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THE EFFECT OF SMALL DOSES OF PLASMOCHIN ON THE VIABILITY OF GAMETOCYTES OF MALARIA AS MEASURED BY MOSQUITO INFECTION EXPERIMENTS

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The observations and experiments reported upon in this paper were made during the winters of 1928 and 1929 in the Panama Division of the United Fruit Co., under the auspices of the Medical Department of the company, Dr. W. E. Deeks, director.

Investigators have generally agreed that plasmochin has a selective action on the gametocytes of malaria. On crescents especially the destructive action of plasmochin has proved to be decidedly more effective than that of any other drug. The result of plasmochin treatment has usually been measured by the time required to free the peripheral blood from crescents. The object of the present work has been to determine by mosquito-feeding experiments the effect of small doses of plasmochin on the viability of gametocytes. Our cases, with one or two exceptions, have had to do with crescent carriers.

We began this work in February, 1928 (1). The experiments of that year are summarized and included in this paper in order to bring all the material together.

A. albimanus was used as the test mosquito in all experiments because of its susceptibility to malaria parasites and its eagerness to bite man. In all of the experiments of 1929 we used only mosquitoes bred in the laboratory. In two cases of the 1928 experiments all or part of the mosquitoes were caught in the adult stage. All proved to be negative, and so no error was introduced through infections contracted previous to use in these experiments.

We fed mosquitoes only once on a given carrier and dissected only mosquitoes known to have taken blood. We included in the records only dissections made approximately 3 days after feeding, in order to allow sufficient time for the growth of oöcysts easily discernible under the microscope. We often used the oil-immersion lens for the examination of mid-guts on which oöcysts were likely to be small.

The mosquitoes were kept at the room temperature obtaining in the Tropics at sea level. A daily record was kept of the temperature of the compartment containing the mosquito cages. This temperature varied from a minimum of 66° F. at 8 a. m. to 85° F. at midday, but nearly all of the readings fell between 70° and 83° F.

The gametocytes were counted in the blood films taken at the time of the mosquito feedings. We usually estimated the number of gametocytes in terms of the number per 1,000 leucocytes, and in all crescent cases at least 1,000 leucocytes were counted. We appreciate, of course, the error in measuring one variable by another, but our object was merely to get comparative readings, and it was unlikely that the leucocyte count of a patient varied materially during a given experiment. In some cases we also determined the number of gametocytes per cubic millimeter of blood.

In all of the 1929 series the doses of plasmochin or quinine were administered by ourselves or in the company hospital under medical supervision. Some exceptions in the 1928 series are noted in the text.

CASE NO. 1

Two days' treatment with quinine, totalling 40 grains, or 260 cg., had no appreciable effect on mosquito infection; all of the 5 *albimanus* fed on the carrier became infected. But 24½ hours after the first dose of plasmochin and 17½ hours after the second no infections occurred, although the number of crescents had remained constant or had slightly increased. We obtained no infections during two more daily feedings, making in all three negative feedings, in every case with considerable numbers of mosquitoes and a fairly high percentage of gametocytes.

Crescents in thin films taken from the patient at the time of the second feeding, January 6, and kept moist, and in thick films, assumed the rounded form characteristic of living gametocytes. No rings were present after January 5.

Case No. 1

Subject: Malaquias Carbojal. Entered hospital Jan. 3, 1929, at 1 p. m.
Race: White (Costa Rican). Diagnosis: Estivo-autumnal malaria. Case No. 24082.
Age: 24. Weight, 104 pounds (47.2 kgs.).

Date (1929)	Day	Treatment			Hour mosquitoes fed	Crescents per 1,000 leucocytes	Results of mosquito dissections			
		Plasmochin	Quinine sulphate	When given			Number dissected	Number positive	Per cent of mosquitoes infected	Average number of oöcysts per positive gut
Jan. 3	First	None	10 grains (65 cg.)							
Jan. 4	Second	None	30 grains (195 cg.)							
Jan. 5	Third	2 cg	13¾ grains (86 cg.)	8.30 a. m.	10 a. m.	97	5	5	100.0	16
		2 cg	8¾ grains (56 cg.)	5 p. m.						
Jan. 6	Fourth	None	10 grains (65 cg.)	8.30 a. m.	10.30 a. m.	100	17	0	0.0	0
			10 grains (65 cg.)	12 m.						
			10 grains (65 cg.)	5 p. m.						
Jan. 7	Fifth	None	10 grains (65 cg.)	8.30 a. m.	9 a. m.	51	16	0	0.0	0
			10 grains (65 cg.)	12 m.						
			10 grains (65 cg.)	5 p. m.						
Jan. 8	Sixth	None	10 grains (65 cg.)	8.30 a. m.	8.30 a. m.	11	13	0	0.0	0

NOTE 1.—The total amount of plasmochin, 4 cg., given on Jan. 5 is at the rate of 1.69 milligrams per kilogram of body weight.
NOTE 2.—On Nov. 27, 1928, same patient was admitted to the hospital with estivo-autumnal malaria (case No. 23892). He received plasmochin compound, No. II, b. i. d. for 12 days, a total of 48 cg. plasmochin and 90 grains quinine sulphate, and was discharged with negative blood.

CASE NO. 2

Three feedings on three successive days before plasmochin treatment gave an increasing percentage of positive mid-guts; but only 11½ hours after the first dose of plasmochin (1.5 cg.) mosquitoes became negative and remained so during three successive days, no further plasmochin being administered. The numbers of crescents diminished somewhat, but on February 13 they were still present at the rate of 192 per cubic millimeter of blood.

We made a careful comparison in thin films of the morphology of crescents taken on February 9 before any sort of treatment had been given, with that found after treatment with plasmochin; the post-plasmochin specimens included films taken on February 12, when crescents first failed to infect mosquitoes, and those taken on February 13, 34½ hours after the plasmochin dose. In the comparison we looked for any evidence of degeneration—faintness of staining, irregularity in the outline of crescents, vacuolization of the cytoplasm, granulation of the chromatin, or displacement of the pigment. Changes, apparently degenerative, appeared in the postplasmochin crescents; but these could be matched by similar changes in the crescents taken before any treatment. We detected only one measurable difference: In the postplasmochin films a slightly larger percentage of crescents exhibited fainter staining than in the control. These comparisons were made by two observers working independently (in one set the observer was not informed as to the source of the films he was examining until after he had made his notes).

The proportion of sexes among gametocytes taken before and after plasmochin varied little, if at all, and we could see no evidence that one sex had been affected by plasmochin more than the other. Crescents in the shed blood assumed rounded forms after plasmochin dosage as well as before it; and in this patient, as in case No. 1, it was evident that at least a part of the crescents were living at a time when they failed to infect mosquitoes.

Case No. 2

Subject: Daniel Caldera. Outpatient, discovered in Chiriquicito malaria survey.
Race: Mixed Negro and Spanish (Panamanian). Diagnosis: Estivo-autumnal malaria.
Age: 3. Weight, 38½ pounds (17.5 kg.).

Date (1929)	Day	Treatment			Hour mosquitoes fed	Crescents per 1,000 leucocytes	Crescents per cubic millimeter of blood	Results of mosquito dissections			
		Plasmochin	Quinine sulphate	When given				Number dissected	Number positive	Per cent of mosquitoes positive	Average number of oöcysts
Feb. 9	First	None	None	------	6.30 p. m.	55	------	6	1	16.6	3
Feb. 10	Second	None	5 grains (32.5 cg.).	9.30 p. m.	7.30 p. m.	48	------	17	11	64.7	3.5
Feb. 11	Third	None	5 grains (32.5 cg.).	8 a. m.	------	------	------	------	------	------	------
			5 grains (32.5 cg.).	4 p. m.	7.30 p. m.	55	------	6	4	66.6	4
Feb. 12	Fourth	1.5 cg.	5 grains (32.5 cg.).	8 a. m.	7.30 p. m.	36	------	16	0	0.0	------
Feb. 13	Fifth	None	5 grains (32.5 cg.).	a. m.	6.30 p. m.	24	192	17	0	0.0	------
			5 grains (32.5 cg.).	p. m.	------	------	------	------	------	------	------
Feb. 14	Sixth	None	5 grains (32.5 cg.).	a. m.	7 p. m.	3	------	16	0	0.0	------
			5 grains (32.5 cg.).	p. m.	------	------	------	------	------	------	------
Feb. 15	Seventh	None	5 grains (32.5 cg.).	a. m.	7 p. m.	2	------	8	0	0.0	------

NOTE.—The single dose of plasmochin given on February 12 equals 0.859 milligrams per kilogram of body weight.

CASE NO. 3

No mosquitoes became infected in feedings made about 24 hours after a single dose of ½ cg. plasmochin, although the number of crescents had materially increased. We observed exflagellation of male crescents with the formation of microgametes in blood taken on the day after plasmochin treatment. The blood was taken from mosquitoes which had engorged themselves on the carrier. Within a few minutes after feeding, the blood was removed from the mosquitoes, spread thinly on a slide, and stained with Giemsa. Exflagellation was demonstrated by this method in blood taken at two different times during the day—the first, 24 hours after the plasmochin dose (a time when subsequent dissections indicated that the gametocytes had lost their power of infecting mosquitoes), and the second, about 2½ hours later.

This carrier was obtained at the very end of our tour and it was impossible to use him for further feedings.

Case No. 3

Subject: Allan Hamilton. Hospital patient.
Race: West Indian negro. Diagnosis: Estivo-autumnal malaria.
Age: 11. Weight 59 pounds (26.9 kg.).

Date (1929)	Day	Treatment			Hour mosquitoes fed	Crescents per 1,000 leucocytes	Crescents per cubic millimeter of blood	Results of mosquito dissections			
		Plasmochin	Quinine sulphate	When given				Number dissected	Number positive	Per cent of mosquitoes infected	Average number of oöcysts
Feb. 26	First	0.5 cg	None	1.30 p. m.	1.15 p. m.	26	130	14	4	28.6	10
Feb. 27	Second	None	None		12.30 p. m.	37		13	0	0.0	

NOTE.—The single dose of one-half centigram of plasmochin given on February 26 is at the rate of 0.185 milligrams per kilogram of body weight.

The following experiments were done in 1928 (reference previously cited):

CASE NO. 4

Crescents had decreased after the plasmochin treatment, but were still present in large numbers (756 per cu. mm. of blood). They had apparently become nonviable. Estivo-autumnal rings persisted in large numbers.

Case No. 4

Subject: Myrtle Stewart. Outpatient, discovered in One-Mile Camp survey.
Race: West Indian negress. Diagnosis: Estivo-autumnal malaria.
Age: 3.

Date (1928)	Day	Treatment			Hour mosquitoes fed	Crescents per 1,000 leucocytes	Crescents per cubic millimeter of blood	Results of mosquito dissections			
		Plasmochin	Quinine sulphate	When given				Number dissected	Number positive	Per cent of mosquitoes positive	Average number of oöcysts per gut
Feb. 13	First	3 cg	10 grains (65 cg.).	p. m.	a. m.	196		14	10	71.4	19
Feb. 14	Second	3 cg	10 grains (65 cg.).	p. m.							
Feb. 15	Third				a. m.	90	756	16[1]	0	0.0	

[1] Of these mosquitoes, 4 were caught in the adult stage. The remainder were laboratory bred.

NOTE 1.—Exact body weight unknown, but estimated at about 50 pounds. Thus the dosage would approximate 1 milligram per kilogram of body weight.

NOTE 2.—First examination of blood made on January 12, 1928; a few estivo-autumnal rings were found, but no crescents. Patient was treated with plasmochin-quinine, and blood was found negative on January 22. On February 13 relapsed with many estivo-autumnal rings and 196 crescents per 1,000 leucocytes in blood.

CASE NO. 5

Crescents had greatly diminished after plasmochin treatment and no longer infected mosquitoes.

In cases 4 and 5 one dose of plasmochin plus quinine was administered to the patient at the hospital, and the remainder was given to him or his parents for him to take at home.

Case No. 5

Subject: Blanche Clark. Outpatient, discovered in malaria survey.
Race: West Indian negress. Diagnosis: Estivo-autumnal malaria.
Age: 14 years. Weight unknown.

Date (1928)	Day	Treatment			Hour mosquitoes fed	Crescents per 1,000 leucocytes	Results of mosquito dissections			
		Plasmochin	Quinine sulphate	When given			Number dissected	Number positive	Per cent of mosquitoes infected	Average number of oöcysts per positive gut
Jan. 30	First	6 cg	11.5 grains (75 cg.).	3 p. m.	1 p. m.	26	13	10	77.0	8
Jan. 31	Second	6 cg	11.5 grains (75 cg.).	(?)						
Feb. 1	Third	None	None		(?)	8	6	0	0.0	0

Two other cases of 1928 may be mentioned. In these we were unable to make any mosquito test before the administration of plasmochin and are not certain that their gametocytes were viable before treatment. In one case the patient had received one day's treatment consisting of 6 cg. plasmochin and 175 cg. quinine when the mosquitoes were fed. He still had about 100 benign tertian gametocytes per 1,000 leucocytes; the gametocytes showed some modification as the result of the treatment. None of the 11 mosquitoes fed on this patient became infected. In the second case the patient had received one day's treatment consisting of 2 cg. of plasmochin and 58 cg. of quinine and still had 26 crescents per 1,000 leucocytes in the blood. Seven mosquitoes caught in the adult stage were fed on this patient and none of them became infected. In both of these cases the species of mosquito was *A. albimanus*.

SUMMARY OF CASES

The results of these experiments seem clear-cut. In no case did mosquitoes become infected after plasmochin treatment. It appears that single doses as small as 0.2 mg. per kg. of body weight may affect the viability of crescents, even though they have increased in numbers, and are still living and capable of exflagellation. Quinine alone showed no measurable effect on the viability of crescents during the period of time covered by the preliminary feedings.

We appreciate the fact that our cases are comparatively few. The conditions of our experiments demanded that the patient have sufficient gametocytes in the blood to infect mosquitoes at a single feeding, and we had much difficulty during our tour in 1929 in getting enough patients suitable for our experiments. In our search for carriers we made many blood parasite surveys on the farms of the Panama division and elsewhere. One or two groups were treated with quinine alone in small doses in the hope that they might develop more abundant crescents. In all, we examined over 1,500 blood specimens and found over 400 with parasites in the peripheral blood. Among these positives we found a considerable number with very few gametocytes, but only 12 with sufficiently heavy infections to afford good "prospects." The situation was made more difficult by the fact that it was necessary to test the infectibility of the gametocytes by mosquito feedings, and we sometimes wasted several days' time before we knew that the patient was not suitable. In five cases the preliminary feedings gave negative results and the cases could not be used.

Nearly all the people examined were West Indian negroes, who often carry large numbers of parasites without showing severe symptoms of malaria. It is possible that another race of people more susceptible to the effects of malaria parasites would have afforded a larger percentage of heavier gametocyte carriers. Sinton (2) believes that the stimulus which induces crescent production is much more marked at the time of an acute attack of the disease than in the period when an immunity has been produced.

