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CHIEF ETIOLOGICAL FACTORS OF PLAGUE IN ECUADOR AND THE ANTIPLAGUE CAMPAIGN

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I. CHIEF ETIOLOGICAL FACTORS

THE INTRODUCTION OF PLAGUE

The first country on the west coast of South America to be invaded by plague was Peru. It is stated that the disease was introduced into Peru through the agency of a vessel from India with a cargo of jute bags in 1903. There is little doubt that plague was carried from Peru to Guayaquil, Ecuador, but the particular vessel that brought the disease is unknown.

The first evidence of plague in Guayaquil was a very fatal epizootic among the rats which occurred early in February, 1908. Surg. B. J. Lloyd, of the Public Health Service, who was stationed in Guayaquil at that time, diagnosed the infection among the rats as plague and predicted that human cases would soon appear. This prediction proved to be correct, as 63 cases followed in the same month and 225 in March, the greatest number ever reported in Guayaquil in one month.

CHARACTER OF THE EPIDEMICS IN GUAYAQUIL

During the 22 years from 1908 to 1930 there were 7,616 cases of plague officially reported in Guayaquil, distributed as follows: In the first five years 3,183 cases, or 42 per cent; in the second five years 2,695 cases, or 35 per cent; in the third 5-year period 909 cases, or 12 per cent; and in the last seven years 829 cases, or 11 per cent. These figures show that during the first 10 years there was a slow decline in the number of cases and then an abrupt fall followed by another sluggish decline. Table 1[1] shows that in the past 12 years the number of cases reported annually has varied little, with the exception of 1921, which was the last year, with over 200 cases reported, and the years 1919, 1922, and 1928, when less than 100 cases occurred.

[1] The tables will be published in the following issue of Public Health Reports.

It should be noted that when the number of cases reported in a year is less than 100, the disease shows a marked increase in the following year and a still greater rise in the second year succeeding the light year, a condition indicating that the disease should reach a greater height in 1930 than it did in 1929. A casual study of Table 1 might give the impression that plague would voluntarily disappear from Guayaquil; but a closer analysis indicates that the disease has probably reached its lowest level, and active outside measures will be necessary to cause it to become extinct.

SEASONAL PERIODICITY

With the exception of the epidemic in 1909 there has been a marked seasonal variation in the number of cases of plague reported. In Table 1 it can be seen that the disease is at its lowest level from May to October, while June and July are months of unusually low incidence. Since 1918 there have been years with three to four consecutive months without any cases being reported. In most years the number of cases began to increase in September. Prior to 1916 the yearly epidemic reached its highest point in October, November, and December, or the last months of the dry season; but since that date the greatest number of cases has been reported in January, February, and March, the first three months of the rainy season. In 1916 the disease was more prevalent than in any other year except the second year, 1909. Since the shift to January and February as the peak months, the number of cases occurring in these months has, on an average, been less than it was in the same months before the shift. It therefore appears that there has been a very marked decrease in the number of cases occurring at the end of the dry season and a slight decrease in the cases at the beginning of the wet or rainy season.

EXPLANATION OF THE CHANGES IN EXTENT AND CHARACTER OF EPIDEMICS

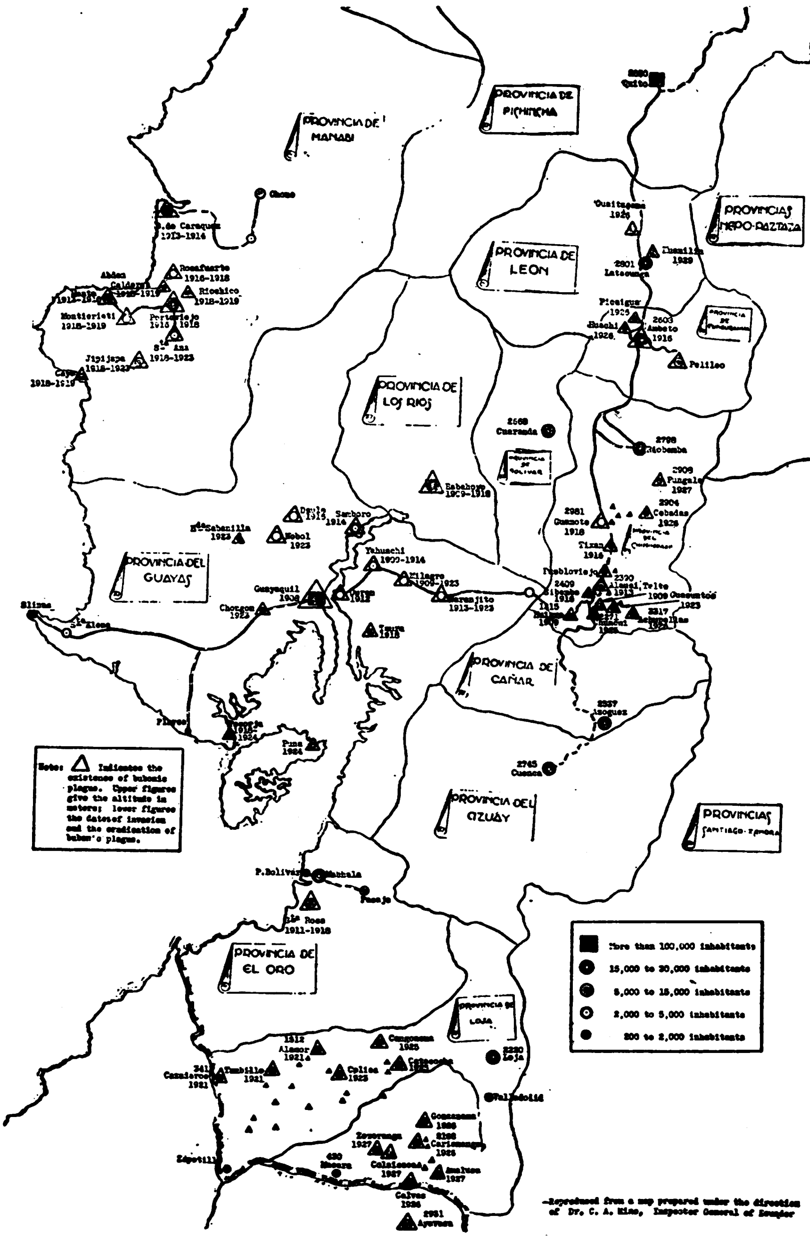
The decreased yearly incidence of human plague in Guayaquil, especially as noted in the past 12 years, is probably due to the effect produced upon the rat population by their continuous exposure to the disease. The climatic conditions are practically the same from year to year, and it is not believed that there has been any marked variation in the *X. cheopis* index for the same seasons of the different years since the onset of plague in 1908. Although some measures have been taken to lessen rat harborage in buildings, and rats have been trapped continuously, the degree of rat infestation was probably as great in the last 12 years as it was during the first years of the epidemics. In fact, the great mortality from plague among the rats during the first epidemic years, as evidenced by finding enormous numbers of dead rats, must have caused a greater reduction in the rat population than measures instituted to control the disease. The results of trapping since 1925 and the reports of householders both point to an excessive rat infestation during the past few years when human plague has been lowest. It therefore appears that the decrease in the human plague epidemics of recent years has been due to a reduction in rodent plague because of a gradually increasing immunity of rats to plague infection.

The shifting of the season of the greatest number of human cases from the last months of the dry season to January, February, and March of the rainy season, as occurred following the year 1916, does not offer an easy explanation. Later in this report will be found evidence indicating that rats harboring outside of buildings in Guayaquil are probably less exposed to plague infection than those living within doors, because the former have a very low *X. cheopis* index. On this basis we may assume that the rats harboring within buildings have developed a greater immunity to plague because of a closer association with the disease, and that each year the infection spreads slowly among the nonimmune indoor rats, particularly the younger rats born each year, until the onset of the rains. The flooded condition of Guayaquil, due to the heavy rainfall, forces large numbers of the outside rats to seek shelter within buildings; and with the advent of these less immune animals, rodent plague increases markedly with a consequent rise in the number of human cases during January, February, and March.

SPREAD OF PLAGUE TO OTHER TOWNS AND VILLAGES

From Guayaquil bubonic plague has spread to a great many inland towns located on the Quayaquil & Quito Railroad, and from them to near-by villages and haciendas. It has also invaded several river towns and minor seaports connected with Guayaquil by vessels.

Table 2 gives a schematic outline of the relationship of plague epidemics in Guayaquil to its appearance in other lowland river towns and to its invasion from these places into the mountain towns and Indian villages or caserios and haciendas. The towns are placed in the order of their distance from Guayaquil. The terminus of the railroad is not in Guayaquil proper, but in the village of Duran, across the Guayas River; the two places, however, are in constant communication by ferries. If the different epidemics of the inland towns are due to the disease in Guayaquil, one would expect to find cases at Duran in the same or preceding years. This has been the case in nearly every instance, although in 1909, 1916, and 1923 apparently no cases were reported in Dúran, and other inland towns were invaded. When plague has been



Map of Ecuador showing plague-infected localities with dates of invasion and eradication.

most prevalent in Guayaquil, as in 1909, 1913, and 1916, the disease has also invaded the inland towns, showing a rather definite relationship.

Milagro is an important link between the lowlands and the mountain districts, because practically all rice and sugar are shipped from this place to the interior. Table 2 shows that plague was present in Milagro every year, except 1919, that it occurred to any extent in the mountain districts.

Plague outside of Guayaquil has always been more or less sporadic in character, and it will be observed in Table 2 that the disease is seldom present more than one year and then disappears for varying periods of time from all the inland towns. Duran is the only exception to this rule.

Plague has appeared at irregular intervals at the river towns of Posera, Nobol, Daule, and Colines, and at the small seaports of Manta, B. d. Caraquez, Puna, and Cayo. There is constant communication by means of many small vessels between these places and Guayaquil. Daule was the first river town infected. Plague was reported here during the severe epidemic of 1916. Manta and the neighboring seaport of B. d. Caraquez were infected in 1913, and Cayo in 1918. From Manta the disease spread to six small neighboring villages. It was reported at intervals in the seaports and near-by villages from 1913 to 1923, when it disappeared and to date has not returned.

Plague invaded the mountain Province of Loja, in southern Ecuador, during 1921 and has been reported at 11 small villages and 21 haciendas in this region since then. As it is very difficult to reach this part of Ecuador from the north, the disease probably spread from Sullana and Paita, Peru, to the Loja district, so that it is in no way related to the plague-infected northern and central parts of Ecuador with which this report is concerned.

TYPES OF PLAGUE FOUND IN ECUADOR

Pneumonic plague is said to have been observed in Ecuador, but is very rare; although the wiping out of two Indian villages in the mountains suggests that this form might have been responsible. Septicemic plague in its usual character is not common, as indicated by the low mortality rate. Bubonic plague is the most common form of the disease, as in most other countries; but it is stated by those treating most of the cases that axillary buboes are very frequent, especially in the mountain districts. Lack of data prevents giving exact statistics of the different types of plague.

There are two forms of plague frequently encountered in Ecuador which are not common in other parts of the world. These two types have been designated locally as "angina pestosa," or a tonsillar form, and "viruela pestosa," or a vesicular form resembling chicken pox and smallpox in some of its manifestations. These forms of plague are more frequent in the mountain regions than in the lowland districts.

It is desired to emphasize the fact that both occur to some extent in Guayaquil. The frequency of angina and viruela pestosa in the higher altitudes is well illustrated in a small family epidemic which occurred at Riobamba in November, 1929. Among 11 cases of plague in a family group, there were 3 cases of the vesicular type and 2 of the tonsillar type—nearly half of the cases being atypical plague. As Doctor Martinez, in charge of the plague hospital at Guayaquil, is preparing a report on these two forms of plague, only a short account will be given here.

Angina pestosa occurs as a violent form of tonsillitis and pharyngitis, with secondary invasion of the cervical glands. This form of plague is the result of a mouth infection due to the habit of the Indians of killing vermin with their teeth. The exact mortality of angina pestosa is not known but it is greater than the ordinary bubonic form although not necessarily fatal, as only one of the two cases in the outbreak at Riobamba died.

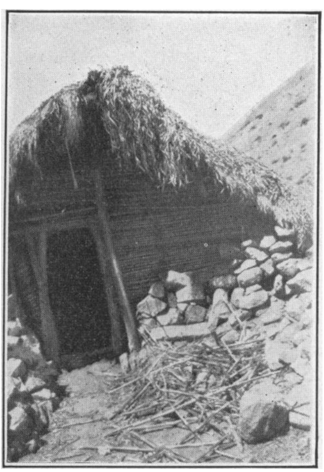
Viruela pestosa begins as the ordinary bubonic disease, but the skin eruption that follows is likely to obscure the buboes. Vesicles develop which pass through stages very similar to those of varicella. The vesicles may be few in number or present to the extent that they are found in a severe case of chicken pox. The vesicles are evidently the result of a septicemia from the primary buboes. The mortality of viruela pestosa is relatively high. Doctor Martinez states that when the vesicles exceed 50 the result is nearly always fatal. Only one of the three cases at Riobamba in November died.

Proof that the vesicles of viruela pestosa are due to bacillus pestis was clearly established in November, 1929, at the laboratory in Guayaquil. A small amount of serum was taken from a vesicle of a patient in the plague hospital and inoculated through the skin of a guinea pig. The guinea pig died in three days. At autopsy there were definite macroscopical plague lesions and smears from the spleen, liver, and heart blood were teeming with the coccobacillus.

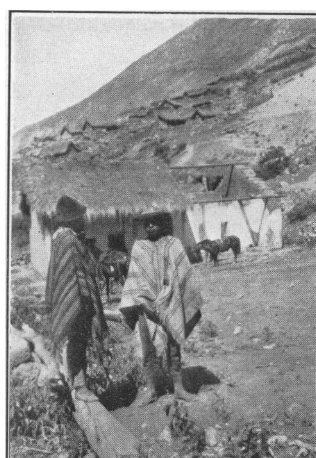
PLAGUE MORTALITY IN ECUADOR

The mortality rate of plague in Guayaquil in recent years has been unusually low. During the past five years only 36.8 per cent of the cases have died. It is probable that this figure is higher than it should be because unreported cases that have recovered can not be included, while most of the fatal cases have been discovered after death. Table 3 gives the percentage of deaths during the 5-year period ended December, 1929. In this table it will be noted that during the months of greatest incidence, October to March, inclusive, the death rate has been higher than during the other months when there was a tendency for the disease to disappear. The greatest mortality rate occurs in the months of December and January.

HUT AT NISAC IN WHICH A CASE OF PLAGUE WAS FOUND DECEMBER 15, 1929



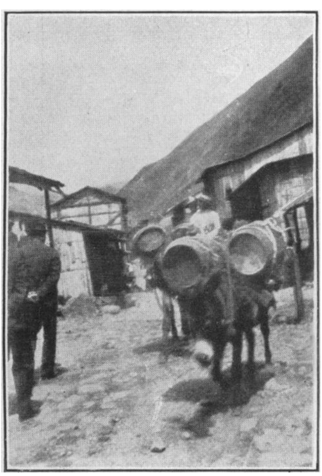
TYPICAL INDIAN HUT AND YARD AT NISAC



TYPICAL INDIANS AT NISAC

FALSE COLUMN—TIN-INCASED POSTS COMMON IN FRONT OF BUILDINGS IN GUAYAQUIL

STREET IN GUAYAQUIL SHOWING FALSE COLUMNS WHICH PROVIDE RAT HARBORAGE



PRIMITIVE WATER SYSTEM OF HUIGRA

VILLAGE HOUSES ABOUT 15 MILES FROM GUAYAQUIL

The yearly death rates have varied from 29 to 45.2 per cent. All cases of plague are given curative serum from the Pasteur Institute at the plague hospital in Guayaquil.

There is no means of determining the actual death rate among the cases in the mountain districts, but persons in charge of this area state that in recent years the mortality has been very low, especially among those with the bubonic type. Of the six bubonic cases at Riobamba in November, 1929, only one, an old woman, died.

LIVING CONDITIONS

As in other countries, plague is most prevalent among people living under poor hygienic conditions and in the crowded tenement areas. There has been no case of plague reported in the last five years among the people living on the two streets, Nueve de Octubre and Malecen Streets, Guayaquil, upon which are located the best type of buildings and where the wealthier people live.

In the mountain districts the Indians live in houses which have one room as the living quarters and often a second room in which they store their grain. Besides the family in the one living room, there are a varying number of unrestrained guinea pigs, often 20 or more. There is a law prohibiting the raising of guinea pigs in houses, but is it not observed or enforced. In certain districts in the mountains there is a frequent history of all the guinea pigs in a house dying either before or after the occurrence of human plague in the same house. There is little doubt that the close association between families and guinea pigs causes many cases of plague. The Indians will not give up their guinea pigs because the meat of this animal is greatly relished and is the chief food at their fiestas.

INDIAN DEATH CEREMONIES

The Indians of the Sierras have a custom which is undoubtedly responsible for causing many cases of plague among them and prevents the disease from dying out in this region as quickly as it does in the towns of the mountains. This is the "velorio," or death wake, held in the house of the deceased. The relatives and friends come from long distances to attend the death ceremony, which lasts from two to five days. They feast and drink, and lie about in the room of the deceased in a drunken stupor most of the time. They handle the body and clothing of the dead person, and later take it to the nearest town for burial. Many cases of plague have been traced to these velorios; in one instance seven of the participants developed the disease. When the Indians return to their homes they may carry not only the disease but infected fleas as well. There is a movement under way to induce the Indians to hold their death ceremonies in a special building for this purpose, and if this plan should be adopted it would tend to reduce other contagious diseases as well as plague.

CLIMATIC CONDITIONS

Official weather reports could be secured for only two cities in Ecuador, Quito, and Ambata, with which this report deals. Guayaquil has no weather bureau, but satisfactory temperature records for the past four years were obtained through the courtesy of Mr. Harold Clum, American consul, who has kept a record of the maximum and minimum daily temperatures during this time.

The tropical climate of Guayaquil is considerably moderated by the cold Humboldt current of the South Pacific. Table 4 gives the average mean temperatures for the past four years. There is little variation in the temperatures of the different months, as the mean high temperatures vary only from 79.9° to 85.1° F., and the mean low temperatures from 70.9° to 75.6 F°. The average mean temperatures ranged only from 75.4° to 80.1° F. The difference in the different mean temperatures for the same months in the four years was less than 1°. The hottest months are January, February, March, and April. These are the months of the rainy season, and consequently the humidity is also very high during this time. In fact, molds grow upon leather goods and other articles in houses of the best type of construction because of the excessive dampness of the rainy season.

The dry season begins in May each year and lasts until the last week in December or the first of January, as a general rule. The humidity of the dry season is moderate, as the sky is overcast with clouds nearly all the time. The onset of the rainy season varies somewhat in the different years as does also the amount of rainfall. No official figures were obtainable regarding the amount of rainfall in Guayaquil, but the average is probably between 40 and 50 inches. The whole city is flooded with water nearly the entire four months of the rainy season of most years.

The rainfall of the rainy season of 1930 was exceptionally low and is believed to have prevented the typical findings of an average year. It is also believed that from the beginning of the rainy season, January 21, to the end of March, 1930, there was less than one-fourth of the usual rainfall. Furthermore, the mean temperature of the first half of January, 1930, was higher than usual by nearly 2½°.

The climate of the other lowland towns of Ecuador is very similar to that of Guayaquil, although as one proceeds along the Guayaquil & Quito Railroad toward the mountains there is an increase in both the amount of rainfall and the temperature. Duran has exactly the same climate as Guayaquil. At Yaguachi there is sufficient moisture to permit the successful raising of sugarcane. From Milagro to the high mountains the rainfall is much greater than at Guayaquil; in fact, at the towns of Barraganetal and Bucay there are rains throughout the year, with a high humidity and temperature. It is desired to emphasize the point here that neither of these two towns has been invaded by plague and that only one case of plague has been reported at the village of Naranjito, which is on the mountain side of Milagro.

Huigra is the first mountain village of any size. The climate is drier here than at Guayaquil. It has fairly warm days and cool nights.

In Table 5 are given the only reliable data that could be obtained of the climatic conditions in the mountain districts. However, it so happens that in the two places of Ambato and Quito we have in the case of the former a town that has been invaded by plague several times, while Quito, with an altitude about 1,000 feet higher than Ambato, has never had a case of plague. Therefore, the extreme limit at which plague is likely to occur in Ecuador is within the narrow zone of the difference between the climatic conditions of these two places. The topographic location of these two cities, Ambato in a narrow deep valley and Quito in a shallower wider valley, as well as the difference in altitude, is a climatic factor. They are only 91 miles apart, but Ambato has an average mean yearly temperature of about 57.5° F., while that of Quito is about 55.3° F. Both cities have considerable variation between their daily high and low temperatures, which is never less than 20° and in most months about 25° or more. During the month of November the daily variation of Ambato is often 35°, from freezing to over 70°. The most important difference in the temperatures of these two places as regards effect on plague is believed to be the mean high temperature. In the case of Ambato the mean high temperature is over 70° F. from October to June. When Ambato is invaded by plague the disease begins in February or March and dies out in June. Quito has only two months with a mean high temperature of 70° F. or higher.

The rainfall of Quito is considerably greater than that of Ambato; but if the relative humidities of the months of July, August, and September are indicative of those of the other months, Quito has a lower humidity than Ambato.

Altitude and temperature are not necessarily rigorously related, for both Riobamba and Latacunga are lower than Quito, yet they have colder climates. Riobamba is situated on the top of the plateau region and not in a valley. The rainfall of Riobamba is less than that of either Quito or Ambato. Guamote and Riobamba have very similar climates, although Guamote is about 1,000 feet higher than Riobamba.

ALTITUDE[2] AND PLAGUE

Guayaquil and the other coast towns are practically at sea level. Bucay, at which plague has never occurred, is in the foothills, with an elevation of 975 feet above sea level.

Huigra is the first mountain town that has been infected with plague. It has an altitude of 4,000 feet. Plague appeared in Huigra in 1909 and has occurred there several times since.

After leaving Huigra, the elevation mounts rapidly. The following is a list of the mountain communities with their elevations and notations regarding the presence of plague at each place:

Sibambe has an elevation of 5,825 feet. Plague first occurred here in 1916. There have been cases at different intervals since that time.

