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THE EXPERIMENTAL PRODUCTION OF SILICOSIS [1]

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By subjecting guinea pigs and rabbits to an atmosphere containing quartz dust 8 hours a day for 6 days a week over a period of 1 year or more, it has been possible to reproduce the lesions characteristic of silicosis in man (*1*). The dust employed is known commercially as "silica smoke"; it contains 90.75 percent of free silica, with iron and alumina as the other major components. Petrographic analysis by Dr. Gabriel, of the United States Bureau of Mines, showed a silica of the chalcedony type, with 15 to 20 percent of normal quartz. In a dusting room 8 by 8 by 8 feet in dimensions, an average concentration of approximately 4,000 million particles per cubic foot of air has been maintained. Over 88 percent of the dust particles in the experimental atmosphere were less than 1.5 microns in diameter and only about 1 percent of them varied between 1.5 and 10 microns. Surviving [2] guinea pigs were killed at intervals during a dust exposure of 790 days. From the examination of their tissues it has been possible to reconstruct a picture of the development of the disease.

THE SILICOTIC NODULE

The essential lesion of silicosis is the silicotic nodule. Its formation depends upon a peculiar activity of phagocytes which have ingested particles of pure quartz. Either because they are stimulated by such particles or because their normal rate of motility is not impeded by the ingestion of an excessive number of particles, the cells migrate rapidly to the nearest mass of lymphoid tissue. As many cells as possible penetrate into the substance of the nodule; the majority remain there while some pass through and are carried to other nodes by centripetal lymph currents. The result is a concentration of the dust in lymph nodules. Silica is toxic and in time its effects are manifested in the phagocytes. Their cytoplasm

[1] The experimental work was carried out in cooperation with the Office of Industrial Hygiene and Sanitation of the U. S. Public Health Service. Submitted for publication in January 1932.

[2] Of the 106 guinea pigs used for this work, 25 percent died of pneumonia and another 25 percent showed more or less evidence of it when they were killed. A small group of 11 rabbits were also exposed, and they have proved more satisfactory, as no pneumonia developed.

degenerates with the appearance of stainable fat, and their nuclei gradually disintegrate. With the death of the cell, the ingested particles are liberated and new cells engulf them, only to suffer the same fate. By a constant repetition of this process both the irritating dust and hypothetical products of cellular activity upon it are liberated in high concentrations in intimate contact with the connective tissue elements of the lymph nodule. They proliferate and form a lesion which at first resembles a tubercle composed of epithelioid cells.

Silver impregnation reveals that the new cells produce reticulin fibrils which are entirely lacking about the motile phagocytes. The proliferating cells, which are at first spherical or ovoid, gradually elongate and assume a spindle form, giving the area the appearance of a cellular fibrosarcoma with numerous mitotic figures. As they mature, the older cells at the center of the area produce increasing amounts of intercellular substance which compresses and ultimately destroys most of the nuclei. Finally the swollen fibers undergo the peculiar hyaline degeneration characteristic of the silicotic nodule. The cells at the periphery, on the other hand, are not generally involved, and they persist as a capsule of loose fibrous tissue about the nodule.

It is believed that the hyalinization may be the result of specific action of silica upon the reticulum. At the center of the nodule, where the silica is perhaps most concentrated, a few fibrils at first become thick and stain intensely with eosin. Gradually the process extends peripherally by an involvement of more fibrils. Still further degeneration may occur, in which case the hyaline becomes fragmented and granular in appearance, quite like caseous matter. Frequently in the rabbit and occasionally in the lymph nodes of the guinea pig such degeneration is followed by extensive calcification. It is believed that the degeneration is another manifestation of the toxicity of silica rather than an effect of local anaemia. In many instances the nodules are extremely vascular, and necrosis may occur close to thin-walled vessels. Later in the disease, fibrosis may compress and render such blood vessels temporarily invisible; but if, as frequently happens, a terminal failure of the right heart ensues, these vessels again become engorged, demonstrating that their occlusion is not yet permanent.

The silicotic nodule in many ways resembles a tubercle; in fact, Mavrogordato has called it a "pseudotubercle." Both lesions develop characteristically in lymphoid tissue; both are due to a proliferation of cells which are indistinguishable by any method of staining yet employed, including "supravital neutral red" and silver impregnations. Giant cell formation is common in each lesion. Both exhibit degenerative changes which may be followed by calcification. As will be shown, both are progressive lesions, but in the case of the silicotic nodule this is, of course, only true in a restricted sense, for obviously quartz particles do not multiply like living tubercle bacilli. The silicotic nodule is generally more regular in outline than the tubercle, and in the lung its surface is generally covered by a more or less definite layer of cuboidal epithelium. Unlike the tubercle, the silicotic nodule frequently encloses a variable number of more or less patent but distorted air spaces. They are lined by cuboidal epithelium, and their lumina often contain phagocytes, dust particles, and cellular debris. As already mentioned, potentially functional blood vessels can be demonstrated in the degenerated center of the silicotic nodule, while in the tubercle they are obliterated early in the development of the lesion. Peripheral infiltration with lymphoid cells, one of the characteristic features of the tubercle, is scanty in the silicotic nodule. In the guinea pig, metastasis of dust from the lung produces disease in the spleen, liver, and abdominal lymph nodes, the same organs which are also involved in tuberculosis.

EVOLUTION OF SILICOSIS

In the lung of the experimental animal the disease evolves in the following manner: Inhaled dust particles are phagocytosed by alveolar cells which rapidly migrate to the nearest lymph nodules. Many of the dust cells remain in the intrapulmonary lymphoid tissue and initiate reaction, but the most extensive accumulation occurs within the tracheobronchial lymph nodes, for they receive the drainage from all portions of the lungs. In them the reaction develops most rapidly and results in a progressive silicosis. The flow of lymph is obstructed, and as a consequence there results a dilatation of the afferent lymphatics located for the most part within the lungs. When lymph stasis has become marked, more dust is held within the intrapulmonary lymph nodules, and these structures are in their turn replaced by sclerosing lesions. Finally, when the lymphatic apparatus is completely disorganized, dust is transported into almost any portion of the pulmonary framework, the alveolar septa, the pleura, the interlobular septa, and the sheaths of bronchi and blood vessels. It stimulates the connective tissue cells, which proliferate to produce both diffuse and nodular fibrosis.

Thus in the parenchyma of the lung typical nodular lesions may develop either about lymphoid tissues or later at any point within the alveolar septa. Involvement of lymphoid nodules along the deep lymphatic trunks which accompany bronchi or blood vessels, produces a characteristic "beading" with nodules which have been interpreted as thrombi within the lymph vessel. This study has shown that such lesions develop entirely outside the lining endothelium of the lymph vessel and that as they expand they encroach upon its lumen, but that they always remain extravascular. Therefore they cannot be considered as thrombi. Silicotic nodules which develop in the lymphoid tissue at the junction of the deep and superficial set of lymphatics will produce characteristic pleural or subpleural nodules. Later, extralymphoid nodules also appear in the pleura. About all lymph vessels whose proximal portions are obstructed or closed there are sheaths of cellular connective tissue. At first these sheaths contain relatively small amounts of dust, and the proliferation in this case may be due to toxic products which diffuse through the walls of the lymphatics; later, more local dust and attendant fibrosis becomes visible. Collars of perilymphatic fibrosis containing heavy deposits of dust have been interpreted to indicate a serious interference with the flow of lymph.

METASTATIC SILICOSIS

The guinea pig, of all animals thus far studied, seems peculiarly inclined to develop metastatic silicosis in the abdominal viscera and lymph nodes. All silicotic animals, including man, exhibit characteristic sclerosis in the hepatic lymph nodes located about the head of the pancreas. In the guinea pig, however, fibrosis in this node is followed by the formation of fine miliary nodules in the portal connective tissues of the liver which have been observed to progress through the stage of cellular fibrosis with early hyaline formation. The pancreas is not involved, but the spleen in this animal regularly develops typical silicotic nodules located usually about small arterioles. The other abdominal lymph nodes are not involved. In rabbits, abdominal disease is confined to the hepatic lymph nodes. In man, these nodes are regularly involved and occasionally nodules appear in the spleen. It is believed that subdiaphragmatic silicosis is a result of bloodstream metastasis of dust particles. An infectious process in the lungs accelerates such metastasis and favors the development of nodules in the other viscera probably because of the increased permeability of the pulmonary vessels. The regular occurrence of abdominal silicosis in the guinea pig is perhaps due to anatomical peculiarities of this species.

TOXIC LESIONS

It has already been shown that silica injures phagocytes which have ingested particles of this substance, and it has also been shown that degeneration occurs in the centers of large silicotic nodules where large quantities of dust are concentrated. There is still another manifestation of toxicity which has not yet been mentioned. In lymph nodes where dust is accumulating, but not in other lymph nodes, the follicles exhibit degenerative changes analagous to those seen in diphtheria and other toxic infections. The follicles undergo hyperplasia and the cells then degenerate. The debris is ingested by mononuclear cells, and usually a few polynuclear leucocytes are attracted to the area. The destroyed cells do not regenerate but are replaced by scar tissue. This reaction, together with the specific silicotic nodules developing in the medulla of the node, finally result in a complete sclerosis of the entire organ.