The list of the 12 most promising carriers with the type and number of gametocytes is given in Table 1. The cases marked "unavailable" lived at considerable distances from the hospital and could not be brought to the laboratory in time for the experiments.

TABLE 1.—*List of good carriers found in malaria surveys of Panama division, 1929*

Check No.	Type of gametocyte	Numbers of gametocytes	Results
No. 1	Estivo-autumnal	94 crescents per 1,000 leucocytes	Infected 5 *A. albimanus.*
2	Tertian	33 gametocytes per 1,000 leucocytes	Failed to infect.
3	Estivo-autumnal	14 crescents per 1,000 leucocytes	Do.
4	do	11 crescents per 1,000 leucocytes	Do.
5	do	3 crescents per field	Unavailable until after gametes reduced.
6	do	6 crescents per 1,000 leucocytes	Unavailable.
7	Quartan	15 gametocytes per 1,000 leucocytes	Failed to infect.
8	Estivo-autumnal	16 crescents per 1,000 leucocytes	Do.
9	do	55 crescents per 1,000 leucocytes	Infected 16 *A. albimanus.*
10	do	103 crescents per 1,000 leucocytes	Unavailable.
11	do	43 crescents per 1,000 leucocytes	Do.
12	do	26 crescents per 1,000 leucocytes	Infected 4 *A. albimanus.*

Four hundred and twenty-five positives were found in the surveys; 12 apparently good gametocyte carriers were discovered, of which 8 were available. Only 3 of these infected mosquitoes.

In order to illustrate the amount of work which may be lost on an unsuitable carrier we give in detail the experiments made on a benign tertian carrier, case A. This case had become infected or had relapsed but recently, and it is possible that the gametocytes had not become sufficiently mature to infect mosquitoes. Gametocytes appeared in considerable numbers, and both sexes were present in the blood at the time of the feeding experiments. They showed definite signs of degeneration after treatment with plasmochin.

Case A

Subject: Bernardino Seguro. Entered hospital Jan. 14, 1929, at 1 p. m.
Race: White (Costa Rican). Diagnosis: Tertian malaria.
Age: 22. Weight: 106½ pounds, or 48.3 kg.

Date (1929)	Day	Treatment			Hour mosquitoes fed	Gametocytes per 1,000 leucocytes	Results of mosquito dissections		
		Plasmochin	Quinine sulphate	When given			Number dissected	Number positive	Per cent of mosquitoes positive
Jan. 14	First	None	10 grains (65 cg.)	3.30 p.m.	3.15 p.m.	33	25	0	0
		4 cg.	17.5 grains (113 cg.)	10 p. m.					
Jan. 15	Second	None	20 grains (130 cg.)	8 a. m.					
		4 cg.	7.5 grains (48 cg.)	4 p. m.	5.15 p.m.	100	34	0	0
Jan. 16	Third	None	10 grains (65 cg.)	8 a. m.					
			10 grains (65 cg.)	12 m.					
			10 grains (65 cg.)	4 p. m.	5 p. m.	47	4	0	0
Jan. 17	Fourth	None	10 grains (65 cg.)	8 a. m.					
			10 grains (65 cg.)	12 m.					
			10 grains (65 cg.)	4 p. m.	5.30 p.m.	(?)	4	0	0

NOTE.—On Jan. 8, 1929, six days before this patient entered the hospital, he was found positive for malaria. At that time no gametocytes or large plasmodia were found in his blood.

THE LENGTH OF TIME GAMETOCYTES MAY BE EXPECTED TO REMAIN NONVIABLE AFTER A SINGLE DOSE OF PLASMOCHIN

A priori it would not seem probable that the effect of a single small dose would last a long time if new gametocytes are being produced continually in the spleen, bone marrow, or elsewhere; and authors generally hold that it is necessary to rid the blood of rings if gametocyte production is to be arrested. In cases 1 and 2 of our experiments, however, crescents, although present, apparently remained nonviable for three days after plasmochin treatment. In case No. 2, rings persisted in the peripheral blood throughout the whole period covered by the experiment. In case No. 3, crescents increased during treatment, although no rings were present in the peripheral blood. In routine blood work we find many cases in which large numbers of rings persist in the blood, although crescents may be lacking or very few. The relation of rings in the peripheral blood to the production of viable crescents is not very definitely known. At all events, it seems probable that a single dose of plasmochin may be effective on crescents during several days at least, whatever the fate of the rings.

Fischer (3) states that a plasmochin treatment (in his series, 15 or 20 cg.) is just as effective in ridding the patient of gametocytes when given in divided doses over 24 to 36 hours as when the same total dosage is spread over several days.

As regards the value of single doses, much depends, of course, on the length of time an untreated carrier usually carries effective numbers of gametocytes. It has been our observation that in a large proportion of cases such infestations tend to run out within a few days. There are exceptions to this rule, of course, but it would seem that in a majority of cases one or two doses of plasmochin given during the infestation would at least materially shorten the period during which the patients carry viable gametocytes.

As might be expected, gametocytes in patients who have relapsed several weeks after a plasmochin treatment are just as infective as those occurring during primary attacks. Of our cases, No. 1 had received a plasmochin treatment about a month previously and another, No. 4, about three weeks. Both of these relapsed cases readily infected mosquitoes.

The mosquito test necessitates keeping on hand an abundance of mosquitoes ready for biting; and the subsequent care of the mosquitoes, the dissections, and the like, require a good deal of time. It would be an advantage if the effect of small doses of plasmochin could be measured by degeneration or other morphological change in the gametocytes discernible by simple microscopic examination.

A number of authors have noted degenerative changes in gametocytes as the results of plasmochin. Roehl (4) mentions the destructive effect of the drug on the gametocytes of bird malaria. In human malaria, Schulemann and Memmi (5) and Manson-Bahr (6) have described degenerative changes in benign tertian gametocytes. We (loc. cit., p. 61) noted a marked modification in such gametocytes after 6 cg. of plasmochin and 175 cg. of quinine.

Schulemann and Memmi (loc. cit.) state that crescents before their disappearance under plasmochin treatment are more difficult to stain. Mason-Bahr (loc. cit.) describes degenerative changes in the crescents in several cases treated with plasmochin-compound. In one case, after a total dosage of 12 cg. of plasmochin and 1.5 grams of quinine, the crescents in dying underwent a peculiar granular degeneration. In another case, after a dosage of 3 cg. of plasmochin plus 0.375 gram quinine, the gametocytes became inert; that is, the majority of them no longer became spherical on being chilled outside of the body, and exflagellation did not occur in any of them. Within 36 hours after the commencement of the treatment (8 cg. plasmochin and 1 gm. quinine), crescents assumed distorted forms, their protoplasm underwent a granular degeneration, and their chromatin was broken into small clumps. Mollow (7) treated a crescent carrier with five 2 cg. doses of pure plasmochin daily. On the fourth day of treatment he noted degenerative changes in the crescents—pale and irregular staining and vacuolization of the cytoplasm. Finally the crescents became completely degenerated. Apparently the male gametocytes were more susceptible to the action of the drug than the female. Muffel (8) noted 48 hours after a daily treatment of 6 cg. of plasmochin that the protoplasm of the crescents became vacuolated and their outline became irregular. The earlier morphological changes appeared before any diminution in the number of the crescents had occurred. Later, degeneration became more advanced; only the pigment with bare traces of protoplasm remained. The action of plasmochin did not appear in all crescents at the same time nor with like distinctness.

Krauss (9) found that senile changes, including vacuolization, which occasionally occur in gametocytes independently of any treatment, may become the rule after plasmochin.

We have already noted that in our experiments the crescents, or a part of them, were still living after plasmochin treatment and showed no degenerative changes sufficiently definite to serve as a useful criterion of viability. However marked the degenerative changes in crescents after larger dosage or more prolonged treatment, it appears that we can not rely on the microscope alone to measure the early effects of very small doses of plasmochin, and the mosquito infection test appears to be the only one of sufficient delicacy to serve that purpose. Possibly wet fixation of films or some more precise staining method might afford evidences of degeneration not exhibited by thin and thick films prepared in the ordinary manner.

THE USE OF PLASMOCHIN AS A GAMETOCIDE IN POPULATIONS

Authors generally hold that treatment with plasmochin is not safe except under immediate medical supervision, because of occasional harmful by-effects of the drug. Muehlens (10) has recommended as a safe dose one not exceeding 1 mg. per kg. of body weight. Such a dose would amount to about 6 or 7 cg. for a person weighing 150 lbs. Fischer (loc. cit.) holds that a dose of 15 or 20 cg. distributed over 36 hours is sufficient to destroy gametocytes, and lies within the limits of safety. Baermann and Smits (11) have summarized the literature of the 4 fatal cases and the 11 very severe cases supposedly due to the by-effects of plasmochin. In all these the total amount of plasmochin given varied between 16 and 40 cg. The authors believe that the dosage recommended by Muehlens is not wholly safe.

Macphail (12) has extended plasmochin treatment to camp work. A daily dose of 6 cg. plasmochin and 20 grains of quinine was given under the supervision of dispensers. Doctor Brosius, of the Panama division, has also demonstrated that plasmochin, combined with quinine and employed in limited dosage, may be safely distributed in a population and taken without the immediate supervision of a physician.

Our experiments indicate that a dosage far below that recommended by Muehlens or Fischer or that used in the camp treatments of the United Fruit Co. is effective against gametocytes, and it is very probable that such small doses can be safely used in any population. It is well to employ caution, of course, but it would at least seem advisable to employ plasmochin for mass treatment of a group suffering severely from malaria, especially where transmission is active. The risk of by-effects of plasmochin would be outbalanced by the malaria danger.

It is presumed that plasmochin would be used in conjunction with quinine, at all events in regions where estivo-autumnal malaria is prevalent; for plasmochin alone is not sufficiently effective against the asexual forms of estivo-autumnal parasites, and good evidence exists that quinine tends to counteract the harmful effects of plasmochin.

It is evident that any drug used to prevent the transmission of malaria must be widely used in a population. In many regions comparatively few persons sick with malaria ever receive the care of a physician in hospitals or elsewhere. Among negroes parasitic infestations may not be followed by serious illness, and patients are not likely to receive medical aid.

In plantations or other localities where populations can be assembled and treated en masse, the employment of plasmochin is comparatively easy. In populations not under such control the problem becomes much more difficult. People are not likely to take any remedy for purely public health purposes.

In some regions people are accustomed to take "chill tonics" for malaria. It is at least worth considering whether a tonic containing sufficient quinine and a very small percentage of plasmochin might not be practical. It is yet to be proved just how little plasmochin would suffice to render gametocytes nonviable if taken in this form. Further, it would be necessary to guard against a possible cumulative effect of the drug. But tonic takers usually discontinue treatment after a few doses, especially if the "fever is broken," and the risk might not be materially greater than it is in a variety of popular remedies where overdose is dangerous and caution must be enjoined.

In conclusion, our experiments indicate that amounts of plasmochin within the limits of safety are effective against gametocytes and may be combined with quinine (and caution) in the treatment of populations. Where plasmochin is now being used for this purpose it is probable that smaller amounts of the drug can be used without diminishing the gametocidal effects of treatments and with a gain in economy and safety.

SUMMARY

1. Plasmochin in small doses, in one case in a single dose of ½ cg., proved to have a definite effect on the viability of crescents as measured by mosquito infection tests.

2. Degenerative changes in crescents after the use of plasmochin did not appear to be definite enough to measure the early effects of small doses of plasmochin.

3. It is probable that the general use in a population of such small doses of plasmochin would be safe and effective in reducing the transmission of malaria.

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STUDIES ON THE BIOCHEMISTRY OF SULPHUR [1]

II. FURTHER STUDIES ON THE DISTINCTIVE REACTION FOR CYSTEINE AND CYSTINE

By M. X. SULLIVAN, *Biochemist, Hygienic Laboratory, United States Public Health Service*

Work on pellagra by Sullivan and others (1919, 1920) suggested that the sulphur metabolism was abnormal in this disease. This finding led to a study of cysteine and cystine, sulphur-containing amino acids which play a very important rôle in nutrition, particularly in cellular respiration and biochemical defense. From this study there was developed a distinctive test for cysteine (Sullivan, 1926.)

Broadly speaking, this distinctive test, the details of which are given later, is that cysteine reacts with 1.2 naphthoquinone-4-sodium sulphonate and alkali to give a red color which is not discharged by reducing agents, such as anhydrous sodium hyposulphite ($Na_2S_2O_4$), formerly known as sodium hydrosulphite.[2]

This test for cysteine, or for cystine after reduction with sodium cyanide, had such a degree of specificity that of 80 compounds tested, amino acids, thiocompounds, amines, etc., the reaction was given only by cysteine or by cystine treated with sodium cyanide.

In the 1926 report (No. I of this series) various modifications of the cysteine test were given. The most satisfactory procedure, however, was the sodium sulphite modification which has been used on most of the subsequent work. The procedure for cysteine, and as modified to include cystine, is as follows:

Cysteine.—To 5 c. c. of solution, containing not more than 400 p. p. m. of cysteine in 0.1 N hydrochloric acid, add (*a*) 1 or 2 c. c. of a freshly prepared 1 per cent solution of sodium cyanide,[3] in 0.8 N sodium hydroxide, mix, and add at once (*b*) 1 c. c. of a freshly prepared 0.5 per cent aqueous solution of 1.2 naphthoquinone-4-sodium sulphonate, mix, and add (*c*) 5 c. c. of 10–20 per cent solution of anhydrous sodium sulphite in 0.5 N sodium hydroxide, mix, and wait 30 minutes at a temperature of 20 to 25° C. A reddish-brown color appears. Then add (*d*) 1 c. c. of a 2 per cent solution of

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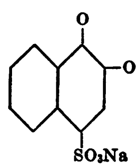
[1] Number I of this series of papers under the title "Studies on the Biochemistry of Sulphur" is "A distinctive Test for Cysteine." Pub. Health Rep. (1926) *41*, 1030. (Reprint 1084.)

[2] Unfortunately, the term "sodium hyposulphite" is in some quarters still applied to sodium thiosulphate ($Na_2S_2O_3+5H_2O$). The latter compound is entirely unsuitable for the test herein described. The term "hyposulphite," as stated, is here used to designate the powerful reducing agent ($Na_2S_2O_4$), which is also known as sodium hydrosulphite. The term "sodium hyposulphite" for the compound ($Na_2S_2O_4$) is that adopted by Chemical Abstracts.

[3] In the earlier work with cysteine no cyanide was added before the addition of the naphthoquinone. In recent work, however, it has been found advantageous to add 1 c. c. of 1 per cent sodium cyanide in 0.8 N sodium hydroxide before adding the naphthoquinone. This 1 per cent sodium cyanide has little if any reducing action on cystine in short contact, but does give somewhat better results with cysteine by preventing any oxidation of cysteine caused by traces of iron salts, or by the 1.2 naphthoquinone-4-sodium sulphonate, and by giving the degree of alkalinity most suitable for the reaction.

sodium hyposulphite ($Na_2S_2O_4$), formally known as sodium hydrosulphite,[4] in 0.5 N sodium hydroxide. The brown-red color in the presence of cysteine (or cystine, reduced with sodium cyanide), is converted to a purer red while all other compounds tested with the possible exception of cystine gave only a yellow color on addition of the hyposulphite ($Na_2S_2O_4$). In the cysteine procedure as given in this paper, strong solutions of cystine give a slightly positive cysteine reaction since, under the conditions, cystine is slightly reduced to cysteine. The further addition of 2 c. c. of a 5 per cent aqueous solution of sodium cyanide is advantageous since it stabilizes the reaction more or less and what is in some cases more important, it gets rid of a purple shade caused by iron compounds, if they are present in amounts large enough to interfere.