Alausi is 8,550 feet above sea level. Plague was first reported here in 1913 and has invaded the town in four different years since 1913. Plague has also appeared in a number of isolated Indian villages and haciendas near Alausi.

Tixan has an elevation of 9,230 feet. Plague was present here in 1916. This is a very small village.

Guamote is a village approximately 10,000 feet above sea level. One case of plague is said to have occurred there in 1918, but there have been no other cases since then. However, the isolated Indian villages and haciendas near Guamote have suffered from plague a number of times. There were cases on the haciendas near Guamote in 1929.

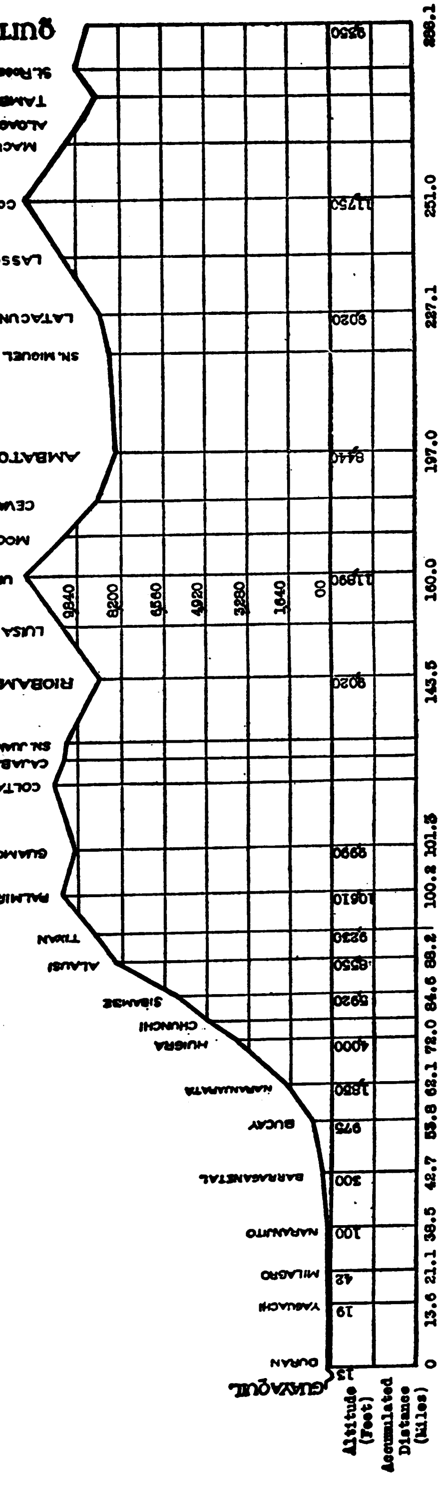
Riobamba, with an elevation of 9,020 feet, has been invaded by plague only once, and that in November, 1929. This was a family outbreak originating in an old lady brought, while sick, from Pungala to her daughter's house in Riobamba. Ten relatives living in the same house or who came in from the outside to wait on her were taken sick with plague. No other cases occurred in Riobamba. The city has a population of about 50,000.

Ambato is only 8,440 feet above sea level. Plague was first reported here in 1916, or three years later than at Alausi. The disease has reoccurred at practically 3-year intervals ever since 1916. In 1926 there were 101 cases of plague in Ambato from February to June. Ambato has a population of about 10,000. The first cases of each epidemic have occurred in houses adjacent to the railroad yard and station.

Latacunga, elevation 9,020 feet, has never been invaded by plague, but the near-by village of Guaytacama, about 500 feet higher than Latacunga, had 53 cases of plague in 1926. The infection was introduced into this village by two individuals who came from Ambato

[2] The altitudes given here are those of the stations of the Guayaquil & Quito Railroad.

PROFILE OF THE GUAYAQUIL & QUITO RY.



Altitudes of stations along the Guayaquil & Quito Railroad while sick or in the incubation period. No cases have been reported in Guaytacama since 1926.

Quito, with an elevation of 9,350 feet, and the terminus of the Guayaquil & Quito Railroad, has never had a case of plague. It is a city of about 100,000 inhabitants.

CHARACTER OF PLAGUE EPIDEMICS IN MOUNTAIN COMMUNITIES

In Alausi and Ambato, in the years when plague is present, the first cases appear in February or March and the last in May or June. In all the towns on the railroad in the sierras the same seasonal prevalence is observed, but the cases in the small Indian villages or caserios and on the haciendas have a much wider seasonal variation than in the towns. In fact it is believed that cases occur in the isolated settlements throughout the year. They are known to have occurred from October to June. The actual number of cases in the small Indian communities is problematical, because the Indians rarely report illnesses, nor do they care for the services of regular physicians. It is only when several cases appear and the inhabitants become frightened that they voluntarily report cases. When burial certificates are applied for, information of a suspicious nature results in an investigation, and plague is often discovered as the cause of death or other cases are found. In the mountain towns plague has a very limited existence, while in the villages and haciendas the disease persists much longer, although not, as a general rule, in the same place, but in the near-by communities. Transmission in the places where the disease persists the longest is rather direct from man to man, as in the small epidemic reported at Riobamba and at Guaytacama, and not through an intermediary host, as the rat.

SPECIES OF RATS FOUND IN DIFFERENT SECTIONS OF ECUADOR

In Guayaquil under normal conditions 75 to 80 per cent of the rats trapped are *Rattus norvegicus*, 15 to 20 per cent *Rattus rattus*, and 5 to 10 per cent *Rattus alexandrinus*. It is realized that the last two species are practically one and that they readily interbreed, with the result that families of young rats can be classified under both headings, and sometimes it is difficult to say whether a particular rat is *rattus* or *alexandrinus*. Hereafter in this report the term *R. rattus* will include both unless *R. alexandrinus* is specifically mentioned.

In the towns of the Sierras *Rattus alexandrinus* is the predominating species, although *Rattus rattus* is nearly as common; but *Rattus norvegicus* is greatly reduced in numbers. In Table 6 are outlined the results of the monthly rat catch at the towns of Ambato and Latacunga. At Ambato from March to December the *norvegicus* rats varied from 38 to 15 per cent, with a total average of 27.7 per cent. At Latacunga, which is about 600 feet higher in altitude and has a colder climate, there were two months when no *R. norvegicus* were caught, and the greatest percentage in any month of the 11 tabulated was 19 per cent. The average for the 11 months was 6.4 per cent *norvegicus*.

The relationship of the species of rats to the occurrence of plague is not clear. One might say that the reason plague has never invaded Latacunga was because of the small percentage of Norway rats found there, but this is not believed to be the correct interpretation. In Ambato, plague is most prevalent from February to June, the months with the greatest percentage of *norvegicus*, and the same is true at Guayaquil; but the increased percentage of *norvegicus* in the months of greatest plague incidence does not necessarily mean that these rats are responsible for the disease. It has been shown that in Guayaquil prior to 1916 the peak of the yearly epidemics occurred in the dry season before the rains increased the percentage of *norvegicus* in buildings.

There is a reddish brown wild rat in Ecuador which, in so far as is known, does not invade buildings. Several of these rats have been searched for fleas, but none could be found on them. At Guamote, three rats caught on an hacienda were unusual in type in that they had the body shape and size of *alexandrinus*, but the dark red coloring of the wild rat, and were evidently a hybrid produced by the mixture of these two rats. No fleas were found on them.

FLEAS FOUND IN ECUADOR, THEIR DISTRIBUTION AND RELATIONSHIP TO PLAGUE

Only three fleas have been encountered during the survey in Guayaquil, *Xenopsylla cheopis*, *Pulex irritans*, and *Ctenocephalus felis*. In the mountainous districts the following fleas were encountered: *Xenopsylla cheopis*, *Pulex irritans*, *Leptopsylla musculi*, *Ceratophyllus londinensis*, *Ctenocephalus canis*, *Hectopsylla suarez*, and *Rhopalopsyllus cavicola*. In Tables 7, 8, 9, and 10 is outlined most of the information obtained regarding the fleas found on rats and mice.

XENOPSYLLA CHEOPIS

As *X. cheopis* is the only rodent flea found on rats and mice in Guayaquil, and *C. felis* was only found at the rate of one per 150 rats and *P. irritans* seven times in over 4,000 rats, there can be no doubt as to the flea which transmits plague from rodents to man in Guayaquil. During the period covered by this report, the *cheopis* index was always in excess of that considered necessary for the continued transmission of plague. There are no accurate figures of the number of *cheopis* found per rat for the other months, but it is known that the tropical rat flea is found in large numbers throughout the year in Guayaquil. A more detailed discussion of *cheopis* will be found later in this report.

Although little information has been obtained regarding the fleas found on rats in other coast towns of Ecuador, there is no doubt that the rodent flea infesting these rats is *cheopis;* but it is believed to be present in much smaller numbers than found on the rats in Guayaquil. Thirty rats were sent to the laboratory in Guayaquil from Duran in November and December. These rats had an index of 3.2. The only flea found on them was *cheopis.* The index in Guayaquil during the same months was 8 and 7.59, respectively. The same findings apply to Huigra which has an elevation of 4,000 feet. Of 19 fleas taken from 9 *alexandrinus* caught in Huigra and sent to the Guayaquil laboratory for classification in January, 1930, all were found to be *cheopis.*

An interesting finding regarding the presence of *cheopis* on guinea pigs from Huigra and from near-by haciendas was discovered during the months of January, February, and March, 1930. Of the fleas collected from 16 live guinea pigs in this area, 25 were *cheopis,* giving an index of about 1.5. This condition was not found in any other region and the only other place where *cheopis* was encountered on guinea pigs was at Alausi, and then only two were found on a much larger number of guinea pigs. Many guinea pigs sent to the Guayaquil laboratory from near-by haciendas have been searched for fleas without finding any species of fleas on them.

The data incorporated in Tables 7, 8, 9, and 10 were obtained chiefly from the records of the director of health at Quito. Some additional information obtained by personal observation has been included in these tables. Doctor Wandemberg, bacteriologist in charge of the Quito laboratory, is to be thanked for forwarding a large number of fleas from different sources to the laboratory in Guayaquil. The number of *cheopis* per rat as given in the tables is known to be excessive, except for those reported in Quito, and is due to the fact that when no fleas are found on rats no report is made to the laboratory in Quito, where all fleas are classified. Fleas are rarely found on rats in Ambato during the months of August, September, October, and November; yet the tables indicate a fairly high index during these months.

Although the *cheopis* index of rats in the higher altitudes is generally low, rats are sometimes found to be infested with large numbers of this species. For instance, 22 of these fleas have been found on one rat at Ambato, and in March, 1930, 22 were recovered from two Norway rats at Quito and 16 from one at Latacunga. These last two findings have not been incorporated in the tables. The finding of *cheopis* on rats in Quito in March is very unusual, in fact these were the first to be found in three years. It appears very probable that these rats were imported from the lowlands.

During the four months from December, 1929, to March, 1930, the following personal observations were made of *cheopis* infestation of rodents in the high Sierras:

Alausi, altitude 8,550 feet: 19 rats, 11 *X. cheopis;* 13 mice, 1 *X. cheopis.*
Ambato, altitude 8,440 feet: 17 rats, 4 *X. cheopis;* 49 mice, 1 *X. cheopis.*
Latacunga, altitude 9,020 feet: 10 rats, 16 *X. cheopis.*
Quito, altitude 9,350 feet: 82 rats, 40 *X. cheopis.*
Guamote, altitude 9,990 feet: 3 rats, no *X. cheopis.*
Riobamba, altitude 9,020 feet: 11 rats, no *X. cheopis.*

In the data presented from the mountain section of Ecuador we have the extreme limits of climate at which *Xenopsylla* may reproduce or exist at all. In Table 8 it can be seen that not a single *cheopis* has been recovered from 129 rats from three places which have climates only slightly colder than that of Quito. The fact that *cheopis* has never been found in Riobamba clearly indicates that this flea can not exist here, because the chances of importing it are greater than in most other towns, as the trains from Guayquil lay over here at night. In Quito, *cheopis* manages to exist and possibly reproduces to a slight extent in certain months, while at Ambato and Alausi there is little doubt that this flea reproduces during part of the year at least. The presence of plague epidemics in Alausi and Ambato during the months when the *cheopis* index is the highest substantiates the claim that this flea must reproduce here in sufficient numbers, as indicated in the tables, to transmit rodent plague; while the noninvasion of Quito shows that *cheopis* is not present in sufficient numbers to produce a rodent epidemic. There is only about 2° difference between the mean temperatures of Ambato and Quito. It is probable that the mean temperatures play little part in determining the survival and reproduction of *cheopis;* and if the mean high temperatures did not reach 70° this flea would not be found in either place. It is during and following the months when the mean high temperatures are 70° or higher that *cheopis* is found most prevalent in both places. At Ambato, plague disappears in June and the *cheopis* index begins to fall. In June the mean high temperature is under 70° and continues under this point until October; but the mean temperatures are as high as those of Quito during the same months. In Quito the *cheopis* index reaches its highest mark during September and October, while the mean high temperature exceeds 70° F. only during the months of August and September. The mean low temperatures in Quito during these months are slightly lower than those of Ambato during the months when the *cheopis* index is falling. It is conceivable that the high day temperatures heat up the harboring places of the rats, and when the nests are in certain locations or materials the low night temperatures do not cool them below the point at which the eggs and larva of *cheopis* may mature.

Both Ambato and Alausi have suffered severely from plague. The disease first appeared at Alausi in 1913 and at Ambato in 1916. In 1916 there were 167 cases of plague reported at Alausi, the greatest number ever reported in any mountain town in Ecuador. This was also the year of the greatest epidemic of plague in Guayaquil, following 1909. The disease no doubt spread to Ambato from Alausi, or both places were infected indirectly from Guayaquil. The plague season of both places corresponds, and it is at the time when *cheopis* is most prevalent on rats. When the epidemics of Alausi and Ambato occur the *cheopis* index of Quito is very low; in fact none of these fleas have ever been found on rats at Quito during the months of April and May.

X. cheopis is also found on mice at Alausi and Ambato, but has never been found on them at Quito. The average *cheopis* index of *Mus musculus* at Ambato is nearly as great as at Guayaquil. The finding of *cheopis* on mice is possibly an indication that these fleas reproduce in a community.

The gradual invasion of plague to the mountain towns probably parallels more or less the advent of *cheopis*. The Guayaquil & Quito Railroad was not open to Quito until 1908; and in a climate antagonistic to this flea it must have taken several years for it to become established in sufficient numbers to transmit plague. The persistence of *cheopis* at Ambato, Alausi, and Quito probably depends upon the more or less continuous introduction of these fleas on rats from Huigra and lowland towns. Upon questioning employees discharging freight cars it was learned that rats were frequently encountered in the cars, particularly those loaded with rice and sugar from the coast towns.

Plague appears at Alausi and Ambato in February or March, or following the onset of the rainy season. Rats no doubt seek shelter in railroad cars as well as in buildings to escape from the floods caused by the heavy rains in the coast district, and are then delivered in large numbers to the mountain towns.

In conclusion it may be said that *Xenopsylla cheopis* is the chief transmitting agent for plague in Guayaquil and other coast towns, in Huigra, Alausi, and Ambato.

CERATOPHYLLUS LONDINENSIS

Ceratophyllus londinensis was found on both rats and mice at altitudes of over 8,000 feet. It was not found on rats caught at Huigra, altitude 4,000 feet. It was the only flea found on rats and mice at Riobamba, but the infestation of rodents was very slight here. The index of *C. londinensis* was greater at Ambato than in any other place in the Sierras, but averaged only about two per rat. Rats caught at Alausi were only slightly infested with this flea. From the low degree of infestation of rodents and the distribution of *Ceratophyllus londinensis* there is little reason to believe that it plays any part in the transmission of plague or if it does it is a very minor agent.

LEPTOPSYLLA

With the exception of Huigra and Riobamba *Leptopsylla* were found on rats and mice in all the mountain towns. The mice had a greater degree of infestation than the rats. It is the most common rodent flea of Guamote and Quito, places at which plague has never occurred to any extent. *Leptopsylla* is less commonly encountered at Ambato than in towns that have little or no plague. It is not probable that *Leptopsylla* are involved in the transmission of plague.

RHOPALOPSYLLUS CAVICOLA

Rhopalopsyllus cavicola is a flea found in South America as far south as Argentina. Its host in Ecuador is the guinea pig. It is found to some extent on tame rabbits and on rats and mice, but only occasionally, as is noted in the following observations made during December, 1929, and the first two months of 1930:

Guamote: 3 rats, 1 *R. cavicola.*
Quito: 62 rats, 2 *R. cavicola.*
Ambato: 14 rats, 1 *R. cavicola;* 170 mice, 2 *R. cavicola.*
Riobamba: 1 rat, 1 *R. cavicola;* 5 mice, 8 *R. cavicola.*
Latacunga: 7 rats, 2 *R. cavicola.*

This flea is found in great numbers on guinea pigs throughout the mountainous region of Ecuador. It was found at Huigra, 4,000 feet above sea level, and at Guamote, approximately 10,000 feet in altitude. Guinea pigs reared in houses are very heavily infested, while those taken from out-door pens were found to be free from fleas in several instances.

Throughout this study of plague in Ecuador the possibility that *R. cavicola* might transmit plague has been constantly kept in mind. The suggestive history of all the guinea pigs in a house dying of plague before or after human cases seemed to indicate that this flea transmitted plague between guinea pigs and to man. In most instances, if not all, in which guinea pigs died of plague, the localities were in the vicinity of Huigra, Alausi, and Ambato, or localities in which *cheopis* is found, as has already been mentioned. It is believed that plague would be much more prevalent in the mountain districts if *R. cavicola* were an active transmitter, because of the enormous number of this species liberated by the deaths of all the guinea pigs in a house. Furthermore, *R. cavicola* is found in large numbers at Latacunga and Quito, places that have not been invaded by plague. The raising of guinea pigs in houses is not confined to the small Indian villages and haciendas, but is also practiced in the towns where the plague epidemics appear to be regulated by the *cheopis* index, as at Alausi and Ambato.

The following experiments were carried out to determine whether or not *R. cavicola* could transmit plague from guinea pigs to man and rats or between guinea pigs.

(1) Six guinea pigs infested with *R. cavicola* were brought from Alausi to the laboratory in Guayaquil. Four of these died in less than 24 hours, however, leaving only two to work with. These two were inoculated with plague; and when they died, a single guinea pig, in a small wire cage, was placed close to one of them, and another guinea pig and two young rats near the other, to collect the fleas from the dead animals. Both dead guinea pigs were found to be macroscopically and microscopically positive for plague.

After waiting 9 days from the day of exposure, the two rats and one guinea pig were killed with cyanide and the other guinea pig after 11 days. The dead animals were searched carefully for fleas. No fleas were found on the two rats, and only one flea, *R. cavicola*, was found on the guinea pig exposed nine days before; but from the other guinea pig 40 *R. cavicola* were collected. None of these animals presented any evidence of plague infection; but in order to be certain that they were negative, other guinea pigs were inoculated with spleen emulsions. None of these latter animals became sick within 15 days.

Although the climatic conditions of Guayaquil are unfavorable for *R. cavicola*, the negative result obtained in the case of the guinea pig from which 40 of these fleas were collected is strong evidence that *R. cavicola* is not a very active transmitter of plague.

(2) Doctor Wandemberg, at Quito, in a climate suitable for *R. cavicola*, was able to keep these fleas alive in test tubes for only three and four days. He also made 25 attempts to induce the *R. cavicola* to bite man when placed on the forearm. Only one flea made any effort to withdraw blood, and this one did not succeed.

Until other evidence is produced contrary to the above experiments, the *R. cavicola* can not be considered an agent in the causation of human plague in Ecuador.

R. cavicola is not found on the guinea pigs or other animals in the coast region of Ecuador.

HECTOPSYLLA SUAREZ

Hectopsylla are somewhat peculiar in appearance, and are encountered most frequently on guinea pigs in the high altitudes of Ecuador. One of these fleas was found among a collection of rat fleas from

Quito. During four months *Hectopsylla* were encountered as follows: 33 from 14 guinea pigs at Guamote; 1 from guinea pigs at Riobamba; and 14 from guinea pigs at Nisac, a small Indian settlement near Alausi. Plague has been present several times at the latter place, but the others are practically immune to the disease—at least it has never been known to spread in them. *Hectopsylla* are not present in sufficient numbers on guinea pigs to be of any consequence in the causation of plague in the mountain districts nor are they found in localities where the disease is most prevalent.

CTENOCEPHALUS FELIS AND CANIS

C. felis and *canis* are found occasionally on rats. None has ever been found on mice. They are not present in sufficient numbers on rats to be implicated in the transmission of plague. The greatest number found on one rat was 30, and this was a very exceptional case. *R. rattus* was very seldom found infested with *C. felis*. The Indian Plague Commission was unable to transmit plague with these fleas, and there is no reason to believe that they play any part in the causation of plague in Ecuador.

PULEX IRRITANS

Pulex irritans is one of the pests of Ecuador. It is found everywhere, on the coast and in the high mountain districts. Every Indian blanket and the blanketlike poncho worn continuously by the mountain Indians is an ideal harboring place and hatchery for these fleas. In December, 1929, 45 *P. irritans* were taken from three Indian blankets, from different Indian houses, in about 15 minutes, and more could have been secured by further search.

This flea is rarely found on rats in Guayaquil. Only seven were found during this survey, and five of these were recovered after the onset of the rainy season. In the mountain districts it is found much more frequently on rats; 48 were found on 83 rats at Quito. It was never encountered on mice at Guayaquil, but four were found among the fleas collected from mice at Ambato. The records of the Department of Health of Quito show that it is very common on rats in the mountains.

P. irritans has not been encountered on guinea pigs as frequently as one would expect, considering that these animals are raised in the flea-infested Indian houses. Only eight were found among fleas taken from over a hundred guinea pigs.

A large number of fleas taken from the clothing of mountain Indians have been classified, but *P. irritans* was the only species found from these sources.

The Indian Plague Commission demonstrated that *P. irritans* was capable of transmitting plague between rats and guinea pigs, and other workers have found them able to transmit plague. Several different writers have reported that cases of human plague were probably produced by this species. By the process of elimination, one is compelled to believe that *P. irritans* is the chief transmitting factor in the causation of plague in the localities in Ecuador where no *X. cheopis* are found and it is probable that some of the cases in Guayaquil and other communities are produced by this flea.

