to a depth of about 122 feet. The four wells penetrate the Cambrian sandstone.

The southeastern section of the city is largely supplied with water from the Lavoie Avenue well and the St. Charles Street well. The former was drilled in 1931 to a depth of 675 feet and since 1933 has accounted for an increasing percentage of the water used. The St. Charles Street well is 100 feet deep and was drilled in 1933, replacing one at the same location drilled in 1921 to a depth of 101 feet. During July 1940, the St. Charles Street well furnished nearly 5 percent of the total pumpage from all wells, in August, about 1.8 percent.

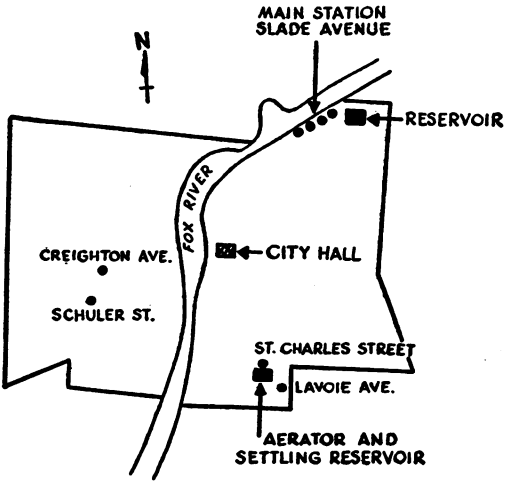

FIGURE 10.—Location of wells in the city of Elgin.

The Schuler Street well, 1,960 feet deep and installed in 1932, is pumped irregularly, being used largely for standby purposes. This well and the nearby Creighton Avenue well pump directly into the distribution system. The Creighton Avenue well [12] is 48 feet deep. The date of its installation is not known, but it was reported in operation as early as 1928. During April, May, June, and July 1940, the Creighton Avenue well furnished 4.7, 9.6, 4.1, and 1.2 percent, respectively, of the total pumpage from all wells.

The two shallow wells (Creighton Avenue and St. Charles Street) supplied between 1934 and 1938 as much as 10 to 25 percent of the water pumped.

As has been noted, there is no common reservoir to which the water is pumped prior to turning it into the distribution system, and the southeastern section in all probability used a water differing in mineral composition from that used in the rest of the city. In the preliminary studies, samples were collected of the treated water at the Main Station (Slade Avenue), another at the City Hall, which is about the center of the mixed area, and should represent a sample of the

[12] A sample from this well collected in December 1939 showed a fluoride (F) content of 0.5 p. p. m.

mixture of the water from both ends of town, and a third sample from the reservoir served by the two wells at the south end of the city. These samples showed a fluoride (F) content of 0.4, 0.4, and 1.0 part per million, respectively. In 1938 a water softening plant using the lime process was installed for the treatment of the public water supply. About 15.6 grains of lime and ½ grain of alum per gallon are applied, followed by chlorination.

In order to learn whether the softening treatment was materially influencing the fluoride content of the water from the four north wells (Slade Avenue Station) raw (untreated) water samples were collected during November 1940 from wells Nos. 1, 2, 3, and 4; the fluoride (F) content of these samples was 0.7, 0.6, 0.5, and 0.5 part per million, respectively. Klassen [13] states that tests made in 1936 of two samples from the Slade Avenue Station showed a fluoride content of 0.7 and 0.5 part per million. A sample at the same time from the St. Charles Street well showed a fluoride content of 1.2 parts per million.

Evanston.—The supply is obtained from Lake Michigan and is treated in a modern water purification plant by mixing, settling, rapid sand filtration, and chlorination. The mixing period is about 17 minutes, followed by a 2-hour settling period. There are 12 rapid sand filters, each having a capacity of 1,400 gallons per minute. About 0.7 grains per gallon of alum is applied for coagulation purposes and 0.3 parts per million of chlorine for sterilization. From 1874 to 1911, when chlorination by the use of hypochlorite of lime was started, the supply was obtained direct from Lake Michigan without any treatment. In 1914 a modern water purification plant was constructed, which was enlarged and improved in 1924.

Oak Park.—Since 1912 the water supply has been obtained from the city of Chicago, the source of this supply being Lake Michigan. This water is chlorinated at Chicago and rechlorinated at Oak Park. Previous to 1912 Oak Park obtained its water supply from deep wells.

Waukegan.—The supply is obtained from Lake Michigan and is treated in a modern water purification plant by aeration, mixing, settling, rapid sand filtration, post aeration, and chlorination. The mixing period is about 5 minutes followed by a period of 3 hours settling; there are 10 rapid sand filters, each having a capacity of 728 gallons per minute. About one grain per gallon of alum is applied for coagulation purposes and 0.3 part per million of chlorine for sterilization. From 1895 to 1929, when the filtration plant was placed in operation, the supply was obtained from Lake Michigan. Previous to 1895 the water supply was obtained from artesian wells.

Other data.—Inasmuch as Oak Park procures its water from the city of Chicago, as does Cicero and numerous other communities in the metropolitan area, three samples were collected during 1939–40 from taps in Cicero having average domestic use, and seven monthly samples were collected during 1940 from a tap in the Chicago distribution system. The three Cicero samples showed 0.1, 0.0, and 0.0 part per million of fluoride; all seven of the Chicago samples showed a fluoride content of 0.0 part per million.

The study published in 1937 by Weart and Klassen (*3*) reported hat the public water supplies of Elmhurst, Maywood, Aurora, Joliet, and Elgin contained 2.0, 1.6, 1.0, 1.4, and 0.9 parts per million of fluorides, respectively. They noted that in the case of ground water

[13] Personal communication dated December 1940.

sources a sample from each well then in service was examined, the value reported for each community representing an arithmetical mean of the several determinations.

Chemical analyses of the common water supplies.—Samples of the common water supplies were collected, generally monthly, during 1939–40. The percentage incidence of mottled enamel and the degree of clinical affection in the age group studied should closely reflect the fluoride (F) content of the water used approximately 9 to 12 years previously.[14] On the basis of the presumptive evidence of observed endemic dental fluorosis (mottled enamel), the fluoride content of the public water supplies in use 9 to 12 years ago in these communities was approximately of the same order of fluoride concentration as found in this survey, with the exception of Maywood. At Maywood an incidence of mottled enamel of 33 percent was observed, a degree of affection that would suggest that the water used during the period when these teeth were calcifying had a fluoride (F) concentration of about 1.4–1.6 parts per million, a concentration close to that (1.6 p. p. m.) reported by Weart and Klassen (*3*) in 1937. Physical changes occurring several years ago in certain of the Maywood wells may account for the fact that the mean fluoride (F) content of the samples reported in this paper was 1.2 parts per million.

Klassen [15] states that samples of water collected in 1936 from Maywood wells Nos. 3, 4, 5, and 6 showed a fluoride (F) content of 1.2, 1.3, 1.8, and 1.8 parts per million. These water samples were collected prior to the installation of the softening treatment and the marked changes made in well No. 6. Raw water samples collected during 1939–40 (not included in table 13) from each of these wells and analyzed by one of us (E. E.) showed fluoride (F) concentrations, in parts per million, as follows: Well No. 3, 1.1 and 1.4; well No. 4, 1.6; well No. 5, 1.3; and well No. 6, 1.1.

A marked difference was noted in the fluoride concentration of the two north wells in contrast to the two south wells, but individual pumping records showing the amount contributed by each of the four village wells for the past 5 years were not available.

The fluoride content of these waters was estimated colorimetrically by means of the zirconium-alizarin reagent (*6*). The results are given in table 13.

[14] A more precise correlation is possible if single age groupings are studied; even more precision is possible if the signs of mottled enamel in single tooth groupings are considered in relation to the period of enamel calcification as outlined by Logan and Kronfeld. Under these conditions it is possible in the case of certain teeth of the 14-year-old group to estimate the fluoride content of the water used 12 to 14 years previously. Hence, "9 to 12 years previously" is merely an approximation of a prior time period, useful in evaluating certain aspects of the study.

[15] Personal communication dated December 30, 1940.

TABLE 13.—*Fluoride (F) content of public water supplies in the 8 suburban Chicago communities studied*

All samples collected from a tap in the distribution system having average domestic use unless otherwise specified]

Source	Ground water					Lake Michigan		
City or village	Elmhurst	Maywood	Aurora [2]	Joliet	Elgin [3]	Evanston	Oak Park	Waukegan
	Parts per million							
December 1939	1.6	----------	1.2	[6] 1.3 [7] 1.2	0.4	0.1	0	0
January 1940	[1]	----------	1.2	[6] 1.3 [7] 1.2	.5	0	0	0
February	2.0	0.9	1.1	1.3	.5	0	0	0
March	----------		1.2	----------	.4	0	----------	0
April	2.0	[4] 1.1 [5] 1.0	1.2	1.3	.4	0	0	0
May	----------	----------	1.2	1.2	.5	0	----------	0
June	1.6	*1.4 *1.1	1.2	1.4	.5	0	*0 *0	0
July	*1.8 *1.9	*1.0 *1.5	1.2	*1.3 *1.3	.4	.1	*0 *0	0
August	----------	----------	1.2	----------	.5	0	----------	0
September	1.9	1.4	1.2	1.3	.4	0	0	----------
October	1.6	1.1	1.3	1.2	.5	0	0	*0 *0
November	*1.8 *1.8	*1.1 *1.4	1.3	*1.1 *1.1	.4	0	*0 *0	----------
Mean	1.8	[8] 1.2	1.2	1.3	.5	0	0	0

*At times the exigency of other duties prevented the district engineer from collecting the sample during the month specified. When two determinations marked by an asterisk (*) are shown for one month, it indicates that two samples were collected during that month, generally about 2 weeks apart.

[1] Container broken.

[2] All samples collected at main pumping station (wells Nos. 11, 12, 12A, and, recently, 5).

[3] All samples collected at the Elgin City Hall; mixture of water from both ends of town.

[4] North reservoir.

[5] South reservoir.

[6] Ottawa St. well.

[7] Washington St. wells.

[8] There is both presumptive and direct evidence that prior to a few years ago the water supply used in Maywood probably contained 1.4 to 1.6 p. p. m. of fluoride (F). See text.