Cystine.—To 5 c. c. of solution, containing not more than 400 parts per million of cystine in approximately 0.1 N hydrochloric acid, add 1 or 2 c. c. of a freshly made 5 per cent aqueous solution of sodium cyanide. Mix and let reduction go on for 10 minutes at about 20° to 25° C. Then add 1 c. c. of a freshly prepared 0.5 per cent solution of 1.2 naphthoquinone-4-sodium sulphonate



and proceed with the addition of sodium sulphite, etc., as given for cysteine.

The cystine procedure has been studied in detail and, as will be shown in a later publication, has been found satisfactory for the determination of cystine in protein when compared with a proper cystine standard similarly treated. The reduction of cystine by cyanide does not give complete formation of cysteine as judged by comparison with cysteine equivalent in amount to the cystine started with. The two procedures for cysteine and for cystine should be kept distinct, that is, in cysteine studies the control should be cysteine and in cystine studies the control should be cystine. Work is being done on the possibility of determining both cysteine and cystine when together in mixtures.

Effect of metallic salts on the estimation of cysteine and cystine.—Heavy metals and oxidizing salts should not be present. The heavy metals will produce precipitates or colloidal solutions, especially on the

[4] In hydrolysates of foodstuffs which contain buffering material 1 or 2 c. c. of 5 N sodium hydroxide must be added before adding the final reducing agent, sodium hyposulphite ($Na_2S_2O_4$). As a rule it is cystine that is found in hydrolysates.

addition of the final reducing agent, sodium hyposulphite ($Na_2S_2O_4$). Oxidative compounds, such as cupric salts or ferric salts, would oxidize cysteine to cystine and, in addition, produce obscuring reactions with the sodium hyposulphite.

Fortunately, however, in situations where cysteine or cystine might be sought for, no interfering metallic compounds occur, and even iron, as a rule, occurs in too small amounts to disturb the reaction for cysteine or cystine. Thus, in extracts of tissue there is not enough active iron to interfere with cysteine if this is present, since reduced glutathione, which is likewise readily oxidized by ferric compounds, occurs in tissue and protein-free extracts thereof as shown by Hopkins (1921) and Tunnicliffe (1925). Further, in hydrolysates of purified proteins which have been analyzed in this laboratory it is cystine that occurs as a rule. In one or two cases where cysteine was present there was little evidence of the presence of active iron. Hemoglobin to the extent of 1 per cent of the weight of the cysteine tested has no effect on the estimation of cysteine, and so in protein-free extracts of tissue there should be little if any interference by hemoglobin.

The only metal that has been found associated with cysteine and cystine is iron in small amounts. The possibility that iron might play a part in a retarding or accelerating way in the cysteine and cystine determinations was contradicted somewhat at least by the fact that our oxidized glutathione tested by the Tschugaeff and Orelkin (1914) dimethylglyoxime method gave as good a test for iron as did cystine, both faint, and still gave a negative reaction with the beta naphthoquinone sulphonate in the cystine procedure. Nevertheless some study was made as to the effect of small amounts of iron on the cysteine and cystine reactions.

By special precautions detailed by Sakuma (1923), Warburg and Sakuma (1923), Harrison (1924), and Warburg (1927), iron-free samples of both of the sulphur-containing amino acids, cysteine and cystine, can be obtained. Ordinarily pure samples of these compounds generally carry a small iron content. Thus the cysteine hydrochloride and cystine employed in most of these experiments contained 0.01 per cent and 0.0025 per cent iron, respectively. These amounts of iron have little effect on the cysteine or cystine reaction described in this and the preceding paper (Sullivan, 1926). A proof of this statement may be found in the fact that when iron as ferrous sulphate, to the extent of 1 per cent of the cysteine, was added to a 200 part per million solution of cysteine, the colorimetric reading was the same as without iron. Even 4 per cent iron as ferrous sulphate made little difference. Similarly, the colorimetric estimation of a 200 part per million cystine solution containing iron as ferric chloride, to the extent of from 1 to 8 per cent of the weight of the cystine, was the same as cystine, 200 parts per million without added iron. In short, the addition of much more iron than is present in our samples of cysteine and cystine made no difference in the colorimetric results. However, the cysteine dissolved in 0.1 N hydrochloric acid slowly oxidized—a step that may be accelerated by the small amount of iron present.[5]

In both the cysteine and cystine reactions, but especially in the cysteine procedure without cyanide, the presence of considerable iron with and without the presence of cysteine and cystine may cause a slow development of a purple shade after addition of sodium hyposulphite; but this purple shade is discharged by the addition of 2 c. c. of 5 per cent sodium cyanide.

To date, with the absence of heavy metals and oxidizing metals or other oxidative material, there has been found no compound which interferes in the reaction for cysteine and cystine.[6]

Having at hand a reaction [7] of remarkable specificity for cysteine, directly, and for cystine, indirectly—that is, after reduction with sodium cyanide—studies have been made with it along various lines as follows: (1) The reaction of various compounds of biological interest recently found in tissue or foodstuffs and of compounds that might occur in hydrolysates such as furfural, levulinic, and pyruvic acids, etc.; (2) the groups involved in the reaction; (3) the isolation of the red cysteine naphthoquinone complex; (4) the application of the reaction to the quantitative estimation of cystine in isolated proteins and foodstuffs; (5) a comparison of the Sullivan method with the Folin-Looney (1922) and the Okuda (1925) iodometric method for the estimation of cystine; (6) a survey of various tissues, normal and abnormal.

All these projects, with the exception of project (3), have been considerably advanced and will be published in the near future. The present paper, however, will deal with the qualitative reaction of some compounds directly and indirectly of biological interest. Among the new compounds tested are ergothionine, Mueller's thioamino acid,

[5] In work with iron-free cysteine and cystine made by Warburg's (1927) simplified method it was found that, when ferrous iron to the extent of 1 per cent of the weight of the cysteine was added, the colorimetric reading was the same as without iron. Warburg (1927) reports copper present in blood serum. From the weight of evidence at hand the copper and the iron which may be present in tissue or in blood serum is either predominantly the reduced form or is inhibited from exercising any oxidative function on the RSH. Thus, as shown by Hopkins (1921) and by Tunnicliffe (1925), glutathione occurs in tissue mainly, if not entirely, as the reduced form, and, as will be shown by the writer later, cysteine occurs at times at least in certain tissues, as, for instance, the liver, which has been reported as containing both iron and copper.

[6] Glutathione extracted from brewers' yeast in this laboratory did not give the cysteine or cystine reaction. In some of their samples of glutathione Johnson and Voegtlin (1927) report a blue-red color when put through the cystine reaction, and Bierich and Kalle (1928) had a similar finding. In the Johnson and Voegtlin preparation the color did not develop as in the cysteine and cystine reaction, but came up on adding the hyposulphite. This blue-red or purple color must be due to impurities, but whether to organic or inorganic remains undetermined.

[7] Since the reaction has come to be known as the "Sullivan reaction," this term will be used when comparison is made with other methods for determining cysteine or cystine. In a later paper by Sullivan and Hess a comparison will be made of various methods of estimating cystine in foodstuffs.

T. B. Johnson's disulphide of thiotyrosine, cystine amine, furfural, levulinic acid, and pyruvic acid. These compounds were also tested by means of the Folin-Looney cystine procedure and the Okuda iodometric method.

Ergothionine.—This sulphur-containing compound isolated from blood by Benedict (1925), Benedict, Newton, and Behre (1926), Hunter and Eagles (1925, 1927), was found by Newton, Benedict, and Dakin (1926) to be identical with the base ergothionine isolated from ergot by Tanret (1909) and shown by Barger and Ewins (1911) to be the betaine of thiohistidine. This compound gives a blue color with the uric-acid reagent of Folin and Denis (1912) and of Folin and Trimble (1924) with and without the use of sodium sulphite. In the Okuda (1925) iodometric method the sample at hand does not react like an (SH) compound, but requires reduction with zinc and hydrochloric acid—that is, it reacts like cystine. It is negative with the Sullivan reaction with and without sodium cyanide.

The disulphide of thiotyrosine

$$\begin{array}{llcll} C_6H_4 & S & - & S & C_6H_4 \\ | & & & & | \\ CH_2 & & & & CH_2 \\ | & & & & | \\ CHNH_2 & & & & CHNH_2 \\ | & & & & | \\ COOH & & & & COOH \end{array}$$

This compound, synthesized by Johnson and Brautlecht (1912), was obtained from Prof. Treat B. Johnson, of Yale University. As stated by Johnson, this thioamino acid has not been discovered among the products of hydrolysis, yet it can not be excluded from consideration until all of the sulphur in proteins can be accounted for. The disulphide of thiotyrosine behaves like cystine in the Folin-Looney procedure and in the Okuda (1925) iodometric method. It is negative in the Sullivan procedure for cystine.

Mueller's thio acid.—Mueller (1921, 1923) isolated a new sulphur-containing amino acid from casein. For this compound Barger and Coyne (1928) suggested the constitution $CH_3SCH_2CH_2CHNH_2COOH$ and the name "methionine." A sample of this thio-acid obtained from Professor Mueller gave negative reactions for cystine by the Folin-Looney, the Okuda, and the Sullivan methods.

Cystine amine.—Cystine amine,

$$\begin{array}{ll} CH_2S - & SCH_2 \\ | & | \\ CH_2NH_2 & CH_2NH_2 \end{array}$$

was synthesized according to the Gabriel (1891) synthesis. This compound, the preparation and properties of which will be discussed in the next paper of this series, fails to give the reaction for cystine in the Sullivan method, but does react like cystine in the Folin-Looney procedure and in the Okuda iodometric method.

Furfural.—Furfural is a substance that might occur in hydrolysates of foodstuffs. Accordingly, 5 c. c. of a 1 per cent solution in 0.1 N hydrochloric acid was tested with the different cystine methods. In the Folin-Looney procedure for cystine, with the uric acid reagent at hand, furfural behaves somewhat like cystine in that it gives a blue color. With Okuda's iodometric method and with the Sullivan method furfural is negative.

Levulinic acid and pyruvic acid.—These acids might arise in the hydrolization of foodstuffs. Five c. c. of a 1 per cent solution in 0.1 N hydrochloric acid are negative in the Sullivan reaction and in the Okuda method for cystine, but are positive in the Folin-Looney procedure with the uric acid reagent at hand.

The reaction of a number of other compounds, especially organic sulphur compounds, could be listed to show that the Sullivan procedure for cysteine and cystine has a greater degree of specificity than has the Okuda method and much greater than the Folin-Looney method. It may be mentioned that reduced glutathione behaves like cysteine in the Okuda method and in the Folin-Looney method, and that oxidized glutathione behaves like cystine in both of these methods. Neither reduced nor oxidized glutathione give the Sullivan test for cysteine or cystine.

DISCUSSION

The method for the testing of cysteine and cystine developed in this laboratory seems to afford on both theoretical and practical grounds an improvement on other methods. The points in its favor may be briefly summarized: (1) Certain compounds containing the sulphydryl group (SH) as, for example, thiocresol, which give a blue color with the Folin-Denis (1912) uric acid reagent and decolorize iodine in the Okuda test for cysteine are negative in the Sullivan method; (2) substances found in tissue such as glutathione and ergothionine which give a blue color with the uric acid reagent are negative; (3) certain possible products of hydrolysis such as pyruvic and levulinic acids and furfural which interfere more or less in the very convenient Folin-Looney colorimetric method for cystine do not interfere; (4) organic disulphide other than cystine, which, if present in the hydrolysate of a foodstuff, would tend to give a positive cystine reaction in the Folin-Looney and in the Okuda procedures are negative in the procedure outlined in this paper.

As pointed out by Folin and Denis (1912) in reference to their, at that time, new colorimetric method for tyrosine "any chemical reaction which is specific for any amino acid and suitable for its quantitative estimation is apt to be valuable and merit investigation." The method as modified for cystine has been investigated in great detail and has been applied quantitatively in analysis of proteins, in tissue extracts, etc. Little application as yet has been made of the direct cysteine reaction aside from the determination of cysteine in tissue extracts, to which we shall refer in a later publication. The cysteine reaction and the reaction modified to include cystine are in reality two entirely different procedures.

The control in cystine determinations should be cystine similarly treated.

The control in cysteine determinations should be cysteine.

The next paper, No. III, shows that for the cysteine reaction three groups are needed (SH), (NH_2), and (COOH). Subsequent papers will cover various applications of the reaction in comparison with the Folin-Looney method and the Okuda method.

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COURT DECISION RELATING TO PUBLIC HEALTH

Township board of health not empowered to make general permanent regulations.—(North Dakota Supreme Court; State *v.* Moher, 224 N. W. 890; decided April 6, 1929.) Section 4176, Compiled Laws 1913, provided as follows:

The board of health (of a township or village) may examine into all nuisances, sources of filth, and causes of sickness and make such temporary regulations respecting the same as it shall judge necessary for the public health and safety of the inhabitants, but upon taking such action the board shall immediately report the same to the county superintendent of public health, who shall then take the matter up and give the board specific instructions or proceed to the place and take such action as he may deem necessary for the protection of public health, and each person who violates any order or regulation made by any board of health, and duly published, is guilty of a misdemeanor and is punishable by a fine not exceeding $100 or by imprisonment in the county jail not exceeding three months.

A township board of health, purporting to act under the above section, made the following order:

It is ordered that from and after the issuance and publication of this order that the dumping of any garbage, refuse, offal, or other filth or any other thing or material dangerous to health in Barnes Township shall be, and is hereby, prohibited and that any violation of this order will be prosecuted as provided by law.

Thereafter the defendant was convicted of dumping garbage in violation of such order. On appeal the supreme court reversed the judgment of conviction and dismissed the case on the ground that the order was a general and permanent regulation which was beyond the power of the board to make. The opinion contained the following language:

The defendant contends that the order of the Board of Health of Barnes Township, for a violation of which he is being prosecuted, was invalid as being beyond the authority of the township board of health to ordain. His contention in this respect is that the order is general and permanent, while the statute, section 4176, supra, authorizes the board to make only temporary regulations respecting subjects with which it is empowered to deal. * * *

* * * It is unnecessary for us to consider how far the legislature might constitutionally go in empowering township boards of health to make general and permanent regulations, since it is apparent that by the statute here in question the legislature restricted their power to the making of temporary regulations respecting matters of sanitation.

The regulation ordained by the Board of Health of Barnes Township on October 4, 1927, and which the defendant is charged with having violated, was general in its nature. Regardless of any nuisance or menace to health that may have provoked it, the regulation referred to no particular person, condition, time, or place. It is a general regulation prohibiting the dumping of garbage at any place within the township at any time by any person. As such it was clearly beyond the power of the township board of health to enact.