There are a number of other reasons for believing that *P. irritans* is responsible for many cases of plague as outlined below:

(1) The large number of *P. irritans* found in Ecuador makes it very probable that some cases of plague are transmitted by these fleas, as they are known to have the power to transmit the disease.

(2) There is no doubt that "angina pestosa" is caused by the Indian habit of killing vermin with their teeth. Therefore either *P. irritans* or lice are the cause of this form of plague, as both are killed, when caught, by biting them.

(3) "Viruela pestosa," or vesicular plague, is a form that is probably caused by some other agent than the usual one, *X. cheopis*, or it would be found more frequently in other countries. In the small epidemic at Riobamba, in which 3 out of 11 cases were this type, the transmitting agent could not have been *cheopis*. *Pediculus corporis* are not found in Guayaquil where the vesicular type of plague occurs, nor in the mountains. The only other flea found in Guayaquil besides *P. irritans* is *C. felis*, which is probably not concerned in plague. We are therefore limited to *P. irritans* and *Pediculus capitis* as the possible transmitting agents of "viruela pestosa."

(4) The low death rate among the mountain Indians indicates that an unusual factor is involved in these cases. This point was well illustrated by the small Riobamba epidemic, when only 3 out of 11 cases died and one of these was a very old woman, while the other two were the unusual forms of plague. None of the five secondary bubonic patients died.

(5) The direct person to person transmission of plague among the mountain Indians points strongly to the human flea as being involved, although lice can not be ruled out on this score, because the Indians are infested with *Pediculus corporis* and *capitis* as well as *Pulex irritans*. That plague was transmitted from person to person in the small epidemic at Riobamba when the 11 cases followed exposure to the old woman brought sick from Pungala and in the epidemic at Guaytacama in 1926 following the arrival of two individuals from Ambato who were taken sick with the disease, can not be disputed. Furthermore, the part played by the Indian death ceremony, or velorio, in the causation of plague in districts in which *X. cheopis* is not found, indicates the same person to person contagiousness.

It might be argued that *cheopis* was carried by man from place to place, but it is improbable that one individual would carry enough *cheopis* to infect 10 others, or that two persons would carry a number sufficient to cause 53 secondary cases as reported above.

In this discussion we find that we are limited to either *Pulex irritans* or *Pediculus* as the transmitting agent in the causation of plague in localities in which *X. cheopis* is not found, and there is some evidence ruling out *Pediculus corporis;* therefore we have to choose between *Pediculus capitis* and *Pulex irritans.* The latter is known to be capable of transmitting plague, while the possibility that *Pediculus capitis* carries the disease is entirely problematical. There is experimental evidence showing that when lice have been fed on plague-infected individuals and their bodies ground up and injected into animals, plague may be produced; but this does not indicate that the louse can transmit plague under normal conditions. It is entirely possible that some cases of the anginal form of plague may be produced by crushing lice between the teeth as well as by killing fleas in the same manner. Until there is more evidence in favor of the louse it is believed that *P. irritans* should be considered the chief transmitter of plague in localities in which *X. cheopis* is not found, and that it also causes some of the cases in Guayaquil. It is not believed that *Pulex irritans* can keep the disease alive indefinitely, and if new cases were prevented from entering the zone in which *cheopis* is not found, this area would soon become free from the disease, although it seems to persist here longer than it does in the more crowded towns, like Ambato and Alausi, in which *X. cheopis* exists in considerable numbers only from February to June.

XENOPSYLLA CHEOPIS INDEX OF GUAYAQUIL

GENERAL CONSIDERATIONS

This study of the flea infestation of rodents at Guayaquil, Ecuador, began September 24, 1929, and ended March 31, 1930. During this time fleas were taken from 5,105 rats, as follows: 29,075 *X. cheopis,* 187 *Ctenocephalus felis,* and 7 *Pulex irritans.* During the same period, 841 *X. cheopis* were found on 3,733 of the species *Mus musculus. Xenopsylla cheopis* was the only rodent flea fround on either rats or mice.

In compiling the tables of this report and in formulating conclusions, the data obtained from 1,357 rats caught from September 24 to October 28 have not been included, because of the change in the method used to take the fleas from the rats on the latter date. The total *cheopis* index for this period was 2.75. During the entire period the same two persons did all the work connected with this study.

Whenever a cage contained more than four rats of the same size under one-half grown, the excess over four were discarded, thus limiting to a certain extent the number of very young rats, because more young rats are caught in cage traps than old and the inclusion of all would have completely overshadowed the data. Even when this means was taken to reduce the young rats, 57 per cent of *R. norvegicus* were less than one-half grown.

Tables 11 to 38 present data dealing with all phases of the *X. cheopis* index as determined by this study. The only table in which the findings for the last four days of October appear is Table 11, and here the results are tabulated under the month of November.

There is reason to believe that the data throughout this report are affected by the constant use of poison to kill rats and all interpretations must be made with this in mind.

The microscope was used throughout the work for the determination of species and sex of fleas. The lowest lens of the low power objective was removed, because the magnification was great enough without it and examination was made much more rapid.

When fleas were removed from rats they were placed in Petri dishes containing pure carbolic acid solution and allowed to clear until the next morning. The differentiation was made in the same Petri dishes.

The *cheopis* index was found to be quite variable, fluctuating greatly from day to day, depending on the nature of the place where the rats were caught, as well as their size, sex, and species; but the former condition affected the index the most. It can readily be understood that the index of a locality is likely to be very misleading unless rats are included in about equal numbers under the different conditions in which they live in the community.

This study has been greatly handicapped by lack of information regarding the number of *X. cheopis* in other years when poison was not in use. Furthermore, the rainy season was much shorter than usual and the rainfall was about one quarter of that of an average year, so that the effects of the longer and damper ordinary year were absent.

COLLECTING FLEAS

From September 24 until October 24 the method used for collecting fleas continued to be the same as had been in use for some time and which consisted in drowning the rats in glass jars and then searching the dead wet rat for fleas.

After observing this method for a month it was believed to be unsatisfactory, because too much reliance was placed on the eyesight of the searcher, especially when the rats had thick hairy coats nearly the same color as the fleas. In taking the rats from their cages they were seized by the throat and strangled, thus causing them to struggle violently, with the result that some of their fleas might be shaken off. Live fleas were frequently found on the dead wet rats, and some of them eluded the searcher, not only entailing the loss of the fleas, but also subjecting the workers to the possibility of being the hosts of plague-carrying fleas. It required much time properly to search a wet rat for fleas, and after three or four hours the searcher becomes tired and careless.

On October 24 the method of killing rats was changed by using cyanide, and the fleas were removed by combing with a fine-toothed comb. The number of fleas obtained by combing was slightly greater than by the old method, but combing was found to be even more time-consuming, and it required the greater part of the day to complete the search, so that the rats were not available for the morning autopsy and on account of the climate could not be kept until the next day. During the course of the day's work on October 27 it was discovered that, when it was thought that all fleas had been removed by combing, still more could be recovered by holding the rat by the tail and striking it with the blade of large dressing forceps. This observation was put into use thereafter and proved very satisfactory.

The method used for collecting fleas, upon which practically all the data in this report are based, was as follows:

The containers in which the rats were killed were 24 ordinary glass jars of 1 gallon capacity such as are used for displaying candy, drugs, and other articles in stores. They have so-called ground glass tops and wide mouths.

Hydrocyanic acid gas was used to kill the rats. It was generated in ordinary flat 4-ounce ointment tins, in the covers of which five or six holes had been punched with a small nail. It was uncertain at first whether the ordinary ointment tin would withstand the action of the acid long enough to be practicable. They were found to be entirely satisfactory as they did not have to be renewed oftener than once every two or three months. If the tops are not removed daily they will be sealed by the action of the acid, so that they can not be taken off without injury to the tin.

Both sodium and potassium cyanide were used for generating the hydrocyanic acid gas. Two or three large lumps of cyanide will last two or three weeks without renewing. Pure commercial hydrochloric acid was found more satisfactory than when diluted with water, because there was practically no solution left in the tin when the pure acid was used. Each morning a few drops of commercial hydrochloric acid was placed on the chemicals in the tins and quickly covered and returned to the jars. An ordinary medicine dropper was used for handling the acid. The jars could be charged with the poison gas two or three hours before being used, and they never had to be recharged the same day. The same jar was frequently used two or three times in a day to kill rats.

The cyanide was used in a small screened room open on two sides. It can be used safely in any well-ventilated room, but of course not in a closed space. There is absolutely no danger to those using this method if ordinary precautions are taken necessary for handling hydrocyanic acid. Masks are not necessary. One must work quickly when placing acid on the chemicals, not only to avoid breathing the generating gas, but also in order to return the ointment tins to the glass jars before the gas escapes. The most uneducated laboratory worker will soon learn a proper respect for and the procedure necessary in safely handling hydrocyanic acid gas when he sees the effect it produces upon rats placed in the jars.

Rats were brought to the laboratory in the traps in which they were caught. No covering was used to prevent the escape of fleas. As most mornings were cloudy, little protection from the sun was needed.

When the trappers arrived with the rats they gave the information that was necessary for the survey. This consisted of the street address, the number of the city block, and the nature of the place where the rat was caught. For the latter purpose a large wall map with each city block numbered was referred to. The tag with the above information was placed under the first empty jar in the series and then the rats were removed from their cages. They were seized by the loose skin on their backs with 12 and 14 inch heavy dressing forceps and placed in the glass jars. Most of the rats could be taken in this way with very little struggling. When the cages contained different sizes and sexes of rats, they were separated in the jars. Rats less than one-half grown were not separated according to sex. Adult rats were usually placed in separate jars even when of the same sex.

After the rats had been transferred to the glass jars, cards were completed for each jar, on which was recorded the information already given, to which was added the date, size, sex, and species of the rats.

When large rats are first placed in the jars it is necessary to hold the tops down or they are likely to be knocked off by the convulsions caused by hydrocyanic acid. The action of the gas is so rapid that most rats are dead in about 30 seconds. When the same jar has been used two or three times or three or four rats are treated in one jar, the concentration of the gas is lowered so that it may then be several minutes before the rats finally expire.

Fleas are killed more quickly and by a lower concentration of gas than are rats. In fact, during the course of this work, rats that were placed in jars containing small percentages of hydrocyanic acid have been removed when unconscious but still alive, their dead fleas and lice were removed, and then the rats allowed completely to recover from the effects of the cyanide. When the amount of gas in the jars becomes low, some of the fleas are found loose from the rats. It is necessary to inspect each jar for fleas after removing the rats. Ordinarily no fleas get separated from the rats, and many times not a single loose flea was found during the course of a day's work.

After the cards have been completed for the rats on hand, the rats are taken from the jars and the fleas removed. The first step consists in seizing the rat at the root of its tail with the long dressing forceps and holding it over a large white enamel bowl, 18 inches in diameter at the top and 8 inches deep, with sloping sides. To remove the fleas the rat is struck downward glancing blows with a blade of the same kind of forceps used in handling them. The rat is supported to a certain extent against the sloping sides of the bowl while being struck, scraped, and "combed" with the blade of the dressing forceps. Sometimes the first few blows produce no apparent results, but they loosen up the fleas, which will soon begin to fall like corn being knocked off the cob. Precaution must be taken not to crush more fleas than necessary. It is surprising how few fleas are injured by this rough treatment; at least this applies to the experience in Guayaquil. Very rarely are the fleas so crushed that their sex and species can not be determined. When cut in two parts, usually both halves can be found. When rats are heavily infested, the fleas can be knocked off faster than an assistant can remove them from the pan.

After all fleas are believed to have been knocked off the rat is turned over to the assistant to be combed and the dirt and hair to be removed from the bowl by rubbing it with a wadded piece of newspaper.

Combing the rat has been greatly facilitated by putting it through the above process, especially the shedding *norvegicus* and the long-haired *rattus*, because a large amount of the hair is knocked off as well as the fleas. Very few fleas are found by combing, but a sufficient number are recovered to warrant continuing this procedure.

Removing fleas by the method just outlined is much more rapid than the two processes first used. From 30 to 45 rats can be received, killed, ticketed, and their fleas secured in two to two and a half hours by two workers. In the case of two young rats that harbored 256 *X. cheopis*, all the fleas were secured in about 10 minutes. When rats have few fleas the work is much more rapid.

The following table gives a comparison of the results obtained by the three methods described. The figures given in the table are for nine consecutive days, three for each method. The rats were caught in the central section of the city.

Method	Number of rats	X. cheopis				
		Number	Males	Females	Index	Per cent females
Drowned and searched	274	606	340	266	2.21	44
Killed with cyanide and combed	114	393	185	208	3.44	53
Combined scraping and combing	154	1,082	624	458	7.02	42

It will be seen in the above table that the *X. cheopis* index was more than doubled when the procedure of knocking the fleas off the rats was adopted. The large percentage of females found by combing was no doubt due to the fact that the female is much larger than the male and consequently relatively fewer males were found when the rats were only combed. Unless conditions are abnormal for *X. cheopis* in a locality where fleas are obtained, any method which gives a larger number of females than males should be investigated to determine whether all the fleas are being removed.

On account of the great variation in the results of the three methods used to remove fleas from rats, only the figures obtained since the adoption of the last process are given in this report.

SIZE, SEX, AND SPECIES

Little discussion is required to supplement the information contained in the tables regarding the *cheopis* index as found for rats of different sizes, sex, and species.

Adult males of both *R. norvegicus* and *R. rattus* have a slightly higher index than the females. At the beginning of the investigation *norvegicus* males had a slightly greater index than the females, but during the last three months the female index was slightly greater. It is curious to note that the total *cheopis* male index is exactly the same for adult Norway males and females. The greatest variation between the sexes occurred in the group of young *norvegicus* one-half to two-thirds grown. Here the male averaged nearly one more flea per rat. Rats over two-thirds grown are considered as adults in this report.

In Tables 15 and 19 are tabulated the indices for rats according to size. Among the *norvegicus* the rats one-half to two-thirds grown had the greatest index and adults the least. These figures do not hold good for *R. rattus*, the adults of which were found to harbor the greatest number of *cheopis*.

In Table 22 an analysis has been made of the flea infestation of rats less than one-half grown caught during the months of November and December. It will be seen in this table that the smallest rats or those that still harbor in the vicinity of the nesting place where they were born have the greatest flea infestation in the case of both *norvegicus* and *rattus*. As the rats increase in age, the flea index gradually decreases until the half-grown stage is reached, when the index increases again. At least this is true for *norvegicus*.

In Table 20 is outlined a comparison of the findings for *rattus* and *alexandrinus*. As one would expect, there is little difference in the flea infestation of these rats.

It will be seen in Table 21 that *rattus* averaged over one flea more per rat than *norvegicus*. The following data taken from the records of this survey prove that *rattus* harbors a greater number of *cheopis* than does *norvegicus*.

(1) In 100 blocks in which both *norvegicus* and *rattus* were caught, 865 *norvegicus* had an index of 4.82 and 261 *rattus* an index of 6.49, or an average of nearly two fleas greater per rat.

(2) There were 62 premises where both species were caught, with the result that 331 *norvegicus* had an index of 4.13 and 113 *rattus* an ndex of 5.82, or again a variation of nearly two *cheopis* per rat.

INDEX OF DIFFERENT ESTABLISHMENTS

In Table 23 will be found a list of some of the establishments in which rats were caught and the relative *cheopis* index for each. The figures given in this table are not as valuable as those for many other localities, because all classes of businesses occupy only the first floor of buildings, the upper floors being living quarters, and rats have a more or less free run of the solidly built blocks because of the tropical Spanish construction of the buildings. It appears that several classes of establishments have as great flea infestation of their rats as places where rice and other grains are sold or even greater. It should be noted that the rats caught in the open, as on wharves and in lumber yards and coal yards, have a *cheopis* index of one-half or lower. There are no storage warehouses on the wharves of Guayaquil.

ZONE INFESTATION

It is rather difficult to divide most cities into definite zones, and in Guayaquil it is an impossibility, because there is hardly a block in Guayaquil that does not have several places where foods or other kinds of stores are sold. Shacks and buildings of the best class of construction are often found side by side.

In Tables 24, 25, and 26 are given the findings for the best zoning possible in Guayaquil. Table 24 gives the data obtained for a composite area of 15 blocks made up of old wooden buildings the ground floors of which are occupied by stores selling and storing rice and other grains and food products. The *cheopis* index of this section, 10.23, is approximately one-third greater than the area of general business houses and better residential sections, and over twice as great as that of blocks composed chiefly of shacks. The index of the better residential section, 7.33, is about one-third greater than that of the poorer section of the city.

Another thing that arrests the attention in looking over the tables is the number of rats caught per block in the different sections. This figure for the different areas was 33 per block in the grain section, 20 per block in the general business section, and only 4.7 per block in the poor area. These figures seem to indicate that the *cheopis* index varies nearly in proportion to the degree of rat infestation.

VARIATION OF THE X. CHEOPIS INDEX IN DWELLINGS

In December an inspection was made of the buildings in the central part of Guayaquil to determine, if possible, the cause of the great variation in the number of *cheopis* found on rats caught in neighboring houses and blocks. After looking the situation over it was decided that the type of building in which the rats were harboring might affect the *cheopis* index, and the survey was completed along this line, as follows, dividing the buildings into four groups, A, B, C, and D:

A. Modern cement constructed buildings.

B. Relatively new or remodeled wooden buildings.

C. Old wooden buildings in which people lived in the congested tenementlike manner.

D. Shacks that were largely constructed with bamboo sides and were generally in need of repairs. The chief harboring place for rats in these structures was under their raised floors.

Not enough rats had been caught in Class A buildings to draw any conclusions regarding their flea infestation, but on the other hand this finding showed the relative freedom of cement buildings from rats.

The *cheopis* index as determined for the other structures was as follows:

Class B, 45 buildings, 173 rats, index 7.37.

Class C, 62 buildings, 171 rats, index 8.79.

Class D, 71 buildings, 172 rats, index 5.24.

It is apparent from the above data that buildings offering the greatest rat harborage within them have the highest *cheopis* index. The index is excessive in both types of wooden buildings, so that the fact that plague is most prevalent in Class C buildings must be due to the congested unhygienic conditions under which they are occupied.

Following the above survey on the 1st of January a record was kept of whether rats were caught in huts or in the better constructed buildings, and also whether they were caught on the ground floors or upper floors of the better type buildings. At that time it was not known what difference would be found in the flea infestation of rats caught on the lower and upper floors of dwelling houses. It was believed that more rats invading houses from outside harboring places and from underneath the lower floors would be caught on the ground floors than on the upper floors, or that the flea infestation of rats caught on the lower floor would be comparable to that found in the 1-story huts. The results obtained, as will be seen in the following discussion, more than repaid the trouble necessary to secure this information. It should be realized that some of the rats caught on the ground floors have their harboring places in the upper floors and that in certain instances the same type of harboring place will be found on the ground floors of houses and in the shacks as are present in the upper stories of buildings. Some of the rats caught on upper floors come from the ground floors and also from outside harboring places.

THE EFFECT OF THE LOCALITY IN WHICH RATS ARE CAUGHT ON THE TOTAL INDEX

It has previously been mentioned that the chief factor affecting the *cheopis* index of a community is the location in which the rats are caught. As we have better information on this point in the case of rats caught in dwelling houses than any other place, the index of these rats is used in proving this point. In Table 27 is tabulated the percentage of the total number of rats caught each month in houses, the total *cheopis* index, and the index for dwellings. It can readily be seen that the total monthly index has been increased or lowered, as the case may be, by the rats caught in houses, as these compose over 50 per cent of the rat catch each month but the first.

For instance, if we take the month of March, which has the low total index of 5.97, and analyze it we find that 56 per cent of the rats caught that month come from dwelling houses and had an index of only 5.02, while the index of the smaller per cent of rats from all other locations was in reality 7.15, so that the total index has been overshadowed by that of the rats from dwellings. Referring to Table 28, we find that only 20 per cent of the Norway rats were caught on the upper floors of buildings, and that they had the high index of 9.76, while 80 per cent of the rats in dwellings came from ground floors and shacks. These rats had an index only slightly over 3, thus causing the low total index of the rats from houses. In other words, the low total index of the month of March depends chiefly on the fact that most of the rats caught then came from ground floors and shacks.

Cheopis index of rats caught on upper floors of dwellings.—It is regretted that information was not obtained regarding the *cheopis* infestation of rats caught on the upper floors of houses throughout the period of this survey. However, the information available, covering the months of January, February, and March, is the most valuable, because it is during these months that the total *cheopis* index fluctuates the most. In Table 11 the total index for the months named above was 4.73, 7.02, and 5.97, respectively; while during the same period the number of *cheopis* found on rats caught above the ground floors of houses varied hardly any in the case of *norvegicus* during January and February, although there was an increase in the index in March. It seems that the conditions responsible for the variation in the three months under consideration did not affect the rats on the upper floors of buildings to any extent, or that the conditions under which *cheopis* lives and multiplies on the upper floors of buildings was not subject to the changes prevailing in other locations.

Cheopis index of rats living under and outside of buildings.—In all, 81 rats were caught in places outside of buildings, such as gardens, wharves, lumber yards, etc., and found to have a total *cheopis* index of only 0.28. Many of these rats were caught during the months when the total index was at its highest level. Furthermore, an inspection was made of a saloon, a hospital, and a hotel in which 153 rats were caught and found to have the low indices of 0.76, 1.80, and 1.31, respectively. Most of these rats were caught during November and December, when the general index was high. The inspection showed that most of the rats obtained from the above sources were invaders from outside the building. In the case of the saloon, there was only one rat run which led underneath the building next to it. The saloon had a concrete floor. The hospital was a modern concrete building with practically no inside harborage, and the hotel had a concrete floor. Rats were invading the kitchen of the hotel from outside sources.

Referring to Tables 28 to 32 we find that both *norvegicus* and *rattus* caught on the ground floors of buildings and in the 1-story shacks have a very low *cheopis* index as compared with rats caught in most other situations except those known to be harboring out of doors. The shacks have little inside harborage, as a rule, and there is no doubt that rats caught on the first floors are invaders from outside in many instances. It should be mentioned that although all the stores and other establishments in Guayaquil occupy the first floor of buildings, the conditions in them are not comparable to houses, because of the harborage places offered by their contents. In Table 31 it can be seen that from 20 to 46 per cent of the rats caught on ground floors and in shacks during the different months were found free from *cheopis*, and that 70 per cent caught on ground floors had four fleas or less, while 72 per cent from shacks fall under the same class. If the rats with good harboring places inside the buildings could be ruled out of these statistics, it would undoubtedly be found that those invading the buildings from outside would have a *cheopis* index of less than one.