As was customary in other quantitative surveys, analyses were made of constituents other than the fluorides. Results of these chemical analyses are given in table 14.

TABLE 14.—*Mineral analyses of the common water supply of each of the 8 suburban Chicago communities studied* [1]

	Elmhurst	Maywood	Aurora	Joliet	Elgin	Evanston	Oak Park	Waukegan
	Parts per million							
Residue on evaporation	737.6	723.2	729.6	566.0	180.0	153.6	152.8	155.2
Loss on ignition	60.8	96.8	107.2	82.8	33.6	34.0	35.6	30.4
Fixed residue	676.8	626.4	622.4	483.2	146.4	119.6	117.2	124.8
Silica (SiO_2)	10.0	11.5	18.4	6.0	26.4	8.0	8.0	4.0
Iron (Fe)	.05	.05	.08	.06	.06	.03	.05	.03
Aluminum (Al)	0	0	0	0	0	.04	0	0
Calcium (Ca)	86.9	20.0	85.5	89.2	14.9	33.7	33.7	34.9
Magnesium (Mg)	25.9	6.1	28.0	30.8	15.9	11.4	11.7	11.5
Sodium and potassium (calculated as Na)	149.8	210.7	130.3	70.5	25.2	3.5	4.4	4.4
Carbonate (CO_3)	0	0	0	0	15.4	0	0	2.4
Bicarbonate (HCO_3)	350.1	351.4	313.5	351.4	103.0	135.4	139.0	139.0
Sulfate (SO_4)	98.1	138.2	48.0	145.8	30.3	23.4	16.8	23.0
Nitrate (NO_3)	.97	.94	1.42	1.59	.33	.62	.46	.89
Chloride (Cl)	180.0	60.0	218.0	31.0	8.0	4.0	5.0	4.0
Phosphate (PO_4)	0	.3	0	0	0	0	0	0
Fluoride (F)	1.8	1.4	1.2	1.2	.4	0	0	0

[1] These samples of water from Aurora and Elgin were received in August 1939; the samples from Elmhurst, Joliet, Evanston, Oak Park, and Waukegan in October 1939, and that from Maywood in June 1940.

Assistant Chemist C. G. Remsburg carried out the determinations other than fluoride, using mostly the methods given in the Standard Methods of Water Analysis of the American Public Health Association. The phosphate was determined colorimetrically by an adaptation of the Benedict and Theis method (J. Biol. Chem., 61: 63 (1924)). The limit of the sensitivity of the procedure used for the fluoride determination may be considered as about 0.1 part per million.

DISCUSSION

General findings.—Marked differences in dental caries experience have been demonstrated in selected population groups (children of continuous residence and continuity of exposure) residing in eight communities in the suburban Chicago area. Considering the relative homogeneity of the population and the sampling method followed, it is difficult from an epidemiological standpoint to attribute these differences to any cause other than the mineral composition of the public water supply. A summary of the findings of this study is shown in table 15.

With respect to the conjectural relationship of the amount of sunlight to dental caries it might be noted that the city (Waukegan) with the highest dental caries experience rate (810) showed the fewest number of cloudy days and was next to Aurora in having the greatest number of clear days.

The characteristic difference in the percentage incidence and dental caries experience rates, proximal caries rates, and amounts of *L. acidophilus* present in the saliva showed no outstanding differences from that observed in the Galesburg-Quincy (Ill.) study (*2*).

TABLE 15.—*Summary of dental caries findings in 2,832 selected white children, aged 12–14 years, in 8 suburban Chicago communities in relation to the fluoride (F) content of the public water supply*

City or village	Elmhurst	Maywood	Aurora	Joliet	Elgin	Evanston	Oak Park	Waukegan
Sampling:								
Total number of 12-14-year-old children present at time of sampling	633	873	1,625	1,412	1,030	2,125	1,662	1,354
Number of 12-14-year-old white children whose histories on repeated questioning indicated continuity of exposure and who were examined	170	171	633	447	403	256	329	423
Percentage of the total present who were examined	26.9	19.6	39.0	31.7	39.1	12.0	19.8	31.2
Water supply: Source	Deep wells					Lake Michigan		
Permanent hardness in parts per million	323.4	75.0	328.5	349.3	102.6	131.0	132.2	134.4
Mean fluoride (F) content, 1939–40, in parts per million	1.8	[1] 1.2	1.2	1.3	.5	0	0	0
Clinical examination:								
Dental caries experience, permanent teeth, per 100 children examined	252	258	281	323	444	673	722	810
Dental caries experience, proximal surfaces, superior incisors, per 100 surfaces	0.60	0.59	0.78	1.3	4.1	10.7	9.0	17.7
First permanent molar mortality, per 100 children examined	11.8	11.7	14.5	19.5	20.3	42.6	31.0	79.9
Percentage of children with no dental caries experience	25.3	29.8	23.5	18.3	11.4	3.9	4.3	3.1
Percentage incidence of endemic dental fluorosis (mottled enamel)	40.0	33.3	15.0	25.3	4.2	1.6	.6	.2
Bacteriology:								
Percentage of those examined bacteriologically whose salivary *L. acidophilus* counts were:								
Negative and <100	35.7	39.6	38.2	35.6	21.2	15.4	18.2	14.9
30,000 and >	24.7	20.9	25.6	26.6	33.2	41.8	43.8	54.6

[1] There is both presumptive and direct evidence that prior to a few years ago the Maywood water contained probably 1.4–1.6 p. p. m. of fluoride (F). See text.

Low dental caries experience associated with the use of fluoride waters near the minimal threshold of mottled enamel.—The location of these communities and the fluoride concentrations of their public water supplies make them peculiarly fitted for epidemiological study of the relationship of fluoride concentration in the domestic water supply to the amount of dental caries experience. The most pertinent finding of the study was the disclosure that water supplies, the fluoride concentrations of which were not far from the minimal threshold of endemic dental fluorosis, 1.0 p. p. m. of F (e. g., Aurora, 1.2 p. p. m.), were associated with unusually low dental caries experience rates. Thus, the dental caries inhibitory factor, presumably present in the water and probably fluoride, was operative at levels where mottled enamel per se was of minimal public health and no esthetic significance. On the other hand, the three communities using the fluoride-free waters were all characterized by high dental caries experience. This suggests that fluoride levels even under 1.0 p. p. m. of F influence dental caries experience. The importance of adequate quantitative data respecting dental caries rates in communities whose public water supplies contain fluoride (F) near or under 1.0 p. p. m. needs no further emphasis.

The fact that low dental caries experience rates were found associated with the use of domestic waters, the fluoride content of which was in the neighborhood of 1.0 p. p. m., naturally brings forth the question of the amount and degree of mildness of the mottled enamel that may follow the continuous use of a domestic water of such concentrations. Examination of an adequate sample of children in communities having the requisites for quantitative evaluation (*7*) has consistently shown that there is a quantitative relation between the fluoride concentration of the water and the degree of clinical affection (*8*, cf. ogive, fig. 2), the action on the group roughly following general pharmacological observations respecting dosage and effect.

From the data of numerous studies (*9*) one would expect that the examination of an adequate group continuously using a domestic water containing 1.0 p. p. m. of fluoride (F) would show about 88 to 90 percent entirely free of macroscopic signs of mottled enamel. In the remainder (10 to 12 percent), some of the teeth would show the "very mild" types of mottled enamel, generally in the bicuspids and second molars.[16]

In communities where the public water supplies contain fluorides just in excess of the minimal threshold (1.0 p. p. m. of F) the reporting of the degree of prevalence as a percentage incidence of the group of

[16] It is, of course, possible that in some few regions of the United States where climatological conditions such as high mean annual temperature, humidity, wind velocity, etc., may introduce factors conducive to a higher water consumption and higher fluoride intake, a water containing 1.0 p. p. m. of fluoride (F) might be found associated with a higher percentage incidence of affection than that stated.

children examined actually overstates rather than understates the degree of affection in the group. Aurora may serve as a case in point. Among the 633 children (table 9) an incidence of mottled enamel of 15 percent was recorded, a child being classified as having mottled enamel when a positive diagnosis of mottled enamel was made for as few as two teeth. Now an incidence of 15 percent in the Aurora children should not be construed as meaning that 15 percent of the tooth population of this group showed positive signs of mottled enamel. Actually, of the 16,448 permanent teeth erupted and in position, a positive diagnosis of mottled enamel [17] was possible only in the case of 845 teeth (5.1 percent), 768 (4.7 percent) being "very mild" and 77 (0.4 percent) "mild." The few evidences of dental fluorosis observed were almost exclusively in the bicuspids and second molars; of the 845 teeth diagnosed as positive, only 57, or 6.7 percent, were incisor teeth.

General dietary likeness, exclusive of water.—Regarding the question of the relationship of diet to dental caries, it seems reasonable to assume that the food habitually consumed by these populations follows a general likeness. Hence, considering the sampling method used, it would seem unlikely that the marked differences in dental caries experience were due to differences in the food used in the communities. One would not expect to find gross dietary differences, with the exception of the domestic water, for example, between the children of Oak Park and Maywood, communities within a radius of about a mile. Or again, it would not seem reasonable to assume that the dietary regime (water excluded) of the 633 Aurora children was sufficiently different from that of the 423 Waukegan children to account for a difference in dental caries experience rates of about 188 percent (281 in Aurora and 810 in Waukegan).

Possible relation to the practice of dentistry.—As constituted at present, dentistry's main function might be defined as: (*a*) The clinical control of dental caries by means of fillings; (*b*) the extraction of teeth because of previous attack by dental caries; and (*c*) the attempt to restore, by operative and prosthetic means, teeth lost as a result of dental caries. Thus variations in the intensity of dental caries attack bear important consequential relationships to the practice of dentistry, influencing as it does not only the community's dental needs but the kind of dentistry practiced. By referring to figure 3 and studying the filled tooth rate and the missing rate it may be quickly seen how widely different were the amounts of dental service rendered in these different

[17] It might be noted that no instances of "moderate" (brown stain) or "severe" (discrete or confluent pitting) were observed. A diagnosis of "very mild" is made when a few small white opaque areas are observed involving less than 25 percent of the affected tooth, generally showing on the tip of the cusp of the bicuspids and second molars.

communities.[18] For instance, the filled tooth rate in any of the three communities using fluoride-free water is greater than the total dental caries experience in any of the communities (Elmhurst, Maywood, Aurora, Joliet) whose public water supplies contain from 1.2 to 1.8 parts per million of fluoride (F). The influence of the intensity of dental caries attack, manifested by markedly different dental caries experience rates, may be found on further study to have an important bearing on both the proper distribution of dentists and the type of dentistry practiced.