Now the defendant is charged with a violation of this regulation. The charge against him is not that he created a nuisance, source of filth, or cause of sickness, but that he violated this general order of the township board of health. Since the board acted without authority in making the regulation, and since the offense charged against the defendant is that of violating the regulation, the objections of the defendant to the prosecution and to the complaint and information on which it was based are good, and the judgment of conviction must be reversed and the case dismissed.

DEATHS DURING WEEK ENDED JUNE 1, 1929

Summary of information received by telegraph from industrial insurance companies for the week ended June 1, 1929, and corresponding week of 1928. (From the Weekly Health Index, June 5, 1929, issued by the Bureau of the Census, Department of Commerce)

	Week ended June 1, 1929	Corresponding week, 1928
Policies in force	74, 266, 314	71, 296, 695
Number of death claims	11, 437	12, 482
Death claims per 1,000 policies in force, annual rate	8. 0	9. 2

Deaths from all causes in certain large cities of the United States during the week ended June 1, 1929, infant mortality, annual death rate, and comparison with corresponding week of 1928. (From the Weekly Health Index, June 5, 1929, issued by the Bureau of the Census, Department of Commerce)

City	Week ended June 1, 1929		Annual death rate per 1,000 corresponding week, 1928	Deaths under 1 year		Infant mortality rate, week ended June 1, 1929 [2]
	Total deaths	Death rate [1]		Week ended June 1, 1929	Corresponding week, 1928	
Total (65 cities)	7,284	12.8	13.2	698	793	[3] 59
Akron	34			3	6	31
Albany [4]	37	16.1	18.7	3	6	59
Atlanta	78	16.0	19.7	6	13	62
White	39			3	3	
Colored	39	([5])	([5])	3	10	
Blatimore [4]	224	14.1	14.0	33	28	106
White	168			24	16	97
Colored	56	([5])	([5])	9	12	143
Birmingham	57	13.4	17.6	4	8	36
White	24			1	5	15
Colored	33	([5])	([5])	3	3	69
Boston	237	15.5	15.8	22	31	61
Bridgeport	34			3	1	52
Buffalo	143	13.5	17.0	9	16	39
Cambridge	29	12.1	15.8	2	0	36
Camden	25	9.7	10.0	2	4	35
Canton	22	9.8	8.1	3	4	71
Chicago [4]	807	13.4	11.7	77	91	69
Cincinnati	141			8	16	47
Cleveland	201	10.4	10.5	14	27	41
Columbus	80	14.0	11.2	4	2	37
Dallas	37	8.9	14.4	6	6	
White	32			6	5	
Colored	5	([5])	([5])	0	1	
Dayton	42	11.9	11.3	2	6	32
Denver	69	12.3	15.1	7	12	68
Des Moines	30	10.3	8.3	0	7	0
Detroit	335	12.7	12.3	45	43	72
Duluth	31	13.9	9.0	2	1	48
Erie	28			2	3	41
Fall River [4]	22	8.6	17.1	2	4	38
Flint	36	12.6	10.5	7	6	85
Fort Worth	36	11.0	9.5	1	4	
White	30			1	2	
Colored	6	([5])	([5])	0	2	
Grand Rapids	41	13.1	11.5	3	2	45
Houston	57			4	11	
White	37			3	8	
Colored	20	([5])	([5])	1	3	
Indianapolis	116	15.9	10.5	9	6	72
White	94			7	5	65
Colored	22	([5])	([5])	2	1	119
Jersey City	86	13.8	12.7	7	10	54
Kansas City, Kans	34	15.0	8.4	4	1	88
White	27			3	1	76
Colored	7	([5])	([5])	1	0	179
Kansas City, Mo	91	12.2	12.4	7	12	59
Knoxville	28	13.9	10.4	1	4	22
White	25			1	1	24
Colored	3	([5])	([5])	0	3	0
Los Angeles	248			28	21	82
Louisville	77	12.2	18.3	7	4	57
White	55			6	1	56
Colored	22	([5])	([5])	1	3	63
Lowell	25			0	7	0
Lynn	26	12.9	14.9	2	4	55
Memphis	82	22.5	24.7	6	7	71
White	47			5	5	95
Colored	35	([5])	([5])	1	2	31
Milwaukee	122	11.7	12.3	10	6	44
Minneapolis	104	11.9	9.3	11	8	68
Nashville	34	12.7	25.1	6	8	97
White	25			5	6	109
Colored	9	([5])	([5])	1	2	63
New Bedford	26			1	4	21
New Haven	49	13.6	17.0	4	10	61

(Footnotes at end of table)

Deaths from all causes in certain large cities of the United States during the week ended June 1, 1929, infant mortality, annual death rate, and comparison with corresponding week of 1928.—Continued

City	Week ended June 1, 1929		Annual death rate per 1,000 corresponding week, 1928	Deaths under 1 year		Infant mortality rate, week ended June 1, 1929 [2]
	Total deaths	Death rate [1]		Week ended June 1, 1929	Corresponding week, 1928	
New Orleans	158	19.2	20.1	18	20	89
White	76			7	10	49
Colored	82	(5)	(5)	11	10	185
New York	1,446	12.6	13.8	140	166	57
Bronx Borough	204	11.2	10.7	18	9	53
Brooklyn Borough	469	10.6	12.4	44	63	45
Manhattan Borough	577	17.2	19.5	58	79	71
Queens Borough	143	8.8	9.7	16	12	65
Richmond Borough	53	18.4	12.5	4	3	72
Newark, N. J	91	10.0	14.4	13	15	69
Oakland	53	10.1	8.2	6	5	67
Oklahoma City	21			3	0	60
Omaha	66	15.5	7.5	6	0	70
Paterson	38	13.7	13.7	6	3	106
Philadelphia	426	10.8	13.1	29	33	41
Pittsburgh	179	13.9	13.9	23	30	79
Portland, Oreg	78			2	3	23
Providence	64	11.7	12.4	3	5	26
Richmond	58	15.6	16.4	7	3	98
White	34			4	1	85
Colored	24	(5)	(5)	3	2	123
Rochester	73	11.6	11.6	5	5	42
St. Louis	218	13.4	13.6	15	10	51
St. Paul	46			5	4	51
Salt Lake City [4]	33	12.5	11.4	2	3	31
San Antonio	67	16.1	19.2	24	24	
San Diego	34	14.9	19.7	3	1	57
San Francisco	134	12.0	11.5	11	8	70
Schenectady	28	15.7	12.3	3	1	96
Seattle	75	10.2	8.1	8	6	85
Somerville	14	7.1	18.3	2	6	72
Spokane	34	16.3	10.5	4	4	104
Springfield, Mass	39	13.6	9.8	6	0	99
Syracuse	48	12.6	15.0	1	8	12
Tacoma	21	9.9	6.2	1	0	26
Toledo	66	11.0	9.3	8	4	75
Trenton	37	13.9	15.8	1	7	18
Utica	25	12.5	18.6	1	4	25
Washington, D. C	139	13.2	12.0	8	4	47
White	76			2	2	17
Colored	63	(5)	(5)	6	2	114
Waterbury	13			2	2	51
Wilmington, Del	30	12.2	16.3	4	4	104
Worcester	41	10.8	14.0	2	6	25
Yonkers	24	10.3	9.1	1	2	23
Youngstown	57	17.1	12.0	9	5	129

[1] Annual rate per 1,000 population.
[2] Deaths under 1 year per 1,000 births. Cities left blank are not in the registration area for births.
[3] Data for 73 cities.
[4] Deaths for week ended Friday.
[5] In 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.

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 June 1, 1929, and June 2, 1928

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 1, 1929, and June 2, 1928

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928
New England States:								
Maine	------	10	4	8	131	78	0	0
New Hampshire	------	------	------	------	76	11	0	0
Vermont	------	------	------	------	1	53	0	0
Massachusetts	54	50	4	102	465	720	3	2
Rhode Island	8	5	------	------	49	217	1	0
Connecticut	17	27	5	13	219	351	1	3
Middle Atlantic States:								
New York	293	287	[1] 10	[1] 53	748	4,133	33	22
New Jersey	109	142	4	10	239	1,796	9	7
Pennsylvania	127	126	------	------	2,074	2,781	12	5
East North Central States:								
Ohio	75	111	10	87	2,508	1,210	26	6
Indiana	11	23	------	15	444	477	3	0
Illinois	200	117	11	153	1,777	208	18	17
Michigan	62	46	5	25	677	974	71	3
Wisconsin	25	15	12	237	1,372	57	3	2
West North Central States:								
Minnesota	14	17	1	------	341	74	1	4
Iowa	7	4	------	------	53	9	1	1
Missouri	55	21	1	12	146	425	16	16
North Dakota	33	1	------	12	130	9	4	0
South Dakota	3	3	------	------	23	210	1	0
Nebraska	8	11	3	2	484	37	1	0
Kansas	3	11	1	2	708	116	5	2
South Atlantic States:								
Delaware	3	2	------	------	14	38	0	0
Maryland [2]	11	39	10	9	46	429	1	1
District of Columbia	11	14	------	1	28	215	0	0
West Virginia	8	10	14	204	196	72	0	2
North Carolina	17	13	------	------	16	439	2	0
South Carolina	7	11	198	421	8	231	0	0
Georgia	2	3	12	47	46	104	0	2
Florida	3	6	1	5	76	175	0	0
East South Central States:								
Kentucky	5	7	------	------	------	130	2	0
Tennessee	1	10	18	103	22	117	2	1
Alabama	5	9	17	108	48	262	0	0
Mississippi	8	8	------	------	------	------	1	------
West South Central States:								
Arkansas	3	4	2	147	4	167	6	1
Louisiana	9	14	5	15	37	168	0	1
Oklahoma [3]	3	9	10	89	17	167	0	0
Texas	15	17	34	78	172	246	0	0

[1] New York City only.
[2] Week ended Friday.
[3] Figures for 1929 are exclusive of Oklahoma City and Tulsa and for 1928 are exclusive of Tulsa.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 1, 1929, and June 2, 1928

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928
Mountain States:								
Montana	3	2	-------	3	35	34	0	4
Idaho	1	3	-------	-------	83	10	0	1
Wyoming	1	1	-------	-------	29	12	0	0
Colorado	6	5	-------	-------	237	119	3	0
New Mexico	-------	2	-------	-------	8	59	1	0
Arizona	1	1	-------	-------	1	9	4	0
Utah [2]	1	2	2	10	3	1	5	0
Pacific States:								
Washington	1	16	-------	-------	150	67	6	1
Oregon	10	5	7	3	205	38	2	0
California	51	74	16	29	133	90	14	3

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928	Week ended June 1, 1929	Week ended June 2, 1928
New England States:								
Maine	0	1	43	25	0	0	-------	4
New Hampshire	0	0	10	2	0	0	0	0
Vermont	0	0	16	9	6	0	0	0
Massachusetts	2	4	200	178	3	0	9	4
Rhode Island	0	0	15	24	0	0	1	0
Connecticut	0	1	41	42	0	1	1	0
Middle Atlantic States:								
New York	1	1	401	432	2	3	15	3
New Jersey	0	0	125	165	0	0	7	1
Pennsylvania	1	1	318	344	0	15	18	11
East North Central States:								
Ohio	1	2	291	207	84	23	17	5
Indiana	0	0	169	70	116	87	6	1
Illinois	0	1	370	231	117	79	9	4
Michigan	2	1	393	156	50	44	4	8
Wisconsin	1	0	144	170	32	19	2	42
West North Central States:								
Minnesota	0	1	77	89	8	3	2	3
Iowa	1	0	94	49	51	44	0	0
Missouri	0	0	52	116	23	33	11	1
North Dakota	1	0	22	23	25	0	0	2
South Dakota	0	0	18	26	17	18	2	0
Nebraska	0	0	85	55	43	24	0	0
Kansas	0	0	79	75	53	73	2	1
South Atlantic States:								
Delaware	0	0	1	2	0	0	1	0
Maryland [2]	0	3	153	55	0	3	6	4
District of Columbia	0	0	15	45	0	0	1	2
West Virginia	0	0	12	20	22	17	6	7
North Carolina	1	1	24	37	3	40	18	8
South Carolina	1	0	6	7	4	1	39	39
Georgia	0	0	7	15	0	0	13	13
Florida	0	2	3	4	0	1	3	18
East South Central States:								
Kentucky	0	0	84	38	32	18	0	2
Tennessee	0	0	9	11	22	23	17	11
Alabama	0	1	13	6	1	23	10	14
Mississippi	0	0	10	5	1	5	14	8
West South Central States:								
Arkansas	1	0	15	16	1	3	8	5
Louisiana	0	1	36	5	0	14	6	16
Oklahoma [3]	0	0	12	42	25	122	2	4
Texas	0	3	50	58	45	37	7	9
Mountain States:								
Montana	1	0	25	10	12	23	0	0
Idaho	0	0	2	4	5	4	0	1
Wyoming	0	0	0	12	9	1	2	7
Colorado	0	2	20	37	13	8	3	2
New Mexico	0	0	8	20	1	5	0	4
Arizona	0	0	0	0	1	5	3	3
Utah [2]	0	0	2	10	5	1	0	1
Pacific States:								
Washington	0	2	21	22	40	21	1	2
Oregon	1	0	9	12	21	33	3	3
California	3	6	296	148	28	35	5	13

[2] Week ended Friday.
[3] Figures for 1929 are exclusive of Oklahoma City and Tulsa and for 1928 are exclusive of 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
October, 1928										
Indiana	1	263	53	--------	31	--------	4	260	51	66
Pennsylvania	17	841	--------	--------	1,361	3	38	924	0	238
April, 1929										
Mississippi [1]	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
South Carolina	--------	85	1,627	1,063	59	652	3	38	22	30
South Dakota	1	20	10	--------	145	--------	0	82	179	1
Virginia	10	79	820	36	877	42	1	108	30	28
Washington [2]	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

[1] The Mississippi report for the month of March, 1929, published in the Public Health Reports of May 10, 1929, page 1151, should have shown 3,426 cases of malaria instead of 3,476 as given.

[2] The Washington report for the month of March, 1929, published in the Public Health Reports of May 10, 1929, page 1151, should have shown 82 cases of meningococcus meningitis instead of 36 cases as given.