It has been claimed that nephritis is common in silicosis and its occurrence has been attributed to the elimination of soluble silica through the kidney. More recent figures from South Africa fail to support this contention, and the experimental study under discussion likewise offers no evidence for such a belief. No trace of a toxic reaction has been detected in the kidney of either rabbits or guinea pigs. Nodular silicosis has not been observed in this organ presumably because of the lack of lymphoid tissue or other mechanism for the localization of particulate matter.

Wherever toxic reactions are detected, there are also deposits of dust in the immediate vicinity, be it in leucocytes, lymph nodes, or silicotic nodules. Such a relationship suggests that little free toxic material liberated from dissolved silica particles circulates within the body fluids for any length of time. The evidence favors the chemical hypothesis of the biological activity of silica. It seems to indicate that if the silica is dissolved, the products which are formed probably recombine either with free ions or with the tissues themselves so that no poisonous substance circulates in the blood to injure remote organs like the kidneys.

PROGRESSIVE NATURE OF SILICOSIS

An incomplete experiment on rabbits emphasizes the well-recognized capacity of silicotic lesions to progress after the cessation of the dust inhalation. A small group of these animals has been exposed to the above-mentioned concentation of quartz dust for a period of 13 months. During this period serial roentgenograms of their chests showed no definite change until about the eleventh month, when a few fine, discrete nodules became visible in the lower lung fields. The mediastinal condition could not be observed because of the relatively large heart shadow in the rabbit. At the end of the exposure, one animal was killed, and a section of its lung showed multiple nodules in the position of the lymphoid tissues, with relatively few dust cells distributed throughout the air spaces. The remaining rabbits were set aside in a normal atmosphere without further dust exposure. The amount of disease visible by X-ray is still continuing to increase, and in several animals which have been killed the size of the nodules is becoming progressively larger. It would appear that either the irritating silica inside the nodule is still in a form capable of provoking further reaction or that phagocytes continue to transport silica from their air spaces to the periphery of the nodule.

DISCUSSION

The evolution of experimental silicosis is consistent with clinical and radiographic observations in human beings. The early sclerosis of the tracheobronchial lymph nodes followed by stasis and perivascular inflammation about the afferent lymph vessels accounts for the widening of the mediastinal shadow and the accentuation of the linear markings seen in roentgenograms. The coincident development of a few small nodules in the intrapulmonary lymphoid tissues is also visualized in the X-ray film. The production of diffuse reaction in the stroma of the lung gives rise to the ill-defined haze Pancoast and Pendergrass (*2*) have described in certain cases of human silicosis. The subsequent enlargement of preexisting nodules in lymphoid tissues and the late development of other nodules at various points in the framework of the lungs is responsible for the terminal nodular appearance of uncomplicated silicosis. The progressive nature of the disease has been emphasized by the experience with rabbits allowed to survive after discontinuing the dust exposure. It has been shown that silicosis can develop without the complicating factor of infection. Where a coexisting tuberculosis or pneumonia intervenes, the process develops more rapidly and spreads throughout the lung and other viscera.

Finally, a comparison of the reaction to quartz dust with that to other types of dust, like carborundum, soft coal, asbestos, and granite, has indicated that there are definite differences in the response to different types of dust.

In the case of quartz the activity of the phagocytes is responsible for the concentration of adequate quantities of an irritating chemical substance in direct contact with the connective tissues, notably those in lymphoid areas. A rapid proliferation in the form of nodules is the result. *Granite* also contains free silica, but other elements in its composition appear to modify the effect of the silica upon the phagocytes and perhaps upon the connective tissues as well. It is generally accepted that silicosis develops slowly in granite workers. Russell, Britten, Thompson, and Bloomfield (*3*) state that "nodular formations or mottlings (seen by X-ray) * * * were conspicuously absent in these cases. Silicosis in granite cutters differs in this way from the usually described case of the South African workers." In the lungs obtained by these investigators from autopsies of Barre granite cutters the author of this paper found no nodule formation after an exposure of 2½ years, but after 20 years such lesions were numerous. In experimental animals granite inhalation for as long as 4 years has produced nodular fibrosis only in the tracheobronchial lymph nodes, while in the lungs there were evidences of lymph stasis and perilymphatic fibrosis. Nodular lesions of the lungs have never been reproduced. It would appear that, in the case of granite, the phagocytes at first fail to concentrate sufficient quantities of dust within the intrapulmonary lymphoid tissues to produce nodular reaction. Late in the disease, when the tracheobronchial lymph nodes are completely sclerosed and lymph stasis is well advanced, the continued inhalation of dust results in the development of local concentrations of dust within the lung adequate to produce nodular lesions. It is the author's opinion that the difference in the reactions to quartz and granite is not entirely due to the lower concentrations of silica in granite dust, but that the nonsiliceous components of this dust modify the behavior of the phagocytes so that they do not concentrate the irritating silica with the same rapidity that they do in the case of quartz.

Asbestos is a silicate of magnesium which has been shown by clinical and experimental (*4*) observations to be capable of producing pulmonary fibrosis. It is largely composed of fibers which, when they are inhaled, do not penetrate into the terminal air passages, but the majority of them come to rest in the tubular respiratory bronchioles. Their size and possibly other properties prevent their transportation by migrating phagocytes. Because of this fact the initial fibrosis in asbestosis does not develop as a nodule but as a sheath about the terminal bronchioles, in and about which the dust is largely localized.

Carborundum dust is particulate and consequently it is readily inhaled into the alveoli. The particles are ingested, often in tremendous quantities, by the available phagocytes, but these cells fail to migrate out of the air spaces in any great numbers. The dust which does reach the tracheobronchial lymph nodes apparently lacks the proper physicochemical properties to stimulate any but a very slight proliferation of connective tissues. In the lungs there is practically no fibrosis.

Soft coal dust in many respects behaves like carborundum within the lung. Both dusts are readily phagocyted, but coal-containing cells migrate somewhat more rapidly than those ingesting carborundum. The characteristic localization for coal-filled cells is in the connective tissues of the bronchi, a position which is apparently attainable through the lymph vessels. Coal appears to possess even less capacity than carborundum to excite proliferative fibrosis.

These observations on the responses to various types of inhaled dust have led to the formulation of the following hypothesis:

The capacity of a dust to excite proliferative reaction upon the part of the connective tissues depends upon two factors, viz, its inherent chemical or physicochemical irritative properties and its ability to

stimulate phagocytes so that they collect it in effective concentrations in intimate contact with the connective tissues.

REFERENCES

(1) Gardner, L. U.: Studies on experimental pneumoconiosis. VIII. Inhalation of quartz dust. Jour. Ind. Hyg., 1932, **14**, 18.
(2) Pancoast, H. K., and Pendergrass, E. P.: A review of pneumoconiosis. Am. Jour. Roent., 1931, **26**, 556.
(3) Russell, A. E., Britten, R. H., Thompson, L. R., and Bloomfield, J. J.: Health of workers in dusty trades. II. Granite industry, Pub. Health Bull. No. 187, July 1929, Government Printing Office, Washington, D. C.
(4) Gardner, L. U., and Cummings, D. E.: Experimental pneumoconiosis. VI. Inhalation of asbestos dust. Jour. Ind. Hyg., 1931, **13**, 65.

A COMMUNICABLE DISEASE METER[1]

A Device for Recording and Comparing the Current Incidence of Communicable Diseases

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Visualization of communicable disease incidence is an aid to efficient public health administration. The significance of this statement has been recognized to a limited extent for a number of years, and various mechanical devices have been suggested for the realization of the objective. In the present article the advantages of visualization will be discussed briefly and a practical method of meeting the requirements will be presented.

ADVANTAGES OF VISUALIZATION

Conceding that it is desirable for those actively engaged in combating communicable diseases to be acquainted with the current incidence of these maladies, it is obviously necessary or at least advantageous to display the information graphically. Ordinarily a health department records its communicable-disease data in statistical form, thereby making it immediately available only to those engaged in its compilation. When, on the other hand, these same data are graphically presented where all may see them, and in a manner that makes them readily understood, the information takes on added value and interest, not only for those charged with the control of communicable maladies but also for the regular and casual visitors in a health department. Thus, newspaper reporters, special writers, visiting public health officials, and citizens often express keen interest in such graphic devices.

[1] Published with the permission of the Commissioner of Health, New York City, who assumes no responsibility for the views expressed.

To the immediate staff engaged in the control of communicable affections a device for visualizing the current morbidity incidence is of manifest value. Not only is the busy executive enabled to learn at a glance when a certain disease is prevailing to an unusual extent, but he is stimulated to sound early warnings and institute prompt offensive and defensive activities. In other words, there is placed at his disposal a sensitive indication for the unleashing of his available weapons against enemies that are often difficult to detect, cope with, and overcome.

EARLY EFFORTS TO PROVIDE GRAPHIC RECORDS

Among the devices proposed for this purpose was one devised by Hitchcock and Carey.[2] This figure took the form of a clock-like dial, one for each disease, on which the monthly endemic median index was designated by one of the movable hands, while the other hand pointed to the daily cumulative number of reported cases of the disease. The arrangement was described as a "time-saver for busy officials, whereby a serious condition is automatically brought to the attention of the staff."