The demonstration of the variation in dental caries experience among selected urban population groups opens up important avenues pertinent to the possibility of control of this highly prevalent disease.

SUMMARY

1. A negative correlation between the fluoride (F) concentration of the public water supply and the dental caries experience of children continuously exposed to such waters is reported. A study of eight suburban Chicago communities discloses marked differences in the amount of dental caries. The dental caries experience rates in Elmhurst, Maywood, Aurora, and Joliet, whose public water supplies contain 1.8, 1.2,[19] 1.2, and 1.3 parts per million of fluoride (F), respectively, were 252, 258, 281, and 323, respectively. At Evanston, Oak Park, and Waukegan, using fluoride-free water, the dental caries experience rates were 673, 722, and 810, respectively.

2. Using the proximal surfaces of the four superior permanent incisors as a basis of measurement, there was 14.3 times as much of this type of dental caries in the 1,008 children from Evanston, Oak Park, and Waukegan as in the 1,421 children from Elmhurst, Maywood, Aurora, and Joliet.

3. The differences in the counts of *L. acidophilus* in the saliva corresponded to the differences in the dental caries experience in the groups of communities studied.

4. Considering the relative homogeneity of these urban populations and the sampling method followed, it is difficult from an epidemiological standpoint to ascribe these observed differences to any cause other than the common water supply.

5. The dental caries inhibitory factor, presumably fluoride, was operative at such low concentrations (e. g., 1.2 p. p. m. of F in Aurora) that mottled enamel as an esthetic problem was not encountered.

[18] It is important to remember, however, that these comparisons are made among highly selected population groups (children of continuous residence). The influence of such marked dental caries differences in selected children upon the dental caries experience of all children in the community has not as yet been determined.

[19] There is evidence to indicate that prior to a few years ago Maywood water probably contained 1.4 to 1.6 p. p. m. of F.

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Acknowledgment is especially made to the numerous educational authorities in each of these eight communities. But for their wholehearted interest and cooperation, this study could not have been made. Special thanks are tendered to Dr. Moreland Emerson, Division of Dental Health Education, whose efforts did much to insure the success of this study.

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THE APPLICATION OF THE HUMAN SERUM OPACITY REACTION FOR EVALUATING THE ANTITOXIN BINDING POWER (LB) OF *CLOSTRIDIUM PERFRINGENS* (TYPE A) TOXOID [1]

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Perfringens toxoids are now used for the production of antitoxin in horses; it is also possible that they could be used for human immunization if suitable toxoids are produced. Thus, for both practical as

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well as theoretical reasons, it is important to know their antitoxin binding power *in vitro*, which would give a fair measure of their antigenic capacity *in vivo*. While the titrations of diphtheria and tetanus toxoids can be carried out with fair accuracy by means of the flocculation test, the latter has not been successfully applied with unconcentrated perfringens (type A) toxin or toxoid. Recently, Weil and Parsons (1939) (*1*) succeeded in obtaining a flocculation reaction with perfringens toxin concentrated 16 to 35-fold by ultrafiltration through 8 percent parlodian membranes. Our preliminary attempts to carry out the flocculation test with formalinized toxoid concentrated by ultrafiltration, however, were unsuccessful.

In 1933 Walbum and Reymann (*2*) attempted to determine the antitoxin binding properties of perfringens toxoids by allowing the antitoxin and the toxoids first to react with each other for a given period, then adding a known toxin, and determining the toxicity, after a further binding period, by injecting animals (Schmidt and Scholz L_{BA} method (*3*)). They concluded, however, that the method was not applicable to perfringens toxoids as the toxoids used had very poor antitoxin binding power. Thus we have left the method of titrating the toxoid by injecting into animals, and then, after an interval, testing the animals for immunity.

Recently we have obtained consistent and reproducible results in the titration of M. L. D. and L+ doses of perfringens type A toxin by means of the opacity test with inactivated normal human serum as introduced by Nagler in 1939 (*4*). We have applied this method for carrying out *in vitro* titrations of the antitoxin binding power (Lb) of perfringens toxoids and have met with considerable success. It is an easy and quick method and the results can be obtained within 24 hours.

The purpose of this communication is to report the method and the results obtained with several samples of formol-toxoids made from perfringens type A toxins.

METHOD

As the toxoids are completely inactive to the measurable methods of titrating toxins, such as by lethal, hemolytic, necrotic, or the opacity test, the present method of titration requires the addition of a toxin of known strength to the experimental mixtures of toxoid and antitoxin. Thus variable amounts of toxoid were mixed with different quantities of the standard antitoxin and after incubating at room temperature for about 4 hours a fixed quantity of the standard toxin was added to each mixture, followed one-half hour later with inactivated normal human serum and then incubated 16 hours at 37° C. The results were read the next morning. After several preliminary experiments the following method was finally adopted:

One-tenth cc. of undiluted toxoid (only concentrated toxoids are required to be diluted depending on the amount of concentration) was added to variable amounts of the standard antitoxin (usually 0.05 cc. to 0.8 cc. of a 1 in 300 dilution of the standard perfringens type A antitoxin of 50 units per cc.) and the volume brought up to the maximum quantity of antitoxin used with physiological salt solution, and left at room temperature for 3 to 4 hours. At the end of this period 0.1 cc. of the standard toxin diluted in borate buffered saline pH 6.6 to contain one L+ dose per cc. was added, followed one-half hour later by 0.1 cc. of inactivated normal human serum. Another row of tubes containing variable doses of the same standard antitoxin (usually 0.05 cc. to 0.25 cc. of a 1:300 dilution) and 0.1 cc. of the same toxin dilution and the required amount of physiological salt solution were incubated for 1 hour at room temperature and then 0.1 cc. of the inactivated normal human serum was added to each tube simultaneously with the toxoid tubes and all of them were left in the incubator at 37° C. for 16 hours. The readings were taken the next morning. The end point in the toxoid-antitoxin mixture was the tube containing the largest amount of antitoxin showing cloudy opacity. Similarly in the control standard toxin-antitoxin mixtures the end point was taken as the tube containing the largest amount of antitoxin showing equivalent opacity and the results were interpreted by interpolation as shown in the following sample protocol.

PROTOCOL 1.—*Toxoid SR61*

Tube No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Standard antitoxin 1:300	cc. 0.8	cc. 0.7	cc. 0.6	cc. 0.5	cc. 0.4	cc. 0.3	cc. 0.2	cc. 0.1	cc. 0.25	cc. 0.2	cc. 0.15	cc. 0.1	cc. 0.05
Toxoid SR61 undiluted	.1	.1	.1	.1	.1	.1.	.1	.1	0	0	0	0	0
Physiological saline	.0	.1	.2	.3	.4	.5	.6	.7	.55	.6	.65	.7	.75
	Incubated at room temperature for 4 hours												
Standard toxin 30, 1.5 mg. per cc.	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
	Incubated at room temperature for:												
	½ hour								1 hour				
Inactivated pooled normal human serum	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
	Incubated at 37° C. for 16 hours												
Overnight readings	0	0	0	0	+	+++	+++	+++	0	0	0	+	+++

+, ++, +++, ++++ indicates gradation of turbidity.

Interpretation of results.—In the above protocol the end points in the toxoid-antitoxin and toxin-antitoxin mixtures are, respectively, 0.4 cc. (tube 5) and 0.1 cc. (tube 12) of 1/300 dilution of the standard antitoxin. Or, in other words, the excess 0.3 cc. of antitoxin contained in tube No. 5 has combined with the amount of toxoid present in the tube. The binding power of the latter may therefore be calculated as follows:

0.1 cc. of toxoid SR61 $\backsimeq$ (0.4–0.1) cc. of 1/300 standard antitoxin
$\backsimeq 3/10 \times 1/300 \times 50$ units of antitoxin

1 cc. of the above toxoid $\backsimeq 3/10 \times 1/300 \times 50 \times 10$ units of antitoxin or 1/2 unit of antitoxin

Since one unit of antitoxin is equivalent to approximately 100 M. L. D. of toxin, 1 cc. of toxoid SR61 is equivalent to 100/2 M. L. D. of toxin in the binding power with antitoxin and this may be expressed as Lb=50.

It may be mentioned here that the M. L. D. of the toxin from which the SR61 toxoid was made was between 0.016 and 0.02 cc., i. e., a little above 50 M. L. D. per cc. Thus it seems that, like with diphtheria and tetanus toxins, there is very little loss of binding power of the perfringens type A toxin after being detoxified by formalin.

In the above protocol a 1/300 dilution of the standard antitoxin was chosen for the sake of convenience. The same results will, however, be obtained with any other suitable dilution within the range. With a 1/300 dilution 0.1L+ dose of toxin (equivalent approximately to 1/50 unit of antitoxin) always gives a positive opacity reaction with 0.125 cc.–0.1 cc. antitoxin equivalent to 1/50–1/60 unit of the standard. As a matter of fact, the test is highly sensitive and a very sharp end point may be obtained with closer dilutions. On this account great care should be taken in selecting toxoids which have been completely detoxified. It may be mentioned here that a toxoid found nontoxic in 1 cc. amounts when inoculated intraperitoneally in mice may still give a positive opacity reaction. For instance a residual toxin equal to 1/2 M. L. D. in the process of detoxifying will not kill a mouse but will give a 3+ reaction by the opacity test. Since we have proposed to use 0.1 cc. of the undiluted toxoid in the toxoid-antitoxin mixtures, toxoids which will produce no opacity reaction in at least 0.1 cc. doses should be selected by a preliminary test.