October, 1928

	Cases
Chicken pox:	
Indiana	154
Pennsylvania	1,541
German measles:	
Pennsylvania	31
Lethargic encephalitis:	
Pennsylvania	9
Mumps:	
Indiana	9
Pennsylvania	963
Ophthalmia neonatorum:	
Pennsylvania	10
Puerperal septicemia:	
Pennsylvania	4
Rabies in man:	
Pennsylvania	1
Tetanus:	
Pennsylvania	6
Trachoma:	
Indiana	1
Whooping cough:	
Indiana	62
Pennsylvania	1,832

April, 1929

	Cases
Chicken pox:	
South Carolina	422
South Dakota	46
Virginia	578
Dengue:	
South Carolina	5
Dysentery:	
Virginia	97
Lethargic encephalitis:	
South Carolina	1
Mumps:	
South Carolina	166
South Dakota	41
Paratyphoid fever:	
South Carolina	3
Rabies in animals:	
South Carolina	31
Tetanus:	
South Carolina	1
Trachoma:	
South Dakota	2
Undulant fever:	
South Carolina	1
Whooping cough:	
South Carolina	936
South Dakota	17
Virginia	711

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 96 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,-420,000. The estimated population of the 89 cities reporting deaths is more than 29,850,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended May 25, 1929, and May 26, 1928

	1929	1928	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	1,555	1,410	
96 cities	816	776	1,968
Measles:			
45 States	14,555	17,897	
96 cities	5,457	7,750	
Meningococcus meningitis:			
46 States	231	138	
96 cities	132	82	
Poliomyelitis:			
46 States	18	28	
Scarlet fever:			
46 States	4,177	3,676	
96 cities	1,626	1,379	1,140
Smallpox:			
46 States	1,060	947	
96 cities	63	102	87
Typhoid fever:			
46 States	288	292	
96 cities	48	49	48
Deaths reported			
Influenza and pneumonia:			
89 cities	725	1,162	
Smallpox:			
89 cities	0	0	

City reports for week ended May 25, 1929

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 non-epidemic 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 1920 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	Population July 1, 1928, estimated	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	78,600	2	1	0		0	28	1	1
New Hampshire:									
Concord	(1)	0	0	0		0	37	0	0
Nashua	(1)	0	0	0		0	0	0	1
Vermont:									
Barre	(1)	1	0	0		0	0	0	0

City reports for week ended May 25, 1929—Continued

Division, State, and city	Population July 1, 1928, estimated	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—contd.									
Massachusetts:									
Boston	799,200	55	40	23	1	1	37	40	23
Fall River	134,300	2	3	2	1	1	1	0	3
Springfield	149,800	4	2	3		0	5	0	3
Worcester	197,600	6	3	1		0	29	0	3
Rhode Island:									
Pawtucket	73,100	5	1	0		0	4	0	4
Providence	286,300	0	6	8		1	73	1	7
Connecticut:									
Bridgeport	(1)	4	5	1	1	0	9	1	2
Hartford	172,300	6	5	9		0	4	4	7
New Haven	187,900	28	1	1		0	19	2	1
MIDDLE ATLANTIC									
New York:									
Buffalo	555,800	14	12	7		0	90	5	18
New York	6,017,500	290	258	280	13	6	103	294	150
Rochester	328,200	5	9	3	1	2	24	15	2
Syracuse	199,300	52	5	0		0	2	22	5
New Jersey:									
Camden	135,400	11	6	8		0	6	2	3
Newark	473,600	77	13	53	1	0	5	82	11
Trenton	139,000	4	3	1		3	14	0	0
Pennsylvania:									
Philadelphia	2,064,200	161	60	21	7	5	65	26	51
Pittsburgh	673,800	45	17	15		0	88	11	26
Reading	115,400	11	2	2		0	9	1	1
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	413,700	10	7	9	1	0	1	0	8
Cleveland	1,010,300	152	23	16	2	0	617	14	13
Columbus	299,000	17	3	1	1	1	67	0	7
Toledo	313,200	31	4	2	1	1	36	7	10
Indiana:									
Fort Wayne	105,300	6	2	0		0	46	0	5
Indianapolis	382,100	44	3	1		1	275	1	18
South Bend	86,100	1	1	0		0	8	0	1
Terre Haute	73,500	2	1	0		0	21	0	0
Illinois:									
Chicago	3,157,400	122	65	154	11	8	1,326	10	76
Springfield	67,200	1	0	0		0	15	1	0
Michigan:									
Detroit	1,378,900	113	43	71	5	2	204	76	27
Flint	148,800	27	4	0		0	14	0	8
Grand Rapids	164,200	7	2	0		0	45	1	5
Wisconsin:									
Kenosha	56,500	11	0	0		0	70	0	1
Milwaukee	544,200	127	12	7	1	1	854	33	13
Racine	74,400	14	1	0		0	17	1	3
Superior	(1)	5	0	0		0	3	1	0
WEST NORTH CENTRAL									
Minnesota:									
Duluth	116,800	18	1	0		0	5	28	0
Minneapolis	455,900	59	15	6		4	227	49	8
St. Paul	(1)	13	9	1		1	158	44	12
Iowa:									
Davenport	(1)	1	0	0			2	0	
Des Moines	151,900	1	1	0			2	0	
Sioux City	80,000	19	1	[2] 1			1	1	
Waterloo	37,100	7	0	0			3	21	
Missouri:									
Kansas City	391,000	30	4	3		0	31	0	10
St. Joseph	78,500	0	1	2		0	19	0	3
St. Louis	848,100	14	39	36	1		36	12	
North Dakota:									
Fargo	(1)		0						
Grand Forks	(1)	0	0	2			2	0	

[1] No estimate of population made.
[2] Nonresident.

City reports for week ended May 25, 1929—Continued

Division, State, and city	Population, July 1, 1928, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
WEST NORTH CENTRAL—continued									
South Dakota:									
Aberdeen	(1)	0	0	0			1	13	
Sioux Falls	(1)	0	0	0			0	0	
Nebraska:									
Omaha	222,800	8	2	3		0	91	0	7
Kansas:									
Topeka	62,800	0	1	0		0	4	2	0
Wichita	99,300	10	1	0		0	157	11	1
SOUTH ATLANTIC									
Delaware:									
Wilmington	128,500	1	2	3		0	9	1	4
Maryland:									
Baltimore	830,400	61	22	8	8	0	3	200	14
Cumberland	(1)	0	1	0		0	0	0	2
Frederick	(1)	0	0	0		0	0	0	0
District of Columbia:									
Washington	552,000	17	10	10	1	1	0	0	9
Virginia:									
Lynchburg	38,600	10	0	2		0	3	93	0
Richmond	194,400	4	1	0		1	28	7	4
Roanoke	64,600	6	1	0		0	1	1	1
West Virginia:									
Charleston	55,200	2	0	1		0	31	0	0
Wheeling	(1)	10	0	0		0	45	0	2
North Carolina:									
Raleigh	(1)	4	0	0		0	0	0	1
Wilmington	39,100	20	0	0		0	0	0	2
Winston-Salem	80,000	2	1	0		0	0	1	2
South Carolina:									
Charleston	75,900	1	0	0	3	0	0	0	2
Columbia	50,600	10	0	0		0	1	2	1
Georgia:									
Atlanta	255,100	2	1	0	10	1	0	0	5
Brunswick	(1)	0	0	0		0	0	0	0
Savannah	99,900	1	0	1	5	0	0	0	0
Florida:									
Miami	156,700	3	1	1		0	56	1	2
Tampa	113,400	0	1	1		0	8	1	1
EAST SOUTH CENTRAL									
Kentucky:									
Covington	59,000	0	0	0		0	0	0	4
Tennessee:									
Memphis	190,200	5	0	0		2	0	0	3
Nashville	139,600	4	0	1		2	0	0	4
Alabama:									
Birmingham	222,400	3	0	1	3	2	1	4	3
Mobile	69,600	1	1	0		0	1	0	0
Montgomery	63,100	19	0	0			2	0	
WEST SOUTH CENTRAL									
Arkansas:									
Fort Smith	(1)	0	0	0			1	1	
Little Rock	79,200	8	0	0		1	1	3	2
Louisiana:									
New Orleans	429,400	1	6	8	2	2	9	0	5
Shreveport	81,300	1	0	0		0	1	0	0
Texas:									
Dallas	217,800	10	3	1		1	88	0	2
Fort Worth	170,600	1	1	2		0	3	0	2
Galveston	50,600	1	0	0		0	0	0	1
Houston	(1)	5	3	1		0	13	0	3
San Antonio	218,100	0	1	2		3	0	0	4

[1] No estimate of population made.

City reports for week ended May 25, 1929—Continued

Division, State, and city	Population, July 1, 1928, estimated	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia deaths reported
			Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
MOUNTAIN									
Montana:									
Billings	(1)	6	0	0	--------	0	3	0	0
Great Falls	(1)	7	0	0	--------	0	11	17	2
Helena	(1)	0	0	0	--------	0	0	0	2
Missoula	(1)	0	0	0	--------	0	1	0	3
Idaho:									
Boise	(1)	0	0	0	--------	0	8	0	1
Colorado:									
Denver	294,200	49	9	7	--------	0	3	26	2
Pueblo	44,200	50	1	0	--------	0	4	0	3
New Mexico:									
Albuquerque	(1)	7	1	1	--------	0	0	0	1
Utah:									
Salt Lake City	138,000	14	3	0	--------	1	2	109	3
Nevada:									
Reno	(1)	0	0	0	--------	0	4	0	0
PACIFIC									
Washington:									
Seattle	383,200	54	4	0	--------	--------	11	38	--------
Spokane	109,100	13	2	4	--------	--------	156	0	--------
Tacoma	110,500	--------	1	--------	--------	--------	--------	--------	--------
Oregon:									
Portland	(1)	8	6	1	--------	4	87	5	5
Salem	(1)	1	0	0	3	0	4	6	0
California:									
Los Angeles	(1)	81	38	12	19	0	27	30	15
Sacramento	75,700	6	3	1	1	1	5	10	4
San Francisco	585,300	17	18	3	1	1	9	27	6

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		
NEW ENGLAND											
Maine:											
Portland	2	10	0	0	0	1	0	0	0	4	17
New Hampshire:											
Concord	1	4	0	0	0	1	0	0	0	0	10
Nashua	1	0	0	0	0	0	0	0	0	0	12
Vermont:											
Barre	0	0	0	0	0	0	0	0	0	4	2
Massachusetts:											
Boston	61	72	0	0	0	15	2	1	0	45	209
Fall River	3	3	0	0	0	5	0	0	0	8	27
Springfield	6	17	0	0	0	4	0	0	0	0	42
Worcester	9	3	0	0	0	1	0	1	0	17	49
Rhode Island:											
Pawtucket	1	1	0	0	0	0	0	0	0	1	21
Providence	10	4	0	0	0	2	0	1	0	0	53
Connecticut:											
Bridgeport	10	2	0	3	0	2	0	0	0	1	30
Hartford	4	5	0	0	0	2	1	0	0	3	50
New Haven	6	4	0	0	0	0	0	0	0	7	32
MIDDLE ATLANTIC											
New York:											
Buffalo	22	24	0	0	0	8	0	0	0	14	141
New York	250	244	0	0	0	107	9	7	1	71	1,442
Rochester	12	2	0	0	0	6	1	0	0	11	78
Syracuse	9	7	0	0	0	0	0	0	0	21	60
New Jersey:											
Camden	5	7	0	0	0	3	1	1	2	3	32
Newark	24	21	0	0	0	7	0	0	0	33	97
Trenton	2	5	0	0	0	0	0	0	0	2	36

1 No estimate of population made.

City reports for week ended May 25, 1929—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
MIDDLE ATLANTIC—continued											
Pennsylvania:											
Philadelphia	85	56	0	0	0	34	3	2	0	62	469
Pittsburgh	30	34	0	0	0	9	1	0	0	41	180
Reading	3	6	0	0	0	2	0	0	0	3	29
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	14	54	2	2	0	5	1	0	0	7	118
Cleveland	32	46	0	0	0	15	1	2	0	45	222
Columbus	8	1	1	1	0	3	0	0	0	43	71
Toledo	9	7	0	0	0	3	0	0	0	33	83
Indiana:											
Fort Wayne	3	5	2	11	0	0	0	0	0	2	29
Indianapolis	13	63	14	0	0	7	1	0	0	28	99
South Bend	3	3	1	2	0	1	0	0	0	0	16
Terre Haute	3	4	1	0	0	0	0	0	0	0	17
Illinois:											
Chicago	106	220	2	2	0	34	3	0	0	41	745
Springfield	3	3	0	1	0	1	0	0	0	0	22
Michigan:											
Detroit	88	203	1	1	0	29	2	0	1	103	328
Flint	6	52	1	10	0	1	0	0	0	3	35
Grand Rapids	5	7	0	1	0	0	0	0	0	27	42
Wisconsin:											
Kenosha	1	0	0	0	0	1	0	0	0	4	14
Milwaukee	23	40	1	0	0	6	0	2	0	85	126
Racine	4	2	1	0	0	1	0	0	0	1	12
Superior	2	0	1	0	0	3	0	0	0	6	7
WEST NORTH CENTRAL											
Minnesota:											
Duluth	7	6	1	0	0	0	1	0	0	1	12
Minneapolis	35	17	3	0	0	5	1	0	0	34	83
St. Paul	21	17	0	0	0	2	0	0	0	51	64
Iowa:											
Davenport	1	0	1	15			0	0		5	
Des Moines	4	33	3	0			0	0		0	38
Sioux City	2	0	1	0			0	0		9	
Waterloo	2	16	0	0			0	0		8	
Missouri:											
Kansas City	10	10	1	4	0	9	1	3	0	9	106
St. Joseph	2	0	1	1	0	1	0	0	0	1	26
St. Louis	29	11	2	2	0	15	1	1	0	70	228
North Dakota:											
Fargo	1		0				0				
Grand Forks	1	0	0	2				0		0	
South Dakota:											
Aberdeen	1	0	0	1			0	0		0	
Sioux Falls	2	1	0	11			0	0		13	
Nebraska:											
Omaha	3	12	5	1	0	2	0	0	0	5	55
Kansas:											
Topeka	2	3	0	0	0	0	0	0	0	17	9
Wichita	2	16	1	0	0	1	0	0	0	3	19
SOUTH ATLANTIC											
Delaware:											
Wilmington	4	2	0	0	0	1	0	0	0	5	25
Maryland:											
Baltimore	28	59	0	0	0	18	2	1	0	89	191
Cumberland	0	1	0	0	0	0	0	0	0	0	13
Frederick	2	0	0	0	0	0	0	0	0	0	2
District of Col.:											
Washington	21	10	1	0	0	19	1	0	0	25	136
Virginia:											
Lynchburg	0	2	0	0	0	2	0	0	0	11	12
Richmond	3	7	0	0	0	3	0	2	0	1	49
Roanoke	0	1	0	0	0	3	0	0	0	0	24
West Virginia:											
Charleston	0	1	0	0	0	0	0	1	0	0	6
Wheeling	2	0	0	0	0	0	0	0	0	3	15