Shortly after this, the writer,[3] then detailed with the bureau of communicable diseases of the Wisconsin State Board of Health, prepared a somewhat similar device, but one which utilized the principle of the thermometer instead of a clock dial. This figure was called an "indicometer" or index measurer, and was used, as well as improved upon, by a number of local health officers throughout the country. The principal improvement in this over Hitchcock and Carey's arrangement was the utilization of a logarithmic instead of an arithmetical recording scale.

FEATURES OF THE PRESENT DEVICE

The present status of the communicable disease meter, as used in the Bureau of Preventable Diseases of the Department of Health in New York City, can best be understood by referring to figure 1, which is a representation of the device in actual operation.[4] The 8 thermometer-like figures appear on a heavy sheet of bristol board, 28 by 44 inches in size, with slots extending from the bulb-like expansions to the tops of the columns. By an ingenious endless belt of

[2] John S. Hitchcock and Bernard W. Carey: A median endemic index, Am. Jour. Pub. Health, 9:5, 355, May 1919.

[3] Robert Olesen: Health by mail: A new system of communicable disease control, Wisconsin Med. Jour., 18: 9, 382, February 1920.

[4] The writer is indebted to Mrs. H. M. Cooper, graph and statistical clerk in the Bureau of Public Health Education, Department of Health, New York City, for executing the design and for offering many valuable suggestions which enhance its successful operation.

durable, maroon-colored paper, operating on rollers behind each slot, the column may readily be raised to the point desired.[5]

The three essential features of the communicable disease indicator, each of which will be discussed briefly, are as follows:

1. The index or monthly case expectancy;
2. The cumulative number of cases, represented by the movable column, which is raised when additional case reports are received;
3. The logarithmic scale.

1. THE INDEX

The index for each disease that it is desired to record should, for the best results, receive separate consideration, preferably with a view to the inclusion of local peculiarities. A median[6] endemic index is often useful but should be employed only after careful consideration of the numerous factors involved. As a result of experience and experimentation a reliable index can usually be evolved.

The factors influencing the selection of indexes may be better appreciated from the experience in New York City. The expected monthly incidence of the principal communicable diseases in this city during 1935, based either on endemic median or average indexes, is shown in table 1. An explanation of the factors exerting an influence upon the selection of the several indexes follows.

TABLE 1.—*Expected monthly incidence of communicable diseases in New York City during 1935, based on median or average indexes*

	Disease									
	Diphtheria	Influenza	Measles		Meningococcus meningitis	Pneumonia	Poliomyelitis	Scarlet fever	Typhoid fever	Whooping cough
Type of index	Average	Median	High median	Low median	Median	Median	Median	Median	Average	Median
Period of time	1930–34	1919–34	------	------	1911–34	1919–34	1911–34	1910–34	1927–34	1915–34
Number of years	5	16	17	8	24	16	24	25	8	20
January	350	504	1,960	150	21	2,586	5	1,098	22	394
February	320	539	2,196	229	23	2,325	4	1,201	22	413
March	332	419	5,053	494	29	2,341	3	1,592	24	541
April	331	212	6,172	649	26	1,745	4	1,431	24	614
May	323	98	5,900	978	23	1,542	4	1,245	26	563
June	288	35	3,871	884	22	987	7	679	33	524
July	196	17	1,368	354	20	498	21	260	55	491
August	121	16	241	127	16	563	37	122	131	509
September	115	32	114	44	19	522	55	146	100	440
October	145	59	134	55	13	816	47	241	67	297
November	197	81	594	71	15	1,141	18	428	33	298
December	278	149	1,086	131	18	1,551	6	769	22	384

[5] For this arrangement and the binding of the figure the write- is indebted to Mr. John F. Sullivan, bookbinder in the Bureau of Records of the New York City Department of Health.

[6] A median endemic index is obtained by arranging data, for instance the number of cases of scarlet fever reported during the same month during a period of years, in arithmetical sequence and selecting the middle number.

Diphtheria.—The index is an average, based upon a 5-year period from 1930 to 1934, because of a sharp drop in morbidity following the intensive application of toxoid immunization. Whether an average or a median is preferable over a comparatively short period marked by an even incidence is a point to be determined by experimentation.

Influenza.—Occasional epidemic figures are excluded when a median is prepared, provided, of course, a sufficient number of years are available. Apparently the New York City median indexes for influenza are reasonably sensitive. These indexes are based upon an experience of 16 years, from 1919 to 1934.

Measles.—A season of low measles incidence is commonly followed by a period of high incidence. Therefore, it is necessary, as shown in table 1, to prepare two sets of median indexes, using the one applicable at a given time. The low indexes are predicated upon an experience of 8 years, while those for high incidence are based on 17 years.

Meningococcus meningitis.—Because of the comparatively even morbidity of this disease it is possible to employ a long range selection of indexes, in this instance from 1911 to 1934, inclusive.

Pneumonia.—Here again the median has been used, the figures being based upon the period from 1919 to 1934.

Poliomyelitis.—Because of its usefulness in warning of an unusual incidence, the monthly median endemic indexes of poliomyelitis should be prepared with care. In New York City the medians show the months during which the highest and lowest incidence of the disease may be expected. These medians, with epidemic numbers pushed well out of the picture by the arithmetical arrangement of the data, cover the period from 1911 to 1934, 24 years.

Scarlet fever.—The monthly indexes for this disease are medians, covering a period of 25 years, from 1910 to 1934. Experience during 1934 has shown that both the monthly and weekly median endemic indexes have been followed very closely. This is plainly shown in figure 2, where there is comparatively close agreement between the weekly expectancy and the weekly case reports of scarlet fever during the year 1934. In several instances the two figures coincided. At the time when this chart was prepared, the case records for the last 2 weeks in December were not available. So far, this is the only disease in which the current incidence so closely approximated the expectancy.

Typhoid fever.—Owing to the marked decrease in typhoid morbidity, beginning in 1927, the monthly indexes for this disease are averages covering the period from 1927 to 1934, inclusive. However, the indexes obtained from averages and medians, as shown in table 2, approximate each other so closely that either might be useful in indicating expectancy.

TABLE 2.—*A comparison of monthly expectancies of typhoid fever in New York City, based on averages or medians, during the period 1927–34, inclusive*

Month	Average	Median	Month	Average	Median
January	19	22	July	55	55
February	21	22	August	123	131
March	24	24	September	96	100
April	21	24	October	73	67
May	26	26	November	31	33
June	31	33	December	22	22

Whooping cough.—As there is no marked periodicity in whooping cough morbidity, the medians in this instance are based upon an experience of 20 years. During 1934 there was an unusual incidence of this disease beginning in June, which was immediately noted on the index measurer.

From the examples given it will be quite obvious that the index, or expectancy, is a figure to be arrived at after continual observation, experimentation, and revision. At the end of each month the index must be changed to indicate the expectancy during the following month. Furthermore, it is desirable that all indexes be revised annually so that new trends may be included in the estimates.

2. THE NUMBER OF REPORTED CASES

A dependable statistical clerk should be charged with the daily adjustment of each of the columns, in accordance with the total number of cases of each disease reported. Thus, the column begins to rise on the first day of each month and is returned to the base line at the end of the month.

3. THE GRADUATIONS

The logarithmic graduations are convenient to show vividly the first few cases of each disease, especially diphtheria, poliomyelitis, scarlet fever, and typhoid fever. By this means the attention is directed to the incidence of cases and the need for early action is emphasized.

Examination of the several scales shows that due allowances have been made for excess incidence. Manifestly it is necessary for each community to employ a scale of such proportions as will meet local requirements. However, even when comparatively few cases are to be recorded, the logarithmic graduations will be found to have advantages over the evenly spaced arithmetical scale.

READING THE METER

It is not difficult to acquire the slight knowledge and experience necessary for reading and interpreting the information graphically displayed by this device. Figure 1, showing the readings during the actual use of the meter on December 6, 1934, conveys the following useful information:

Diphtheria.—The diphtheria expectancy during December is 278 cases, while, to date, 24 cases have been reported. The disease prevails within normal bounds, though investigations are indicated to determine whether there is a grouping of cases. The continuation of the toxoid immunization campaign is likewise indicated.

Influenza.—There is evidence of an unusual incidence of this disease, for the index will be exceeded at the present rate of case reporting. Dissemination of information known to be helpful under such circumstances would be timely.

Measles.—Experience has shown that a year of high measles incidence is usually inaugurated about the forty-seventh week. Therefore, while the high period should already have begun, 1,086 cases being the December expectation according to intensive calculations, the cumulative report of 10 cases indicates that the expectations have not yet been realized.

Pneumonia.—Closely allied to influenza and often considered in conjunction therewith, it appears that this disease is likewise due to approximate or exceed its expectancy. Warnings should be issued.

Poliomyelitis.—The disease, as may be expected at this season of the year, is quiescent and no cases have so far been reported during the month.

Scarlet fever.—The expectancy is 777 cases, this being a month of higher incidence, but the cumulative case report is 135, which is less than one-fifth of what may be expected on this day of the month. Hence, the disease is prevailing within normal bounds.