Protocol 2

Toxoid	Toxoid-antitoxin mixtures														Standard toxin-antitoxin mixtures				
	Amount of antitoxin in cc., 1:300 dilution																		
	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	3	2	1	0.25	0.2	0.15	0.1	0.05
19	0	0	0	0	0	0	0	0	0	+	++	+++	+++++	+++++	0	0	0	+	+++
24	0	0	0	0	0	0	0	0	0	±	+++	+++	+++++	+++++					
SR61	0	0	0	0	0	0	0	0	0	+	+++	+++++	+++++	+++++					
1	0	+	++	+++	+++	+++	+++	+++	+++	+++	+++	+++++	+++++	+++++					
2	±	++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++++	+++++	+++++					
3	0	0	0	0	0	0	0	0	±	++	+++	+++++	+++++	+++++					
17	0	0	0	0	0	0	±	+	++	+++	+++	+++++	+++	+++					
SR621	0	0	0	0	0	0	+	++	+++	+++	+++	+++++	+++++	+++++					
26	0	0	0	0	0	0	0	0	0	+	+++	+++++	+++++	+++++	0	0	+	+++	+++
51	0	+	++	+++	+++	+++	++++	+++	+++	+++	+++	+++	+++	+++					
54	0	0	0	0	0	0	+	++	+++	+++	+++	++++	++++	+++++					
12	0	0	0	0	0	0	0	0	0	0	±	++	+++	+++++					
23	0	0	0	0	0	±	+++	+++	+++	+++	+++	+++++	+++++	+++++					
224	0	0	0	0	0	0	0	0	+	+++	+++	+++++	+++++	+++++					
25	0	+	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++++	+++++	+++++					

Fifteen samples of formol-toxoid prepared from different batches of *Cl. perfringens* type A toxin of variable potencies and giving no opacity reaction with 0.1 cc. of undiluted toxoid were tested against the standard antitoxin by the method described above. It may be mentioned here that it took as long as 40 to 60 days to detoxify completely some of the toxins using 0.3 percent formalin and incubating at 37° C. The results of the titration of the toxoids by the opacity reaction are given in protocol 2. The units of antitoxin neutralized by 1 cc. of each toxoid and the Lb value of the different samples calculated according to the method described above are shown in table 1.

TABLE 1.—*The M. L. D. of perfringens toxins and the Lb values of their corresponding toxoids*

Toxoid sample	M. L. D. of original toxin	pH after incubating with formalin	Units of antitoxin neutralized per cc. toxoid	Lb/cc.
19	.02 -.025	6.2	0.5	50
24	.02	6.2	.5	50
SR61	.016 -.02	6.2	.5	50
1	.01	6.5	1.08	108
2	.006	6.2	1.16	116
3	.008	5.4	.5	50
17	.01	6.1	.66	66
SR621	.01 -.02	6.2	.75	75
26	.025 -.05	6.2	.417	41.7
51	.006 -.0125	5.4	1.08	108
54	.0125-.025	6.2	.66	66
12	.025 -.05	6.2	.33	33
23	.0125-.025	5.4	.75	75
224	.006 -.0125	6.2	.5	50
25	.006 -.0125	6.2	1.08	108

In order to determine the correlation between the *in vitro* tests (Lb value) and *in vivo* tests, guinea pigs were immunized with 12 of the toxoids. Six guinea pigs were used for each toxoid and each pig was given 6 doses of 1 cc. distributed over a period of 2 weeks (only 5 doses were given with the last 7 toxoids). Two weeks after the last injection they were bled from the heart and the sera tested for antitoxin content, using the neutralization test in mice. The results are given in table 2.

TABLE 2.—*Correlation between the Lb values and the antigenic properties of perfringens toxoids*

Toxoid	Lb/cc.	Guinea pigs inoculated	Guinea pigs responding (percent)	Average units per guinea pig
1	108	6	(Pooled sera)	0.5 - .75
2	116	6	do	1.0 -1.5
3	50	6	do	.25- .5
17	66	6	do	.75
SR621	75	6	do	.5 - .75
26	41.7	5	20	.25- .5
51	108	5	40	.57
54	66	6	50	.25
12	33	5	20	.125
23	75	5	40	.25- .5
224	50	6	50	.25
25	108	6	66	.5 - .75

It will be seen from table 2 that there is a general correspondence between the Lb values and the antitoxin content of the sera of guinea pigs immunized with the toxoids. There are, however, two irregularities noted in the case of toxoids No. 1 and No. 51, both of which showed Lb values of 108. With toxoid No. 1 the pooled antisera is comparatively low in antitoxin content; with No. 51 toxoid the number of guinea pigs responding to the inoculation is low. Such discrepancies have also been noted with Lf values and the corresponding antisera in the case of diphtheria toxoids. The relationship between M. L. D. and Lb values as shown with toxoid SR61 in protocol 1 has been lost with two of the samples shown in table 1. This is probably due to the fact that some of the toxins from which the toxoids were made were allowed to stand for 10 days before the actual process of detoxifying with formalin was started. The pH may also be a factor.

DISCUSSION

The method described above for estimating the antitoxin binding power of *Cl. perfringens* type A toxin is simple and rapid. The results are consistent and reproducible, and the Lb values can be well compared with the Lf values of diphtheria toxoids.

The Lb values are obtained in terms of equivalents of antitoxin units. The latter may again be resolved into equivalents of M. L. D. of toxin, taking 100 M. L. D. equivalent to 1 unit of antitoxin. For the sake of convenience Lb values have been arbitrarily described here in terms of equivalents of M. L. D. instead of antitoxin units.

As is the case with diphtheria and tetanus toxoids there is only a slight loss of antigenicity due to detoxifying with formalin. But in order to show the relationship between toxicity and antigenicity, the toxins should be detoxified immediately after the M. L. D. of the toxin has been determined.

One other fact which should be noted is that the toxoids must be completely detoxified so that at least 0.1 cc. of the undiluted sample will not give a positive opacity reaction with inactivated normal human serum.

SUMMARY

The human serum opacity reaction proposed by Nagler for titrating perfringens toxins and antitoxins has been successfully applied for estimating the antitoxin binding power of *Cl. perfringens* type A toxoids.

ACKNOWLEDGMENTS

This work was first started in the Connaught Laboratories, Toronto, Canada, by one of us (S. C. S.) and we wish to express our indebtedness to Doctor H. Plummer of that laboratory for initiating this work.

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DISABLING MORBIDITY AMONG INDUSTRIAL WORKERS, FINAL QUARTER OF 1940, WITH AN INDEX OF THE PREVIOUS PUBLICATIONS OF THIS SERIES [1]

By WILLIAM M. GAFAFER, *Senior Statistician, United States Public Health Service*

The data presented in this paper are derived from periodic reports on sickness and nonindustrial injuries causing disability lasting more than one week among over 200,000 male members of 26 industrial sick benefit associations, group insurance plans, and company relief departments. The companies are located in Pennsylvania, Illinois, Massachusetts, Connecticut, New York, Ohio, Maine, South Dakota, New Jersey, and Canada.

The year 1940.—During the year 1940 there were recorded over 19,000 cases of sickness and nonindustrial injuries, representing, as shown in table 1, the slight increase in frequency of 7 percent as compared with the 5 years 1935–39. Excesses for 1940 are also shown for appendicitis, pneumonia, and bronchitis, the percentage excesses being, respectively, 21, 20, and 13.

Final quarter of 1940.—A comparison of the fourth-quarter frequencies for 1940 with the corresponding frequencies for 1939 reveals, principally, a 15 percent decrease in pneumonia and a 15 percent increase in appendicitis, the rate for appendicitis, as indicated in table 2, being the highest fourth-quarter rate for the 10-year period 1931–40, and over 20 percent greater than the mean (3.8) for the 10 fourth quarters.

[1] From the Division of Industrial Hygiene, National Institute of Health. The report for the third quarter appeared in the Public Health Reports, **55**: 2397–2398 (Dec. 27, 1940).

TABLE 1.—*Frequency of disabling cases of sickness and nonindustrial injuries lasting 8 consecutive calendar days or longer among* MALE *employees in various industries, by cause, the fourth quarter of 1940 compared with the fourth quarter of 1939, and the full year of 1940 compared with the full years 1935–39, inclusive*[1]

Cause (numbers in parentheses are disease title numbers from the International List of Causes of Death, 1939)	Annual number of cases per 1,000 males				
	Fourth quarter		Full year		
	1940	1939	1940	1939	1935–39
Sickness and nonindustrial injuries[2]	83.8	80.7	96.4	89.5	89.9
Nonindustrial injuries (169–195)	11.8	10.6	11.7	10.3	11.1
Sickness	72.0	70.1	84.7	79.2	78.8
Respiratory diseases	30.1	28.7	37.8	34.3	33.1
Influenza and grippe (33)	12.6	10.8	17.4	16.5	15.3
Bronchitis, acute and chronic (106)	4.7	4.8	5.3	4.2	4.4
Diseases of the pharynx and tonsils (part of 115)	4.1	3.8	4.9	4.5	4.5
Pneumonia, all forms (107–109)	2.7	3.2	3.6	3.1	3.0
Tuberculosis of the respiratory system (13)	.6	.5	.7	.7	.8
Other respiratory diseases (104, 105, 110–114)	5.4	5.6	5.9	5.3	5.1
Nonrespiratory diseases	40.0	39.7	44.8	42.9	43.2
Digestive diseases	12.5	11.6	14.4	13.4	13.5
Diseases of the stomach, except cancer (117, 118)	3.4	3.3	3.9	3.5	3.8
Diarrhea and enteritis (120)	1.1	1.0	1.3	1.2	1.2
Appendicitis (121)	4.6	4.0	5.1	4.4	4.2
Hernia (part of 122)	1.2	1.1	1.5	1.4	1.6
Other digestive diseases (part of 115 and 122, 116, 123–129)	2.2	2.2	2.6	2.9	2.7
Nondigestive diseases	27.5	28.1	30.4	29.5	29.7
Diseases of the heart and arteries, and nephritis (90–99, 102, 130–132)	4.0	4.6	4.4	4.5	4.1
Other genitourinary diseases (133–138)	3.0	2.1	2.8	2.3	2.4
Neuralgia, neuritis, sciatica (part of 87)	2.0	2.4	2.4	2.2	2.2
Neurasthenia and the like (part of 84)	.9	1.0	1.1	1.0	1.0
Other diseases of the nervous system (80–83, 85, part of 84 and 87)	.9	.9	1.0	1.1	1.1
Rheumatism, acute and chronic (58, 59)	3.4	3.0	4.0	3.5	3.9
Diseases of the organs of locomotion, except diseases of the joints (part of 156)	2.9	2.7	2.9	2.6	2.9
Diseases of the skin (151–153)	2.4	2.6	2.7	2.7	2.9
Infectious and parasitic diseases[3] (1–12, 14–24, 26–29, 31, 32, 34–44)	1.2	1.5	1.8	2.1	2.4
All other diseases (45–57, 60–79, 88, 89, 100, 101, 103, 154, 155, part of 156, 157, 162)	6.8	7.3	7.3	7.5	6.8
Ill-defined and unknown causes (200)	1.9	1.7	2.1	2.0	2.5
Average number of males covered in the record	210,672	192,664	202,173	177,782	165,704
Number of organizations	26	26	26	26	

[1] In 1940 and 1939 the same organizations are included; the rates for the years 1935–39, however, are based on records from the same 26 organizations and some additional reporting organizations.
[2] Exclusive of disability from the venereal diseases and a few numerically unimportant causes of disability.
[3] Except influenza, respiratory tuberculosis and the venereal diseases.