City reports for week ended May 25, 1929—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—continued											
North Carolina:											
Raleigh	0	0	1	0	0	0	0	1	0	5	9
Wilmington	0	1	0	1	0	0	0	0	0	1	14
Winston-Salem	1	0	1	0	0	0	0	0	0	26	11
South Carolina:											
Charleston	0	0	1	1	0	3	1	0	0	1	30
Columbia	0	1	0	0	0	0	1	1	0	8	4
Georgia:											
Atlanta	3	0	4	0	0	3	1	0	0	10	65
Brunswick	0	0	0	0	0	0	0	0	0	0	4
Savannah	0	0	0	0	0	2	1	2	0	1	33
Florida:											
Miami	0	0	0	0	0	1	0	0	0	9	22
Tampa	1	0	0	0	0	1	0	0	0	8	23
EAST SOUTH CENTRAL											
Kentucky:											
Covington	1	4	0	4	0	1	0	0	0	0	20
Tennessee:											
Memphis	3	5	2	0	0	7	1	7	0	7	66
Nashville	2	10	2	0	0	1	1	1	0	2	40
Alabama:											
Birmingham	1	0	6	0	0	6	2	2	0	5	62
Mobile	0	0	0	0	0	3	0	1	0	0	20
Montgomery	1	1	0	0			0	0		1	
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	1	0	0	0			0	0		0	
Little Rock	1	1	0	0	0	4	1	1	0	0	
Louisiana:											
New Orleans	4	22	0	0	0	20	2	2	0	0	136
Shreveport	0	2	1	0	0	3	0	0	1	0	36
Texas:											
Dallas	2	2	1	4	0	3	1	0	0	9	45
Forth Worth	1	6	4	5	0	0	0	2	0	0	28
Galveston	0	0	0	0	0	0	0	0	0	0	21
Houston	2	4	1	0	0	6	0	0	0	0	63
San Antonio	1	0	0	0	0	8	0	0	0	0	82
MOUNTAIN											
Montana:											
Billings	1	0	0	0	0	1	0	0	0	0	11
Great Falls	1	1	1	0	0	0	0	0	0	1	9
Helena	1	0	0	0	0	0	0	0	0	0	5
Missoula	0	1	0	3	0	0	0	0	0	0	15
Idaho:											
Boise	0	1	0	0	0	0	0	0	0	1	7
Colorado:											
Denver	11	6	1	0	0	5	0	1	0	20	68
Pueblo	1	0	1	0	0	0	0	1	0	0	12
New Mexico:											
Albuquerque	0	2	0	0	0	6	0	0	0	0	8
Utah:											
Salt Lake City	2	4	2	1	0	1	0	0	0	22	38
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	6
PACIFIC											
Washington:											
Seattle	9	2	4	0			0	0		58	
Spokane	4	4	5	2			0	0		18	
Tacoma	2		3				0				
Oregon:											
Portland	5	2	9	16	0	3	1	0	0	0	80
Salem	0	1	0	2	0	0	0	0	0	0	
California:											
Los Angeles	25	48	7	2	0	28	1	1	0	37	245
Sacramento	1	25	1	3	0	2	1	2	0	7	29
San Francisco	16	56	1	0	0	17	1	0	0	30	163

City reports for week ended May 25, 1929—Continued

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									
Massachusetts:									
Boston	2	1	1	0	1	0	1	2	0
Worcester	1	1	0	0	0	0	0	0	0
Rhode Island:									
Providence	0	1	0	0	0	0	0	0	0
Connecticut:									
New Haven	2	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC									
New York:									
Buffalo	1	2	0	1	0	0	0	0	0
New York	20	7	1	1	0	0	1	0	0
New Jersey:									
Newark	1	0	0	0	0	0	0	0	0
Trenton	0	0	0	1	0	0	0	0	0
Pennsylvania:									
Philadelphia	5	4	1	0	0	0	0	0	0
Pittsburgh	3	3	0	0	0	0	0	0	0
EAST NORTH CENTRAL									
Ohio:									
Cleveland	9	0	1	1	0	0	0	0	0
Toledo	2	1	0	0	0	0	0	0	0
Indiana:									
Indianapolis	0	1	0	0	0	0	0	0	0
Illinois:									
Chicago	12	4	0	0	0	0	0	0	0
Michigan:									
Detroit	29	15	1	1	0	0	0	0	1
Flint	11	6	0	0	0	0	0	0	0
Wisconsin:									
Milwaukee	6	1	0	0	0	0	0	0	0
WEST NORTH CENTRAL									
Minnesota:									
Minneapolis	0	0	0	0	0	0	0	1	0
Missouri:									
Kansas City	5	5	0	0	0	0	0	0	0
St. Joseph	0	1	0	0	0	0	0	0	0
St. Louis	5	0	0	0	0	0	0	0	0
Nebraska:									
Omaha	1	0	0	0	0	0	0	0	0
Kansas:									
Wichita	1	0	0	0	0	0	0	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	0	0	0	1	0	0	0	0	0
Virginia:									
Richmond	1	1	0	0	0	0	0	0	0
South Carolina:									
Charleston	0	0	0	0	0	1	0	0	0
Georgia:									
Atlanta	1	0	0	0	0	0	0	0	0
Savannah	0	0	0	0	5	1	0	0	0
Florida: [1]									
Miami	0	0	0	0	2	0	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Memphis	1	0	0	0	0	1	0	0	0
Alabama:									
Birmingham	1	0	0	1	3	0	0	0	0
Mobile	0	0	0	0	2	0	0	1	0

[1] Typhus fever: 1 case at Tampa, Fla.

51330°—29——3

City reports for week ended May 25, 1929—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 SOUTH CENTRAL									
Arkansas:									
Little Rock	1	0	0	0	0	1	0	0	0
Louisiana:									
New Orleans	3	1	2	2	6	2	0	0	0
Shreveport	0	0	0	0	0	1	0	0	0
Texas:									
Dallas	0	0	0	0	0	1	0	0	0
Fort Worth	0	0	0	0	0	1	0	0	0
San Antonio	0	0	0	0	0	2	0	0	0
MOUNTAIN									
Montana:									
Great Falls	0	1	0	0	0	0	0	0	0
Colorado:									
Denver	0	0	0	1	0	0	0	0	0
Utah:									
Salt Lake City	4	4	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Seattle	1	0	0	0	0	0	0	0	0
California:									
Los Angeles	3	1	0	0	0	0	1	1	0
Sacramento	2	1	0	0	0	0	0	0	0
San Francisco	0	0	2	1	0	0	0	0	0

The following table gives the rates per 100,000 population for 98 cities for the 5-week period ended May 25, 1929, compared with those for a like period ended May 26, 1928. 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 estimated aggregate populations of more than 31,000,000. The 91 cities reporting deaths have nearly 30,000,000 estimated population. The number of cities included in each group and the estimated aggregate populations are shown in a separate table below.

Summary of weekly reports from cities, April 21 to May 25, 1929—Annual rates per 100,000 population, compared with rates for the corresponding period of 1928 [1]

DIPHTHERIA CASE RATES

	Week ended—									
	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
98 cities	136	130	136	125	139	123	[2] 124	139	[3] 135	131
New England	111	133	81	133	118	113	95	110	109	64
Middle Atlantic	194	172	190	171	206	178	159	205	188	213
East North Central	143	131	159	107	145	109	143	114	165	102
West North Central	85	84	77	78	104	55	[2] 124	96	[2] 101	72
South Atlantic	58	94	69	96	64	90	62	111	49	117
East South Central	54	56	20	35	27	42	27	21	14	42
West South Central	130	101	103	81	91	93	115	65	47	28
Mountain	78	133	61	80	52	71	26	97	61	71
Pacific	60	56	75	125	40	102	57	120	[4] 53	92

[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, 1929 and 1928, respectively.
[2] Fargo, N. Dak., not included.
[3] Fargo, N. Dak., and Tacoma, Wash., not included.
[4] Tacoma, Wash., not included.

Summary of weekly reports from cities, April 21 to May 25, 1929—Annual rates per 100,000 population, compared with rates for the corresponding period of 1928—Continued

MEASLES CASE RATES

	Week ended—									
	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
98 cities	842	1,284	931	1,421	897	1,379	[3] 889	1,351	[3] 905	1,309
New England	566	1,593	500	1,322	484	1,120	434	1,159	556	1,290
Middle Atlantic	153	1,868	165	2,273	186	2,261	196	2,281	194	2,192
East North Central	1,962	727	2,319	793	2,191	787	2,135	680	2,283	772
West North Central	1,711	1,021	1,775	892	1,548	941	[2] 1,714	1,121	[2] 1,423	943
South Atlantic	536	1,810	435	2,235	521	1,781	474	1,536	242	1,320
East South Central	20	1,297	129	610	41	814	68	968	27	743
West South Central	289	401	356	397	379	340	344	272	447	263
Mountain	366	842	444	753	296	1,143	183	1,152	313	833
Pacific	389	386	297	266	436	328	439	264	[4] 549	304

SCARLET FEVER CASE RATES

	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
98 cities	296	267	300	255	291	254	[3] 291	253	[3] 270	233
New England	294	329	280	345	262	347	249	292	283	306
Middle Atlantic	246	313	245	303	209	285	219	279	196	268
East North Central	451	281	467	254	453	265	472	272	448	254
West North Central	281	276	261	219	277	243	[2] 284	280	[2] 210	207
South Atlantic	97	222	114	186	244	172	210	207	159	176
East South Central	109	161	224	147	129	126	102	77	136	84
West South Central	225	109	285	150	320	186	186	219	123	207
Mountain	122	204	78	275	52	115	104	133	113	18
Pacific	407	110	357	154	292	205	307	143	[4] 356	130

SMALLPOX CASE RATES

	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
98 cities	13	25	12	14	11	18	[3] 11	24	[3] 10	17
New England	0	0	0	0	2	0	0	0	7	9
Middle Atlantic	0	0	0	0	0	0	0	0	0	0
East North Central	17	28	15	15	17	20	14	22	20	16
West North Central	13	68	13	31	27	43	[2] 16	65	[2] 16	27
South Atlantic	2	33	0	15	0	17	2	33	4	29
East South Central	0	98	20	14	27	63	14	42	27	63
West South Central	24	28	43	36	8	8	51	61	16	24
Mountain	26	151	122	106	26	159	148	159	35	133
Pacific	82	43	40	31	40	36	15	54	[4] 18	38

TYPHOID FEVER CASE RATES

	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
98 cities	8	4	8	6	11	8	[3] 9	6	[3] 8	8
New England	5	5	7	2	11	5	9	7	7	11
Middle Atlantic	4	3	5	4	3	2	6	4	5	6
East North Central	4	2	3	3	6	3	3	2	3	5
West North Central	12	6	10	2	31	8	[2] 6	2	[2] 8	4
South Atlantic	17	6	11	15	15	21	17	6	15	6
East South Central	20	7	27	0	27	28	0	28	75	14
West South Central	36	24	32	28	55	16	67	4	12	12
Mountain	0	0	9	0	0	18	0	0	17	0
Pacific	7	0	10	15	7	31	7	23	[4] 8	36

[2] Fargo, N. Dak., not included.
[3] Fargo, N. Dak., and Tacoma, Wash., not included.
[4] Tacoma, Wash., not included.

Summary of weekly reports from cities, April 21 to May 25, 1929—Annual rates per 100,000 population, compared with rates for the corresponding period of 1928—Continued

INFLUENZA DEATH RATES

	Week ended—									
	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
91 cities	13	33	8	33	10	34	[2] 8	30	[3] 10	26
New England	7	14	2	21	2	16	2	41	7	18
Middle Atlantic	12	34	6	28	8	31	8	28	8	21
East North Central	6	35	5	36	7	42	7	36	8	33
West North Central	12	46	18	80	3	64	[2] 0	28	[2] 15	18
South Atlantic	13	33	11	23	17	10	7	17	6	11
East South Central	30	54	30	115	37	107	30	84	44	180
West South Central	45	37	8	25	38	37	4	17	28	33
Mountain	52	44	17	35	26	27	17	27	9	53
Pacific	13	17	16	7	13	17	23	10	[4] 7	7

PNEUMONIA DEATH RATES

	Apr. 27, 1929	Apr. 28, 1928	May 4, 1929	May 5, 1928	May 11, 1929	May 12, 1928	May 18, 1929	May 19, 1928	May 25, 1929	May 26, 1928
91 cities	118	204	124	213	110	219	[3] 106	196	[3] 117	181
New England	145	138	106	189	90	258	88	207	122	253
Middle Atlantic	130	246	136	265	123	268	114	219	129	212
East North Central	99	214	125	211	101	232	115	222	118	174
West North Central	111	135	126	193	105	181	[2] 73	132	[2] 125	126
South Atlantic	127	178	109	189	109	86	120	155	94	119
East South Central	96	222	170	230	148	245	89	261	104	253
West South Central	93	191	93	92	97	166	114	125	69	146
Mountain	87	106	165	159	87	133	113	97	139	124
Pacific	125	125	75	74	98	98	49	104	[4] 88	91

[2] Fargo, N. Dak., not included.
[3] Fargo, N. Dak., and Tacoma, Wash., not included.
[4] Tacoma, Wash., not included.

Number of cities included in summary of weekly reports and aggregate population of cities of each group, approximated as of July 1, 1929 and 1928, respectively

Group of cities	Number of cities reporting cases	Number of cities reporting deaths	Aggregate population of cities reporting cases		Aggregate population of cities reporting deaths	
			1929	1928	1929	1928
Total	98	91	31,568,400	31,052,700	29,995,100	29,498,600
New England	12	12	2,305,100	2,273,900	2,305,100	2,273,900
Middle Atlantic	10	10	10,809,700	10,702,200	10,809,700	10,702,200
East North Central	16	16	8,181,900	8,001,300	8,181,900	8,001,300
West North Central	12	9	2,712,100	2,673,300	1,736,900	1,708,100
South Atlantic	19	19	2,783,200	2,732,900	2,783,200	2,732,900
East South Central	6	5	767,900	745,500	704,200	682,400
West South Central	8	7	1,319,100	1,289,900	1,285,000	1,256,400
Mountain	9	9	598,800	590,200	598,800	590,200
Pacific	6	4	2,090,600	2,043,500	1,590,300	1,551,200

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Two weeks ended May 25, 1929.—During the two weeks ended May 25, 1929, cases of certain communicable diseases were reported from eight Provinces of Canada as follows:

WEEK ENDED MAY 18

Disease	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				5			2		7
Influenza	8		54	2					64
Smallpox			3	30	2	7		6	48
Typhoid fever			19	6	1	1	1		28

WEEK ENDED MAY 25

Disease	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis				1				3	4
Influenza			2	11					13
Smallpox			3	7		5		7	22
Typhoid fever		4	10	11		1	3		29

Quebec Province—Vital statistics—February, 1929.—Births, deaths, and marriages for the month of February, 1929, with deaths from certain diseases for the same month, are shown in the following table:

February, 1929

Estimated population	2,691,000
Births	5,768
Birth rate per 1,000 population	27.9
Deaths	2,935
Death rate per 1,000 population	14.2
Infant mortality rate	133.1
Marriages	829
Deaths from:	
Cancer	156
Cerebrospinal meningitis	14
Diabetes	18
Diarrhea	90
Heart disease	278

February, 1929—Continued

Deaths from—Continued.	
Influenza	326
Lethargic encephalitis	1
Measles	5
Pneumonia	288
Poliomyelitis	1
Scarlet fever	14
Syphilis	6
Tuberculosis (pulmonary)	195
Tuberculosis (all other forms)	44
Typhoid fever	10
Violence	45
Whooping cough	10

Quebec Province—Communicable diseases—Week ended May 25, 1929.—The Bureau of Health of the Province of Quebec reports cases of certain communicable diseases for the week ended May 25, 1929, as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	2	Mumps	29
Chicken pox	52	Scarlet fever	117
Diphtheria	42	Smallpox	3
German measles	12	Tuberculosis	35
Influenza	2	Typhoid fever	10
Measles	121	Whooping cough	18

GREAT BRITAIN

England and Wales—Vital statistics—January-March, 1929.—During the first quarter of the year 1929, 160,181 births and 204,293 deaths were registered in England and Wales, giving a birth rate, on an annual basis, of 16.5 per 1,000 population and a death rate of 21 per 1,000. The rates are provisional.