Typhoid fever.—It is unlikely that the expectancy of 22 cases will be reached, as the number of cases recorded during one-fifth of the month is three.

Whooping cough.—Undoubtedly the normal expectancy of 384 cases will be exceeded by the middle of the month. Educational measures for the lessening of the disease have already been instituted but so far have proved ineffective. Therefore, additional steps are required.

Supplemental monthly charts.—Because the communicable disease meter covers only a month at a time, it is helpful to maintain graphic representations showing what happened during the months preceding the period actually under observation. An example of such a chart is shown in figure 3. Here it will be seen that the height of each column indicates the monthly expectancy while the hatched portions show the number of cases actually reported. The excess of cases

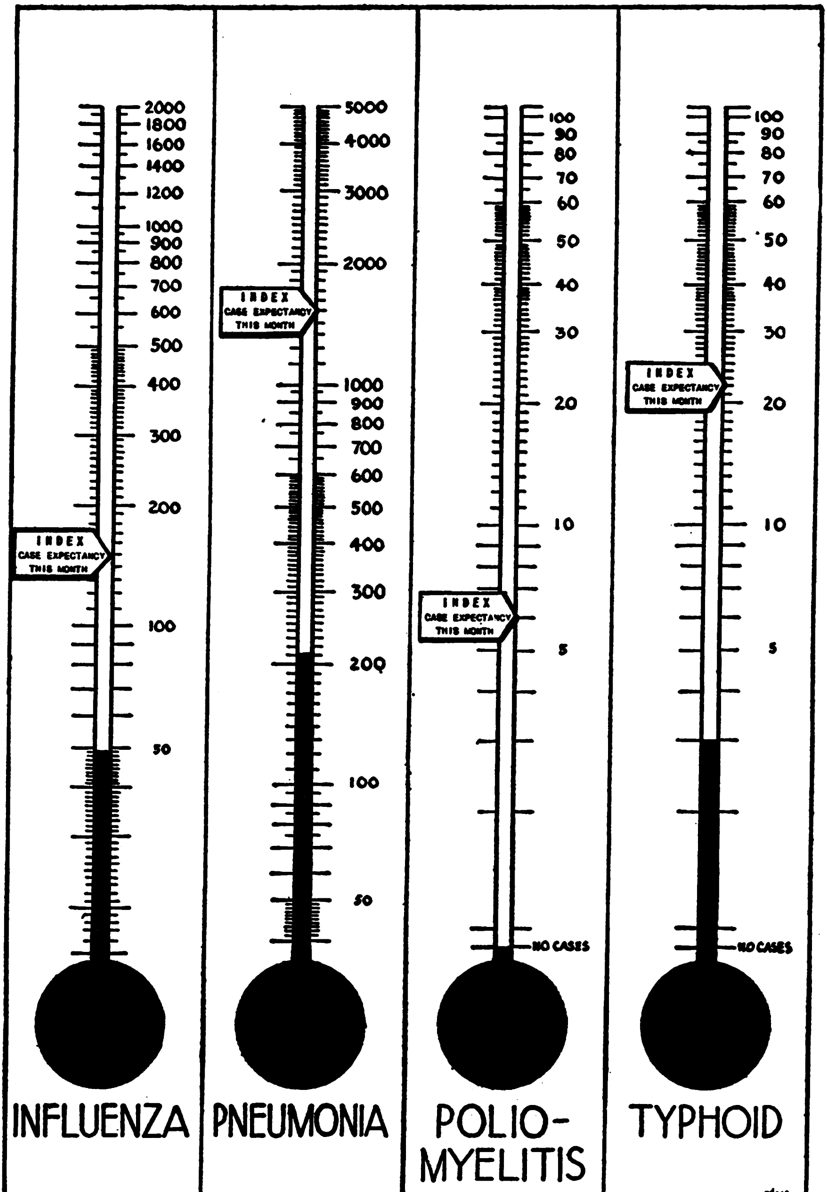
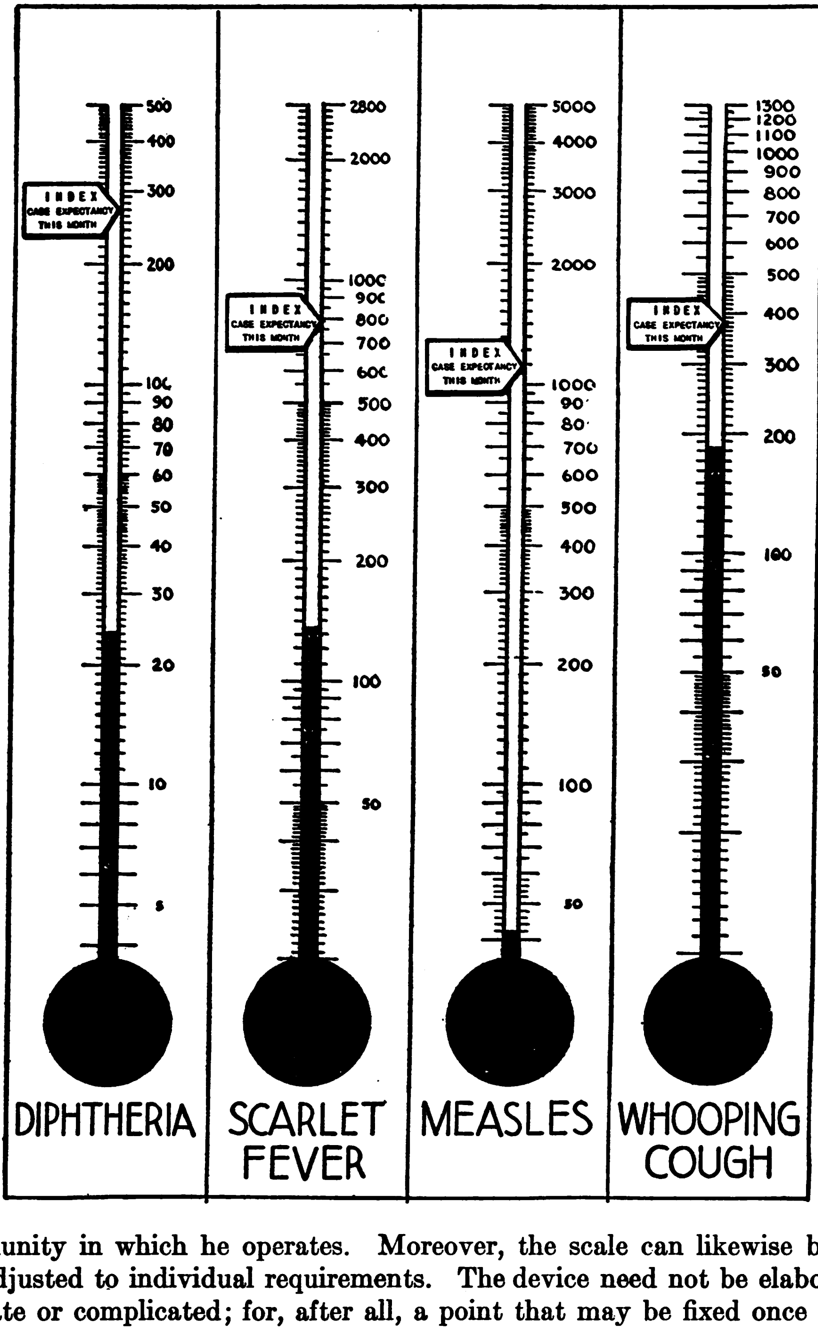


FIGURE 1.—The sections of the meter reproduced on this page and the page opposite show the actual readings on December 6, 1934.

over the expectancy is shown in solid black. Such a chart is useful in conjunction with current experience as displayed on the meter. At the end of the year such graphs become valuable permanent records.

ADAPTATION OF METER TO SMALLER COMMUNITIES

With the instructions given it should be a comparatively simple matter for any health officer to prepare indexes applicable to the com-



munity in which he operates. Moreover, the scale can likewise be adjusted to individual requirements. The device need not be elaborate or complicated; for, after all, a point that may be fixed once a