Pneumonia, bronchitis, and appendicitis, 1931–40.—The behavior of the frequencies of pneumonia, bronchitis, and appendicitis for the years 1940 and 1939 is sufficiently striking to raise the question of the magnitude of the frequencies recorded for these causes in previous years. Table 2 gives the pertinent data for the 10 years 1931–40. It will be observed that all 3 causes show the highest frequencies for the year 1940. Close inspection of the annual frequencies reveals the trend corresponding to each cause to be increasing, bronchitis and appendicitis at approximately the same rate, and pneumonia slightly more rapidly. The 1940 frequencies for the 3 causes when related to the corresponding 10-year means yield the following percentage excesses: pneumonia, 44 percent; bronchitis, 29 percent; and appendicitis, 24 percent.

TABLE 2.—*Frequency of disabling cases of pneumonia and appendicitis for the fourth quarters of 1931–40 and of bronchitis, pneumonia, and appendicitis for the years 1931–40—cases lasting 8 consecutive calendar days or longer among* MALE *employees in various industries*

Year in which onset of disability occurred	Annual number of cases per 1,000 males				
	Fourth quarter		Year		
	Pneumonia, all forms	Appendicitis	Bronchitis, acute and chronic	Pneumonia, all forms	Appendicitis
1931–40 (mean)	2.4	3.8	4.1	2.5	4.1
1931	1.7	3.6	3.6	2.1	3.7
1932	2.6	3.6	3.6	2.0	3.4
1933	1.9	3.6	2.8	1.7	3.4
1934	2.1	3.8	3.2	2.0	4.1
1935	2.0	3.6	3.9	2.3	3.8
1936	2.2	3.6	4.9	2.6	4.2
1937	3.1	4.2	4.7	2.9	4.5
1938	2.9	3.5	4.3	2.3	4.0
1939	3.2	4.0	4.2	3.1	4.4
1940	2.7	4.6	5.3	3.6	5.1

Index of the reports.—To expedite the locating of a particular number of the Public Health Reports covering industrial sickness for a definite period of time, the following chronological index is presented:

Time period covered	Public Health Reports, date of issue	Time period covered	Public Health Reports, date of issue
First 6 months, 1920	Dec. 3, 1920	Third quarter, 1934	Jan. 25, 1935
First 9 months, 1920	Mar. 4, 1921	Fourth quarter, 1934	Apr. 26, 1935
1920	July 1, 1921	1934	Nov. 1, 1935
January 1920–June 1921	Jan. 6, 1922	First quarter, 1935	Aug. 23, 1935
1921, 1920	Dec. 29, 1922	Second quarter, 1935	Nov. 15, 1935
1923, 1920–23	Oct. 31, 1924	Third quarter, 1935	Jan. 31, 1936
1924, 1920–24	Jan. 22, 1926	Fourth quarter, 1935	May 22, 1936
1927, 1920–27	Feb. 22, 1929	1935	Jan. 1, 1937
1928, 1920–28	Jan. 17, 1930	First quarter, 1936	July 24, 1936
First quarter, 1929	Sept. 13, 1929	Second quarter 1936	Dec. 4, 1936
Second and third quarters, 1929	Feb. 14, 1930	Third quarter, 1936	Jan. 29, 1937
Fourth quarter, 1929	May 23, 1930	Fourth quarter, 1936	Apr. 30, 1937
First and second quarters, 1930	Oct. 24, 1930	1936	Sept. 17, 1937
Third and fourth quarters, 1930	Apr. 3, 1931	First quarter, 1937	Aug. 27, 1937
First quarter, 1931	July 31, 1931	Second quarter, 1937	Oct. 29, 1937
Second quarter, 1931	Oct. 16, 1931	Third quarter, 1937	Jan. 14, 1938
Third quarter, 1931	Jan. 15, 1932	Fourth quarter, 1937	Apr. 8, 1938
Fourth quarter, 1931; 1921–31	Apr. 29, 1932	First quarter, 1938; 1932–37	Sept. 2, 1938
First quarter, 1932	July 15, 1932	Second quarter, 1938	Oct. 28, 1938
Second quarter, 1932	Nov. 25, 1932	Third and fourth quarters, 1938	Apr. 28, 1939
Third quarter, 1932	Dec. 16, 1932	1921–38, by triennia	May 31, 1940
Fourth quarter, 1932	Mar. 31, 1933	First quarter, 1939	Aug. 25, 1939
1932	July 28, 1933	Second quarter, 1939	Oct. 20, 1939
First quarter, 1933	July 7, 1933	Third quarter, 1939	Jan. 5, 1940
Second quarter, 1933	Sept. 29, 1933	Fourth quarter, 1939	Apr. 12, 1940
Third quarter, 1933	Jan. 12, 1934	First quarter, 1940; 1939, 1938	Aug. 2, 1940
Fourth quarter, 1933	Mar. 30, 1934	Second quarter, 1940	Nov. 15, 1940
1933	May 25, 1934	Third quarter, 1940	Dec. 27, 1940
First quarter, 1934	June 29, 1934	Fourth quarter, 1940	Present report.
Second quarter, 1934	Oct. 19, 1934		

THE PREVALENCE OF DISABLING ILLNESS AMONG MALE AND FEMALE WORKERS AND HOUSEWIVES [1]

This bulletin, based upon data collected in the National Health Survey in 83 cities of the United States, is primarily concerned with comparisons between the rates [2] of illness found in three groups of adults: male workers, female workers, and housewives. The findings are summarized as follows:

1. Illness, as measured by the proportion of persons disabled on the day of the visit, was, for each age group, greater among female workers than it was among male workers. The rate for females, aged 15–64 years, exceeded that for males by 48 percent. The excess was about 50 percent in the age group 15–24, increased to a maximum in the age group 25–34, and decreased thereafter with advancing age.

2. When workers were divided into an employed and an unemployed group, similar relationships between the rates for male and female workers obtained. (Unemployed workers include those on work relief.)

3. When workers were grouped into four broad classes by occupation, the proportion disabled on the day of the visit was, in each class, greater among female than among male workers.

4. The business and professional, and the clerical classes (each sex), had rates of approximately the same magnitude; these rates were lower than those for the industrial and the "other" classes. (The business and professional class excludes farm owners and tenants; the industrial class is composed of skilled workers and foremen, semiskilled workers, and unskilled workers, excluding farm laborers and servants; "other" workers include servants, farmers and farm laborers, and those persons who had never before worked at a gainful occupation but who were seeking work.)

The excesses in the rates for industrial workers, aged 15–64, over the corresponding rates for nonmanual workers (business and professional and clerical) were 32 percent for males and 17 percent for females; the excesses in the rates for "other" workers over those for nonmanual workers were 36 percent for males and 44 percent for females.

When illnesses from puerperal and female genital causes and from occupational injuries were excluded, these percentage excesses among industrial and "other" workers were somewhat reduced. When, in addition, workers were separated into an employed and an unemployed group, these percentage excesses were still further reduced. Indeed, among employed men there was little variation between the

[1] Public Health Bulletin No. 260, same title as above, by David Hailman. U. S. Government Printing Office, 1941. Available from the Superintendent of Documents, Washington, D. C., at 10 cents per copy.

[2] Unless otherwise stated, the rates mentioned in this summary are based upon all causes, disease and accident, including puerperal and female genital causes and occupational injuries, and are adjusted to the age composition of workers and housewives enumerated in the National Health Survey.

rates for the four occupational classes (excluding occupational injuries). Among employed women there was little variation between the rates for the three occupational classes (excluding illnesses from puerperal and female genital causes and occupational injuries); only the rate for "other" workers was significantly in excess.

5. The rate for housewives, aged 15–64, was 59 percent in excess of the rate for female workers (47 percent when illnesses from puerperal and female genital causes were excluded). The excess was greatest in the early and late adult years. A great proportion of the excess among housewives 15–24 years of age was due to puerperal and female genital causes.

6. Excluding illnesses from puerperal and female genital causes and occupational injuries, the rate for female workers and housewives (combined) was about twice the rate for male workers for all ages (15–64) and for each age group.

7. While the illness rate for all causes for female workers, aged 15–64, was in excess of that for males (48 percent), there was great variation in this excess by the cause of the illness (diagnosis) and for some causes the rate for males was higher than that for females. The greater percentage excesses in the rates for female workers over those for males were shown for cancer and other tumors, nervous and mental diseases, tonsillitis and other throat diseases, colds and influenza, home accidents, sinusitis, gall-bladder and liver diseases, public accidents (excluding automobile), and appendicitis. The greater excesses in the rates for male workers over those for females were for hernia, ulcer of the stomach and duodenum, occupational accidents, hemorrhoids, and pneumonia.

8. Except in the case of accidents, the rate for housewives was higher than the rate for female workers for every diagnosis or group of diagnoses (26 groups). The higher percentage excesses were recorded for confinements, hernia, orthopedic impairments, varicose veins, female genital diseases, gall-bladder and liver diseases, tuberculosis, cardiovascular-renal diseases, ulcer of the stomach and duodenum, and asthma and hay fever. With the exception of confinements and female genital diseases, all of these large excesses were for chronic diseases.