The data just given seem clearly to indicate that rats, both *norvegicus* and *rattus*, living outside of buildings have a very low *cheopis* index—too low for the continued transmission of plague—and substantiates the claim that the house-dwelling rat is the reservoir for plague and that these rats have probably developed a greater immunity to the disease because of their constant association with it than the outside rats. Consequently, when these animals are forced to seek shelter from the floods of the rainy season the disease spreads rapidly among them and from them to man, and thus we find that human plague reaches it highest point with the onset of the rainy season in January and February.

It should be pointed out here that the harboring places of *norvegicus* are not confined to the lower floors, basements, sewers, and other places as is frequently stated. The number of this species caught on upper floors and their flea index shows that they dwell in the upper floors of houses as well as below ground and out of doors.

If the theory advanced above is correct, then one can say that the value of the rat proofing of buildings not only depends on the fact that it prevents inside harborage, but also that rats which may invade this type of building in seach of food will be unlikely to carry plague because of the few fleas with which they are infested.

RELATIONSHIP OF X. CHEOPIS INDEX TO THE DEGREE OF RAT INFESTATION

In general, it can truly be said that the *cheopis* index will vary in accordance with the number of rats infesting a city block or building, and that the number of rats will be proportional to the rat harborage and food supply, conditions usually best provided in grain warehouses and other places where food is stored. Evidence in support of the above statement has already been introduced in this report, and here a short reference will be made to certain findings which show that the number of fleas is not always proportional to the number of rats caught, as indicated by the following data for three different types of establishments:

Hotel A: 51 rats trapped, index 13.75.
Hotel B: 58 rats trapped, index 0.76.
Saloon A: 26 rats trapped, index 23.38.
Saloon B: 37 rats trapped, index 1.80.
Hospital A: 21 rats trapped, index 6.33.
Hospital B: 48 rats trapped, index 1.31.

The number of rats trapped as given above does not mean the total number caught with snap and cage traps, but only those brought to the laboratory alive for the determination of their fleas. It has already been explained that the rats caught in the B institutions were invaders and that these buildings had practically no inside harborage. In the case of the A buildings we have old wooden structures with innumerable hiding and nesting places in them and there is little doubt that the trapped rats resided inside these buildings. We may therefore say that the *cheopis* index will be proportional to the number of rats when they are harboring inside buildings which offer suitable places for flea reproduction.

RELATIONSHIP OF INDEX TO CLIMATIC CONDITIONS

The temperature is favorable for the reproduction of *cheopis* throughout the year. Hirst states that the most favorable range of temperature is between 70° and 80° F., with an optimum at about 75° F. The mean temperature of Guayaquil falls within these figures and only exceeds them by a fraction of 1° during March and April, as shown in Table 4. In Table 33 will be found figures giving the *cheopis* index and all available climatic conditions at bimonthly intervals during this study. It can be seen in this table that the first half of January was hotter than usual by about 2° and that the rainy season began late in January, and after February 26 the rainfall was slight. The short rainy season and light rainfall are not believed to have affected the *cheopis* index to the extent that occurs in an average year. The use of poison has also influenced the findings, due to climatic conditions.

In every table of this report, with the exception of the tables for rats caught on the upper floors of houses, there was a depression in the *cheopis* index for January which was followed by a marked rise in February. Table 33 shows that the first half of January was very hot, with a mean temperature of 82.1° F., and that with the onset of rain in the second half the temperature fell. The rains of January were light, and heavy rains did not begin until the first of February, to continue until February 26. It therefore appears that the heat of January caused the fleas to leave their hosts, affecting both male and female *cheopis;* but these fleas continued to live apart from the rats until the dampness caused by the heavy rains forced them to return to their hosts, thus producing the rise noted in the index in February. During the rains of February, more *C. felis* and *P. irritans* were found on rats, indicating that fleas will more readily attach themselves to any host when forced to do so by dampness. This may be a factor in the causation of plague during the rainy months, as *cheopis* may more readily attach itself to man at such a time.

It is evident that when rats have harboring places which protect them from outside weather conditions, as is noted in the findings for rats caught on the second floors of houses, the *cheopis* index will not be greatly affected, as found in the above situation.

From the tables reporting the findings during January, February, and March for the rats caught in the buildings affording poor weather protection, it appears that there was a marked reduction in the *cheopis* index of rats infesting these buildings during the months mentioned. In Table 26 it may be seen that the index fell from 6 to 4 in January; and instead of the rise noted in February in the other tables, there was a further fall in this month and a still greater reduction in March. There is little doubt that if the rainy season had been as long and severe during the time of this investigation as usual the reduction in the number of *cheopis* on the rats in the poorly constructed section of the city would have been much greater.

In studying spot maps of plague cases of Guayaquil it was found that during the months from May to October, when the disease is least prevalent and tends to disappear, practically all cases are confined to the central section of the city in which the two or three story wooden buildings are located, while in the large surrounding area made up almost entirely of bamboo huts or other shacks the disease is practically extinct. It therefore appears that the central section of the city is the endemic area in which plague is carried over the unfavorable season each year in the better constructed wooden buildings of two and three floors.

The explanation of the disappearance of plague from the section of the city composed of shacks or bamboo huts affording poor protection is no doubt due to the unfavorable conditions produced by the rainy season which reduces the *cheopis* index below the point necessary for the continued transmission of plague, and also the smaller number of rats infesting this area.

It has been pointed out that plague disappears each year at the lowland towns on the railroad and rivers. As these places are made up almost entirely of bamboo-constructed buildings similar to those in Guayaquil, and are subject to the same severe rainy season, the explanation of the disappearance of plague in them is the dampness as in Guayaquil.

At the beginning of this report, reference was made to the fact that only one case of plague had ever been reported in Naranjito, and that no cases have ever occurred at Barraganetal and Bucay. The latter place is a railroad division point, and trains often lie over here at night, thus subjecting it to the invasion of rats from other railroad points. These places lie in the rainy belt between Milagro and the mountains, and there freedom from plague unquestionably depends upon the dampness found in this section of Ecuador.

It is believed that we are now prepared to state that excessive dampness and a mean temperature of about 80° is unfavorable for the reproduction of *Xenopsylla cheopis*, when prolonged for three or four months or longer, and the buildings in which rats harbor do not protect their fleas from these conditions. Plague will tend to disappear in any tropical community in which the climatic conditions are similar to those stated above.

CHEOPIS MALE AND FEMALE INDEX

Reports of flea surveys seldom include much information regarding the relative number of *cheopis* males and females; and it is believed that valuable information may be obtained by such a study in a community.

The male and female indices will be found in nearly all of the tables in this report. In Table 34 is listed the percentage of females found during the different months. The percentage varied from 40 to 50, and the general average was 45 per cent. There is little doubt that the percentage of female *cheopis* during this survey was increased by the use of poison to kill rats. This subject will be discussed in more detail later. Under normal favorable conditions for *cheopis* reproduction it is believed that the ratio of males to females should be about 60 to 40, because under favorable conditions the female is separated from its host more than the male for the purpose of depositing its eggs. Any variation from the above figures should be analyzed for the cause.

The presence of 50.3 per cent of the female fleas on rats during the month of February is explained by the dampness at that time. During the first half of February the female index was markedly higher than the male.

In order to determine the effects of favorable and unfavorable harboring conditions of rats on the percentage of male and female *cheopis* found on them, Table 35 was prepared. In the first section of this table are listed data regarding sex as found on rats harboring four or less fleas, which number is considered as indicating that the rats of this group were living where conditions that were not favorable for *cheopis*, regardless of the location in which the rats were caught. In the third section are listed the data found for rats with 10 or more fleas or the rats harboring where *cheopis* must have favorable conditions for living and reproduction. If the first section of Table 35 is compared with the last it will be found that during the months of January and February the per cent of females found on rats is generally greater when the conditions are unfavorable for the fleas than when they are considered the best. In February the female percentage is practically the same, which indicates that dampness apparently affected the fleas in protected harboring places. In the first division of the third section, which is for rats caught above the ground floor of houses, the percentage of females is 40 in January and 41 in March; and, as stated before, this figure is believed to indicate conditions suitable for *cheopis* reproduction, while any variation in it as given in all divisions of the first section suggests that the fleas are existing under unfavorable conditions. It will be noted in the first section of the table, under "bamboo shacks," that the percentage of females did not increase in February, which probably is explained by the assumption that there were not enough fleas in the shacks to cause an increase.

In conclusion it can be said that when the percentage of female *cheopis* is over 40, these fleas are not existing under the most favorable conditions; and the higher the percentage, the more unfavorable the conditions.

EFFECTS OF POISON ON CHEOPIS INDEX

Mention has already been made of the belief that the use of poison for killing rats has affected the *cheopis* index throughout this report. There is no doubt that poison caused the deaths of many rats every month and that the greatest number were killed during the first three poisonings. Therefore, if poison affected the *cheopis* index the greatest effect should be observed during the latter part of October and in November and December. The tables present much evidence that the number of *cheopis* per rat was excessive at the beginning of this survey. For instance, the index for the first half of November in Table 33 was over eight fleas per rat and then fell until the second half of December, when it reached 8.5. During December the area in which the traps were located was covered twice with poison, and the number of rats caught per hundred traps reached a very low figure. Tables 15 and 19 show that the young rats one-half to two-thirds grown, or the less astute rats of both *norvegicus* and *rattus*, have an index of over 10 in November, which is never equalled again during the survey. This group of rats are the ones most likely to take poison. In Table 29 the rise in the *cheopis* index during March of both *norvegicus* and *rattus*, but particularly the latter species (which has an index of 26 fleas per rat), when caught on upper floors, must have been produced by the use of poison, because the *cheopis* index in general is falling in March.

In charting the curve of the *cheopis* index at 3-day intervals it was found that immediately following the completion of poisoning in the areas where the traps were located, there was a marked rise in the *cheopis* index following the first four poisonings. The highest point reached by the *cheopis* curve at 3-day intervals followed the second poisoning, with the exception of a rise in March, due to the catching of two rats with 256 fleas on them. During January, February, and March the effects of climatic conditions overshadow the results of poisoning.

The effects of poison are even more marked on the number of female *cheopis* per rat than on the total index. From the data given in Table 33 it is found that the percentage of females in the last half of October was 42, in the first half of November 44, and in the second half of November 47. There were no climatic conditions at this time to cause an increase in the female *cheopis* index, and it is only explained by the release of fleas from dead rats. As the female *cheopis* is more used to separating itself from its host and then returning or going to another host, it is reasonable to suppose that this sex is more active in finding a new host if the rat upon which it was living is killed, thus accounting for the increase in these fleas when poison is destroying rats.

It can be concluded that the use of poison increases the total *cheopis* index and the percentage of female *cheopis* on rats, and that these findings in the laboratory may be useful in determining the effectiveness of poison.

The curve of the *cheopis* index of *Mus musculus* shows a marked rise following the use of poison, the same as that noted for rats.

PERCENTAGE OF RATS HAVING DIFFERENT DEGREES OF X. CHEOPIS INFESTATION

Tables 37 and 38 are interesting in that they show the percentage of rats having different degrees of flea infestation and the per cent of fleas found on these rats. They show the distribution of fleas on rats during the different months.

It will be seen in Table 37 that many rats were found free from fleas throughout this survey. During November and December the same percentage of flea-free rats occurred. In January there was a rise in the percentage of rats without fleas; in fact, from January 1 to 20 only 11 per cent of the rats had no fleas, but after the onset of the rainy season the percentage jumped to 28 for the remainder of the month. In February one-fifth of the rats had no fleas, and in March over one-fourth. It is evident that with the onset of the rains many of the rats driven for shelter into buildings from outside harboring places were free from *cheopis* infestation.

It is generally considered that a *cheopis* index of two or more is necessary to cause plague epidemics. From the figures given in Table 37 it was found that the following percentage of rats harbored two or more fleas during the different months: November, 71 per cent; December, 73 per cent; January, 61 per cent; February, 68 per cent; and March, 59 per cent. The figure for March indicates a marked fall in the number of rats which would be likely to transmit plague.

CHEOPIS INDEX OF MUS MUSCULUS

In Table 39 will be found the monthly *cheopis* index of *Mus musculus*. No other flea was found on mice in Guayaquil. This table is of interest, because it shows that *cheopis* is not found in sufficient numbers on mice for these animals to be considered any particular menace in transmitting plague. Three was the greatest number of fleas ever found on one mouse. Fleas were obtained from mice by drowning them and then searching the dead wet animal.

The high index of November is believed to have been caused by the use of poison, while that of February was no doubt due to the rainy weather. The mouse index did not fall in January or March as did that of rats, probably because they harbor inside of buildings in places better protected from the weather.

EPIDEMIOLOGICAL SUMMARY

(1) *Xenopsylla cheopis* is the flea chiefly concerned in the causation of plague in Ecuador. It is the only flea causing rat plague. If it were not for this flea, plague would soon disappear.

(2) *X. cheopis* is found at altitudes of over 9,000 feet, but not in sufficient numbers to cause plague epidemics.

(3) The highest altitude at which *X. cheopis* is implicated in the causation of plague epidemics is about 8,554 feet, the elevation of Alausi and vicinity.

(4) *X. cheopis* is the only rat flea found in the lowlands and in the mountains up to an altitude of 4,000 feet.

(5) The constant importation of *X. cheopis*-infested rats is probably necessary to maintain these fleas in sufficient numbers in the high altitudes for them to cause plague epidemics.

(6) *X. cheopis* may reproduce when the mean temperature is between 55° and 56° F., but a mean high temperature of about 70° F. or higher is necessary.

(7) *X. cheopis* can not exist at Riobamba, which has a mean temperature slightly lower than that of Quito, but also a lower altitude.

(8) Plague occurs in Ecuador at altitudes of over 10,000 feet above sea level.

(9) Plague does not persist in the mountain towns after June or the onset of the colder months, but does occur in the Indian villages and haciendas after it has disappeared from the larger railroad towns. Plague would not reappear in the mountain towns if they were not reinfected.

(10) By means of the Guayaquil & Quito Railroad plague-infected rats are transported from Duran to the other lowland towns and to the mountain towns. Duran is infected through the means of the constant ferry service between it and Guayaquil. The latter place is the source of all the plague epidemics in the central part of Ecuador

and the disease would disappear if not for the endemic center in Guayaquil.

(11) The floods in the lowland section of Ecuador cause rats to seek shelter in railroad cars, and they are then carried in large numbers to the mountain districts.

(12) Every year that plague has been present in Ambato it has first appeared in the vicinity of the railroad station.

(13) The endemic area for plague in Guayaquil is the section of the city in which is located the two and three-story wooden buildings.

(14) The dampness caused by the rainy season is the chief factor in reducing the *cheopis* index. The greatest effect of dampness is produced in buildings which are poorly constructed to protect their interiors from the effects of weather, such as buildings made of bamboo. Dampness does not affect the *cheopis* index of rats harboring on the second and third floors of houses or in warehouses as it does the index of those harboring in poorly constructed buildings.

(15) High temperatures will cause *cheopis* to leave their hosts, but do not kill them, at least not the temperatures of Guayaquil.

(16) Dampness forces fleas to seek their hosts or some other host if their natural one is not available.

(17) The disappearance of plague from the lowland towns outside of Guayaquil is due to the effect of dampness on the rats harboring in their bamboo-constructed buildings.

(18) Rats harboring outside of buildings in Guayaquil have a *cheopis* index too small to cause epidemics of plague among them.

(19) *Rattus rattus* and *rattus alexandrinus* have a higher *cheopis* index than *R. norvegicus*.

(20) The lessened incidence of plague in Guayaquil since 1916 is due to an immunity developed by the rat population.

(21) The immunity to plague is greatest among rats harboring within buildings, or the house rats.

(22) *R. norvegicus* lives on the second floors of buildings and may be caught there in large numbers.

(23) The shift of the peak season of human plague in Guayaquil from the last months of the dry season to the first months of the rainy season is due to the high immunity of the house rat and the lack of immunity of the outside rat, which is forced to seek shelter inside of buildings during the rainy season.

(24) Under normal conditions the percentage of *cheopis* females should be about 40. Dampness, unfavorable rat harboring conditions for *X. cheopis*, and the deaths of many rats as produced by poisoning and as probably occurs when there is a rat epizootic of any kind, cause an increased numbe- of *cheopis* females to be found on rats.

(25) The method of removing fleas outlined in this report has proved to be very satisfactory, and is much superior to simply combing rats to obtain their fleas.

(26) Very young Norway rats, one-sixth grown or younger, have a greater *cheopis* index than any other group of rats. The index gradually decreases until the rats are one-half to two-thirds grown and then increases. Adult *norvegicus* have fewer *cheopis* than young rats.

(27) The sex of rats is not an important factor in determining *cheopis* infestation.

(28) The data in this report is not typical in all respects, because of the influence of killing rats with poison on the *cheopis* index.

(29) Poison causes an increase in the total *cheopis* index and in the per cent of female *cheopis*. The efficiency of poison in killing rats may be watched in the laboratory by following the total and female *cheopis* indices.

(30) The nature of the harboring place of rats is a more important factor in determining the number of *cheopis* than the character of the place in which they are caught.

(31) The *cheopis* index varies in proportion to the number of rats when the rats are harboring inside of buildings.

(32) The following fleas were found during this survey in Ecuador: *Xenopsylla cheopis, Pulex irritans, Ctenocephalus felis* and *canis, Rhopalopsyllus cavicola, Hectopsylla suarez, Leptopsylla musculi*, and *Ceratophyllus londinensis*.

(33) *Pulex irritans* is the only flea other than *X. cheopis* concerned in the transmission of human plague in Ecuador. This flea is probably the cause of nearly all cases of plague in the high mountain districts where *cheopis* is not found. *P. irritans* no doubt causes some cases of human plague in Guayaquil and other places where *cheopis* is the chief transmitting flea.

(34) Plague transmitted by *P. irritans* probably does not have as great a mortality rate as that produced by *X. cheopis*.

(35) *P. irritans* is probably the agent involved in the causation of the two unusual types of plague found in Ecuador and called "viruela pestosa" and "angina pestosa."

(36) *P. corporis* and *capitis* may be responsible for some cases of plague, particularly "angina pestosa," which is due to the practice of the natives of killing infected vermin between the teeth.

(37) *X. cheopis* is not found in sufficient number on *Mus musculus* for these animals to be able to transmit plague to any extent and these animals are of very little importance in the causation of plague.

(The concluding part of this article, dealing with antiplague measures in Ecuador, will be published in the following issue of PUBLIC HEALTH REPORTS.)

BIOLOGICAL PRODUCTS

ESTABLISHMENTS LICENSED FOR THE PROPAGATION AND SALE OF VIRUSES, SERUMS, TOXINS, AND ANALOGOUS PRODUCTS

There is presented below a list of the establishments holding licenses issued by the Treasury Department in accordance with the act of Congress approved July 1, 1902, entitled "An act to regulate the sale of viruses, serums, toxins, and analogous products in the District of Columbia, to regulate interstate traffic in said articles, and for other purposes."

The licenses granted to these establishments for the products mentioned do not imply an indorsement of the claims made by the manufacturers for their respective preparations. The granting of a license means that inspection of the establishment concerned and laboratory examinations of samples of its products are made regularly to insure the observance of safe methods of manufacture, to ascertain freedom from contamination, and to determine the potency, or safety, or both, of diphtheria antitoxin, scarlet fever streptococcus antitoxin, tetanus antitoxin, botulinus antitoxin, antidysenteric serum, antimeningococcic serum, antipneumococcic serum, bacterial vaccines made from typhoid bacillus, paratyphoid bacillus A, and paratyphoid bacillus B, diphtheria toxin-antitoxin mixture, diphtheria toxoid, diphtheria toxin for Schick test, scarlet fever streptococcus toxin for Dick test, scarlet fever streptococcus toxin for immunization, and the arsphenamines, the only products for which potency standards or tests have been established.

The enumeration of the products is as follows: Serums are placed first, the antitoxins, being more important, heading the list. The other products are arranged generally in the order of their origin. The items in each class are arranged alphabetically.

Establishments Licensed and Products for which Licenses have been Issued

AMERICAN ESTABLISHMENTS

Parke, Davis & Co., Detroit, Mich.—License No. 1:

Diphtheria antitoxin; perfringens antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; vibrion septique antitoxin; antianthrax serum; antidysenteric serum; antigonococcic serum; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum; hemostatic serum (Lapenta); normal horse serum; thryroidectomized horse serum; vaccine virus; rabies vaccine (Cumming); tuberculin old; tuberculin T. R.; tuberculin B. E.; tuberculin B. F.; bacterial vaccines made from acne bacillus, acne diplococcus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, prodigiosus bacillus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid-antitoxin mixture; diphtheria toxoid, diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; animal epidermal extract; animal food extract; vegetable food extract; pollen extract; modified bacterial derivatives made from colon bacillus, gonococcus, paratyphoid bacillus A, paratyphoid bacillus B, pneumococcus, staphylococcus albus, staphylococcus aureas, streptococcus, and typhoid bacillus; bacterial antigen made from colon bacillus, gonococcus, pertussis bacillus, pneumococcus, staphylococcus albus, staphylococcus aureus, and streptococcus.

H. K. Mulford Co., Broad and Wallace Streets, Philadelphia, Pa.—License No. 2:

Diphtheria antitoxin; erysipelas streptococcus antitoxin; perfringens antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; vibrion septique antitoxin; antianthrax serum; antidysenteric serum; antigonococcic serum; antimelitensis serum; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum, antivenin (Nearctic crotalidae); antivenin Bothropic; antivenin (crotalus terrificus); normal horse serum; vaccine virus; rabies vaccine (Pasteur); rabies vaccine (killed virus); tuberculin old; tuberculin T. R.; tuberculin B. E.; tuberculin B. F.; tuberculin proteose-free (Lyons); bacterial vaccines made from acne bacillus, cholera vibrio, colon bacillus, dysentery bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, micrococcus melitensis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, plague bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; sensitized bacteria vaccines made from acne bacillus, cholera vibrio, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; pollen extract; animal epidermal extract; animal food extract; vegetable food extract; poison ivy extract; poison oak extract; pneumococcus antibody solution; bacterial antigen made from streptococci.