During the 13 weeks ended March 30, 1929, deaths from certain communicable diseases were reported in 107 county boroughs and great towns, including greater London, as follows:

Disease	Deaths	Deaths per 1,000 population	Disease	Deaths	Deaths per 1,000 population
Diarrhea and enteritis (under 2 years)	718		Scarlet fever	139	0.03
Diphtheria	632	0.13	Smallpox	3	
Influenza	12,711	2.59	Typhoid fever	28	
Measles	869	.18	Whooping cough	2,274	.46

Estimated population, excluding noncivilians, 19,647,730.

Deaths from certain communicable diseases were reported in 156 smaller towns for the quarter ended March 31, 1929, as follows:

Disease	Deaths	Disease	Deaths
Diarrhea and enteritis (under 2 years)	107	Scarlet fever	17
Diphtheria	128	Smallpox	2
Influenza	2,281	Typhoid fever	8
Measles	84	Whooping cough	417

England and Wales—Communicable diseases—Thirteen weeks ended March 30, 1929.—During the 13 weeks ended March 30, 1929, cases of certain communicable diseases were reported in England and Wales as follows:

Disease	Cases	Disease	Cases
Diphtheria	15,900	Puerperal pyrexia	1,628
Ophthalmia neonatorum	1,295	Scarlet fever	29,002
Pneumonia	46,411	Smallpox [1]	3,283
Puerperal fever	569	Typhoid fever	380

[1] During the first quarter of the year 1929, 8 deaths from smallpox were reported in England and Wales.

ITALY

Communicable diseases—Four weeks ended March 10, 1929.—During the four weeks ended March 10, 1929, communicable diseases were reported in the Kingdom of Italy as follows:

Disease	Feb. 11-17		Feb. 18-24		Feb. 25-Mar. 3		Mar. 4-10	
	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected	Cases	Communes affected
Anthrax	24	20	6	5	26	18	15	12
Cerebrospinal meningitis	10	7	10	9	14	13	35	10
Chicken pox	162	54	153	60	174	82	161	57
Diphtheria	349	197	445	255	378	233	404	206
Dysentery			1	1	2	2	3	3
Lethargic encephalitis	4	4	3	3	3	3	6	6
Measles	1,571	216	1,595	204	997	228	1,476	188
Poliomyelitis	1	1	3	3	27	12	6	6
Rabies							1	1
Scarlet fever	219	91	283	103	246	108	217	84
Typhoid fever	132	80	134	77	143	93	117	71

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

From medical officers of the Public Health Service, American consuls, health section of the League of Nations, and other sources. The reports contained in the following table 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		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Week ended— February, 1929		March, 1929					April, 1929				May, 1929		
					16	23	2	9	16	23	30	6	13	20	27	4	11	18
Ceylon	C		7				2	2										
	D		4				2	2										
Colombo	C		3	2												1		
	D		1														1	
China: Canton	C		3						1	1	1		1		1		1	
	D		1										1		1	1	1	
India	C	23,528	17,038	12,566	2,193	1,881	1,766	1,787	1,905	2,130	2,036							
	D	14,950	10,507	7,912	1,280	1,092	1,007	1,046	993	1,165	1,135							
Bassein	D	1		6	2	1	1	2	1	3	12	29	26	47	23	22		
Bombay	C	4		1					1		4	1		2	1			
	D	4						1			1	1					1	
Calcutta	C	247	103	129	43	56	72	90	108	155	154	135	154	184				
	D	155	61	85	30	31	40	43	56	83	79	89	96	97	109	159		
Madras	C	102	16	4	2	3	1	3										
	D	42	17	5	1		3											
Madras Presidency	C	1																
	D	1																
Moulmein	D	1						1	4	1	1	1		4	1	1		
Negapatam	C	1	6	18	1	1	1											
	D	1																
Rangoon	C	5	6	15	1	4	5	3	3	6	5	1	5	1				
	D	3	5	9		1	4	1	2	6	28	1	4	2	2	2		
Tuticorin	C	2	115	85	5	1												
	D		61	52	2	2												
India (French):																		
Chandernagor	C	25	4						1	1	1		1		2			
	D	10	4						1	1	1		1					
Karikal	C	7	54	150	28	10	28	22	14	6			3					
	D	4	41	128	21	8	21	21	12	3			3					
Pondicherry Province	C	37	92	139	29	18	29	10	30	12	4							
	D	30	55	104	24	18	24	8	24	10	4							

Indo-China (see also table below):																		
Phnompenh	C	1	6	2	7	22	12	1		2	3	1	3	8	3	1	5	3
	D	1	1	1	5	20	10	1		1	3	1	1	5	2	1	5	1
Saigon	C		6	6					2	5	5		3	3	3	4	17	15
	D		4	3						1		1	2	1	3	2	15	9
Kwangchow-Wan (see table below).																		
Siam	C	104	224	195	39	43	41	42	50	74	117	156	175	85	114	245	310	196
	D	68	150	138	26	32	22	37	33	59	73	104	119	61	86	138	193	136
Anthoang	C		4	1	3													
	D		1	1	2													
Ayudhaya	C	2	16	4			4				1		2		3	24	2	
	D	2	14	4			4				1		2	1	3	13		
Bangkok	C	18	22	50	17	19	12	13	10	14	3	11	15	16	41	29		36
	D	12	6	43	12	7	5	12	7	9	1	4	10	13	31	20		22
Chaxoengsao	C			9		1												1
	D			9		1												1
Dhannapuri	C	6	16	3	1	1	1						2			15		
	D	5	10	2		1							1			6		
Lobpuri	C		74		2			1					1					
	D		61		1								1					
Nagara Pathom	C							2								36		13
	D							2								20		10
Nondpuri	C	1	4															
	D	1	2															
Pradhumdham	C			1														
	D			1														
Singhapuri	C		17	6	1													
	D		12	7	1													
Smud Prakar	C	37	30	10	1													
	D	28	10	8														
Smud Sagara	C	34																
	D	16																
On vessel:																		
S. S. Ekma at Penang from Singapore	C							P										
S. S. Media, at Colombo from Calcutta	C															1		
S. S. Tilawa at Penang from Singapore	C								P									
S. S. Elephanta at Penang from Calcutta	C									P								

Place		November, 1928	December, 1928	January, 1929			February, 1929			March, 1929			April, 1929		
				1-10	11-20	21-31	1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30
Indo-China (French) (see also table above):															
Annam	C	5									3	3		13	7
Cambodia	C	21	25	26	25	28	29	40			26	3		40	44
Cochin-China	C	156	697	232	202	226	107	115			13	170		51	37
Kwangchow-Wan	C	1													

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

PLAGUE

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929			April, 1929				May, 1929			
						16	23	30	6	13	20	27	4	11	18	25
Argentina: [1]																
Buenos Aires [2]	C							1	1							
	D							1	1							
Catamarca Province—Recreo	C	9														
Cordoba Province—Laborde	C		1													
Jujuy Province—Perico	C		1	3												
Rosario	C		2	1			[3] 20									
Tucuman Province—El Mollar	C	5														
Azores: St. Michaels Island	C		2	1			1									
Belgian Congo:																
Djugu	C			1	4											
	D			1	1											
Lenza	C	1	1													
Brazil:																
Para	C			1												
Porto Alegre	C											1				
Santos	C	2														
British East Africa (see also table below):																
Uganda	C	124	155	152	112	18	20	34	58							
	D	121	152	149	108	17	19	31	57							
Canary Islands:																
Teneriffe	C	1														
Laguna	C			1												
Ceylon:																
Colombo	C	4	8	6	4		2	2		2	2	1			1	
	D	4	8	5	3				1	1	2	1			1	
Plague-infected rats		5		2	2	2				1						
China:																
Hainan	C			P	1											
Suyuan Province	C			P	1											
Dutch East Indies:																
Celebes—Makassar	D		1													
Plague-infected rats				1												
Java—																
Batavia and West Java	C	43	54	74	70	21	17	13	13	14						
	D	42	53	73	69	21	16	14	14	14						
Plague-infected rats		1			4		2		3	5	3					
East Java and Madura	C					1	1									
	D					1	1									

Surabaya	C	1		6												
	D			6												
Kediri Residency	C			P												
Ecuador (see table below).																
Egypt:																
Alexandria	C			3										1		
	D			1												
Beni-Suef	C	4	9	3	4	2				1	5		1			
	D	1	2	3	1	1	1				1		1			
Daqahliya	C														3	4
Girga	C	1														
Kena Province	C	4														
Port Said	C											1	1	1		1
Suez	C				1		1	1					1	1		
Greece (see also table below):																
Corfu	C	1														
India	C	7,767	7,841	12,600	16,570	4,259	3,682	3,833								
	D	4,863	5,234	9,815	12,064	3,021	3,247	2,835								
Bassein	D		1	4	3	1	2	2	1		2		1			
Bombay	C	4		2	4	1	3	2	2	3	2					
	D	6		4	4	1	3	1	1	3	1		1			
Plague-infected rats		32	35	38	38	9	17	18	13	18	20	26	17			
Cochin	D		10													
Madras Presidency	C	686	500	434	333	50	43	32	7							
	D	307	231	235	189	32	27	18	3							
Rangoon	C	1	1	4	4		3	5	4	5	4					
	D	1	2	5	4		3	3	3	6	4		3			
Plague-infected rats				5	11	2	2	6	5	3	1	2	4			
Indo-China (see also table below):																
Pnompenh	C	4	8	10	5	3	2	4	1		3	5		1	4	
	D	4	6	9	3	3	2	4	1		3	5		1	2	
Saigon	C				1											
Tourane	C				5											
Iraq:																
Baghdad	C	10	9	6	10	4	5	2		1	1	2	4	5		1
	D	5	8	3	3		2	1		1	1	2	3	2		
Plague-infected rats				6	22	3	2	2	7	2						
Diyalah Liwa	C									5	2					
	D									4	3					
Naudham	C			2												
	D			1												
Plague-infected rats				1												
Japan: Osaka—Plague-infected rats															1	
Madagascar (see also table below): Tamatave	C		2	1												
	D	1			2											
Morocco	C						22	59	25		19		12	4		
	D						14	43	16		12		4	1		

[1] During the period from Nov. 10 to Dec. 11, 1928, 13 cases of plague were reported at El Mollar, Tucuman Province, Argentina. During the same period 1 case of plague was reported at Chipion and 1 at Ucacha, both in Cordoba Province, Argentina.

[2] 18 plague-infected rats were reported at Buenos Aires, Argentina, from July 1 to Dec. 31, 1928.

[3] Unofficial report.

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

PLAGUE—Continued

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929 16	23	30	April, 1929 6	13	20	27	May, 1929 4	11	18	25
Nigeria:																
Lagos	C	43	12	14	11	1	1	1	1	4	1	1	2			
	D	41	11	12	11	1	1	1	1	4	1	1	2			
Plague-infected rats		30	28	48	50	13		3	2			1				
Peru (see table below).																
Senegal (see table below).																
Siam	C	9	4	45	9		2	4	1	5	1		2		1	
	D	8	3	17	9		2	4		3			1			
Bangkok	C		4	1	1									1		
	D		1	2	1									1		
Nagara Pathom	C				3			4		1		1		3		
	D				2			4		1		1		2		
Panknampo	C	8														
Straits Settlements: Singapore	C				1							1				
	D				1							1				
Syria (see table below).																
Union of South Africa:																
Cape Province	C	1	4					1		1						
Orange Free State	C		1	6	2	P	1	2		3	1					
	D			1				2			1					
Transvaal	C		3				5	3								
	D						5	3								
Uruguay:																
Montevideo	C							4								
Rivera	C		1													
On vessel:																
S. S. Bangkok, at Rotterdam, from Buenos Aires via Dakar (Press report)	C															1
S. S. Chenonceaux, at Singapore, from Colombo	C						1									
	D						1									
S. S. Ganzanmaru, at Osaka, from Haipong	C													1		
S. S. Halydan, at Bangkok, from Singapore	C		1													
S. S. Seiyomaru, at Osaka, from Bombay—Plague-infected rats														1		
S. S. Soudades, at Hamburg, from Rosario, Argentina—Plague-infected rats										2				1		
S. S. Sjomand, at Alexandria, from Batoum	C			1												
S. S. Sumatra, at Osaka, from Bombay	C										1			1		

Place		November, 1928	December, 1928	January, 1929	February, 1929	March, 1929	April, 1929
British East Africa (see also table above):							
Kenya	C	16	15	7	4	10	1
Uganda	C					121	
	D					113	
Ecuador: Guayaquil	C	21	20	25	54	26	
	D	8	7	12	22	4	
Plague-infected rats		29	75	29	27	14	
Greece (see also table above)	C	1	2	3			
	D	1	1	1			
Indo-China (see also table above)	C			11		3	13
Madagascar (see also table above)	C		282	233	348	196	
	D		263	224	335	194	
Ambositra Province	C	14	79	169	164		
	D	14	74	159	164		
Antisirabe Province	C	6	4	15	21		
	D	6	4	15	21		
Itasy Province	C	6	11	3	10		
	D	6	11	3	10		
Moramanga Province	C	32	28	22	7		
	D	32	27	21	4		
Tamatave	C	2	2	4			
	D	2	2	4			
Madagascar—Continued.							
Tananarive Province	C	159	158	208	146		
	D	141	144	192	136		
Peru	C	18	26	37			
	D	6	6	9			
Senegal:							
Baol [1]	C	18	4			6	1
	D	6	2			3	1
Cayor [1]	C		14				
	D		10				
Dakar [1]	C						5
	D						4
Louga [1]	C	2					
	D	1					
Rufisque [1]	C	8					
	D	4					
Thies [1]	C	11			8	4	20
	D				7	3	20
Tivaouane [1]	C				12		
	D				2		
Syria: Beirut	C	3					

[1] Reports incomplete.