9. The rate for female workers and housewives (combined) was higher than the rate for male workers for 21 of 26 diagnoses (or groups). The greater percentage excesses in the combined rate for females over that for males were recorded for cancer and other tumors, gall-bladder and liver diseases, nervous and mental diseases, "other chronic diseases," home accidents, tonsillitis, and cardiovascular-renal diseases. For only two diagnoses—hernia and ulcer of the stomach—were there considerable excesses in the rate for males over the combined rate for females.

10. With few exceptions, for each diagnosis the age curves for male workers, for female workers, and for housewives follow similar curves, although at different levels.

ADDITIONAL CONTRIBUTIONS TO OUTSIDE JOURNALS OF PERSONNEL OF THE PUBLIC HEALTH SERVICE [1]

The following articles by personnel of the Williams Malaria Research Laboratory, Columbia, S. C., were published in journals other than those of the U. S. Public Health Service during the year 1940.

Coatney, G. R., and West, E.[2]: Studies on *Haemoproteus sacharovi* of mourning doves and pigeons, with notes on *H. maccallumi*. Am. J. Hyg., **31** (Sec. C): 9–14 (1940).

Coatney, G. R.: Studies on *P. relictum* in the pigeon. I. Periodic phenomena of the asexual cycle. Am. J. Hyg., **31** (Sec. C): 15–18 (1940).

Young, M. D., Stubbs, T. H., and Coatney, G. R.: Studies in induced malaria in Negro paretics. I. Periodic phenomena of the asexual cycle. Am. J. Hyg., **31** (Sec. C): 51–59 (1940).

Young, M. D., Coatney, G. R., and Stubbs, T. H.: Studies in induced malaria in Negro paretics. II. The effect of modifying the external conditions. Am. J. Hyg., **32** (Sec. C): 63–70 (1940).

Young, M. D., and Coatney, G. R.: Reference citations and microfilm. Science, **92**: 429 (1940).

COURT DECISION ON PUBLIC HEALTH

Action by employee for lead poisoning.—(Georgia Court of Appeals, Division No. 2; *Middlebrooks* v. *Atlanta Metallic Casket Co.*, 11 S. E.2d 682; decided November 16, 1940.) An action was brought to recover damages on account of lead poisoning alleged to have been contracted by the plaintiff while in the employ of the defendant company. In his petition the plaintiff alleged, among other things, that the material from which caskets were made by the defendant was covered and coated with lead; that he operated a grinding disc to cut down the joints and corners of caskets under construction; that the machine threw into the air great quantities of lead and solder particles; that he did not know of the danger of contracting lead poisoning but that the defendant knew or should have known of such danger; and that the defendant did not warn him of the danger and negligently failed to furnish him with any mask, suction device, proper ventilation, or a safe place in which to work. There was presented to the court of appeals the question of the sufficiency of the petition and that court, in holding that the trial court erred in dismissing the plaintiff's petition, stated in its syllabus the principles applicable, as follows:

[1] These references were received too late to be included in the listing published in the Public Health Reports of March 7, 1941, p. 454.

[2] Not employed by the Public Health Service.

1. A master must warn a servant of the conditions under which he is employed which are liable to engender disease, and must furnish suitable protection from such danger, provided that the master is in a position to have greater knowledge of the danger than the servant.

2. While the master is chargeable with knowledge of the fact that fumes or dust, given off by the various substances used in industrial processes, are poisonous to persons who inhale them and may engender in his servant lead poisoning, a disease, the servant, in the absence of a warning by the master, will not be presumed to have knowledge thereof.

3. A servant in a metallic casket manufacturing business, the material from which the caskets are made being covered and coated with lead, will not be held as a matter of law to have known that the inhalation by one of fumes, dust, and particles of lead would likely engender or produce in the person inhaling them lead poisoning, an incurable disease, so as to be charged with assumption of the risk.

DEATHS DURING WEEK ENDED MARCH 29, 1941

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

	Week ended Mar. 29, 1941	Corresponding week, 1940
Data from 88 large cities of the United States:		
Total deaths	8,814	9,081
Average for 3 prior years	8,954	
Total deaths, first 13 weeks of year	123,710	123,083
Deaths under 1 year of age	541	514
Average for 3 prior years	545	
Deaths under 1 year of age, first 13 weeks of year	7,091	6,712
Data from industrial insurance companies:		
Policies in force	64,588,630	65,901,954
Number of death claims	12,619	13,732
Death claims per 1,000 policies in force, annual rate	10.2	10.9
Death claims per 1,000 policies, first 13 weeks of year, annual rate	10.8	10.7

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 APRIL 5, 1941

Summary

For the current week 56,338 cases of measles were reported by the State health authorities, as compared with 55,805 cases for the preceding week and with 47,421 for the next earlier week. To date (first 14 weeks), a total of 381,925 cases has been reported this year, as compared with 451,906 cases for the corresponding period in 1938, the year of highest measles incidence in the 5 years 1936–40.

The highest current incidence, as shown by case rates, is recorded for the East North Central and Middle Atlantic States, both of which areas, however, reported decreases from the preceding week. Slight increases were reported from all other geographic areas except the Mountain States, but the indications are that the peak for measles for the present season has about been reached.

No significant changes were noted in the incidence of the other 8 communicable diseases reported weekly by the State health officers. The number of reported cases of influenza dropped from 7,048 for the preceding week to 4,119, but it may be that the figures for the earlier week included some delayed reports. Only 33 cases of smallpox were reported, of which 15 occurred in Wisconsin. Of 21 cases of poliomyelitis, 5 were reported in Florida, and of 40 cases of endemic typhus fever, 18 occurred in Texas. Five cases of Rocky Mountain spotted fever were reported, 2 each in Montana and Wyoming and 1 in South Dakota. Three cases of tularemia were reported in North Carolina.

The death rate for the current week for 93 major cities in the United States was 12.0 per 1,000 population, as compared with 12.3 for the preceding week and with a 3-year (1938–40) average of 12.4 for the corresponding week (88 cities).

Telegraphic morbidity reports from State health officers for the week ended April 5, 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
	Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940	
NEW ENG.												
Maine	1	1	1	4	-----	6	151	668	195	0	0	0
New Hampshire	1	1	0	-----	-----	-----	86	41	35	0	0	0
Vermont	1	0	0	-----	-----	-----	57	8	45	0	0	0
Massachusetts	9	0	2	-----	-----	-----	759	472	736	3	1	1
Rhode Island	0	0	0	-----	-----	-----	7	203	48	0	0	0
Connecticut	9	0	1	5	8	10	209	83	83	1	1	2
MID. ATL.												
New York [1]	18	18	31	[3] 24	[3] 11	[3] 17	8,459	668	1,563	6	1	3
New Jersey	7	1	9	25	6	13	3,326	462	462	1	1	1
Pennsylvania	11	24	31	-----	-----	-----	5,310	264	661	7	7	7
E. NO. CEN.												
Ohio	7	12	13	35	67	20	9,278	25	270	1	0	2
Indiana	17	6	11	15	16	69	806	59	59	1	5	5
Illinois	25	22	27	16	22	61	3,660	63	63	2	0	2
Michigan [3]	9	3	11	5	22	12	4,727	388	388	3	0	1
Wisconsin	0	1	1	103	175	69	1,649	469	469	0	1	1
W. NO. CEN.												
Minnesota	2	1	4	2	2	1	6	160	227	0	0	1
Iowa	9	2	2	52	4	5	180	135	135	0	0	0
Missouri	5	9	23	4	4	21	299	29	29	1	0	1
North Dakota	3	0	0	3	12	24	33	5	5	0	0	0
South Dakota [4] [5]	1	0	0	1	5	-----	16	3	2	0	0	0
Nebraska	3	5	1	1	-----	-----	42	13	108	0	0	0
Kansas	3	5	5	7	19	19	1,169	582	43	1	1	1
SO. ATL.												
Delaware	0	1	1	-----	-----	-----	319	3	21	0	0	0
Maryland [3]	1	0	6	44	25	16	344	5	292	5	0	0
Dist. of Col	0	1	4	3	-----	1	328	2	45	1	0	0
Virginia	10	16	13	388	292	292	2,619	82	248	5	1	3
West Virginia [3]	9	9	8	29	171	171	612	7	21	3	1	3
North Carolina [1]	15	17	17	22	33	34	1,680	163	204	1	0	2
South Carolina	8	9	2	415	552	528	647	16	32	4	0	0
Georgia [1]	5	8	8	164	168	344	1,207	150	150	1	0	1
Florida [1]	6	5	7	178	6	6	1,136	124	124	1	0	1
E. SO. CEN.												
Kentucky	9	4	8	84	13	21	1,808	146	146	0	1	6
Tennessee	10	1	5	96	140	141	706	84	83	2	1	5
Alabama [1]	4	5	10	124	172	648	698	113	113	3	1	7
Mississippi [3]	0	8	4	-----	-----	-----	-----	-----	-----	6	2	1
W. SO. CEN.												
Arkansas	4	3	3	276	134	134	332	10	10	3	3	1
Louisiana [1]	2	6	7	11	45	45	94	34	34	1	0	1
Oklahoma	5	4	8	175	68	115	46	17	55	1	1	1
Texas [1]	34	24	30	1,173	882	882	1,825	890	436	2	6	3
MOUNTAIN												
Montana [5]	4	2	0	9	-----	11	17	16	20	0	0	0
Idaho	1	1	1	-----	2	4	20	35	15	0	0	0
Wyoming [5]	1	1	1	-----	1	-----	57	43	43	0	0	0
Colorado	9	12	10	35	34	-----	397	31	31	0	0	0
New Mexico	2	0	0	-----	-----	4	197	50	54	0	0	0
Arizona [1]	2	0	1	146	122	92	98	104	104	1	0	1
Utah [3]	0	0	0	69	4	3	13	498	102	0	0	0
Nevada	0	-----	-----	-----	-----	-----	38	-----	-----	0	-----	-----
PACIFIC												
Washington	6	1	2	11	2	1	48	1,014	362	1	2	1
Oregon	0	13	2	16	22	42	404	592	54	2	0	1
California	21	9	26	349	151	151	419	352	616	0	2	2
Total	309	271	395	4,119	3,412	3,931	56,338	9,381	12,280	70	39	65
14 weeks [4]	4,117	5,213	7,218	573,312	152,441	123,386	381,925	86,250	117,137	694	559	1,226