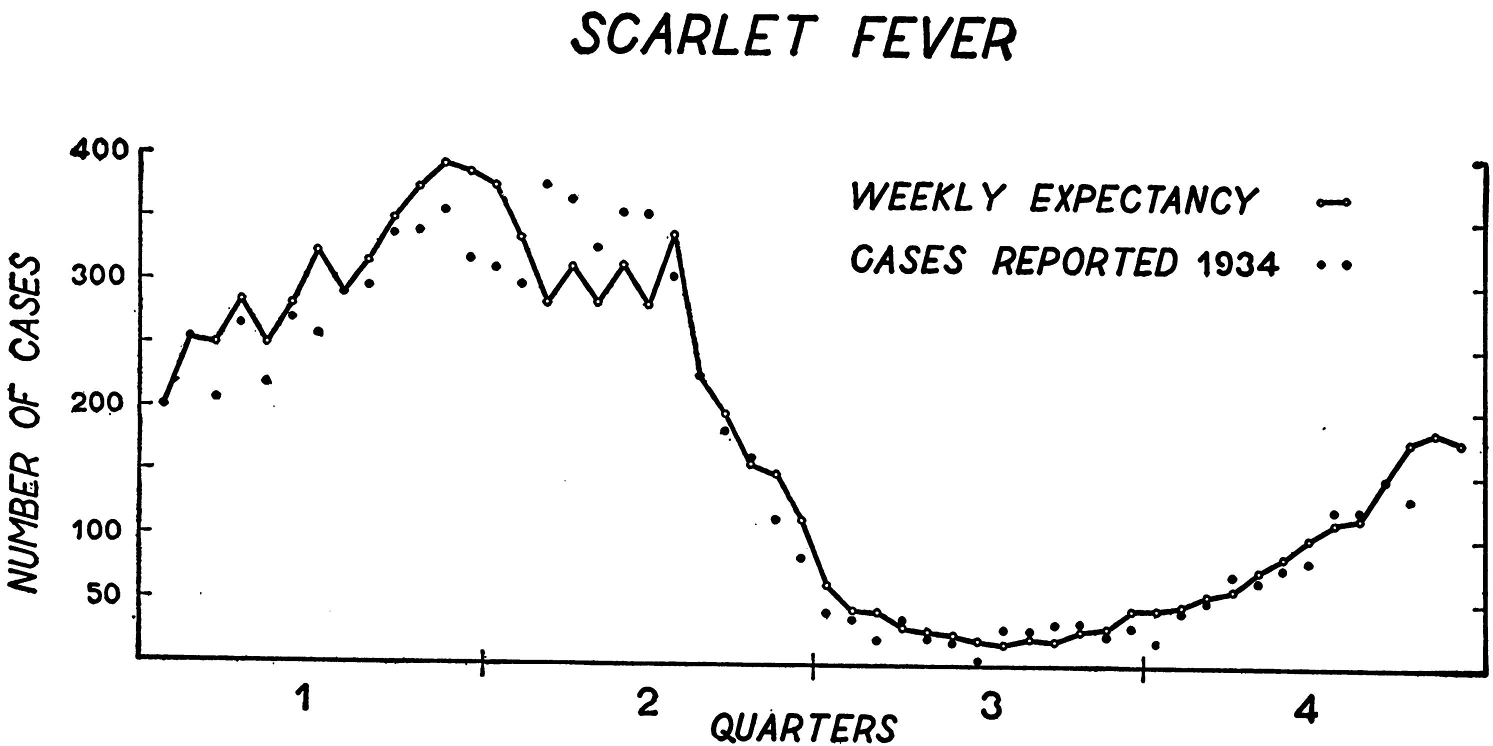


FIGURE 2.—Comparison of weekly median endemic indexes of scarlet fever in New York City with actual weekly reports of the disease during the year 1934.

month and an indicator for the total reported cases is all that is needed for successful operation. Simple charts in black and white are invariably better than ornate, highly colored creations. Manifestly a workable and satisfactory meter can be devised by almost anyone. It is also quite likely that useful innovations and improvements can be made by many of the health officers who utilize the method described.

CAUTIONS TO BE OBSERVED

The device which has been presented must not be regarded as an automatic instrument possessing scientific accuracy. It is very far

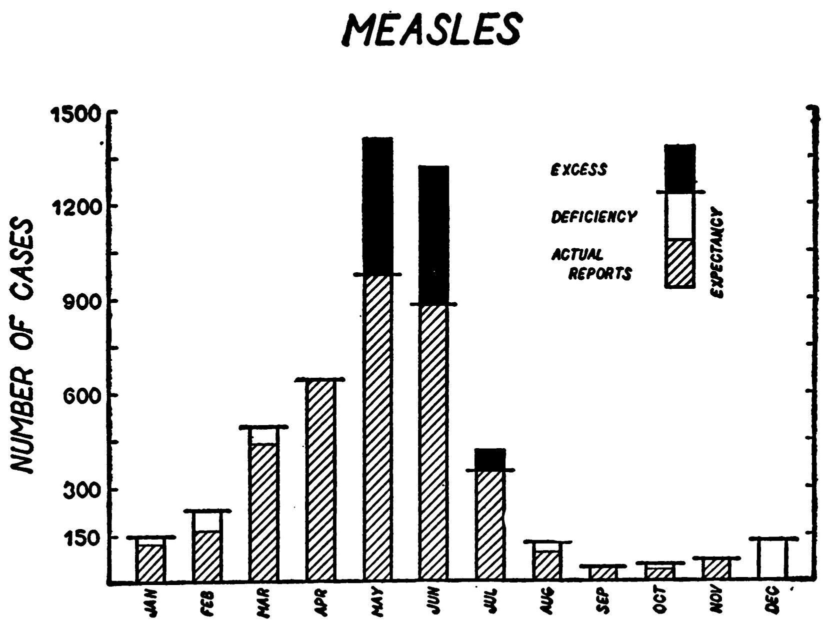


FIGURE 3.—Comparison of monthly median endemic indexes of measles in New York City with actual monthly reports of the disease during the year 1934.

from having such qualifications. However, if it will be remembered that this meter, with its obvious limitations, is designed to aid the health officer and inform others concerning the current incidence of communicable diseases, as well as to give timely warnings of unusual incidence, then its maintenance may be considered justifiable.

SUMMARY

A device has been described and the means of obtaining the necessary collateral data has been outlined whereby a cumulative record of actual communicable disease reporting may be compared with the expected incidence. This device, when it is intelligently used and the results are properly interpreted, should direct the health officer's attention to an undue incidence of disease and thus aid in combating the affection. To some extent, also, it may assist in forecasting an unusual occurrence of one of the communicable diseases, thereby marshaling the resources of a health department before the blow descends.[7]

PERSONAL HYGIENE FOR FOOD HANDLERS IN NEW YORK CITY

On September 18, 1934, the Board of Health of New York City amended the section of the Sanitary Code which provided for the annual medical examination of food handlers. This amendment abolished the yearly examination, but prohibited persons affected with a communicable disease from working in a food-handling establishment and prohibited food dealers from employing any such persons. Medical examination of those engaged in the milk industry is still required.

This amendment was made only after the Commissioner of Health, Dr. John L. Rice, had become convinced that the routine medical examination of food handlers and the issuance of medical certificates had proved illogical and ineffective, and after the unqualified endorsement of the step by outstanding public health authorities, whose unanimous opinion was that such examinations were not of sufficient value to warrant the expense incurred.

The routine annual medical examination of food handlers was inaugurated by the New York City Department of Health in December 1915. At that time, according to Doctor Rice, the plan was adopted not only as an effort to impress upon food handlers the role

[7] Since this article was submitted for publication a suggestion has been offered for providing a direct reading of the "meter" by placing a *daily* expectancy scale on one side of each column. If, for instance, the expectancy of a disease is 60 cases in a 30-day month, the number of cases expected on the 1st day would be 2 cases, on the 5th day 10, on the 17th day 34, etc.

This daily expectancy can be indicated in the following manner: On the unnumbered edge of the slot a strip of clear cellophane about ⅜-inch wide could be fastened so as not to interfere with the insertion of small daily indicators. Small pieces of red or green cellophane, pointed at the indicating end and approximately ½ by ¼ inch in size, each bearing a number from 1 to the number of days in the month under consideration, could be inserted beneath the clear cellophane and pointed to the appropriate numbers on the scale. By this means a direct reading can be made without the need for mental calculation. Thus, on the 11th of the month, when 22 cases of the particular disease are expected according to past experience, there may actually have been reported 33 cases. The excess incidence of 9 cases is immediately apparent.

In preparing the daily case expectancy several points should be kept in mind:

1. The daily expectancy must be calculated each month for each disease. Furthermore, the daily indicators must be placed in their proper relation to the scale at the beginning of each month.

2. Communciable diseases do not ordinarily increase with mathematical regularity. Thus, a disease may prevail to a greater extent during the latter than the earlier portion of a month or vice versa and thereby fail to correspond to the expected number of cases on a given day. However, this irregularity is merely another indication of the meter's lack of mathematical precision, for which no claim has been made.

3. When the case expectancy is low, it may not be possible to utilize the daily accumulated expectancy except for a few widely separated days. In the event that a daily expectancy is not required, the indicators may be placed at intervals, as for instance the 10th, 20th, and 30th days of the month. This is a matter for determination by the experience with the several diseases.

This suggestion is entirely practicable, and it illustrates, as the author has predicted, one of the numerous improvements that can be made by persons examining or using the device.

played by infection in the spread of communicable diseases, but also as a means of encouraging the practice of periodic health examinations. At first the examinations were made only in special clinics established by the Department of Health; but later the privilege of making them was extended to private physicians, and in January 1933 the Department abolished its special clinics for these examinations. About 350,000 food handlers had been examined annually.

Doctor Rice states that overreliance on the physical examination has brought with it a diminishing emphasis on personal hygiene and general sanitation; and he believes that greater attention to personal cleanliness and sterilization of eating and drinking utensils will not only accomplish much more than the routine examination of food handlers, but will be much less costly. Personnel and money formerly devoted to this activity are now available for more productive health work.