The Cutter Laboratory, Berkeley, Calif.—License No. 8:

Diphtheria antitoxin; bacillus odematiens antitoxin; perfringens antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; vibrion septique antitoxin; antistreptococcic serum; normal horse serum; vaccine virus; rabies vaccine (Pasteur); rabies vaccine (killed virus); tuberculin old; tuberculin B. F.; bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; pollen extract; poison ivy extract; poison oak extract.

Bureau of Laboratories, Department of Health, foot East Sixteenth Street, New York City.—License No. 14:

Vaccine virus.

Lederle Laboratories Inc., Pearl River, N. Y.—License No. 17:

Diphtheria antitoxin; erysipelas streptococcus antitoxin; bacillus histolyticus antitoxin; bacillus odematiens antitoxin; perfringens antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; vibrion septique antitoxin; antianthrax serum; antidysenteric serum; antigonococcic serum; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum; measles immune serum; normal horse serum; vaccine virus; rabies vaccine (Pasteur); rabies vaccine (killed virus); tuberculin old; tuberculin B. E.; tuberculin B. F.; bacterial vaccines made from acne bacillus, cholera vibrio, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, plague bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, staphylococcus citreus, streptococcus, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; pollen extract; poison ivy extract; poison oak extract.

Bacterio-Therapeutic Laboratory, Asheville, N. C.—License No. 23:

Watery extract of tubercle bacilli (von Ruck); modified tubercle bacillus derivative (von Ruck).

G. H. Sherman, M. D., Inc., 14600 East Jefferson Avenue, Detroit, Mich.—License No. 30:

Bacterial vaccines made from acne bacillus, brucella melitensis, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, nonvirulent tubercle bacillus, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; pollen extract.

The Abbott Laboratories, Fourteenth Street and C.-W. Interurban Railroad tracks, North Chicago, Ill.—License No. 43.

Bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; bacterial antigen made from staphylococcus aureus; pollen extract.

St. Louis Pasteur Institute, 3514 Lucas Avenue, St. Louis, Mo.—License No. 50:

Rabies vaccine (killed virus).

The Upjohn Co., Kalamazoo, Mich.—License No. 51:

Bacterial vaccines made from colon bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; pollen extract.

E. R. Squibb & Sons' Research and Biological Laboratories, New Brunswick, N. J.—License No. 52:
Diphtheria antitoxin, erysipelas streptococcus antitoxin, scarlet fever streptococcus antitoxin, tetanus antitoxin; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum; normal horse serum; vaccine virus; rabies vaccine (Pasteur); rabies vaccine (killed virus); bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, staphylococcus citreus, streptococcus, and typhoid bacillus; bacterial antigen made from staphylococcus aureus; leucocytic extract from the horse; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; pollen extract; poison ivy extract; poison oak extract; arsphenamine, neoarsphenamine, sulpharsphenamine, solution of arsphenamine.

Eli Lilly & Co., Indianapolis, Ind.—License No. 56:
Diphtheria antitoxin; erysipelas streptococcus antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; antimeningococcic serum; antistreptococcic serum; normal horse serum; vaccine virus; rabies vaccine (Harris); tuberculin old; tuberculin T. R.; tuberculin B. E.; tuberculin B. F.; bacterial vaccines made from acne bacillus, cholera vibrio, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, meningococcus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, plague bacillus, pneumococcus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; bacterial vaccine made from partially autolized pneumococci; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; ricinoleated antigen made from scarlet fever streptococci.

Swan Myers Co., 219 North Senate Avenue, Indianapolis, Ind.—License No. 58:
Bacterial vaccines made from acne bacillus, brucella melitensis, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, micrococcus tetragenus, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; bacterial antigen made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, micrococcus catarrhalis, pneumococcus, staphylococcus albus, staphylococcus aureus and streptococcus; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; pollen extract.

Gilliland Laboratories, Marietta, Pa.—License No. 63:
Diphtheria antitoxin; scarlet fever streptococcus antitoxin; tetanus antitoxin; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum; normal horse serum; vaccine virus; rabies vaccine (Pasteur); rabies vaccine (killed virus); tuberculin old; tuberculin B. E.; tuberculin B. F.; bacterial vaccines made from acne bacillus, gonococcus, influenza bacillus, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization.

Antitoxin and Vaccine Laboratory, Department of Public Health, Commonwealth of Massachusetts, 375 South Street, Jamaica Plain, Boston 30, Mass.—License No. 64:
Diphtheria antitoxin; scarlet fever streptococcus antitoxin; antimeningococcus serum; antipneumococcus serum; vaccine virus; bacterial vaccines made from paratyphoid bacillus A, paratyphoid bacillus B, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxin for Schick test.

United States Standard Products Co., Woodworth, Wis.—License No. 65:
Diphtheria antitoxin; tetanus antitoxin; antimeningococcic serum; normal horse serum; rabies vaccine (killed virus); bacterial vaccines made from paratyphoid bacillus A, paratyphoid bacillus B, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test.

D. L. Harris Laboratories, Metropolitan Building, St. Louis, Mo.—License No. 66:
Rabies vaccine (Harris).

The Arlington Chemical Co., Yonkers, N. Y.—License No. 67:
Bacterial vaccines made from colon bacillus, micrococcus tetragenus, pneumococcus, staphylococcus albus, staphylococcus aureus, staphylococcus citreus, streptococcus; pollen extract; animal epidermal extract; animal food extract; vegetable food extract.

Dermatological Research Laboratories, 1720 Lombard Street, Philadelphia, Pa. (branch of Abbott Laboratories, Chicago, Ill.)—License No. 68:
Arsphenamine; neoarsphenamine; sulpharsphenamine; bismuth arsphenamine sulphonate.

H. A. Metz Laboratories, 122 Hudson Street, New York City.—License No. 69.
Arsphenamine; neoarsphenamine; sodium arsphenamine; silver arsphenamine; neosilver arsphenamine; sulpharsphenamine.

Synthetic Drugs and Diarsenol Laboratories, 771 Ellicott Square, Buffalo, N. Y.—License No. 70:
Arsphenamine; neoarsphenamine; sodium arsphenamine; sulpharsphenamine.

Mallinckrodt Chemical Works, St. Louis, Mo.—License No. 77:
Arsphenamine; neoarsphenamine; sulpharsphenamine.

Merck & Co. (Inc.), 916 Parrish Street, Philadelphia, Pa.—License No. 82:

Arsphenamine; neoarsphenamine; sulpharsphenamine; a compound of glucose with arsphenamine base.

Terrell Laboratories, Texas National Bank Building, Fort Worth, Tex.—License No. 84:

Rabies vaccine (killed virus).

Jensen-Salsbery Laboratories, Twenty-first and Penn Streets, Kansas City, Mo.—License No. 85:

Botulinus antitoxin; rabies vaccine (killed virus); bacterial vaccine made from brucella melitensis.

Cook Laboratories, 536 Lake Shore Drive, Chicago, Ill.—License No. 86:

Bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus.

The Neosol Co., 72 Kingsley St., Buffalo, N. Y.—License No. 90:

Solution of neoarsphenamine; solution of sulpharsphenamine.

Hollister Stier Laboratories, Paulson Medical and Dental Bldg., Spokane, Wash.—License No. 91:

Bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenza bacillus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, staphylococcus albus, staphylococcus aureus, streptococcus, typhoid bacillus, and xerosis bacillus; pollen extract.

DePree Laboratories, Holland, Mich.—License No. 93:

Arsphenamine; neoarsphenamine; sulpharsphenamine

Medical Arts Laboratory, Medical Arts Bldg., Oklahoma City, Okla.—License No. 98:

Rabies vaccine (killed virus).

Bureau of Laboratories, Department of Health, Lansing, Mich.—License No. 99:

Diphtheria antitoxin; scarlet fever streptococcus antitoxin; bacterial vaccine made from paratyphoid bacillus A, paratyphoid bacillus B, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; scarlet fever streptococcus toxin for Dick test; scarlet fever streptococcus toxin for immunization; bacterial antigen made from staphylococcus aureus.

Messrs. G. D. Searle & Co., 4735 Ravenswood Avenue, Chicago, Ill.—License No. 100; Arsphenamine; neoarsphenamine; sulpharsphenamine.

National Drug Co., 5109 Germantown Avenue, Philadelphia, Pa.—License No. 101:

Diphtheria antitoxin; tetanus antitoxin; antimeningococcic serum; antipneumococcic serum; antistreptococcic serum; normal horse serum; vaccine virus; rabies vaccine (killed virus); bacterial vaccines made from acne bacillus, colon bacillus, Friedländer bacillus, gonococcus, influenze bacillus, micrococcus catarrhalis, paratyphoid bacillus A, paratyphoid bacillus B, pertussis bacillus, pneumococcus, pseudodiphtheria bacillus, staphylococcus albus, staphylococcus aureus, streptococcus, and typhoid bacillus; diphtheria toxin-antitoxin mixture; diphtheria toxoid; diphtheria toxin for Schick test; pollen extract.

American Chemical Laboratories, 5109 Germantown Avenue, Philadelphia, Pa.—License No. 102:

Poison ivy extract; poison oak extract.

Balyeat Hay Fever and Asthma Clinic, 1200 North Walker Street, Oklahoma City, Okla.—License No. 103:

Pollen extract; vegetable food extract; animal epidermal extract.

FOREIGN ESTABLISHMENTS

Institut Pasteur de Paris, Paris, France.—License No. 11. Selling agents for the United States: Pasteur Laboratories of America, 366 West Eleventh Street, New York City:

Diphtheria antitoxin; tetanus antitoxin; antianthrax serum; antidysenteric serum; antiplague serum; antistreptococcic serum; bacterial vaccines made from cholera vibrio, plague bacillus, staphylococcus albus and staphylococcus aureus.

Interessen Gesellschaft Farbenindustrie Aktiengesellschaft, Hoechst am Main, Germany.—License No. 24. Selling agents for the United States: H. A. Metz Laboratories, 107 Varick Street, New York City. Diphtheria antitoxin; tetanus antitoxin; antistreptococcic serum; normal horse serum; tuberculin old; tuberculin T. R.; tuberculin B. E.; tuberculin B. F.; bacterial vaccines made from cholera vibrio, gonococcus, staphylococcus albus, staphylococcus aureus, and staphylococcus citreus; typhoid bacillus; sensitized bacterial vaccine made from typhoid bacillus; arsphenamine; neoarsphenamine; sodium arsphenamine; silver arsphenamine; neosilver arsphenamine; sulphoxylarsphenamine.

E. Merck, Darmstadt, Germany.—License No. 31. Selling agents for the United States: Merck & Co. 45–47 Park Place, New York City: Tuberculin Ointment (Moro).

Connaught Antitoxin Laboratory, University of Toronto, Toronto, Canada.—License No. 73:

Diphtheria antitoxin; tetanus antitoxin; diphtheria toxoid.

Les Establissements Poulenc Frères, 92 Rue Vieille-du-Temple, Paris, III, France.—License No. 74. Selling agents for the United States: Geo. J. Wallau, 153 Waverly Place, New York City:

Bacterial vaccines made from gonococcus, micrococcus tetragenus, pertussis bacillus, staphylococcus albus, staphylococcus aureus, and synococcus.

Laboratoire de Biochimie Médicale, 92 Rue Michel-Ange, Paris, France.—License No. 83. Selling agents for the United States: Anglo-French Drug Co., 1270 Broadway, New York City. Selling agents for Porto Rico: Chas. Vere, Box 216, San Juan, P. R.: Sulpharsphenamine.

Istituto Sieroterapico Milanese, via Darwin 20, Milan, Italy.—License No. 87. Selling agents for the United States: Opo-Pharmacal Co., 27 Cleveland Place, New York City:

Antianthrax serum; bacterial vaccines made from gonococcus, pneumococcus, staphylococcus albus, staphylococcus aureus, staphyloccus citreus and streptococcus; neoarsphenamine.

Boots Pure Drug Co., Ltd., Nottingham, England.—License No. 92. Selling agents for the United States: The United Drug Co., 43 Leon Street, Boston, Mass.: Arsphenamine diglucoside.

Etablissements Mouneyrat, Villaneuve-la-Garenne, Seine, France.—License No. 94. Selling agents for the United States: G. J. Wallau, 153 Waverly Place, New York City: Phospharsphenamine.

Institut National de Vaccinotherapie, 26 Rue Pages, Suresnes (Seine), near Paris, France.—License No. 95. Selling agents for the United States: Lee S. Smith Manufacturing Co., Pittsburgh, Pa.:

Bacterial vaccines made from colon bacillus, enterococcus, Friedländer bacillus, micrococcus catarrhalis, micrococcus tetragenus, pneumococcus, staphylococcus albus, staphylococcus aureus and streptococcus.

Behringswerke, A. G., Marburg-am-Lahm, Germany.—License No. 97:

Bacterial vaccines made from colon bacillus, gonococcus, pneumococcus, pyocyaneus bacillus, staphylococcus albus, and staphylococcus aureus, streptococcus.

Laboratorio di Terapia Sperimentale, Corso Torino 26 Rosso, Genoa, Italy.—License No. 38:

Bacterial vaccines made from colon bacillus, enterococcus, gonococcus, pneumococcus, prodigiosus bacillus, pseudodiphtheria bacillus, pseudogonococcus, staphylococcus albus, staphylococcus aureus, staphylococcus citreus and streptococcus.

DEATHS DURING WEEK ENDED AUGUST 16, 1930

Summary of information received by telegraph from industrial insurance companies for the week ended August 16, 1930, and corresponding week of 1929. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

	Week ended Aug. 16, 1930	Corresponding week, 1929
Policies in force	75, 808, 527	74, 586, 141
Number of death claims	13, 653	12, 148
Death claims per 1,000 policies in force, annual rate	9. 4	8. 5

Deaths [1] from all causes in certain large cities of the United States during the week ended August 16, 1930, infant mortality, annual death rate, and comparison with corresponding week of 1929. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

[The rates published in this summary are based upon mid-year population estimates derived from the 1930 census. The rates are not exactly comparable with similar rates published in the Public Health Reports earlier than the issue of August 22, 1930, which were based upon estimates made before the 1930 census was taken]

City	Week ended Aug. 16, 1930				Corresponding week, 1929		Death rate [2] for first 33 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1930	1929
Total (78 cities)	6, 621	10. 0	679	[4] 53	10. 5	721	12. 4	13. 3
Akron	49	10. 1	6	55	7. 2	6	8. 1	9. 8
Albany [5]	30	12. 2	5	109	14. 9	5	15. 3	16. 8
Atlanta	78	15. 2	15	159	17. 1	7	16. 7	16. 7
White	36		10	317		3		
Colored	42	(6)	5	79	(6)	4	(6)	(6)
Baltimore [5]	184	11. 9	6	20	12. 4	21	14. 6	15. 4
White	139		3	13		13		
Colored	45	(6)	3	49	(6)	8	(6)	(6)
Birmingham	67	13. 5	5	47	13. 9	9	14. 4	17. 0
White	31		4	62		2		
Colored	36	(6)	1	24	(6)	7	(6)	(6)
Boston	168	11. 2	24	68	11. 8	18	14. 6	16. 0

See footnotes at end of table.

Deaths[1] *from all causes in certain large cities of the United States during the week ended August 16, 1930, infant mortality, annual death rate, and comparison with corresponding week of 1929*—Continued

City	Week ended Aug. 16, 1930				Corresponding week, 1929		Death rate[2] for first 33 weeks	
	Total deaths	Death rate[2]	Deaths under 1 year	Infant mortality rate[3]	Death rate[2]	Deaths under 1 year	1930	1929
Bridgeport	10	3.5	1	17	10.3	4	11.5	12.9
Buffalo	138	12.5	12	53	11.4	8	13.5	14.6
Cambridge	21	9.6	2	37	9.7	4	12.3	13.3
Camden	18	8.0	2	36	8.0	0	14.3	15.0
Canton	18	8.9	0	0	5.5	1	10.4	11.8
Chicago[5]	493	7.6	52	46	9.6	47	10.8	11.8
Cincinnati	124	14.4	14	83	12.7	7	16.1	17.7
Cleveland	134	7.7	11	33	9.2	14	11.5	13.2
Columbus	59	10.6	10	98	11.3	9	16.5	15.6
Dallas	61	12.1	10		10.5	8	12.1	12.3
White	45		8			8		
Colored	16	(6)	2		(6)	0	(6)	(6)
Dayton	51	13.2	8	118	9.8	7	10.6	11.9
Denver	82	14.8	10	104	13.5	5	14.8	15.3
Des Moines	24	8.8	3	52	11.4	2	12.2	12.1
Detroit	209	6.9	28	43	8.6	42	9.8	11.7
Duluth	14	7.2	1	27	13.4	0	11.4	11.9
El Paso	37	18.8	11		17.1	6	18.2	21.1
Erie	31	13.9	4	85	12.3	2	11.6	13.1
Fall River[5]	15	6.8	0	0	13.6	3	12.7	15.1
Flint	26	8.6	5	58	8.2	7	9.5	11.0
Fort Worth	40	12.9	3		12.1	1	11.6	13.3
White	33		3			0		
Colored	7	(6)	0		(6)	1	(6)	(6)
Grand Rapids	24	7.4	2	30	7.5	4	10.8	10.4
Houston	59	10.5	13		13.2	7	12.6	13.2
White	44		10			5		
Colored	15	(6)	3		(6)	2	(6)	(6)
Indianapolis	82	11.7	5	37	15.0	14	15.1	15.2
White	59		3	26		7		
Colored	23	(6)	2	108	(6)	7	(6)	(6)
Jersey City	52	8.6	6	52	8.6	5	11.8	13.2
Kansas City, Kans	18	7.7	0	0	9.4	2	11.3	14.0
White	11		0	0		2		
Colored	7	(6)	0	0	(6)	0	(6)	(6)
Kansas City, Mo	96	12.7	12	93	12.6	11	13.9	14.6
Knoxville	22	10.8	6	141	18.6	6	14.4	14.8
White	13		6	156		6		
Colored	9	(6)	0	0	(6)	0	(6)	(6)
Los Angeles	269	11.3	25	76	9.9	16	11.4	11.8
Louisville	94	15.9	6	52	12.2	10	14.1	15.6
White	72		5	49		10		
Colored	22	(6)	1	72	(6)	0	(6)	(6)
Lowell[7]	19	9.9	1	24	9.3	1	14.1	15.1
Lynn	13	6.6	3	76	7.2	1	11.1	11.9
Memphis	68	14.0	9	107	13.0	11	18.1	19.6
White	25		4	74		9		
Colored	43	(6)	5	169	(6)	2	(6)	(6)
Milwaukee	82	7.5	7	35	7.2	8	10.1	11.6
Minneapolis	77	8.6	6	39	8.8	6	10.9	11.4
Nashville	60	21.3	8	124	17.8	9	18.0	19.8
White	35		7	144		5		
Colored	25	(6)	1	63	(6)	4	(6)	(6)
New Bedford[7]	18	8.3	2	51	8.3	1	11.5	13.4
New Haven	30	9.6	1	19	9.6	3	13.5	13.8
New Orleans	137	15.6	18	104	15.2	14	18.1	18.3
White	94		10	88		12		
Colored	43	(6)	8	135	(6)	2	(6)	(6)
New York	1,131	8.4	106	45	8.8	113	11.3	12.0
Bronx Borough	160	6.5	15	35	6.3	9	8.2	8.7
Brooklyn Borough	379	7.6	40	43	7.4	38	10.2	10.8
Manhattan Borough	443	12.5	40	66	12.6	50	17.0	17.4
Queens Borough	110	5.2	9	26	7.4	16	7.3	8.0
Richmond Borough	39	12.9	2	37	15.5	0	14.9	16.4
Newark, N. J	75	8.8	12	63	9.8	10	12.6	13.5
Oakland	48	8.8	1	12	10.6	8	11.2	11.7
Oklahoma City	49	13.8	7	137	12.4	5	10.9	11.2
Omaha	48	11.7	5	57	13.2	4	14.3	14.3
Paterson	28	10.6	2	35	9.8	2	12.7	14.1
Philadelphia	432	11.5	50	74	11.3	56	13.0	13.8
Pittsburgh	131	10.2	16	59	10.8	18	14.3	15.5

See footnotes at end of table.

Deaths[1] *from all causes in certain large cities of the United States during the week ended August 16, 1930, infant mortality, annual death rate, and comparison with corresponding week of 1929*)—Continued.

City	Week ended Aug. 16, 1930				Corresponding week, 1929		Death rate[2] for first 33 weeks	
	Total deaths	Death rate[2]	Deaths under 1 year	Infant mortality rate[3]	Death rate[2]	Deaths under 1 year	1930	1929
Portland, Oreg	55	9.6	3	37	10.9	5	12.7	13.2
Providence	49	10.2	3	28	10.4	2	13.8	15.4
Richmond	48	13.7	1	15	12.6	7	15.5	17.2
White	21		1	22		3		
Colored	27	(6)	0	0	(6)	4	(6)	(6)
Rochester	62	9.9	7	62	12.1	10	12.0	13.1
St. Louis	225	14.3	17	55	10.6	18	14.9	15.4
St. Paul	33	6.3	4	41	8.6	2	10.4	11.0
Salt Lake City[5]	21	7.8	3	47	12.1	1	12.9	13.6
San Antonio	56	11.4	11		16.2	9	16.0	15.4
San Diego	35	12.2	2	42	9.8	1	14.6	15.9
San Francisco	130	10.8	6	41	12.2	7	13.4	13.6
Schenectady	16	8.7	1	31	12.0	7	11.5	13.0
Seattle	71	10.2	4	40	10.4	6	11.2	11.4
Somerville	11	5.5	1	33	4.1	1	10.2	9.6
Spokane	29	13.1	2	52	11.3	1	12.6	13.4
Springfield, Mass	27	9.4	1	16	14.1	2	12.6	13.3
Syracuse	33	8.3	6	74	10.9	7	12.2	13.7
Tacoma	25	12.2	1	26	8.8	1	12.9	12.1
Toledo	49	8.8	4	37	10.7	5	13.0	14.1
Trenton	42	17.8	1	19	13.6	7	17.4	17.9
Utica	9	4.6	0	0	13.8	3	15.4	16.2
Washington, D. C	130	13.9	18	104	13.0	16	15.7	16.1
White	70		9	78		6		
Colored	60	(6)	9	160	(6)	10	(6)	(6)
Waterbury	17	8.7	1	26	6.8	1	10.2	10.0
Wilmington, Del.[7]	32	15.9	2	45	11.4	1	15.0	14.5
Worcester	29	7.7	1	13	9.9	5	13.3	13.2
Yonkers	18	6.9	0	0	11.4	3	8.3	9.5
Youngstown	26	7.9	2	31	11.9	5	10.5	12.6

[1] Deaths of nonresidents are included. Stillbirths are excluded.
[2] These rates represent annual rates per 1,000 population, as estimated for 1930 and 1929 by the arithmetical method.
[3] Deaths under 1 year of age per 1,000 live births. Cities left blank are not in the registration area for births.
[4] Data for 73 cities.
[5] Deaths for week ended Friday.
[6] For the cities for which deaths are shown by color the colored population in 1920 constituted the following percentages of the total population: Atlanta, 31; Baltimore, 15; Birmingham, 39; Dallas, 15; Fort Worth, 14; Houston, 25; Indianapolis, 11; Kansas City, Kans., 14; Knoxville, 15; Louisville, 17; Memphis, 38; Nashville, 30; New Orleans, 26; Richmond, 32; and Washington, D. C., 25.
[7] Population April 1, 1930; decreased 1920 to 1930; no estimate made.