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended April 5, 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
	Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940		Apr. 5, 1941	Apr. 6, 1940	
NEW ENG.												
Maine	1	0	0	10	11	15	0	0	0	0	0	3
New Hampshire	0	0	0	3	0	9	0	0	0	0	0	0
Vermont	0	0	0	19	9	12	0	0	0	0	0	0
Massachusetts	0	0	0	220	185	274	0	0	0	1	0	1
Rhode Island	0	0	0	7	22	25	0	0	0	0	0	0
Connecticut	0	0	0	162	117	117	0	0	0	2	3	1
MID. ATL.												
New York [1]	0	1	2	610	920	920	0	0	0	4	6	6
New Jersey	0	0	0	338	371	174	0	0	0	3	0	2
Pennsylvania	1	1	0	394	406	598	0	0	0	1	7	7
E. NO. CEN.												
Ohio	2	1	0	411	363	361	0	1	3	2	4	4
Indiana	0	0	0	161	206	206	2	2	9	1	2	0
Illinois	0	2	1	466	952	763	1	5	8	1	1	3
Michigan [3]	1	0	0	301	365	413	0	0	9	3	2	3
Wisconsin	3	1	0	154	81	241	15	1	4	0	1	1
W. NO. CEN.												
Minnesota	0	0	0	68	74	144	2	2	5	0	0	0
Iowa	0	0	0	42	35	221	1	11	40	1	2	1
Missouri	0	0	0	120	111	115	1	0	23	0	1	2
North Dakota	0	0	0	4	15	17	0	1	3	0	1	1
South Dakota [4] [5]	0	0	0	27	17	18	1	2	6	0	1	0
Nebraska	0	0	0	38	13	34	0	3	6	0	0	0
Kansas	0	1	0	37	61	142	1	0	18	1	1	1
SO. ATL.												
Delaware	0	0	0	7	8	5	0	0	0	0	0	0
Maryland [3]	0	0	0	38	50	50	0	0	0	1	0	3
Dist. of Col	0	1	0	14	17	17	0	0	0	0	1	1
Virginia	1	1	0	58	71	49	0	0	0	2	4	4
West Virginia [3]	0	1	1	58	53	53	0	0	0	2	2	2
North Carolina [1]	0	0	0	34	31	32	0	0	0	2	0	2
South Carolina	0	0	0	3	6	6	0	2	0	10	0	0
Georgia [1]	0	0	0	19	10	10	0	0	0	2	3	1
Florida [1]	5	1	0	2	9	8	0	0	0	10	1	3
E. SO. CEN.												
Kentucky	0	0	0	146	89	69	0	0	1	1	6	4
Tennessee	1	1	0	71	91	35	0	1	0	0	3	3
Alabama [1]	0	1	0	20	12	9	0	0	0	0	2	2
Mississippi [3]	1	0	1	9	6	6	0	0	0	2	2	1
W. SO. CEN.												
Arkansas	0	1	0	12	6	10	1	1	1	1	1	3
Louisiana [1]	0	0	0	8	12	10	0	0	0	2	2	9
Oklahoma	0	0	0	21	16	22	3	3	3	1	1	1
Texas [1]	0	4	0	71	49	60	3	3	5	5	7	9
MOUNTAIN												
Montana [5]	0	0	0	37	22	17	0	0	6	0	1	1
Idaho	0	1	0	5	14	17	0	0	4	0	0	0
Wyoming [5]	0	0	0	29	4	17	0	0	3	1	0	0
Colorado	0	0	0	40	35	35	0	4	4	3	2	0
New Mexico	0	0	0	6	22	19	0	1	0	1	2	2
Arizona [1]	1	0	0	5	7	11	0	0	0	0	0	1
Utah [3]	0	0	0	12	14	30	0	1	1	0	0	0
Nevada	0	------	------	0	------	------	0	------	------	2	------	------
PACIFIC												
Washington	0	0	0	17	57	37	2	3	5	1	2	0
Oregon	1	0	0	5	20	43	0	0	6	2	0	1
California	1	4	1	124	123	196	0	2	9	2	4	2
Total	21	23	17	4,463	5,188	5,703	33	49	213	73	78	115
14 weeks [4]	372	377	293	51,670	66,711	85,084	638	1,003	4,333	1,061	1,080	1,514

See footnotes at end of table.

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

Division and State	Whooping cough	
	Week ended—	
	Apr. 5, 1941	Apr. 6, 1940
NEW ENG.		
Maine	13	61
New Hampshire	0	21
Vermont	14	31
Massachusetts	222	132
Rhode Island	26	8
Connecticut	72	26
MID. ATL.		
New York [1]	335	401
New Jersey	94	116
Pennsylvania	375	270
E. NO. CEN.		
Ohio	284	180
Indiana	21	21
Illinois	81	148
Michigan [3]	426	114
Wisconsin	131	82
W. NO. CEN.		
Minnesota	102	30
Iowa	40	11
Missouri	44	33
North Dakota	16	0
South Dakota [4] [5]	27	5
Nebraska	23	1
Kansas	170	32
SO. ATL.		
Delaware	6	15
Maryland [3]	93	216
Dist. of Col	18	14
Virginia	76	58
West Virginia [3]	134	124
North Carolina [1]	263	106
South Carolina	111	31
SO. ATL.—con.		
Georgia [1]	22	42
Florida [1]	19	16
E. SO. CEN.		
Kentucky	74	115
Tennessee	66	43
Alabama [1]	23	23
Mississippi [3]	----------	----------
W. SO. CEN.		
Arkansas	43	3
Louisiana [1]	3	5
Oklahoma	59	10
Texas [1]	322	284
MOUNTAIN		
Montana [5]	24	6
Idaho	10	8
Wyoming [3]	1	3
Colorado	99	2
New Mexico	26	70
Arizona [1]	38	30
Utah [3]	60	109
Nevada	8	----------
PACIFIC		
Washington	115	64
Oregon	11	29
California	485	372
Total	4,725	3,521
14 weeks [4]	60,638	41,351

[1] Typhus fever, week ended April 5, 1941, 40 cases, as follows: New York, 1; North Carolina, 3; Georgia, 10; Florida, 3; Alabama, 3; Louisiana, 1; Texas, 18; Arizona, 1.
[2] New York City only.
[3] Period ended earlier than Saturday.
[4] Delayed report for South Dakota, week ended Mar. 29, 1941: Diphtheria, 1; influenza, 2; measles, 13; scarlet fever, 10; whooping cough, 13.
[5] Rocky Mountain spotted fever, week ended Apr. 5, 1941, 5 cases, as follows: South Dakota, 1; Montana, 2; Wyoming, 2.

WEEKLY REPORTS FROM CITIES

City reports for week ended March 22, 1941

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	125	525	110	5,912	819	2,212	26	386	21	1,182	----
Current week [1]	64	318	46	18,361	512	1,426	5	357	16	1,119	----
Maine: Portland	0	----	0	1	2	0	0	0	0	13	22
New Hampshire:											
Concord	0	----	0	1	0	1	0	1	0	0	12
Nashua	0	----	0	0	0	0	0	0	0	9	6
Vermont:											
Barre	----	----	----	----	----	----	----	----	----	----	----
Burlington	0	----	0	0	0	0	0	0	0	0	9
Rutland	0	----	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	0	----	1	238	19	55	0	9	0	42	254
Fall River	1	----	0	0	0	11	0	2	0	2	34
Springfield	0	----	0	4	0	15	0	0	0	2	36
Worcester	0	----	0	65	7	5	0	1	0	1	54
Rhode Island:											
Pawtucket	0	----	0	0	1	1	0	0	1	0	10
Providence	0	----	0	2	3	5	0	2	0	11	71
Connecticut:											
Bridgeport	0	----	0	3	0	5	0	0	0	1	22
Hartford	0	----	0	0	1	1	0	0	0	3	22
New Haven	0	----	0	0	0	23	0	1	0	8	32
New York:											
Buffalo	0	----	1	48	8	35	0	5	0	7	147
New York	17	32	5	6,328	112	272	0	72	0	74	1,648
Rochester	0	----	0	25	0	2	0	0	0	13	49
Syracuse	0	----	0	0	5	5	0	2	0	10	42
New Jersey:											
Camden	0	1	0	22	0	10	0	0	0	0	19
Newark	0	9	1	321	3	49	0	6	0	12	81
Trenton	0	2	1	0	4	59	0	4	0	0	60
Pennsylvania:											
Philadelphia	7	2	2	1,628	35	92	0	15	0	49	521
Pittsburgh	1	3	0	170	16	7	0	6	0	51	153
Reading	0	----	0	198	1	3	0	1	0	6	29
Scranton	0	----	----	1	----	1	0	----	0	0	----
Ohio:											
Cincinnati	1	2	0	123	4	13	2	8	0	3	121
Cleveland	0	14	0	2,803	10	30	0	11	0	51	189
Columbus	0	1	1	150	6	13	0	0	1	43	93
Toledo	0	----	0	53	4	6	0	2	0	14	72
Indiana:											
Anderson	0	----	0	1	0	2	0	1	0	0	6
Fort Wayne	0	----	0	60	4	0	0	1	0	0	28
Indianapolis	2	----	0	149	15	19	0	3	0	8	121
Muncie	0	----	0	36	3	13	0	0	0	0	15
South Bend	0	----	0	32	0	5	0	0	0	0	21
Terre Haute	0	----	1	0	1	0	0	0	0	0	12
Illinois:											
Alton	0	1	0	0	1	2	0	0	0	0	15
Chicago	5	6	2	1,968	32	208	0	22	0	30	810
Elgin	1	----	0	362	0	0	0	0	0	0	11
Moline	1	13	0	14	0	0	0	0	0	3	11
Springfield	0	----	2	3	3	2	0	2	0	3	22
Michigan:											
Detroit	5	10	2	1,210	18	135	0	13	1	124	310
Flint	0	----	0	110	5	3	0	0	0	5	36
Grand Rapids	0	1	0	449	1	9	0	1	0	8	41
Wisconsin:											
Kenosha	0	----	0	132	0	0	0	0	0	0	11
Madison	0	----	0	38	0	2	0	0	0	2	11
Milwaukee	0	1	1	138	10	31	0	2	0	31	106
Racine	0	----	0	14	0	4	0	1	0	5	12
Superior	0	----	0	1	0	2	0	0	0	0	7
Minnesota:											
Duluth	0	----	2	0	0	0	0	0	0	6	22
Minneapolis	0	----	0	5	2	18	0	1	0	37	70
St. Paul	0	----	0	1	8	5	0	2	1	12	68

[1] Figures for Barre estimated; report not received.