In promoting the personal hygiene of food handlers, the following steps have been taken by the Department of Health:

1. An informative article entitled "Personal Hygiene of Food Handlers—An Obstacle to the Dissemination of Communicable Diseases" has been prepared which, with suitable modifications, is being used for the following purposes:

(*a*) Radio lectures.
(*b*) Newspaper "stories".
(*c*) Trade journals.
(*d*) Conventions of hotel, restaurant, and other associations.
(*e*) Groups of hotel and restaurant managers.
(*f*) Mimeographed or printed copies for any of the above.
(*g*) Lecture for inspectors in the Bureau of Foods and Drugs.

2. Placard emphasizing the importance of personal cleanliness on the part of food handlers for display in the washrooms of eating places. The distribution of 20,000 of these placards is well under way.

3. Folder for individual food handlers. This is a small, convenient, pocket-size booklet for distribution to each of the 350,000 food handlers in the city.

In addition to the steps that have actually been taken, it is the intention, as soon as funds can be procured, to print and distribute an adequate number of copies of the sections of the Sanitary Code relating to the cleanliness of food-handling establishments. Furthermore, efforts will be made to place a representative of the Department of Health on the programs of conventions, meetings, and other gatherings of people engaged in the various phases of food preparation and handling so that first-hand information on the subject may be given.

The amended section of the Sanitary Code reads as follows:

SECTION 146. *Employment of persons affected with a communicable disease prohibited; medical certificate required where milk is produced, pasteurized, etc.*—No person who is affected with any disease in a communicable form or is a carrier of such disease shall work in any place where food or drink is prepared, cooked, mixed, baked, exposed, bottled, packed, handled, stored, manufactured, offered for sale, or sold, and no food dealer shall employ any such person or any person suspected of being affected with any disease in a communicable form or of being a carrier of such disease.

No person producing milk in the city of New York for the purpose of sale and no wholesale dealer in milk or cream or operator of a creamery or of a milk or cream receiving station, pasteurizing or bottling plant, or manufacturer of frozen desserts at wholesale in the city of New York, or whose products are shipped into said city shall employ any person, and no persons shall work in such place, unless he has filed with his employer a medical certificate signed by a duly licensed physician stating the date of examination, and that such person is free from any disease in a communicable form. Such medical certificate shall be good for 1 year from the date of such examination.

Under the new regulation the maintenance of disease-free food handlers is a responsibility in which both the employee and the employer must share. Moreover, in the event that a diseased food handler is discovered, both parties are liable to prosecution.

DEATHS DURING WEEK ENDED MAY 4, 1935

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

	Week ended May 4, 1935	Corresponding week, 1934
Data from 86 large cities of the United States:		
Total deaths	8,715	8,607
Deaths per 1,000 population, annual basis	12.1	12.0
Deaths under 1 year of age	533	641
Deaths under 1 year of age per 1,000 estimated live births	49	58
Deaths per 1,000 population, annual basis, first 18 weeks of year	12.6	12.5
Data from industrial insurance companies:		
Policies in force	67,870,719	67,748,069
Number of death claims	13,604	13,221
Death claims per 1,000 policies in force, annual rate	10.5	10.2
Death claims per 1,000 policies, first 18 weeks of year, annual rate	10.7	11.0

PREVALENCE OF DISEASE

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

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended May 11, 1935, and May 12, 1934

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 11, 1935, and May 12, 1934

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934
New England States:								
Maine	1	3	1	1	160	39	0	0
New Hampshire	1					122	0	0
Vermont	1				39	58	0	0
Massachusetts	10	14			374	1,566	2	2
Rhode Island					319	56	1	0
Connecticut	5	2	1		1,535	90	1	0
Middle Atlantic States:								
New York	35	39	[1] 10	[1] 9	3,027	1,205	19	3
New Jersey	27	18	7	12	2,037	689	2	0
Pennsylvania	44	39			3,543	3,880	7	3
East North Central States:								
Ohio	30	29	26	67	1,544	1,944	27	3
Indiana	13	15	17	12	376	1,296	3	0
Illinois	69	29	30	19	2,188	2,700	17	8
Michigan	7	14		3	5,459	367	5	1
Wisconsin	2	3	8	43	1,613	2,558	1	1
West North Central States:								
Minnesota	12	17	2		585	326	0	0
Iowa	8	6	2	2	445	311	3	0
Missouri	18	48	54	41	487	883	7	6
North Dakota	1	2	2		30	213	0	0
South Dakota		3			38	256	1	0
Nebraska	3	12	11		234	423	3	2
Kansas	14	7	4	3	1,034	836	2	0
South Atlantic States:								
Delaware		1	2		12	173	0	0
Maryland [2]	6	11	9	8	67	2,504	12	1
District of Columbia	8	11	1			94	11	0
Virginia	9	12			581	1,407	11	2
West Virginia	14	2	35	20	449	141	5	2
North Carolina	7	18	2	90	200	1,861	2	1
South Carolina	4	7	80	246	29	411	1	0
Georgia [3]	10	2				498	2	0
Florida	6	8	1	2	50	578	1	0
East South Central States:								
Kentucky	9	11	10	13	506	418	6	1
Tennessee	12	5	28	21	112	487	4	2
Alabama [3]	13	9	51	36	164	645	1	3
Mississippi [3]	11	5					1	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 11, 1935, and May 12, 1934—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934
West South Central States:								
Arkansas	-------	4	70	3	62	16	2	2
Louisiana	15	24	15	20	70	216	0	3
Oklahoma [4]	8	14	51	23	66	245	4	0
Texas [3]	38	72	92	171	161	774	0	1
Mountain States:								
Montana [3]	-------	5	16	25	364	89	2	0
Idaho [3]	-------	-------	1	-------	8	34	0	1
Wyoming [3]	1	-------	-------	-------	124	39	0	0
Colorado	7	11	-------	-------	307	1,082	0	0
New Mexico	5	3	5	-------	66	98	0	0
Arizona	2	1	10	1	11	62	2	1
Utah [3]	2	1	-------	5	14	107	0	0
Pacific States:								
Washington	4	1	-------	1	436	197	3	0
Oregon [3]	-------	1	32	-------	288	43	0	1
California	36	39	28	23	1,682	731	6	2
Total	528	578	714	920	30,896	32,768	177	52
First 19 weeks of year	12,527	14,748	98,748	43,528	521,529	504,033	2,664	1,079

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934
New England States:								
Maine	0	0	12	22	0	0	1	13
New Hampshire	0	0	7	21	0	0	0	0
Vermont	0	0	9	5	0	0	1	4
Massachusetts	0	1	191	198	0	0	8	2
Rhode Island	0	0	10	14	0	0	1	0
Connecticut	0	1	108	70	0	0	0	0
Middle Atlantic States:								
New York	0	2	1,147	835	0	0	5	9
New Jersey	0	0	204	194	0	0	1	1
Pennsylvania	1	1	660	638	0	0	8	13
East North Central States:								
Ohio	0	1	664	909	0	1	5	6
Indiana	0	0	114	113	1	1	2	3
Illinois	0	1	1,287	513	4	5	6	2
Michigan	1	1	369	629	0	0	1	7
Wisconsin	2	0	431	335	10	32	1	1
West North Central States:								
Minnesota	0	0	367	90	9	6	1	1
Iowa	1	0	83	41	6	4	1	1
Missouri	0	2	60	79	1	7	5	7
North Dakota	0	0	56	41	1	0	0	2
South Dakota	0	0	11	6	9	1	0	0
Nebraska	1	0	80	25	28	12	0	5
Kansas	0	0	56	31	22	8	3	4
South Atlantic States:								
Delaware	0	0	6	11	0	0	0	3
Maryland [3]	0	1	54	38	0	0	5	14
District of Columbia	0	0	64	10	0	0	0	1
Virginia	3	0	26	24	0	0	6	10
West Virginia	0	0	63	57	0	0	9	7
North Carolina	0	0	8	18	1	1	3	2
South Carolina	0	0	3	2	0	0	5	7
Georgia [3]	0	0	12	4	0	1	9	3
Florida	1	0	3	2	0	0	1	4
East South Central States:								
Kentucky	0	0	38	44	0	0	6	9
Tennessee	0	0	21	13	1	2	6	2
Alabama [3]	1	0	7	6	1	0	4	0
Mississippi [3]	0	0	4	13	0	0	3	2

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended May 11, 1935, and May 12, 1934—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934	Week ended May 11, 1935	Week ended May 12, 1934
West South Central States:								
Arkansas	2	1	6	8	0	1	2	5
Louisiana	2	0	10	27	0	6	14	14
Oklahoma [4]	4	0	14	16	2	4	5	1
Texas [3]	1	2	28	45	3	37	7	15
Mountain States:								
Montana [5]	0	1	7	15	9	1	0	1
Idaho [5]	0	1	3	3	0	14	1	1
Wyoming [5]	0	0	10	2	7	12	0	0
Colorado	0	0	149	15	3	5	0	0
New Mexico	0	0	13	13	2	0	2	0
Arizona	0	10	41	5	0	0	0	1
Utah [2]	0	0	91	8	0	4	0	0
Pacific States:								
Washington	2	0	61	40	25	2	3	8
Oregon [5]	0	0	57	36	3	6	1	3
California	7	20	218	172	18	1	4	11
Total	29	46	6,943	5,456	166	174	146	205
First 19 weeks of year	459	428	136,417	113,896	3,623	2,888	2,540	3,034