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 August 23, 1930, and August 24, 1929

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended August 23, 1930, and August 24, 1929

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929
New England States:								
Maine	3	------	------	------	6	7	0	1
New Hampshire	2	4	8	------	------	------	0	0
Vermont	2	1	------	------	5	1	0	0
Massachusetts	44	45	2	1	44	21	5	2
Rhode Island	1	5	------	------	------	------	0	0
Connecticut	10	9	------	------	6	17	1	0
Middle Atlantic States:								
New York	51	101	[1] 4	[1] 5	70	58	9	8
New Jersey	38	53	1	3	35	15	4	6
Pennsylvania	37	53	------	------	91	61	12	6
East North Central States:								
Ohio	7	26	4	------	12	15	1	5
Indiana	11	11	6	------	5	3	10	1
Illinois	56	80	4	4	17	51	6	4
Michigan	17	38	------	------	37	46	2	23
Wisconsin	11	19	3	11	45	39	2	4
West North Central States:								
Minnesota	6	15	1	------	2	3	2	1
Iowa	1	1	------	------	------	14	1	2
Missouri	12	10	1	------	10	6	3	8
North Dakota	1	6	------	------	------	8	1	0
South Dakota	4	2	------	------	3	2	0	0
Nebraska	2	1	------	------	1	7	0	0
Kansas	9	10	------	------	4	15	5	0
South Atlantic States:								
Delaware	3	1	------	------	6	------	0	0
Maryland [2]	9	16	1	5	4	1	1	1
District of Columbia	3	9	------	------	8	------	1	1
Virginia	------	------	------	------	------	------	------	------
West Virginia	9	10	4	------	11	11	0	2
North Carolina	77	101	2	------	2	------	0	1
South Carolina	11	50	86	132	1	------	0	0
Georgia	5	19	9	25	4	1	2	0
Florida	1	6	2	------	1	2	0	0
East South Central States:								
Kentucky	------	------	------	------	------	------	1	0
Tennessee	10	16	2	11	3	6	3	0
Alabama	12	41	3	2	6	9	4	1
Mississippi	10	25	------	------	------	------	5	------
West South Central States:								
Arkansas	3	5	2	3	------	1	0	0
Louisiana	14	17	3	6	------	------	1	0
Oklahoma [3]	4	22	4	8	3	7	0	1
Texas	16	33	------	2	15	8	2	0
Mountain States:								
Montana	2	5	------	------	1	34	0	0
Idaho	------	------	------	------	1	3	1	0
Wyoming	------	1	------	------	------	2	0	0
Colorado	5	6	------	------	4	10	0	1
New Mexico	5	3	------	------	------	------	2	1
Arizona	5	------	------	------	2	------	0	1
Utah [2]	------	------	3	5	1	------	0	1

[1] New York City only.
[2] Week ended Friday.
[3] Figures for 1930 are exclusive of Oklahoma City and Tulsa.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended August 23, 1930, and August 24, 1929—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929
Pacific States:								
Washington	3	3	--------	--------	21	24	0	4
Oregon	6	2	6	2	13	9	2	0
California	36	38	13	9	59	23	5	8

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929	Week ended Aug. 23, 1930	Week ended Aug. 24, 1929
New England States:								
Maine	2	0	12	21	0	0	3	0
New Hampshire	1	0	0	0	0	0	0	2
Vermont	0	0	1	0	0	0	0	0
Massachusetts	27	6	42	44	0	0	23	16
Rhode Island	1	0	2	1	0	0	0	0
Connecticut	2	2	4	7	0	0	2	5
Middle Atlantic States:								
New York	72	30	61	51	0	6	30	70
New Jersey	5	1	17	16	0	0	12	18
Pennsylvania	8	6	48	66	0	0	46	19
East North Central States:								
Ohio	13	5	40	28	8	19	47	30
Indiana	3	0	16	21	15	5	9	12
Illinois	8	3	57	89	17	9	44	35
Michigan	5	5	28	71	8	29	20	7
Wisconsin	3	0	26	33	9	7	6	6
West North Central States:								
Minnesota	12	0	7	30	3	6	7	5
Iowa	6	1	11	15	15	1	1	22
Missouri	8	0	10	17	7	4	28	20
North Dakota	2	0	3	1	1	1	2	1
South Dakota	5	0	2	5	0	2	2	2
Nebraska	4	0	4	5	2	1	3	3
Kansas	30	1	14	16	7	4	17	11
South Atlantic States:								
Delaware	0	0	1	0	0	0	6	1
Maryland [2]	1	0	5	14	0	0	70	21
District of Columbia	1	0	4	2	0	0	2	4
Virginia	--------	8	--------	--------	--------	--------	--------	--------
West Virginia	0	3	8	15	2	1	39	25
North Carolina	4	2	34	41	5	1	52	50
South Carolina	0	3	3	8	0	2	65	53
Georgia	0	1	12	15	0	0	39	42
Florida	0	2	1	0	0	0	4	1
East South Central States:								
Kentucky	0	0	8	29	9	1	73	23
Tennessee	0	10	10	11	0	0	97	77
Alabama	1	0	16	24	1	0	41	28
Mississippi	1	1	5	8	2	0	31	31
West South Central States:								
Arkansas	7	0	9	8	6	0	28	23
Louisiana	10	0	8	7	0	0	22	26
Oklahoma [3]	10	1	4	18	4	1	54	63
Texas	4	1	10	8	3	17	32	40
Mountain States:								
Montana	0	0	6	5	1	7	2	7
Idaho	0	0	0	4	1	7	2	1
Wyoming	3	0	7	1	0	0	2	3
Colorado	1	0	6	5	1	2	8	6
New Mexico	1	0	3	1	0	2	4	25
Arizona	2	0	0	1	1	0	4	3
Utah [2]	0	0	4	2	0	2	1	3
Pacific States:								
Washington	0	0	3	5	7	12	3	7
Oregon	0	0	7	7	5	6	1	5
California	62	11	34	69	9	22	19	17

[2] Week ended Friday.
[3] Figures for 1930 are exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of monthly State reports 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
July, 1930										
Alabama	2	24	9	738	133	85	6	39	2	133
California	16	211	83	17	1,995	10	450	209	100	117
Idaho	6	1			21		1	1	10	2
Louisiana	6	39	11	143	11	50	98	33	24	154
Minnesota	3	53	1		239		58	116	14	20
Nevada									1	
North Carolina	5	95	31		118	1,094	22	112	29	268
Oklahoma [1]	3	18	19	394	36	57	41	34	116	167
Pennsylvania	20	331		5	2,053	2	9	529	1	99
Rhode Island	1	10			47		1	24	0	2
South Dakota	5	13	4	2	84		6	15	70	5
Washington	8	26	21		507	1	5	66	126	15
West Virginia	1	17	36		92		2	63	29	96

July, 1930

	Cases
Actinomycosis:	
California	1
Anthrax:	
Louisiana	1
Chicken pox:	
Alabama	25
California	376
Idaho	20
Louisiana	1
Minnesota	136
Nevada	5
North Carolina	77
Oklahoma [1]	13
Pennsylvania	542
Rhode Island	16
South Dakota	36
Washington	98
West Virginia	25
Conjunctivitis:	
Oklahoma [1]	1
Rhode Island	1
Dysentery:	
California (amebic)	4
California (bacillary)	21
Minnesota	1
Minnesota (amebic)	14
Oklahoma [1]	89
Pennsylvania	3
Washington	1
Food poisoning:	
California	67
German measles:	
California	31
North Carolina	42
Pennsylvania	183
Rhode Island	13
Washington	37
Granuloma, coccidioidal:	
California	4
Hookworm disease:	
California	1
Louisiana	18
Oklahoma [1]	1
Impetigo contagiosa:	
Washington	2
Jaundice:	
California	2
Leprosy:	
California	2
Louisiana	1
Lethargic encephalitis:	
Alabama	4
California	1
Minnesota	2
Pennsylvania	12
Washington	4
Mumps:	
Alabama	18
California	696
Idaho	14
Louisiana	1
Pennsylvania	461
Rhode Island	9
South Dakota	2
Washington	146
Ophthalmia neonatorum:	
California	1
North Carolina	3
Oklahoma [1]	1
Pennsylvania	12
Rhode Island	1
South Dakota	1
Paratyphoid fever:	
California	6
North Carolina	3
Washington	1
Puerperal septicemia:	
Louisiana	1
Pennsylvania	17
Washington	3

[1] Exclusive of Oklahoma City and Tulsa.

	Cases
Rabies in animals:	
California	69
Louisiana	6
Rhode Island	5
Rabies in man:	
Alabama	1
Pennsylvania	1
South Dakota	1
Rocky Mountain spotted or tick fever:	
California	1
Idaho	8
Nevada	2
Septic sore throat:	
Louisiana	1
North Carolina	5
Oklahoma [1]	20
Washington	1
Tetanus:	
California	6
Pennsylvania	15
Trachoma:	
California	9
Oklahoma [1]	7
South Dakota	1
Trichinosis:	
California	3
Pennsylvania	11
Tularaemia:	
California	1
Idaho	1
Louisiana	1
Typhus fever:	
Alabama	3
North Carolina	4
Undulant fever:	
California	10
Louisiana	2
Minnesota	5
Pennsylvania	4
Washington	6
Vincent's angina:	
Oklahoma [1]	1
Whooping cough:	
Alabama	94
California	683
Idaho	72
Louisiana	39
Minnesota	112
North Carolina	900
Oklahoma [1]	47
Pennsylvania	1,014
Rhode Island	55
South Dakota	11
Washington	234
West Virginia	174

[1] Exclusive of Oklahoma City and Tulsa.

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 95 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 31,720,000. The estimated population of the 89 cities reporting deaths is more than 30,330,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended August 16, 1930, and August 17, 1929

	1930	1929	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	573	824	
95 cities	191	372	424
Measles:			
45 States	738	717	
95 cities	198	145	
Meningococcus meningitis:			
46 States	101	102	
95 cities	51	59	
Poliomyelitis:			
46 States	303	114	
Scarlet fever:			
46 States	642	796	
95 cities	188	237	241
Smallpox:			
46 States	214	225	
95 cities	16	41	10
Typhoid fever:			
46 States	1,045	822	
95 cities	129	118	172
Deaths reported			
Influenza and pneumonia:			
89 cities	322	341	
Smallpox:			
89 cities	0	0	

City reports for week ended August 16, 1930

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible but no year earlier than 1921 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	1	1	0	----------	0	0	3	1
New Hampshire:								
Concord	0	0	0	----------	0	0	0	0
Manchester	0	0	0	----------	0	0	0	1
Vermont:								
Barre	0	0	0	----------	0	0	0	0
Burlington	0	0	0	----------	0	1	0	0
Massachusetts:								
Boston	4	18	11	----------	0	14	4	10
Fall River	1	1	1	----------	0	2	1	2
Springfield	2	1	2	----------	0	1	0	0
Worcester	0	3	2	----------	0	2	0	0
Rhode Island:								
Pawtucket	0	0	0	----------	0	0	0	1
Providence	2	3	0	----------	0	1	0	1
Connecticut:								
Bridgeport	----------	2	----------	----------	----------	----------	----------	----------
Hartford	0	2	1	----------	0	7	2	1
New Haven	0	1	0	----------	0	0	0	0
MIDDLE ATLANTIC								
New York:								
Buffalo	5	8	7	----------	1	9	6	10
New York	8	86	24	----------	2	39	17	92
Rochester	0	2	1	----------	0	0	0	1
Syracuse	----------	2	----------	----------	0	----------	----------	1
New Jersey:								
Camden	0	2	0	----------	0	8	0	0
Newark	0	6	6	----------	0	1	3	3
Trenton	0	1	0	----------	0	0	1	2
Pennsylvania:								
Philadelphia	9	28	6	----------	0	16	16	25
Pittsburgh	2	11	3	----------	2	9	4	13
Reading	0	0	1	----------	0	0	1	3
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	0	3	2	----------	0	0	0	5
Cleveland	3	19	1	3	0	3	4	3
Columbus	0	2	0	----------	0	1	1	1
Toledo	1	5	0	----------	1	3	0	1
Indiana:								
Fort Wayne	0	1	0	----------	0	0	0	1
Indianapolis	0	2	0	----------	0	0	3	4
South Bend	0	0	1	----------	0	0	0	0
Terre Haute	0	1	0	----------	0	1	0	1
Illinois:								
Chicago	7	54	40	3	0	8	14	13
Springfield	0	0	0	----------	0	0	0	1
Michigan:								
Detroit	9	24	13	----------	0	7	2	9
Flint	0	2	0	----------	0	5	0	1
Grand Rapids	0	1	0	----------	0	1	1	2

City reports for week ended August 16, 1930—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—continued								
Wisconsin:								
Kenosha	0	1	0		0	1	3	0
Madison	0	1	2			0	0	
Milwaukee	13	6	1		0	3	12	2
Racine	2	0	0		0	0	0	1
Superior	0	1	0		0	0	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth	0	0	0		0	0	1	0
Minneapolis	1	10	6		1	2	1	3
St. Paul	2	4	0		0	0	0	0
Iowa:								
Davenport	0	1	0			0	0	
Des Moines	0	1	0			0	0	
Sioux City	0	1	0			0	0	
Waterloo	0	0	2			0	0	
Missouri:								
Kansas City	0	1	0		0	2	0	4
St. Joseph	0	0	0		0	0	0	0
St. Louis	1	15	3			5	6	
North Dakota:								
Fargo	0	1	0		0	0	10	0
Grand Forks	0	0	0			0	0	
South Dakota:								
Aberdeen	0	0	0			1	0	
Nebraska:								
Omaha	1	2	2		0	0	0	2
Kansas:								
Topeka	1	1	0		0	0	1	0
Wichita	0	0	1		0	7	0	0
SOUTH ATLANTIC								
Delaware:								
Wilmington	0	0	0		0	0	0	0
Maryland:								
Baltimore	1	12	7	2	0	1	0	12
Cumberland	0	0	0		0	0	0	0
Frederick	0	0	0		0	0	0	0
District of Columbia:								
Washington	2	6	1		0	6	0	8
Virginia:								
Lynchburg	0	1	0		0	0	1	0
Norfolk	0	1	3		0	0	0	1
Richmond	0	5	3		0	3	0	1
Roanoke	0	1	3		0	1	0	0
West Virginia:								
Charleston	0	0	0		0	0	0	1
Wheeling	0	0	0		0	0	0	2
North Carolina:								
Raleigh	0	0	1		0	0	0	0
Wilmington	1	0	1		0	0	0	1
Winston-Salem	0	1	0		0	0	0	1
South Carolina:								
Charleston	0	0	0	3	0	0	0	3
Columbia		1						
Georgia:								
Atlanta	1	2	1	1	0	0	0	3
Brunswick	0	0	0		0	0	0	0
Savannah	0	0	1	1	0	1	1	1
Florida:								
Miami	0	1	0		0	0	0	2
St. Petersburg	0	0	0		0	0	0	0
Tampa	0	1	0		0	0	0	2
EAST SOUTH CENTRAL								
Kentucky:								
Covington	0	0	1		0	0	0	0
Tennessee:								
Memphis	0	2	1		0	0	0	1
Nashville	1	2	0		0	1	0	4
Alabama:								
Birmingham	0	3	2		0	2	0	2
Mobile	0	0	1		0	0	0	1
Montgomery	0	0	0			0	0	

City reports for week ended August 16, 1930—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria: Cases, estimated expectancy	Diphtheria: Cases reported	Influenza: Cases reported	Influenza: Deaths reported	Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
WEST SOUTH CENTRAL								
Arkansas:								
Forth Smith	0	1	1			0	0	
Little Rock	0	0	0		0	0	0	0
Louisiana:								
New Orleans	0	5	4		0	1	0	12
Shreveport	0	1	0		0	0	0	0
Oklahoma:								
Oklahoma City	0	1	0		0	0	0	
Tulsa	0	1	1			0	0	
Texas:								
Dallas	0	4	2		0	1	0	5
Forth Worth	0	2	0		0	0	0	2
Galveston	0	0	0		0	0	0	2
Houston	0	2	2		0	0	0	3
San Antonio	0	2	5		0	0	1	2
MOUNTAIN								
Montana:								
Billings	0	0	0		0	0	0	2
Great Falls	0	0	0		0	1	0	0
Helena	0	0	0		0	0	0	1
Missoula	0	0	0		0	1	0	1
Idaho:								
Boise	0	1	0		0	0	0	0
Colorado:								
Denver	3	6	2		0	1	5	8
Pueblo	0	1	0		0	2	4	1
New Mexico:								
Albuquerque	0	0	0		0	0	0	0
Utah:								
Salt Lake City	5	2	0		0	0	3	1
Nevada:								
Reno	0	0	0		0	0	0	0
PACIFIC								
Washington:								
Seattle	1	2	0			10	11	
Spokane	0	2	0			1	0	
Tacoma	0	1	2		0	2	0	0
Oregon:								
Portland	1	4	0		0	9	5	2
Salem	0	0	0		0	0	0	0
California:								
Los Angeles	3	22	13		0	6	10	13
Sacramento	1	2	0		0	1	5	2
San Francisco	2	9	0		0	1	1	1

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
NEW ENGLAND											
Maine:											
Portland	0	0	0	0	0	0	1	0	0	6	13
New Hampshire:											
Concord	0	0	0	0	0	0	0	0	0	0	6
Manchester	1	0	0	0	0	0	0	0	0	0	22
Vermont:											
Barre	0	0	0	0	0	0	0	0	0	0	3
Burlington	1	0	0	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	15	13	0	0	0	11	3	1	0	43	168
Fall River	1	0	0	0	0	0	1	0	0	3	15
Springfield	1	0	0	0	0	1	0	1	0	2	26
Worcester	2	5	0	0	0	7	0	0	0	5	29

City reports for week ended August 16, 1930—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
NEW ENGLAND—continued											
Rhode Island:											
Pawtucket	0	0	0	0	0	1	0	0	0	0	12
Providence	2	3	0	0	0	4	1	0	1	4	49
Connecticut:											
Bridgeport	2	------	0	------	------	------	0	------	------	------	------
Hartford	1	0	0	0	0	1	1	0	0	3	25
New Haven	1	0	0	0	0	1	1	0	0	5	30
MIDDLE ATLANTIC											
New York:											
Buffalo	5	2	0	0	0	12	1	0	0	43	128
New York	25	11	0	0	0	75	35	17	0	94	1,131
Rochester	2	0	0	0	0	0	1	0	0	1	56
Syracuse	1	------	0	------	0	1	0	------	0	------	33
New Jersey:											
Camden	0	0	1	0	0	2	0	0	0	0	18
Newark	4	5	0	0	0	9	1	2	0	19	72
Trenton	0	1	0	0	0	8	1	0	0	4	42
Pennsylvania:											
Philadelphia	15	12	0	0	0	24	8	7	1	36	432
Pittsburgh	6	3	0	0	0	10	3	5	2	14	131
Reading	0	0	0	0	0	1	0	0	0	4	19
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	4	3	0	0	0	8	2	0	0	1	124
Cleveland	9	9	0	0	0	10	4	2	0	27	134
Columbus	2	2	0	0	0	2	0	0	0	1	59
Toledo	2	0	0	1	0	3	2	6	0	8	49
Indiana:											
Fort Wayne	0	0	0	0	0	0	0	0	0	0	31
Indianapolis	2	0	1	1	0	6	1	0	1	13	------
South Bend	1	1	0	0	0	2	0	0	0	0	12
Terre Haute	0	0	0	0	0	0	0	0	0	0	13
Illinois:											
Chicago	24	21	0	1	0	25	6	7	1	63	493
Springfield	0	0	0	0	0	1	2	1	0	1	22
Michigan:											
Detroit	22	12	1	3	0	14	5	6	0	107	209
Flint	4	1	1	0	0	0	1	0	0	11	26
Grand Rapids	3	1	0	0	0	1	0	0	0	5	24
Wisconsin:											
Kenosha	0	2	0	0	0	0	0	0	0	2	4
Madison	0	2	0	0	------	------	0	0	------	1	------
Milwaukee	6	3	0	0	0	5	0	0	0	48	82
Racine	1	5	0	0	0	1	0	0	0	4	14
Superior	1	3	0	0	0	0	0	0	0	0	7
WEST NORTH CENTRAL											
Minnesota:											
Duluth	3	1	0	0	0	1	1	0	0	3	14
Minneapolis	12	3	1	0	0	2	1	0	0	8	77
St. Paul	6	0	0	0	0	0	1	0	0	9	42
Iowa:											
Davenport	0	1	1	3	------	------	0	0	------	0	------
Des Moines	2	0	0	0	------	------	0	1	------	0	------
Sioux City	0	1	1	0	------	------	0	0	------	1	------
Waterloo	0	0	0	0	------	------	0	0	------	2	------
Missouri:											
Kansas City	2	2	0	0	0	6	3	3	0	2	96
St. Joseph	0	0	0	0	0	0	1	0	0	0	11
St. Louis	8	5	0	1	0	8	7	9	1	7	225
North Dakota:											
Fargo	1	0	0	0	0	0	0	0	0	0	5
Grand Forks	2	0	0	0	------	------	0	0	------	0	------
South Dakota:											
Aberdeen	0	0	0	0	------	------	0	4	------	1	------
Nebraska:											
Omaha	1	1	0	2	0	1	0	1	0	1	48
Kansas:											
Topeka	2	1	0	0	0	1	0	0	0	5	5
Wichita	1	1	0	0	0	0	1	2	0	5	29