City reports for week ended March 22, 1941—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								
Iowa:											
Cedar Rapids	0	------	--------	5	-------	0	0	-------	0	0	--------
Davenport	0	------	--------	0	-------	5	0	-------	0	0	--------
Des Moines	1	------	--------	4	-------	2	0	-------	0	3	36
Sioux City	1	------	--------	1	-------	2	0	-------	0	9	--------
Waterloo	0	------	--------	33	-------	1	0	-------	0	7	--------
Missouri:											
Kansas City	0	1	1	18	9	11	1	1	1	20	109
St. Joseph	0	------	0	6	4	0	0	0	0	0	13
St. Louis	0	2	1	129	8	64	0	7	0	21	204
North Dakota:											
Fargo	0	------	0	0	1	1	0	0	0	10	3
Grand Forks	0	------	--------	0	-------	0	0	-------	0	0	--------
Minot	1	------	--------	2	-------	0	0	-------	0	2	6
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	0	-------	0	0	--------
Sioux Falls	0	------	--------	0	-------	1	0	-------	0	0	7
Nebraska:											
Lincoln	0	------	--------	2	-------	7	0	-------	0	1	--------
Omaha	0	------	0	1	2	2	0	3	0	2	61
Kansas:											
Lawrence	0	------	0	42	0	0	0	0	0	1	5
Topeka	0	------	0	188	1	4	0	0	0	12	16
Wichita	0	------	0	1	2	1	0	1	0	15	28
Delaware:											
Wilmington	0	------	0	170	5	3	0	2	0	0	29
Maryland:											
Baltimore	2	6	2	54	20	28	0	15	0	54	252
Cumberland	0	------	0	0	1	1	0	0	0	3	14
Frederick	0	------	0	0	0	0	0	0	0	0	5
Dist. of Col.:											
Washington	2	2	0	287	9	23	0	12	1	7	185
Virginia:											
Lynchburg	0	------	0	10	1	0	0	0	0	0	14
Norfolk	1	65	0	201	4	4	0	0	0	7	26
Richmond	0	------	1	51	5	0	0	5	0	2	50
Roanoke	0	------	0	153	0	2	0	0	0	2	24
West Virginia:											
Charleston	0	2	0	24	2	0	0	1	0	0	23
Huntington	0	------	--------	25	0	0	0	0	0	3	--------
Wheeling	0	------	0	5	5	2	0	1	0	4	27
North Carolina:											
Gastonia	0	------	0	19	0	1	0	0	0	4	--------
Raleigh	0	------	0	275	0	0	0	3	0	9	19
Wilmington	2	------	0	2	4	0	0	0	0	1	24
Winston-Salem	1	------	2	11	0	0	0	0	0	8	17
South Carolina:											
Charleston	0	35	1	64	6	1	0	0	3	1	27
Florence	0	4	0	2	1	0	0	0	0	0	6
Greenville	0	------	0	49	0	3	0	0	0	7	3
Georgia:											
Atlanta	0	11	0	24	5	0	1	4	0	3	100
Brunswick	0	------	0	5	1	0	0	0	0	0	6
Savannah	0	17	2	15	4	2	0	2	1	0	26
Florida:											
Miami	0	7	1	14	0	1	0	2	1	2	47
Tampa	0	1	1	0	0	0	0	1	0	3	41
Kentucky:											
Ashland	0	------	0	1	2	1	0	0	0	0	7
Covington	0	1	0	21	1	2	0	1	0	0	15
Lexington	0	------	0	3	1	0	0	0	0	1	17
Louisville	1	12	0	399	13	0	0	3	0	10	83
Tennessee:											
Knoxville	1	------	0	56	1	6	0	3	0	4	33
Memphis	0	5	1	111	2	4	0	3	1	13	76
Nashville	0	------	1	56	4	10	0	2	0	3	65
Alabama:											
Birmingham	1	22	0	70	4	2	0	5	2	8	73
Mobile	0	9	1	14	4	0	0	0	0	11	23
Montgomery	1	2	--------	20	-------	0	0	-------	0	1	--------
Arkansas:											
Fort Smith	0	------	--------	11	-------	0	0	-------	0	0	--------
Little Rock	0	11	0	17	8	1	0	0	0	3	8
Louisiana:											
New Orleans	1	4	2	9	10	4	0	19	0	11	149
Shreveport	0	------	0	0	1	2	1	1	0	0	23

City reports for week ended March 22, 1941—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								
Oklahoma:											
Oklahoma City	0	2	1	0	3	7	0	0	0	0	39
Tulsa	0	------	0	42	1	4	0	1	0	5	23
Texas:											
Dallas	4	2	2	13	7	12	0	1	1	1	76
Fort Worth	0	------	1	88	3	2	0	5	0	0	51
Galveston	0	------	0	4	1	0	0	1	0	0	18
Houston	1	3	1	1	4	2	0	5	1	0	80
San Antonio	0	4	1	0	7	0	0	9	0	0	74
Montana:											
Billings	0	------	0	0	0	0	0	0	0	0	7
Great Falls	0	------	0	1	4	3	0	0	0	0	12
Helena	0	------	0	0	0	2	0	0	0	0	3
Missoula	0	------	0	0	1	1	0	0	0	0	11
Idaho:											
Boise	0	------	0	6	0	1	0	0	0	0	11
Colorado:											
Colorado Springs	0	------	0	0	0	6	0	4	0	1	11
Denver	4	12	1	145	5	7	0	5	0	56	82
Pueblo	0	------	0	2	0	0	0	0	0	10	8
New Mexico:											
Albuquerque	0	------	0	35	0	0	0	3	0	0	10
Utah:											
Salt Lake City	4	------	0	5	1	3	0	0	0	18	19
Washington:											
Seattle	0	------	1	0	3	2	0	8	0	22	129
Spokane	0	------	0	3	0	1	0	0	1	0	24
Tacoma	0	------	1	8	1	0	0	0	0	8	40
Oregon:											
Portland	1	------	0	14	1	1	0	0	0	2	78
Salem	0	------	0	2	0	0	0	0	0	0	------
California:											
Los Angeles	0	20	0	52	8	59	0	22	0	47	340
Sacramento	2	------	0	3	4	4	0	0	1	14	27
San Francisco	1	65	1	6	3	9	0	12	0	64	173

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Massachusetts:				West Virginia:			
Boston	2	2	0	Wheeling	0	1	0
New York:				Florida:			
New York	1	1	0	Miami	0	0	2
Indiana:				Tennessee:			
Terre Haute	1	1	0	Memphis	0	1	0
Illinois:				Alabama:			
Chicago	3	1	0	Birmingham	0	0	1
Minnesota:				Louisiana:			
St. Paul	0	0	1	Shreveport	0	1	0
Maryland:				California:			
Baltimore	1	1	0	Los Angeles	2	0	1
District of Columbia:				San Francisco	1	0	0
Washington	1	0	0				

Encephalitis, epidemic or lethargic.—Cases: Topeka, 2. Deaths: New York, 1; Topeka, 2.
Pellagra.—Cases: Atlanta, 1; Savannah, 1; New Orleans, 1; San Antonio, 1.
Typhus fever.—Cases: New York, 2; Savannah, 2; Miami, 1; Mobile, 1.

TERRITORIES AND POSSESSIONS

HAWAII TERRITORY

Plague (rodent).—A rat found on March 10, 1941, at Kalopa Homesteads, Hamakua District, Island of Hawaii, has been proved positive for plague.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended March 1, 1941.—During the week ended March 1, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis	1	7	2	13	14	2		1	5	45
Chickenpox		10	1	133	413	20	17	13	86	693
Diphtheria		14	2	29		2	2			49
Dysentery				5						5
Influenza		77			18	5			89	189
Measles	1	239	311	195	910	148	88	276	1,120	3,288
Mumps				221	212	33	11	20	39	536
Pneumonia		14			16	2		1	19	52
Scarlet fever		22	10	104	179	9	1	21	29	375
Tuberculosis		29	8	81	31	21		1		171
Typhoid and paratyphoid fever		1	1	10	2	1			1	16
Whooping cough				99	238	10	1	1	8	357

CUBA

Provinces—Notifiable diseases—4 weeks ended March 1, 1941.—During the 4 weeks ended March 1, 1941, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana[1]	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer	1		2	9		12	24
Diphtheria		28		3	1	7	39
Hookworm disease	1	23					24
Leprosy					1	2	3
Malaria	18	1		27	2	492	540
Measles	61		2	8	8		79
Poliomyelitis			1			1	2
Scarlet fever		1					1
Tetanus, infantile						2	2
Tuberculosis	21	70	19	42	10	38	200
Typhoid fever	20	70	3	19	7	28	147
Whooping cough		2					2
Yaws						1	1

[1] Includes the city of Habana.

JAMAICA

Communicable diseases—4 weeks ended March 15, 1941.—During the 4 weeks ended March 15, 1941, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox	1	14	Puerperal fever		1
Diphtheria	3	2	Scarlet fever		1
Dysentery	10	6	Tuberculosis	8	55
Erysipelas		2	Typhoid fever	11	59
Leprosy		7			

SWITZERLAND

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

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	31	Poliomyelitis	11
Chickenpox	164	Scarlet fever	377
Diphtheria and croup	73	Trachoma	1
German measles	7	Tuberculosis	231
Influenza	59	Typhoid fever	3
Measles	297	Undulant fever	5
Mumps	81	Whooping cough	133
Paratyphoid fever	5		

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 March 28, 1941, pages 674-678. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Peru.—Plague has been reported in Peru, by Departments, as follows: January 1–31, 1941, Lambayeque, 1 case, 1 death; Libertad, 4 cases, 2 deaths; Lima, 2 cases, 2 deaths; February 1–28, 1941, Libertad, 1 case. Plague-infected rats were also found in Lambayeque Department.

Yellow Fever

French Equatorial Africa.—On March 12, 1941, 1 fatal case of yellow fever was reported in the Gabon estuary, Donguila Department, French Equatorial Africa.

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