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Typhus fever, week ended May 11, 1935, 12 cases, as follows: Georgia, 3; Alabama, 5; Texas, 4.
[4] Exclusive of Oklahoma City and Tulsa.
[5] Rocky Mountain spotted fever, week ended May 11, 1935, 17 cases, as follows: Montana, 11; Idaho, 1; Wyoming, 4; Oregon, 1.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
February 1935										
Wisconsin	6	11	733		8,204		1	2,702	113	5
March 1935										
Wisconsin	11	15	211		7,492		1	2,017	141	7
April 1935										
Arkansas	3	14	84	55	334	24	3	6	9	8
Florida	1	15	7	21	314	11	0	12	2	13
Indiana	24	74	144		1,819		1	722	9	2
Maine		5	12		690		1	49	0	15
Massachusetts	9	26		1	2,156	1	1	1,029	0	13
Nebraska	11	16	28		1,714		2	218	135	2
New Hampshire			3				0	45	0	1
North Carolina	13	52	50		1,180	62	8	87	5	20
Vermont		6			116		0	79	1	1

February 1935

	Cases
Wisconsin:	
Chicken pox	1,957
Epidemic encephalitis	1
German measles	2,496
Mumps	1,473
Ophthalmia neonatorum	3
Septic sore throat	5
Undulant fever	6
Whooping cough	992

March 1935

Wisconsin:	
Chicken pox	1,546
Epidemic encephalitis	4
German measles	12,415
Mumps	1,907
Septic sore throat	5
Trachoma	1
Undulant fever	5
Whooping cough	789

April 1935

Chicken pox:	
Arkansas	37
Florida	279
Indiana	497
Maine	149
Massachusetts	1,081
Nebraska	148
North Carolina	612
Vermont	119
Dengue:	
Florida	2
Dysentery:	
Florida (bacillary)	2
Massachusetts (amoebic)	1
Massachusetts (bacillary)	5
Epidemic encephalitis:	
Indiana	4
Massachusetts	1
German measles:	
Maine	299
Massachusetts	8,695
North Carolina	160
Lead poisoning:	
Massachusetts	4
Mumps:	
Arkansas	77
Florida	200
Indiana	109
Maine	40
Massachusetts	486
Nebraska	255
Vermont	30
Ophthalmia neonatorum:	
Massachusetts	61
North Carolina	2
Rabies in animals:	
Indiana	89
Maine	1
Massachusetts	36
Rabies in man:	
North Carolina	1
Septic sore throat:	
Maine	3
Massachusetts	31
Nebraska	4
North Carolina	6
Trachoma:	
Arkansas	2
Maine	1
Trichinosis:	
Maine	43
Massachusetts	1
Tularaemia:	
Florida	2
North Carolina	2
Typhus fever:	
Florida	1
North Carolina	1
Undulant fever:	
Arkansas	3
Massachusetts	6
North Carolina	1
Vincent's infection:	
Maine	1
Whooping cough:	
Arkansas	131
Florida	91
Indiana	335
Maine	57
Massachusetts	522
Nebraska	24
North Carolina	1,651
Vermont	90

PLAGUE-INFECTED GROUND SQUIRRELS IN MODOC AND SAN LUIS OBISPO COUNTIES, CALIF.

Reports have been received from the Director of Public Health of California, of 7 plague-infected ground squirrels received at the laboratory May 3 and 6, 1935, from ranches in Modoc County, Calif., 12 to 13 miles west and 4 to 5 miles south of Alturas. Also, 1 plague-infected ground squirrel received April 26 from a ranch at Santa Margarita, San Luis Obispo County, was reported.

WEEKLY REPORTS FROM CITIES

City reports for week ended May 4, 1935

[This table summarizes the reports received regularly from a selected list of 121 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference]

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								
Maine:											
Portland	0	------	0	0	3	2	0	1	0	10	20
New Hampshire:											
Concord	0	------	0	0	3	3	0	0	0	0	12
Nashua	0	------	------	0	------	0	0	------	0	0	------
Vermont:											
Barre	0	------	0	9	1	0	0	0	0	1	------
Burlington	0	------	------	28	------	1	0	------	0	0	21
Massachusetts:											
Boston	4	------	3	33	28	45	0	18	1	78	246
Fall River	1	------	0	1	0	8	0	3	1	5	22
Springfield	0	------	0	100	3	12	0	0	0	7	37
Worcester	0	------	0	5	8	17	0	1	0	9	64
Rhode Island:											
Pawtucket	0	------	0	0	0	0	0	0	0	0	9
Providence	0	------	2	409	5	5	0	1	0	15	58
Connecticut:											
Bridgeport	0	------	0	10	3	9	0	2	0	1	43
Hartford	0	------	0	8	2	12	0	0	0	15	49
New Haven	0	------	1	552	2	1	0	0	0	0	------

City reports for week ended May 4, 1935—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								
New York:											
Buffalo	0	------	0	69	18	75	0	7	0	15	144
New York	17	------	5	1,882	178	519	0	84	3	234	1,608
Rochester	0	1	0	163	11	16	0	2	0	29	84
Syracuse	0	------	0	599	7	12	0	1	0	19	62
New Jersey:											
Camden	1	1	0	2	1	10	0	0	0	0	27
Newark	0	3	0	448	13	7	0	4	1	45	104
Trenton	0	------	0	8	2	4	0	3	0	1	42
Pennsylvania:											
Philadelphia	2	5	5	92	49	128	0	14	2	90	538
Pittsburgh	3	8	6	484	42	30	0	9	0	11	180
Reading	1	------	2	70	1	5	0	0	0	4	33
Scranton	0	------	------	44	------	3	0	------	0	1	------
Ohio:											
Cincinnati	2	------	3	12	21	25	0	8	0	2	144
Cleveland	5	23	2	342	28	58	0	14	0	35	218
Columbus	2	1	1	114	9	34	0	8	1	3	82
Toledo	1	1	1	133	3	7	0	9	0	6	79
Indiana:											
Fort Wayne	------	------	------	------	------	------	------	------	------	------	------
Indianapolis	1	------	1	217	21	16	0	4	0	14	102
South Bend	0	------	0	2	1	3	0	0	0	0	11
Terre Haute	0	------	0	0	0	1	0	1	0	0	21
Illinois:											
Chicago	20	6	2	1,407	77	647	0	52	0	48	731
Springfield	0	------	0	16	4	17	0	0	0	5	28
Michigan:											
Detroit	6	------	1	2,452	40	110	0	20	0	105	305
Flint	0	------	0	13	3	21	0	1	------	0	30
Grand Rapids	0	------	0	219	0	12	0	2	0	9	30
Wisconsin:											
Kenosha	0	------	0	24	1	12	2	0	0	6	8
Milwaukee	0	------	0	208	6	142	0	6	0	51	91
Racine	0	------	0	81	0	15	0	1	0	12	18
Superior	1	------	0	20	0	1	0	0	0	0	8
Minnesota:											
Duluth	------	------	------	------	------	------	------	------	------	------	------
Minneapolis	2	------	2	130	8	162	0	1	0	13	114
St. Paul	2	------	0	15	10	63	0	1	0	9	68
Iowa:											
Davenport	0	------	------	1	------	0	0	------	0	0	------
Des Moines	0	------	------	390	------	2	0	------	0	1	28
Sioux City	0	------	------	11	------	1	0	------	0	4	------
Waterloo	0	------	------	2	------	4	0	------	0	1	------
Missouri:											
Kansas City	1	------	0	84	10	7	0	3	0	2	101
St. Joseph	2	------	0	4	10	1	0	1	0	0	39
St. Louis	7	------	0	16	12	28	0	12	0	10	210
North Dakota:											
Fargo	0	------	1	4	3	16	0	0	0	1	7
Grand Forks	0	------	------	0	------	2	0	------	0	3	------
South Dakota:											
Aberdeen	0	------	------	13	------	1	0	------	0	0	------
Nebraska:											
Omaha	2	------	2	75	9	6	0	1	0	2	47
Kansas:											
Topeka	------	------	------	------	------	------	------	------	------	------	------
Wichita	0	1	0	178	5	0	0	4	0	5	45
Delaware:											
Wilmington	1	------	0	9	5	4	0	0	0	0	27
Maryland:											
Baltimore	3	4	2	43	29	70	0	15	0	34	234
Cumberland	0	------	0	3	1	2	0	1	0	0	12
Frederick	0	------	0	1	0	0	0	0	0	0	3
Dist. of Col.:											
Washington	7	------	0	60	16	78	0	14	0	6	166
Virginia:											
Lynchburg	2	------	0	12	2	4	0	2	0	23	18
Richmond	0	------	2	65	6	1	0	5	0	0	64
Roanoke	1	------	0	22	2	1	0	1	0	2	15
West Virginia:											
Charleston	1	------	0	15	0	0	0	0	0	5	13
Huntington	0	------	------	6	------	2	0	------	0	0	------
Wheeling	0	------	0	115	4	5	0	1	0	0	21