City reports for week ended August 16, 1930—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
SOUTH ATLANTIC											
Delaware:											
Wilmington	0	2	0	0	0	0	0	0	0	1	32
Maryland:											
Baltimore	5	1	0	0	0	10	9	7	1	23	184
Cumberland	0	0	0	0	0	0	1	1	1	0	12
Frederick	0	0	0	0	0	0	0	0	0	0	1
District of Col.:											
Washington	4	4	0	0	0	13	4	2	3	9	130
Virginia:											
Lynchburg	0	0	0	0	0	0	1	1	0	1	11
Norfolk	1	2	1	0	0	2	1	5	0	0	-------
Richmond	2	2	0	0	0	3	2	1	0	0	33
Roanoke	1	0	0	0	0	1	1	1	0	3	11
West Virginia:											
Charleston	1	0	0	0	0	0	1	[1] 4	1	3	21
Wheeling	0	1	0	0	0	1	0	0	0	3	17
North Carolina:											
Raleigh	0	0	0	0	0	2	0	0	0	2	8
Wilmington	0	1	0	0	0	0	1	0	0	6	12
Winston-Salem	0	2	1	0	0	2	2	1	0	0	16
South Carolina:											
Charleston	0	0	0	0	0	2	2	0	0	0	18
Columbia	1	-------	0	-------	-------	-------	1	-------	-------	-------	-------
Georgia:											
Atlanta	3	1	0	0	0	3	4	1	2	0	78
Brunswick	0	0	0	0	0	0	0	0	0	0	3
Savannah	0	0	0	0	0	2	0	1	0	0	25
Florida:											
Miami	0	1	0	0	0	1	0	1	0	2	19
St. Petersburg	0	-------	0	-------	0	0	0	-------	0	-------	6
Tampa	0	0	0	0	0	0	0	2	0	0	26
EAST SOUTH CENTRAL											
Kentucky:											
Covington	0	1	1	0	0	2	0	0	1	0	20
Tennessee:											
Memphis	1	4	0	1	0	4	7	13	0	20	68
Nashville	0	0	0	0	0	2	6	5	0	4	60
Alabama:											
Birmingham	2	3	0	0	0	3	6	4	1	4	67
Mobile	0	0	0	0	0	0	0	0	1	0	25
Montgomery	1	0	0	0	-------	-------	1	0	-------	0	-------
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	0	0	0	0	-------	-------	0	0	-------	0	-------
Little Rock	0	1	0	0	0	1	2	1	0	0	-------
Louisiana:											
New Orleans	2	2	0	0	0	15	5	5	0	4	137
Shreveport	0	0	0	0	0	1	2	0	1	0	28
Oklahoma:											
Oklahoma City	1	1	0	0	0	2	2	4	1	0	49
Tulsa	0	0	0	0	-------	-------	2	1	-------	0	-------
Texas:											
Dallas	2	3	0	0	0	3	3	4	2	2	61
Fort Worth	1	0	1	0	0	3	3	0	0	0	40
Galveston	0	0	0	0	0	0	0	0	0	0	11
Houston	1	1	0	1	0	3	0	2	1	0	59
San Antonio	0	2	0	0	0	5	1	0	1	0	56
MOUNTAIN											
Montana:											
Billings	0	0	0	0	0	0	0	0	0	0	7
Great Falls	0	2	0	0	0	0	0	0	0	1	8
Helena	0	0	0	0	0	0	0	1	0	3	5
Missoula	0	0	0	0	0	0	1	0	0	0	8
Idaho:											
Boise	0	0	0	0	0	0	0	0	0	1	2

[1] Includes 3 nonresidents.

City reports for week ended August 16, 1930—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
MOUNTAIN—con.											
Colorado:											
Denver	2	2	0	0	0	7	2	0	1	20	79
Pueblo	0	0	0	0	0	1	1	0	0	2	6
New Mexico:											
Albuquerque	0	0	0	0	0	1	1	0	0	0	8
Utah:											
Salt Lake City	1	1	0	0	0	2	2	2	0	29	21
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	4
PACIFIC											
Washington:											
Seattle	2	4	0	0	-------	-------	2	1	-------	29	-------
Spokane	2	0	0	3	-------	-------	1	0	-------	0	-------
Tacoma	1	1	1	1	0	0	1	0	0	4	-------
Oregon:											
Portland	1	0	4	0	0	1	1	0	0	0	55
Salem	0	0	0	0	0	0	0	0	0	2	-------
California:											
Los Angeles	7	6	1	1	0	25	3	4	0	20	269
Sacramento	1	0	0	1	0	1	1	0	0	0	18
San Francisco	5	5	0	0	0	4	3	1	0	2	160

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
NEW ENGLAND									
Maine:									
Portland	0	0	0	0	0	0	0	1	2
Massachusetts:									
Boston	2	0	0	0	0	0	2	13	3
Worcester	0	0	0	0	0	0	0	1	0
Rhode Island:									
Providence	0	0	0	0	0	0	1	1	0
MIDDLE ATLANTIC									
New York:									
Buffalo	0	0	0	0	0	0	1	8	2
New York	13	5	0	2	0	1	16	2	0
Rochester	0	0	0	0	0	0	0	1	0
Syracuse	0	0	0	0	0	0	2	0	3
New Jersey:									
Newark	4	0	0	0	0	0	1	0	0
Pennsylvania:									
Philadelphia	10	2	0	0	0	0	1	9	1
Pittsburgh	2	0	0	0	0	0	1	1	0
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	2	0	0	0	0	0	1	0	0
Cleveland	0	0	0	0	0	0	1	1	0
Illinois:									
Chicago	5	3	0	0	0	0	2	11	2
Michigan:									
Detroit	2	0	0	0	0	0	2	3	1
Wisconsin:									
Kenosha	0	0	0	0	0	0	1	1	0

City reports for week ended August 16, 1930—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
WEST NORTH CENTRAL									
Minnesota:									
Duluth	1	0	0	0	0	0	0	0	0
Minneapolis	1	0	0	0	0	0	0	2	0
Missouri:									
Kansas City	2	0	0	0	0	0	0	0	0
St. Louis	0	0	1	0	0	0	0	1	0
North Dakota:									
Fargo	0	0	1	0	0	0	0	0	0
Kansas:									
Wichita	0	0	0	0	0	0	0	4	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	0	0	0	1	0	0	1	0	0
Virginia:									
Norfolk	0	0	0	0	0	0	0	8	1
South Carolina:									
Charleston	0	0	0	0	1	0	0	0	0
Georgia: [1]									
Atlanta	0	0	0	0	2	2	0	0	0
Florida:									
Tampa [1]	0	0	0	1	0	0	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Memphis	0	1	0	0	0	0	1	0	0
Nashville	0	2	0	0	0	0	0	0	0
Alabama:									
Birmingham	2	0	0	0	1	1	0	0	0
Mobile	0	0	0	0	0	2	0	0	0
Montgomery	0	0	0	0	1	0	0	0	0
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	0	0	0	0	5	1	0	0	0
Shreveport [1]	0	0	0	0	0	0	0	1	0
Texas:									
Dallas	0	0	0	0	0	3	0	0	0
Fort Worth	0	0	0	0	0	1	0	0	0
Houston	0	0	0	0	0	0	0	1	0
San Antonio	0	0	0	0	0	0	0	1	0
MOUNTAIN									
Colorado:									
Denver	0	0	0	0	0	0	0	3	0
New Mexico:									
Albuquerque	0	0	0	0	0	0	0	1	1
Utah:									
Salt Lake City	2	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Seattle	1	0	0	0	0	0	1	1	0
Tacoma	1	1	0	0	0	0	0	0	0
California:									
Los Angeles	1	0	0	0	0	0	1	18	0
San Francisco	0	0	1	0	1	0	1	1	0

[1] Typhus fever, 13 cases and 1 death: 8 cases at Savannah, Ga., and 5 cases at Tampa, Fla., and 1 death at Shreveport, La.

The following table gives the rates per 100,000 population for 98 cities for the 5-week period ended August 16, 1930, compared with those for a like period ended August 17, 1929. The population figures used in computing the rates are approximate estimates, authoritative figures for many of the cities not being available. The 98 cities reporting cases have an estimated aggregate population of more than 32,000,000. The 91 cities reporting deaths have more than 30,500,000 estimated population.

Summary of weekly reports from cities, July 13 to August 16, 1930—Annual rates per 100,000 population, compared with rates for the corresponding period of 1929 [1]

	Week ended—									
	July 19, 1930	July 20, 1929	July 26, 1930	July 27, 1929	Aug. 2, 1930	Aug. 3, 1929	Aug. 9, 1930	Aug. 10, 1929	Aug. 16, 1930	Aug. 17, 1929
DIPHTHERIA CASE RATES										
98 cities	49	73	38	68	39	67	[2] 38	[3] 63	[4] 31	61
New England	33	83	22	58	33	54	31	45	[5] 41	38
Middle Atlantic	48	76	35	75	35	67	[6] 35	70	[7] 23	59
East North Central	66	105	49	103	49	99	48	81	36	86
West North Central	38	54	34	21	34	25	[8] 30	31	27	23
South Atlantic	42	30	35	28	37	47	16	30	[9] 34	47
East South Central	13	27	27	27	7	34	[10] 27	[3] 30	34	82
West South Central	37	69	34	99	37	95	[11] 54	118	52	122
Mountain	69	17	69	9	34	9	17	35	17	44
Pacific	38	41	33	31	52	46	66	43	35	3[illegible]
MEASLES CASE RATES										
98 cities	151	98	107	69	68	49	[2] 51	[3] 30	[4] 33	24
New England	235	146	175	101	97	97	91	31	[5] 65	29
Middle Atlantic	205	47	152	27	91	35	[6] 67	15	[7] 40	15
East North Central	71	210	60	149	34	84	28	58	19	35
West North Central	57	52	63	58	42	38	[8] 47	33	30	13
South Atlantic	112	43	46	17	55	11	22	9	[9] 22	15
East South Central	47	7	61	7	40	7	[10] 27	[3] 7	20	0
West South Central	11	4	7	27	11	8	[11] 14	19	7	23
Mountain	240	61	172	70	154	26	112	61	43	52
Pacific	361	109	191	77	118	43	73	24	50	46
SCARLET FEVER CASE RATES										
98 cities	54	64	50	59	39	40	[2] 32	[3] 44	[4] 31	39
New England	60	56	66	56	55	63	42	52	[5] 51	49
Middle Atlantic	37	35	36	19	22	24	[6] 19	23	[7] 17	17
East North Central	87	103	76	110	50	62	46	72	39	50
West North Central	42	54	30	77	49	35	[8] 28	44	28	40
South Atlantic	44	69	37	60	40	28	18	41	[9] 26	73
East South Central	20	55	54	27	7	34	[10] 18	[3] 15	54	14
West South Central	22	72	49	57	56	38	[11] 45	42	34	38
Mountain	77	78	26	26	60	9	69	44	43	78
Pacific	57	65	45	65	40	48	45	56	38	53

[1] The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1930 and 1929, respectively.
[2] Rochester, N. Y., Wichita, Kans., Memphis, Tenn., and Houston, Tex., not included.
[3] Montgomery, Ala., not included.
[4] Bridgeport, Conn., Syracuse, N. Y., and Columbia, S. C., not included.
[5] Bridgeport, Conn., not included.
[6] Rochester, N. Y., not included.
[7] Syracuse, N. Y., not included.
[8] Wichita, Kans., not included.
[9] Columbia, S. C., not included.
[10] Memphis, Tenn., not included.
[11] Houston, Tex., not included.

Summary of weekly reports from cities, July 13 to August 16, 1930—Annual rates per 100,000 population, compared with rates for the corresponding period of 1929—Continued

SMALLPOX CASE RATES

	Week ended—									
	July 19, 1930	July 20, 1929	July 26, 1930	July 27, 1929	Aug. 2, 1930	Aug. 3, 1929	Aug. 9, 1930	Aug. 10, 1929	Aug. 16, 1930	Aug. 17, 1929
98 cities	6	13	7	8	4	7	[2] 2	[3] 5	[4] 3	7
New England	0	0	0	0	0	0	0	0	[5] 0	0
Middle Atlantic	0	0	0	0	0	0	[6] 0	0	[7] 0	3
East North Central	10	32	8	16	2	13	6	12	3	16
West North Central	13	21	21	21	13	6	[8] 4	10	6	4
South Atlantic	4	2	2	0	4	0	2	0	[9] 0	0
East South Atlantic	0	7	20	7	0	7	[10] 0	[3] 7	7	7
West South Central	7	0	4	8	15	4	[11] 5	0	4	0
Mountain	17	44	17	9	0	26	0	0	0	9
Pacific	21	34	26	22	26	34	5	17	14	12

TYPHOID FEVER CASE RATES

	July 19, 1930	July 20, 1929	July 26, 1930	July 27, 1929	Aug. 2, 1930	Aug. 3, 1929	Aug. 9, 1930	Aug. 10, 1929	Aug. 16, 1930	Aug. 17, 1929
98 cities	16	18	18	18	18	19	[2] 17	[3] 17	[4] 21	20
New England	9	9	7	29	7	11	4	13	[5] 5	11
Middle Atlantic	4	10	7	7	5	11	[6] 10	11	[7] 15	19
East North Central	9	8	13	8	13	10	11	11	10	5
West North Central	23	19	47	13	23	33	[8] 20	15	28	6
South Atlantic	40	32	38	37	48	22	60	22	[9] 41	39
East South Central	67	144	74	103	121	150	[10] 54	[3] 45	148	123
West South Central	64	57	41	69	45	53	[11] 5	61	45	46
Mountain	26	52	17	44	26	9	34	9	26	61
Pacific	19	5	12	7	19	19	12	29	14	17

INFLUENZA DEATH RATES

	July 19, 1930	July 20, 1929	July 26, 1930	July 27, 1929	Aug. 2, 1930	Aug. 3, 1929	Aug. 9, 1930	Aug. 10, 1929	Aug. 16, 1930	Aug. 17, 1929
91 cities	3	3	3	3	1	3	[2] 3	1	[12] 1	3
New England	0	0	0	2	0	0	0	0	[5] 0	0
Middle Atlantic	3	2	1	2	0	2	[6] 2	1	2	2
East North Central	2	3	3	4	1	4	1	1	0	2
West North Central	0	3	3	3	0	0	[8] 3	6	3	3
South Atlantic	0	6	4	4	5	4	9	0	[9] 0	0
East South Central	0	0	0	0	0	15	[10] 0	0	0	22
West South Central	11	20	11	4	0	8	[11] 0	0	0	12
Mountain	9	0	0	9	0	9	17	0	0	17
Pacific	6	3	3	0	3	0	6	0	0	3

PNEUMONIA DEATH RATES

	July 19, 1930	July 20, 1929	July 26, 1930	July 27, 1929	Aug. 2, 1930	Aug. 3, 1929	Aug. 9, 1930	Aug. 10, 1929	Aug. 16, 1930	Aug. 17, 1929
91 cities	44	55	57	49	53	54	[2] 54	53	[12] 54	57
New England	35	70	40	31	38	43	42	38	[5] 39	52
Middle Atlantic	56	65	72	57	62	61	[6] 61	60	72	71
East North Central	32	40	38	38	44	47	47	43	28	35
West North Central	38	36	56	51	47	39	[8] 44	45	27	33
South Atlantic	49	54	79	60	60	51	66	41	[9] 65	62
East South Central	59	52	103	52	59	75	[10] 51	60	59	90
West South Central	50	27	77	86	61	78	[11] 56	121	92	78
Mountain	51	96	77	61	60	61	69	61	120	35
Pacific	18	63	9	25	46	50	43	41	49	72

[2] Rochester, N. Y., Wichita, Kans., Memphis, Tenn., and Houston, Tex., not included.
[3] Montgomery, Ala., not included.
[4] Bridgeport, Conn., Syracuse, N. Y., and Columbia, S. C., not included.
[5] Bridgeport, Conn., not included.
[6] Rochester, N. Y., not included.
[7] Syracuse, N. Y., not included.
[8] Wichita, Kans., not included.
[9] Columbia, S. C., not included.
[10] Memphis, Tenn., not included.
[11] Houston, Tex., not included.
[12] Bridgeport, Conn., and Columbia, S. C., not included.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended August 9, 1930.—The Department of Pensions and National Health reports cases of certain communicable diseases in Canada for the week ended August 9, 1930, as follows:

Province	Cerebrospinal fever	Influenza	Poliomyelitis	Smallpox	Typhoid fever
Prince Edward Island [1]					
Nova Scotia		5			
New Brunswick					4
Quebec			1		21
Ontario	6		10	3	7
Manitoba					2
Saskatchewan			13		
Alberta			2		1
British Columbia			1	1	2
Total	6	5	27	4	37

[1] No case of any disease included in the table was reported during the week.

Quebec Province—Communicable diseases—Week ended August 16, 1930.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended August 16, 1930, as follows:

Disease	Cases	Disease	Cases
Chicken pox	9	Scarlet fever	26
Diphtheria	17	Smallpox	2
Erysipelas	1	Tuberculosis (pulmonary)	25
Leprosy	1	Tuberculosis (other forms)	5
Measles	1	Typhoid fever	17
Mumps	3	Whooping cough	25
Poliomyelitis	1		

VIRGIN ISLANDS

Communicable diseases—July, 1930.—During the month of July, 1930, cases of certain diseases were reported in the Virgin Islands as follows:

	Cases
St. Thomas and St. John:	
Chancroid	2
Gonorrhea	4
Pellagra	2
Syphilis	19
Tuberculosis	2
St. Croix:	
Gonorrhea	3
Syphilis	1
Tuberculosis	1

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

From medical officers of the Public Health Service, American consuls, International Office of Public Hygiene, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	May 4–31, 1930	Week ended— June, 1930				July, 1930				August, 1930				
						7	14	21	28	5	12	19	26	2	9	16	23	30
Afghanistan	C										[1] P							
China:																		
Canton	C				3		2				2	1						
Manchuria—Dairen	C	1																
Swatow	C				3	4	3							1				
India	C	5,914	10,817	41,462	56,311	10,088	10,103	10,162	6,767	6,728								
	D	3,371	5,866	27,906	44,878	7,802	7,110	6,455	4,344	3,712								
Bassein	C			7	7													
	D			5	5													
Bombay	C		4												2			
Calcutta	C	269	354	647	609	78	73	94	77	81	53	49	37	18	10			
	D	153	220	414	372	44	36	36	63	54	28	23	23	7	7			
Negapatam	C						1											
	D						1											
Rangoon	C	3	2	1	9	1	1	2	2	1								
	D	1	2	1	3	1	1	1	1	1								
India (French):																		
Chandernagor	C	4	1	6	6			1	2			1						
	D	2	3	5	6			1	1									
Karikal	C	4	12	1					3									
	D	1	9	1					3									
Indo-China (see also table below):																		
Pnompenh	C	9		2	1	5	10	11	14	9	16	7		5	3	3		
	D	7	6		5	1	4	7	6	6	9	5	2	3	2	1		
Saigon and Cholon	C	5	14	76	160	17	19	7	5	7	1	1	1	2	2	1		
	D	4	6	55	101	11	10	2		3					1			

[1] An outbreak of cholera was reported in June, 1930, in Afghanistan.

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

CHOLERA—Continued

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	May 4–31, 1930	Week ended— June, 1930: 7	14	21	28	July, 1930: 5	12	19	26	August, 1930: 2	9	16	23	30
Philippine Islands: [3]																		
Ports—																		
Cebu	C								1	20	13	13	9	5	4			
	D									9	7	12	8	4	4			
Iloilo	C										1	11	17	9	19	32	4	
	D											9	13	10	13	19	9	
Manila	C				1										1			4
Provinces—																		
Antique	C													14	4		3	
	D													7	4		2	
Bohol	C														45	67	31	
	D														26	37	15	
Bulacan	C					1			2		1	1	3					
	D					1												
Capiz	C											2		3	1			
	D											1		2	1			
Cebu [3]	C				1	13	26	118	198	313	222	115	57	63	37	4		
	D				1	11	23	50	86	131	83	60	35	37	27	3		
Iloilo [3]	C							1	1	20	45	85	66	250	227	176	88	
	D								1	10	23	64	49	146	164	119	64	
La Union	C										1							
Leyte [3]	C							21	26	11								
	D							12	7	11								
Masbate [3]	C								10	14	32	25	20	37	27			
	D								3	2	18	5	4	18	11			
Misamis, Occidental [3]	C									1	2							
	D									1	2							
Negros, Occidental [3]	C				10	5	55	50	30	62	163	172	165	178	99	50	72	
	D				7	2	27	36	23	42	90	122	104	118	72	34	47	
Negros, Oriental	C									1	1	6	17	9	2			
	D										1	3	9	3	3			
Nueva Acija	C												1					
	D												1					
Pampanga	C							1	1	2								
Pangasinan	C									2		1						

	D									2								
Rizal	C						1				1							
	D						1				1							
Samar	C														5	4	10	
	D														5	3	8	
Surigao	C														15	4	21	
	D														9	2	10	
Tarlac	C													2				
Siam	C	7	1	29	33	8	10	6	3	8								
	D	4		13	21	3	9	4	3	4								
Bangkok	C	2	2	15	9	5	3	3	1		3	4	1	1				
	D		1	4	3		3		2		1	1	1	1				
Nagara Pathom	C	1		10														
	D	1		2														
Songkla	C										8		2					
	D										4		2					
On vessel:																		
S. S. at Suva, Fiji Islands	C	1																
S. S. Sutley, at Batavia, from Calcutta	C	1																
S. S. Sassari, at Massoua, from Jeddah	C				1													
	D				1													
On small boat at Port Cebu, from Bantayan Island	C					1												
	D					1												

Place		January, 1930	February, 1930	March, 1930	April, 1930			May, 1930			June, 1930			July, 1930		
					1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31
Indo-China (French) (see also table above):																
Annam [4]	C	1	4	52			60		20	3	2	14				1
Cambodia [4]	C	147	90	81	18	6		5	31	52	56	88				43
Cochin-China [4]	C	177	65	82	48			188	224	259	147	126				46

[2] Figures for cholera in the Philippine Islands are subject to correction.

[3] Figures for cholera in the Philippine Islands for the weeks ended July 12 and July 19, 1930, have been corrected since the last issue of the PUBLIC HEALTH REPORTS from late reports.

[4] Reports incomplete.

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

PLAGUE

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	May 4–31, 1930	Week ended— June, 1930: 7	June 14	June 21	June 28	July, 1930: 5	July 12	July 19	July 26	August, 1930: 2	Aug. 9	Aug. 16	Aug. 23
Algeria:																	
Algiers	C										1	2			1		
Constantine	C					1				1							
Oran	C											2	1		1		1
Argentina:																	
Andalgala.[1]																	
Villa Lia	D	2															
Azores: Ponta Delgada	C			8													
	D			5													
Belgian Congo	C									2				1			
	D									2							
British Africa: Gambia	C																P
British East Africa (see also table below):																	
Tanganyika	C	7		44													
	D			20													
Uganda	C	47	98	117	227	121	77	105	103								
	D	43	87	105	195	75	70	93	90								
Canary Islands: Las Palmas	D														1		
Ceylon:																	
Colombo	C	3	4	1	6	1				1	2					1	
	D	3	4	1	5	1				1	2					1	
Plague-infected rats		3	2	4		1											
Chile: Antofagasta	C	1	1	1													
	D		2	1													
Dutch East Indies:																	
Batavia and West Java	C	153	124	87	82	19	27	28	24	19							
	D	150	122	81	82	19	27	28	24	19							
Plague-infected rats		3	3	8	5	3	1								1		
Java and Madura	D	296	223	173	185	40	55	56									
Ecuador (see table below).																	

Egypt:																	
Alexandria	C	1	4	[1]2	13	3	6	6	4	8	8	3	4	2	2	4	3
	D		1	2	3	2		2	5	2	3	2	3	2	1	3	
Assiout	C			14	20	4	2	3		1	1						
	D			5	5		1		2	1	1						
Beheira	C		4														
Beni-Suef	C		4														1
Dakahlieh	C	8	5	5	11	1											
	D		1		2												
Gharbieh	C			1										3			
	D			1										1			
Girga	C			1							1						
Minieh	C				7	1	1	4	4	2	1						
	D				1		1										
Port Said	C			1	2	1			1				1	1			
France: St. Ouen	C											1					
	D											1					
Greece (see also table below):																	
Patras	C		1					1				1					
Pyrgos	C		1														
Hawaii Territory, Hamakua, Hawaii: Plague-infected rats								1									
India	C	5,639	4,087	2,215	648	55	59	62	64	70							
	D	3,940	3,344	1,960	635	42	52	43	50	46							
Bassein	C		3														
	D		1														
Bombay	C	1	7	4	6	1		2					1				
	D	1	5	8	5			1	1				1				
Plague-infected rats		31	86	108	81	6	7	8	5	13	14	10	15	10	8		
Madras Presidency	C	230	157	44	38	26	10	3		10	1	10					
	D	140	87	19	11	15	2	5		4	1	9					
Rangoon	C	7	3	5	4				1				2	2	1		
	D	6	3	4	3				1				2	1	1		
Plague-infected rats		7	3	4	5			1		2	2		2	4			
India (Portuguese)	D				7												
Indo-China (see also table below):																	
Pnompenh	C			3	3	6					1	1			2		
	D	13	13	4	1	5	1		1		1	1					
Saigon and Cholon	C		1		1	1		1									
	D		1					1									
Iraq: Baghdad	C	6	7	6	37	12	4	8	4	10	4	2	2	4	3	2	
	D	1	4	2	18	7	3	5		5		1	1		2	1	
Japan: Osaka (vicinity of)—Plague-infected rats		6	4	3													
Kwang-Chow-Wan	C	25	7	37	34	23		8								4	
Madagascar (see also table below): Tamatave	C			1		1											
Morocco	C	48	55	121	71	2		1					1		8		
	D	13	18	45	34	4									1		
Nigeria: Lagos	C	7	13		2	1		3	1	1				2	1		
	D	7	5		2	1		3	1	1				2	1		
Plague-infected rats		42	25	7	17	1	4	1	5								
Senegal (see table below).																	

[1] On Mar. 11, 3 deaths from bubonic plague were reported in Andalgala, Catamarca Province, Argentina, since Feb. 5, 1930.

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

PLAGUE—Continued

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	May 4–31, 1930	Week ended— June, 1930: 7	14	21	28	July, 1930: 5	12	19	26	August, 1930: 2	9	16	23
Siam	C	17	16	5	5												
	D	13	15	6	4												
Bangkok	C	1	5		5									1	2		
	D	1	4		4										2		
Nagara Pathom	C	5	1	10													
	D	6	1	9													
Nagara Rajsima	C	2	1	1										1			
	D		1	1										1			
Syria: Beirut	C						2	5	5		2	4	3		1		1
Tunisia:																	
Sfax district	C	22		1	21	6		3					6		1		
Tunis	C	5	1	4	1		1				1	4					
	D					1					1						
Union of Socialist Soviet Republics:																	
Salsk Region	C					1			1								
	D					1											
Stavropol Region	C					1											
	D					1											
Union of South Africa:																	
Cape Province	C	2	1		P	1											
	D	1	1														
Orange Free State	C	11	5	1													
	D	3	3														
Transvaal	C	2	1														
	D		1														

Place		February, 1930	March, 1930	April, 1930	May, 1930	June, 1930	July, 1930
British East Africa (see also table above):							
Kenya	C	69	85	16	171	107	36
Uganda	C	109					50
	D	90					47
Ecuador: Guayaquil	C	2	2	0			
	D	2		0			
Plague-infected rats		2	2	0			
Greece (see also table above)	C			1		1	
Indo-China (see also table above)	C	30	27	4		11	1
Madagascar (see also table above):							
Ambositra Province	C	49	25	14	1		
	D	41	20	12	1		
Antsirabe Province	C	22	38	46	19		
	D	22	36	45	19		
Itasy Province	C		4				
	D		4				
Miarinarivo Province	C	25	14	1	5	1	
	D	25	14	1	5	1	
Madagascar—Continued.							
Moramanga Province	C	7	5	3	1	3	
	D	4	5	3		3	
Tananarive Province	C	110	52	39	15	6	
	D	107	52	38	14	6	
Senegal:							
Baol [1]	C		18	24	13	2	62
	D		8	12	11	2	48
Dakar [1]	C			2	52	53	140
	D			2	42	117	122
Louga [1]	C	2		33	54	60	138
	D			10	27	21	103
Thies [1]	C		3	12	21	52	54
	D		2	9	8	35	30
Tivaouane [1]	C		11	71	135	43	119
	D		8	38	69	28	70

[1] Incomplete reports.

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

SMALLPOX

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	Week ended— May, 1930: 10	17	24	31	June, 1930: 7	14	21	28	July, 1930: 5	12	19	26	August, 1930: 2	9	16
Algeria:																			
Algiers	C	1	5	1		1		2						1					
Constantine	C										1				1				
Oran	C		1																
Arabia: Aden	C	2	3	1									1						
Bolivia: La Paz.[1]																			
British Borneo: Sarawak	C	19																	
British East Africa (see also table below):																			
Tanganyika	C	49	103	57	33	45	55	276	385	755	196	274	64	4					
	D	8	7	14	3	5	8	54	154	90	31	26	13	2					
British South Africa:																			
Northern Rhodesia	C		9	1			57	2											
	D			2			9												
Southern Rhodesia	C	6		66	53		42	60	75	1	3		1	12	18				
	D			1	4		8	1											
Canada:																			
Alberta	C	4	10	4										2	1	2	1		
Edmonton	C	1	4	3															
British Columbia—Vancouver	C	16	20	17			2	2	1	1			2	2	1	1	1	1	
Manitoba	C	2	4	4			7	3			4								
Ontario	C	86	100	77	14	24	24	20	14	10	13	10	3	5	6	10	8	3	
North Bay	C	1			1														
Ottawa	C	11	19	21	3	10	7	5	6		8	1	1	1	4	7	5	1	1
Toronto	C						3	1	2	1	1			1					
Quebec	C											4	3						
Montreal	C																7		
Saskatchewan	C	76	47	41	20	6	10	3		12	10			2		3			
Regina	C				1		3												
Ceylon:																			
Angoda, Western Province	C	10		6															
	D	1		2															
Colombo	C	3																	
	D	2																	

China:																			
Canton	C	11	6	3					1										
	D	3	2	3															
Chungking	C	P		P	P		P	P	P			P	P	P	P	P			
Foochow	C	P		P		P		P		P		P							
Hong Kong	C	62	38	18	5	5	2		2	1	1			2					
	D	51	25	23	4	2	3		1		1	1		1					
Manchuria—																			
Harbin	C			1		10	10												
Kwantung—Dairen	C	5		2	1		7			11	5		8						
	D						4				1								
Nanking	C	P	P	P	P			P	P	P				P	P	P	P		
Shanghai—																			
Foreigners only	C	2	2	3		1	1		1	1	1	2	1	1	1	1	3		
Including natives	D	7	10	10		1	2	2	1		1	1							
Swatow	D	6	6	3	1		1	4	1		1	2	1				1		
Tientsin	C	1	2	2	1														
Chosen (see table below).																			
Colombia:																			
Barranquilla	C	102	2	1															
Buenaventura	C	1		15	2		1	1	1	1		4	4	3	2	1			
Costa Rica:																			
Port Limon	C			6				2	2										
San Jose [2]	C		10	7															
Curacao (alastrim)	C		14	2	2					1			2						
Dutch East Indies:																			
Borneo	C		185	90		10	4	2	2	10				2					
	D		12	31	1					1									
Java—																			
Batavia and West Java	C	14	78	64	1	1	5	5	1	4	6	2	3	1	3	1	1		
	D	7	6	11	1	1	3	2		1	2		2	1	1	1	1		
East Java and Madura	C			4											1				
Sanggi Islands	C	12	5	160	14	12													
	D		1	24	1	4													
Sumatra	C		48																
	D		5																
Egypt: Port Said	C			1		1								2		1			
Great Britain:																			
England and Wales	C	1,530	1,700	1,427	462	324	304	327	237	266	241	182	156	138	126	109	70	86	
Ashton under Lyne	C	29	15	18	6	3	4	4			3	4		4	2	2			
Bradford	C	2		3		1		1					1						
Cardiff	C		2	3									2						
Leeds	C	11	16	2									1						
London	C	699	710	602	222	138	148	129	130	136	125	107	84	52	62	48	36	50	
London and Great Towns	C	1,156	1,239	1,066	339	250	235	254	197	208	190	158	127	96	102	83	61	73	
	D	5	3	3															
Sheffield	C		8	2															
Stoke-on-Trent	C	41	122	85	19	9	13	21	3	10	15	4	3	2	1	3	1	1	
Scotland	C								1		3			1					
	D													1					

[1] From Jan. 1 to May 31, 1930, 44 deaths from smallpox were reported in La Paz, Bolivia.
[2] 5 cases of smallpox were reported Apr. 14, 1930, in Costa Rica outside of city of San Jose.

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

SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place		Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Apr. 6–May 3, 1930	Week ended— May, 1930: 10	17	24	31	June, 1930: 7	14	21	28	July, 1930: 5	12	19	26	August, 1930: 2	9	16
India	C	36,036	39,329	34,843	6,533	6,549	5,416	4,337	3,686	3,559	3,174	2,552	2,258						
	D	7,710	9,109	6,983	1,449	1,814	1,196	993	1,065	913	905	648	733						
Bombay	C	638	718	430	52	68	58	40	36	35	23	19	17	15	11	7	6		
	D	314	431	270	33	49	44	35	27	23	19	10	13	9	9	2	5		
Calcutta	C	399	361	495	109	70	52	71	46	45	45	25	27	19	13	14	4		
	D	287	305	403	94	72	40	52	50	37	29	30	17	17	12	10	4		
Cochin	C	184	291	183	13	8	7	9	4	1	10	1	27		4	2	2		
	D	29	35	13	5	1	2		2	1	1		17						
Karachi	C	38	33	30		6	7	1	5		1	1				1	2		
	D	16	47	17	2		1	1	2		1						2		
Madras	C	159	173	133	24	13	15	20	9	10	8	8	6	10	17	16	19		
	D	29	36	27	4	5	6		6	3	1		4	1	3	4	3		
Moulmein	C	143	146	43	27	29	20	13		9	6	6	4	10	3	1			
	D	40	41	7	4	6	5	6		3	3	1	3	4	1	2			
Negapatam	C	1					1			1		1			1		2		
Rangoon	C	7	10	4	2		3	1	1	5	1	2	2	1	1				
	D	2	5		1						1	1							
Tuticorin	C						5				1								
Vizagapatam	C	9	69	6	3	1	1			1									
	D	1	18	2		3													
India (French):																			
Chandernagor	C	11	6	10	6	2	8	8	4	8	5	2	3	1	4				
	D	5	2	2	2	4	1				2	1	1	1	1				
Karikal	C	12	24	19	6	5	1		4	3	1	3	1		1				
	D	8	7	8	2	1			2	2	1	3	1		1				
Pondicherry Province	C	52	21	24	9	13	10	8	4	4	9	6	4	9	8	5			
	D	40	13	20	7	12	10	7	4	4	9	6	3	9	8	5			
India (Portuguese)	C	50	38	44	2	27	5	13		3	18	7	1						
	D	5	2	8		3	1	4		2	2	6							
Indo-China (see also table below):																			
Pnompenh	C				1		1	1							1				
	D			2					1						1				
Saigon and Cholon	C	4	3	5	1	1		1	1										
	D	2	1	5		1		1									1	1	
Iraq:																			
Baghdad	C	3		8	1				1				1	1	1				1
	D	1		1	1										1				1

Basra	C	1		1														
Mossoul Liwa	C	12		22	13		8			1		3	47	20				
	D	2		3	2		1			1			19	1				
Ivory Coast (see table below).																		
Jamaica (alastrim)	C							2										
Japan: Tokyo	C			1														
	D			1														
Macao	D	2	3	2	1													
Mexico (see also table below):																		
Jalisco (State) Guadalajara	D	14	22	20			6	1	4		5	6	3	1				1
Juarez	C	3	2								6							
	D	1									1							
Mexico City and surrounding territory	C	38	106	99	30	15	17	18	17	23	20	17	10	12	4			
	D	21	31	47	6	12	8	6	5	4	3	5	2	3	1			
Progreso	C						1											
	D						1				1							
San Luis Potosi	C	1																
	D	1																
Morocco (see table below).																		
Nigeria: Lagos	C	2	1	1								1						
Philippine Islands: Sarangani and Balut Islands	C	3																
Poland	C	2		7		1		2										
Portugal: Lisbon	C	7	7	8	6		2		1		2	7		7		6		6
Rumania	C	1	2															
Siam	C	2		8	2								2					
	D			4														
Somaliland, British: Boales	C	19	2															
	D	2	6															
Spain	C									4		8		1	1	3	2	
Straits Settlements	C		5	5	1	3	2	5	5		1	3	1	2	7	1	1	1
	D		1	2		1	1	1	1		1		1	1	1			
Sudan (Anglo-Egyptian)	C	79	60	42		5	13	1	4	8	1	54	8	1		3		
	D	6	5	4			1	1				3		1				
Sudan (French) (see table below).																		
Switzerland: Berne Canton	C															1		
Syria (see table below).																		
Taiwan: Taihoku (see table below).																		
Tunisia: Tunis	C	3	3	4		1		1			2					1		
Turkey (see table below).																		
Union of South Africa:																		
Cape Province	C	P	P	P	P	P	P	P										
Orange Free State	C	P	P															
Transvaal	C	P	P															
Upper Volta	C	26	2	3				1			8	5						
Zanzibar	C		13															
On vessel:																		
S. S. Tairoa, at Liverpool, from London	C	1																
S. S. Karagola, at Lourenco Marques, from India	C	1																
S. S. Elysia, at Port Sudan, from Bombay	C			1														
S. S. Naldera, at Port Said	C				1													
S. S. Manoa, from Honolulu to San Francisco	C											1						

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

SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place		January, 1930	February, 1930	March, 1930	April, 1930			May, 1930			June, 1930			July, 1930		
					1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31
Indo-China (see also table above)	C	460	434	26	261				173	132	80	133				238
Ivory Coast	C			7												
Sudan (French)	C	229	213	609	371		150	40	56	178	76				34	
	D	25	11	49	30		6	7	7	18	18					
Syria: Beirut	C	70	18	17	10	2	7			7	6	1				2
Taiwan: Taihoku	C		43	58	10	2										

Place		January, 1930	February, 1930	March, 1930	April, 1930	May, 1930	June, 1930
British East Africa (see also table above):							
Kenya	C	12	12	175	174	171	142
Uganda	C	184	109			78	
	D	155	99			69	
Chosen	C	1	4		5		
	D		1		1		

Place		January, 1930	February, 1930	March, 1930	April, 1930	May, 1930	June, 1930
France	C	9	23	8		3	
Mexico: Durango (see also table above)	D	12	6	5	4	4	3
Morocco	C	29	74		10	18	5
Turkey	C	215	114		3	16	
	D	66	42				

TYPHUS FEVER

[C indicates cases; D, deaths; P, present]

Place		Feb. 9-Mar. 8, 1930	Mar. 9-Apr. 5, 1930	Apr. 6-May 3, 1930	Week ended— May, 1930				June, 1930				July, 1930				August, 1930	
					10	17	24	31	7	14	21	28	5	12	19	26	2	9
Algeria:																		
Algiers	C	4	6	8	1	2	4	8	2		1			1	2	3		
Constantine Department	C	5	11	15		4		2	11		1			1	1			
Oran	C							3				4		2	1			1
Arabia: Aden	C		1															
	D		1															
Bolivia: La Paz.[1]																		
Brazil: Porto Alegre	C	2			1													
Bulgaria	C	13	9	15	1		5		1		9	6		4	5	1		1
	D	1		1	1		1		1						1			
China:																		
Manchuria—Harbin	C	1	4	52					2									
Shanghai	C		1															
Chosen (see table below).																		
Czechoslovakia (see table below).																		
Egypt:																		
Alexandria	C			1							1	1	1					
Beheira Province	C	18	2	2	9	21	9	10	17	16	7	5		5	1	9		
	D	5			4	4	4	1	1	1		2		1		1		
Cairo	C	1															2	
Port Said	C	1																
Great Britain: Scotland—																		
Dunfermline	C													1				
Glasgow	C					1												
	D					1												
Greece (see table below):																		
Iraq: Baghdad Liwa	C		2															
Ireland:																		
Irish Free State—																		
Galway County—Oughterard	C															2		
Kerry County—Dingle	C			5														
Leitrim County—Mohill	C											9				1		
Mayo County—																		
Ballina	C							2		1				1				
Swinford	C					7	7											
Westport	C														2		1	

[1] 12 deaths from typhus fever were reported in La Paz, Bolivia, from Jan. 1 to May 31, 1930.

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

TYPHUS FEVER—Continued

[C indicates cases; D, deaths; P, present]

Place		Feb. 9-Mar. 8, 1930	Mar. 9-Apr. 5, 1930	Apr. 6-May 3, 1930	Week ended— May, 1930: 10	May 17	May 24	May 31	June, 1930: 7	June 14	June 21	June 28	July, 1930: 5	July 12	July 19	July 26	August, 1930: 2	Aug. 9
Ireland—Continued.																		
Irish Free State—Continued.																		
Roscommon County—																		
Roscommon	C														1			
Strokestown	C														1			
Wicklow County—Shillelagh	C									1		3	1		1			
Northern Ireland—Cookstown	C	3																
Latvia (see table below).																		
Lithuania (see table below).																		
Mexico: Mexico City, including municipalities in Federal District	C	9	4	4		2		4	2	3	1	3	2		2			
	D		1	4				3		1								
Morocco	C	21	38	15	3	6	1	1	1		6	8		4	8	4		
	D		7	3														
Palestine	C	1	6	1		2			2				3	1	1	1		1
Poland	C	183	228	243	64	45	34	28	39	15	26	37		24		12	10	
	D	8	13	15	2	2		1	3	3	2	3		4			1	
Portugal:																		
Lisbon	C			4														
Oporto	C	1	2	1														
Rumania	C	293	185	186	60	58	61	48		32								
	D	23	12	11	10	11	6	8		3								
Spain: Valencia	C									2		1		3				
	D													1				
Tunisia	C	3			2	2	1	1			2	16			14	10	2	5
Turkey (see table below).																		
Union of South Africa:																		
Cape Province	C	P	P	P	P	P	P	P			P	P	P	P				
Natal	C	3	P	P	P	P		P			P		P	P				
Orange Free State	C	P	P		P	P	P	P			P	P	P	P				
Transvaal	C			P														
Yugoslavia (see table below).																		

Place		January, 1930	February, 1930	March, 1930	April, 1930	May, 1930	June, 1930
China: Harbin	C	------	------	37	204	240	------
Chosen: Seoul	C	------	17	------	3	------	------
Czechoslovakia	C	10	2	42	29	12	------
Greece: Athens	C	12	6	3	1	3	3
Latvia	C	18	------	------	------	3	3
Lithuania	C	2	70	62	73	27	16
	D	------	5	4	4	------	------
Turkey	C	2	3	1	3	16	2
Yugoslavia	C	26	33	46	22	16	6
	D	3	5	2	4	1	------

YELLOW FEVER

	Cases
Brazil:	
Mage, on the Leopoldina Railway, between Rio de Janeiro and Nictheroy, Apr. 22, 1930	2
Campos, Rio de Janeiro Province, May 23, 1930	1
Para, June 23, 1930	2
Gold Coast:	
July 10, 1930	1
Albosso, Aug. 5, 1930 (deaths)	1
Liberia, Monrovia, June 3, 1930	1
Nigeria, Lagos, July 12, 1930 (probably laboratory infection)	1