City reports for week ended May 4, 1935—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								
North Carolina:											
Raleigh	0	------	0	26	3	2	0	0	2	15	12
Wilmington	0	------	0	1	1	0	0	1	0	7	9
Winston-Salem	1	------	0	1	1	1	0	1	0	20	16
South Carolina:											
Charleston	0	3	0	0	3	0	0	0	0	0	26
Columbia	0	------	0	0	0	0	0	1	0	0	13
Georgia:											
Atlanta	3	4	4	4	11	4	0	6	0	4	78
Brunswick	0	------	0	0	1	0	0	0	0	0	4
Savannah	0	------	0	2	2	2	0	5	0	3	38
Florida:											
Miami	1	2	0	3	2	1	0	1	0	3	35
Tampa	1	1	1	51	1	1	0	1	0	2	27
Kentucky:											
Ashland	------	------	------	------	------	------	------	------	------	------	------
Lexington	0	------	0	0	3	0	0	2	0	4	20
Louisville	0	4	1	344	12	14	0	3	0	17	67
Tennessee:											
Memphis	4	------	1	1	12	8	0	6	0	10	90
Nashville	2	------	0	0	15	2	0	5	0	12	50
Alabama:											
Birmingham	1	------	2	32	4	2	0	2	0	3	61
Mobile	0	------	1	10	1	0	0	2	1	0	20
Montgomery	1	------	------	2	------	0	0	------	0	0	------
Arkansas:											
Fort Smith	------	------	------	------	------	------	------	------	------	------	------
Little Rock	1	------	0	16	0	1	0	1	0	4	------
Louisiana:											
New Orleans	------	------	0	22	13	14	0	10	1	0	134
Shreveport	1	------	0	4	8	0	0	3	2	0	40
Oklahoma:											
Oklahoma City	2	6	2	0	10	1	0	0	1	0	36
Tulsa	0	------	------	0	------	0	0	------	0	16	------
Texas:											
Dallas	3	------	0	0	5	4	0	1	0	0	55
Fort Worth	0	------	0	------	5	2	0	------	0	6	27
Galveston	0	------	0	0	1	0	0	0	0	0	8
Houston	14	------	0	2	8	0	0	4	0	0	68
San Antonio	0	------	0	0	6	0	0	2	0	0	40
Montana:											
Billings	0	------	0	12	0	1	0	0	0	0	5
Great Falls	0	------	0	6	1	0	0	0	0	7	17
Helena	0	------	0	5	2	0	0	0	0	4	4
Missoula	0	------	0	15	1	0	0	0	0	0	9
Idaho:											
Boise	0	------	0	1	1	2	0	0	0	0	10
Colorado:											
Denver	5	31	0	151	8	143	0	7	1	2	85
Pueblo	0	------	0	98	0	4	0	0	0	6	11
Utah:											
Salt Lake City	1	------	1	5	4	107	0	1	0	116	34
Nevada:											
Reno	0	------	0	1	0	0	0	1	0	0	5
Washington:											
Seattle	0	------	0	239	11	16	1	2	0	2	90
Spokane	0	------	0	76	3	4	0	0	1	0	37
Tacoma	0	------	0	8	2	2	5	0	0	0	26
Oregon:											
Portland	0	------	0	117	6	8	0	1	1	0	88
Salem	0	------	------	2	------	0	0	------	0	0	------
California:											
Los Angeles	7	28	2	61	------	52	13	21	1	15	324
Sacramento	1	------	0	226	0	15	3	5	0	4	27
San Francisco	3	------	0	53	7	22	0	11	1	40	179

City reports for week ended May 4, 1935—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Rhode Island:			
Providence	0	2	0
New York:			
New York	20	10	2
Syracuse	1	0	0
Pennsylvania:			
Philadelphia	1	0	0
Pittsburgh	2	1	0
Ohio:			
Cincinnati	7	4	0
Cleveland	2	0	0
Toledo	1	1	0
Indiana:			
Indianapolis	4	0	0
Terre Haute	0	1	0
Illinois:			
Chicago	17	4	1
Michigan:			
Detroit	2	2	0
Grand Rapids	1	1	0
Wisconsin:			
Racine	0	0	1
Minnesota:			
Minneapolis	2	0	0
Iowa:			
Des Moines	1	0	0
Sioux City	3	2	0
Missouri:			
Kansas City	3	1	0
St. Joseph	2	0	0
St. Louis	3	0	0
Nebraska:			
Omaha	1	0	0
Maryland:			
Baltimore	7	0	0
District of Columbia:			
Washington	9	6	0
Georgia:			
Atlanta	1	0	0
Florida:			
Tampa	1	0	0
Tennessee:			
Nashville	3	0	0
Arkansas:			
Little Rock	3	0	0
Louisiana:			
New Orleans	0	0	1
Oklahoma:			
Oklahoma City	3	0	0
Tulsa	1	1	0
Washington:			
Seattle	1	1	1
Spokane	1	1	0
Oregon:			
Portland	2	0	0
California:			
Los Angeles	0	0	1
San Francisco	0	1	1

Dengue.—Miami, 1 case.

Epidemic encephalitis.—Cases: Springfield, Mass., 1; Philadelphia, 1; Pittsburgh, 1; Columbus, 1; Detroit, 2; Baltimore, 1; Washington, 1; Atlanta, 1; Missoula, 1; San Francisco, 1.

Pellagra.—Cases: Raleigh, 2; Charleston, S. C., 2; Atlanta, 3; Savannah, 7; Miami, 2; Tampa, 2; San Francisco, 1.

Typhus fever.—Cases: Baltimore, 1; Houston, 1.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended April 6, 1935.—During the 2 weeks ended April 6, 1935, 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				4	2					6
Chicken pox		17		262	436	108	89	20	102	1,034
Diphtheria		3		15	10	15	2			45
Dysentery				4	5					9
Erysipelas		1		6	11	2	1	2	2	25
Influenza		51		40	64				256	411
Measles		155	98	1,344	5,937	292	331	173	145	8,475
Mumps		8	1		485	53	1	23	84	655
Paratyphoid fever					2					2
Pneumonia		4			43		9		26	82
Poliomyelitis				1						1
Scarlet fever		22	19	270	280	39	23	29	58	740
Smallpox					2		1			3
Tuberculosis	3		15	153	120	16	11	4	33	355
Typhoid fever				16	6	1			6	29
Undulant fever					4		1		2	7
Whooping cough		2	3	162	302	39	124	5	76	713

ITALY

Communicable diseases—4 weeks ended March 3, 1935.—During the 4 weeks ended March 3, 1935, cases of certain communicable diseases were reported in Italy as follows:

Disease	Feb. 4–10		Feb. 11–17		Feb. 18–24		Feb. 25–Mar. 3	
	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected
Anthrax	19	19	8	8	19	18	7	7
Cerebrospinal meningitis	26	15	25	23	18	14	32	23
Chicken pox	333	118	415	143	364	119	407	141
Diphtheria and croup	628	319	700	354	486	246	559	315
Dysentery	4	3	5	4	3	3	5	5
Lethargic encephalitis	1	1	1	1			5	5
Measles	2,920	346	3,347	361	3,059	332	2,616	352
Poliomyelitis	6	6	8	8	10	10	4	4
Scarlet fever	409	144	351	120	283	108	277	109
Typhoid fever	216	138	216	129	164	115	196	121

SPAIN

Vital statistics—1934.—The following table shows the number of births and deaths, together with death rates from certain causes, reported in Spain during 1934.

Population, estimated Dec. 31, 1933	24, 242, 038
Number of deaths	388, 221
Death rate per 1,000 population	16.01
Number of births	637, 446
Birth rate per 1,000 population	26.30
Stillbirths	21, 104
Deaths under 1 year of age	72, 027
Death rates per 100,000 population from—	
Bronchitis	70.5
Diarrhea and enteritis	188.5
Diphtheria	5.2
Measles	13.7
Pneumonia	158.4
Scarlet fever	2.4
Tuberculosis, pulmonary	88.4
Tuberculosis, other forms	23.1
Typhoid and paratyphoid fever	12.8
Whooping cough	4.2

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

(NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for Apr. 26, 1935, pp. 580–594. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued May 31, 1935, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Plague

Egypt—Alexandria.—On May 7, 1935, 1 case of bubonic plague was reported at Alexandria, Egypt.

Hawaii Territory—Hawaii Island—Hamakua District.—On May 8, 1935, 1 plague-infected rat was found in Hamakua District, Hawaii Island, Hawaii Territory.

Indo-China—Saigon-Cholon.—During the week ended May 4, 1935, 1 case of plague was reported at Saigon-Cholon, Indo-China.

Iraq.—During the week ended May 4, 1935, plague was reported in Iraq, as follows: 1 case at Baghdad, and 1 case in Baghdad Province, Iraq.

United States—California.—A report of plague-infected ground squirrels in California appears on page 718 of the this issue of Public Health Reports.

Smallpox

British Guiana.—A small outbreak of a mild form of smallpox was reported May 3, 1935, at Mabaruma in the northwest district of the colony of Essequibo approximately 100 miles northwest of Georgetown, British Guiana. All cases have been isolated and the district quarantined.

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