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

SMALLPOX

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929: 16	23	30	April, 1929: 6	13	20	27	May, 1929: 4	11	18	25
Algeria:																
Algiers	C	1							3		4		1	4		
Cherchell	C				21	11	19	12		1						
Oran	C	7			1		1			1	1					
Arabia: Aden	C	1	1	2		1	11	9	9	28	17	19	5	3		
	D						1	4	3	6	4	6	4	3		
British East Africa (see also table below), Kenya—Mombasa	C		3													
Brazil (see table below).																
British South Africa:																
Northern Rhodesia	C	67	173													
	D	8	23													
Southern Rhodesia	C	5		1	17		68	1			13					
Tanganyika	C			13	3											
Canada:																
Alberta	C	21	3	3	5			7			5		3			
Calgary	C				1								2			
Edmonton	C		14	2	2	2			10		4		1			
British Columbia—Vancouver	C	25	51	66	70	22	17	18	7	12	19	8	7		6	7
Manitoba	C	29	23	21	15			3				1	1		2	
Winnipeg and vicinity	C	17	2													
New Brunswick	C							3								
Nova Scotia	C		5	2						1						
Ontario	C	15	36	83	83	12	21	14	10	15	37	21	40		30	7
Niagara Falls	C						1									
North Bay	C	1			4							2	1	1		7
Ottawa	C	2			1											
Toronto	C			1			1		1	1						
Windsor	C											3		3		
Prince Edward Island	C			2	2											
Quebec	C	125	37	24	28	4	3	2	5	11	8	11	4	3	3	3
Montreal	C	3	8	10	16	3		1				3	1			1
Quebec	C	6	4	8			1		2	1					1	
Riviere du Loup	C									1						
Saskatchewan	C	52	14	35	70		13				9	3	1		7	
Moose Jaw	C	1					1									
Regina	C	2	1	6												
Saskatoon	C			4			1									

China:																
Amoy	C	2	5	P	5	1	1	1				2				
Canton	C	14	18	87	86	22	42	38	33	29	21	19	16	25		
	D		2	2	15	3	4	4	4	2	3	5	2	2		
Chefoo	C	P									P					
Foochow	C	P	P	P	P	P	P		P							
Hong Kong	C	202	319	307	189	26	31	22	13	21	16	11	5	8	10	5
	D	78	152	286	246	51	47	29	10	39	36	15	7	6	8	4
Manchuria—																
Changshun	C			3	2					1						
Fushun	C			5												
Harbin	C	4	2	5					1							
Kwantung—Dairen	C	5		2	9				1	6	2	2		8	4	
	D			2	3					3		1			1	
Mukden	C		1	3					1							
	D			1												
Shanghai—																
Foreigners only	C	6	23	23	11	1	1	1	1	1						
Including natives	D	32	64	60	41	3	8	5	9	7	2	5	2	8	6	
Swatow	C				9	12	7	6	8	22	32	20	19			
Tientsin	C	2	6	3	2	2		2	4	2						
Tsingtao	C				P	P		P	P	P	P	P				
Yunnanfu	C					P	P	P	P	P						
Colombia: Cartagena	D	7			7											
Curacao (alastrim)	C										1					
Dominican Republic	C			1												
Dutch East Indies:																
Balikpapan	C				1	1	4					3				
Belawan Deli	C	6	7	26	9	2	2	2	1	1		3				
	D	2	3	6	6		1	1								
Borneo	C			30	26											
Samarinda	C	27	11	4	47	1			1		1					
	D	4	3		4		3									
Celebes—Makassar	C	1						4	2	6	9	10	14			
	D								2	5	4	7	9			
Java—																
Batavia and West Java	C	1														Z
Surabaya	C	2														
Palembang	C				9											
	D				2											
Sumatra—																
Baros	C		96	106	36		9		7							
	D		30	26	5				2							
Medan	C	3	9	11	9	2	2	2	1	1						
	D	1	5	5	6	1	1	1								
Ecuador (see table below).																
Egypt:																
Gharbieh	C				1											
Port Said	C			1							1					
Suez	C	1									1	4				
France (see table below).																

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

SMALLPOX—Continued

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929			April, 1929				May, 1929			
						16	23	30	6	13	20	27	4	11	18	25
Great Britain:																
England and Wales	C	719	733	890	1,083	272	288	323	273	339	374	354	356	277		
Birmingham	C										1					
Bradford	C	1		1	2		3				1					
Bristol	C			1												
Cardiff	C	1		4					1	1						
Castleford	C	8	16	48	85	13	17	17	9	5	14	5	7			
Hull	C	1		2												
Leeds	C	2	1	3	6	1	3	3	1	1	1	1				
Liverpool	C			1					1							
London	C	14	36	40	54	11	13	19	15	29	49	56	67	50		
London and Great Towns	C			433	425	123	131	193	151	206	250	203	229	159		
	D		1			2			1	1	2	2	1	1		
Newcastle-on-Tyne	C	3		6	6	2			14	1			2	1	10	
Nottingham	C	3	3	1		2										
Stoke-on-Trent	C	11	4	14	18	4	28	20	20	42	30	27	34			
Scotland—																
Aberdeen	C										1	1				
Dundee	C	1														
Glasgow	C								1	12	6	1		1		
Greece (see table below).																
Hedjaz	C		48	153	108		24	30	30	23	22	13	9	23		
	D		15	56	40		10	21	21	16	14	10	12	13		
Honduras: Puerto Castilla	C														1	
India	C	5,902	7,877	12,531	14,890	4,205	4,310	5,174								
	D	1,602	2,143	3,045	3,285	873	990	955								
Bombay	C	11	34	158	397	142	119	94	86	104	57	85	69			
	D	4	21	78	188	58	52	51	45	46	30	48	51			
Calcutta	C	13	10	32	104	35	32	22	28	34	24	25	18			
	D	7	6	16	29	24	21	13	19	26	16	16	16			
Karachi	C		6	5	147	43	57	58	48	29	57	33	25			
	D			223	14	14	13	10	33	8	22	17	12			
Madras	C	58	94	35	260	88	96	104	104	107	87	70	63			
	D	16	25	6	61	11	23	23	26	20	26	22	16			
Moulmein	C	5	3	2	14	5	3	5	5		1	3	3			
	D	1	1		4	2		1	1		1	3	2			

Negapatam	C	33	8	26	5	4	3		2	1		3	3			
	D	5		6	4				1							
Rangoon	C	1	1	8	17	3	2	4	4	3	2	1				
	D			1	6	1	2		3	1		1				
Tuticorin	C			2	1							1				
Vizagapatam	C		2	8	52	8	3	15		9	4	11	4			
	D				9	1	2	2		1	4		3			
India (French):																
Karikal	C					1			1			1				
	D					1			1			1				
Pondicherry Province	C	48	75	59	79	6	21	23	20	21	11	12	16			
	D	46	62	51	61	6	17	18	19	19	8	11	13			
Indo-China (see also table below):																
Pnompenh	C	44	38	77	62	13	19	27	9	9	19	9	3	6	8	
	D	20	21	42	36	5	10	14	4	5	13	4	2	4	4	
Saigon	C		12	5	2		1		1	1			1		1	
	D		6	1											1	
Iraq:																
Baghdad	C	46	20	17	7	2	3		1	2	1	1	2			1
	D	45	29	3	5		1									
Basra	C	35	11	18	7	2	1	1	5	2	1	3	2	2		
	D	26	7	10	5			1	1		1	3	2	1		
Diyalah Liwa	C													48		
	D													13		
Hillah Liwa	C		54	20												
	D		14	9												
Kirkuk Liwa	C	173	86		18											
	D	38	17		4											
Mossoul	C	294	55	30	28											
	D	110	39	17	4											
Sinjar	C		53	61												
	D		5	15												
Italy:																
Palermo	C	3	3													
Rome and vicinity	C		1	2												
Turin	C				1											
Ivory Coast (see table below).																
Jamaica (outside Kingston) (alastrim)	C		1								1			1		
Kingston (alastrim)	C	1														
Japan:																
Kobe	C				1											
Nagasaki	C			3												
	D			2												
Osaka	C				1											
Shimane Province	C							16								
Macao	D		9	24	75	6	3	14	9	9	6	3	2	2	2	
Mexico:																
Acapulco	C												1		1	
	D												1		1	
Aguascalientes	D	2	1	3	3		2		5	1	6		2		2	
Chiapas Province	C							P								
Chihuahua	D			1												
Jalisco (State): Guadalajara	D	4	1	8	8		2	4	7	3	1					

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

SMALLPOX—Continued

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929			April, 1929				May, 1929			
						16	23	30	6	13	20	27	4	11	18	25
Mexico—Continued.																
Juarez	D		5	1	1	3										
Mexico City and surrounding territory	C		7	2	2	1										
Oaxaca—Zacatepec	C										P					
Palomas	C				1											
Tampico	C				1		2									
Vera Cruz	D						2									
Morocco (see table below).																
Nicaragua: Managua	C									P						
Nigeria:																
Lagos	C					1										
Southern Provinces	C			162												
	D			31												
Norway: Stavanger	C									2						
Panama Canal Zone	C							P								
Poland	C	8	1	41						2		4				
	D			3												
Portugal (see also table below).																
Lisbon	C		2	4		3				2		2				
Oporto	C							1			1		1			
Senegal (see table below).																
Siam	C	8	19	2	4								47			
	D		2										6			
Bangkok	C	1														
Spain: Valencia	C				2		4	1								
Straits Settlements: Singapore	C		1	5	3			1								
Sudan (Anglo-Egyptian)	C	220	491	265	188	30	22	37	156	127	138	12	100	162	264	200
	D	42	57	34	54	6	2	6	15	17	3	3	3	5	48	28
Sudan (French) (see table below).																
Sweden: Stockholm	C	1														
Syria (see table below).																
Tunisia: Tunis	C	2	14		5						2					

Union of South Africa:																
Cape Province	C	P									P					
Natal	C		1													
Transvaal	C								P	P	P					
Upper Volta	C			3	4			3	1	7		8		2		
On vessel:																
S. S. Assyria, at Suez, from Bombay	C													1		
S. S. City of Venice, at Suez, from Calcutta	C														1	
S. S. Le Panto, at Suez, Egypt	C												4			
S. S. Lopez-Lopez, at Suez	C									1						
S. S. Malwa, at Suez	C										1					
S. S. Mancar, at Suez, from Calcutta	C									1						
Tantalus (motor ship), at Amsterdam	C				3											
S. S. Tuscania, at Glasgow, from Bombay	C								P							

Place		November, 1928	December, 1928	January, 1929	February, 1929			March, 1929			April, 1929			May 1-10, 1929
					1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30	
Indo-China (see also table above)	C	144	243	311	128	236			200	361	500		155	
Ivory Coast	C									4				
Senegal	C				80			17	8	45	50	7		
	D				8			1	3	7	15			
Sudan (French)	C		2						26		10	9	64	2
	D								3					
Syria: Beirut	C	2	1	1	21	24	3		10	2	2	16		4

Place		November, 1928	December, 1928	January, 1929	February, 1929	March, 1929	April, 1929
Angola	C			1			
Brazil: Porto Alegre	C	3					
British East Africa (see also table above):							
Kenya	C	37	31			23	1
Chosen: Chinampo	C				1		
Ecuador: Guayaquil	C	6	13	12	4	2	
	D	1	1	1	1		

Place		November, 1928	December, 1928	January, 1929	February, 1929	March, 1929	April, 1929
France	C		18	9	3	5	
Greece	C	6	6	8	5	2	4
	D			1	1		
Morocco	C	2		7	11	8	12
Persia	D		119	68	23	8	
Turkey	C			16	7		1
	D			6			

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

TYPHUS FEVER

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Week ended— February, 1929		March, 1929					April, 1929				May, 1929		
					16	23	2	9	16	23	30	6	13	20	27	4	11	18
Algeria:																		
Algiers	C								3	1		2	4	2	3	2	1	
Constantine Department	C			2	2			11	P	2								
Oran	C			5				2						2	1	5		
Bulgaria	C	9	5	7	3		19	17	7	18	10	5	5	16				
	D							2	1	3		1	1	1				
Sofia	C			1														
Chile: Valparaiso	C	1																
China:																		
Canton	C			2														
	D			2														
Hong Kong	C			1														
Manchuria—																		
Harbin	C	2								1								
Kwantung	C							1										
Chosen (see table below).																		
Czechoslovakia (see table below).																		
Egypt:																		
Alexandria	C								1						1			
Assouan Province	C				2													
	D				2													
Beheira Province	C				6	7						67	50				23	84
	D											9	9					18
Daqahliya Province	C	15	11						34									
	D	1	2															
Gharbieh	C			1		2												
	D					1												
Menoufieh Province	C													35				
Port Said	C																	1
Greece (see table below).																		
Ireland (Irish Free State):																		
Cavan County—Carrickmacross	C																1	
Cork County	C						1											
Donegal County—Inishowen	C															1		

Dublin	C			1														
	D			1														
Kerry County—																		
Dingle	C								2						1	1		
Killarney	C							1					2					
Lithuania (see table below).																		
Mexico (see also table below):																		
Aguascalientes	D	2							3		2							
Chihuahua	D		1															
Mexico City, including municipalities in Federal District	C	12	9	11	1	3	1	2	1	1	2		3			1		
	D	1	2	3	1			1					1					
San Luis Potosi	D		1															
Morocco	C	16	4	20	6	10	1		7		6	6		8	8	12		
	D															4		
Norway: Oslo	C																2	
Palestine	C	12	2	3		2					2		1					2
Peru (see table below).																		
Poland	C	117	203	222	47	57	47	51	91	55	69	80	67	79	88	80		
	D	11	16	15	6	2	4	6	5	3	7	5	2	3	7	13		
Portugal: Oporto	C	1																
Rumania	C	42	167	173	42	32	70	67	62	60	49	49		27				
	D	1	11	23	3	7	8	10	7	5	9	9		3				
Tunisia	C	6		2	3				9		9	2	7	2	8	2		
Turkey (see table below).																		
Union of South Africa:																		
Cape Province	C	P	P	P	P	P	P	P	P	P	P	P	P	P				
Natal	C	P	2			2			P	P		P		P				
Orange Free State	C	P	P	P	P	P												P
Transvaal	C		P	1								P	P	P				
Yugoslavia (see table below).																		

Place		November, 1928	December, 1928	January, 1929	February, 1929	March, 1929	April, 1929
Chosen:							
Chemulpo	C	1					
Seoul	C		3	4		3	
Czechoslovakia	C			6	7	41	
	D				1	1	
Greece: Athens	C	4	1	13	4	4	
	D			5			
Indo-China: Tonkin	C						2

Place		November, 1928	December, 1928	January, 1929	February, 1929	March, 1929	April, 1929
Lithuania	C	4	11	32	24	62	101
	D			3	3	1	7
Mexico: Sonora (see also table above)	D			1			
Peru	C	3					
Turkey	C		19	1	3	11	3
	D				1		
Yugoslavia	C	17	7	15	13	7	
	D				2		

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

YELLOW FEVER

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

Place		Nov. 18–Dec. 15, 1928	Dec. 16, 1928–Jan. 12, 1929	Jan. 13–Feb. 9, 1929	Feb. 10–Mar. 9, 1929	Week ended— March, 1929			April, 1929				May, 1929				June 1, 1929
						16	23	30	6	13	20	27	4	11	18	25	
Belgian Congo: Tumba	C											1					
Brazil:																	
Bahia	C		2					1									
	D		1					1									
Guaratingueta	C				[2] 1												
	D				[2] 1												
Para	D		2	1					5								
Pernambuco	C								4								
Rio de Janeiro [1]	C	2	2	16	92	66	59	61	66	57	51	39	33	24	22	17	7
	D		2	17	67	32	30	38	32	34	23	20	17	18	11	6	3
Sao Paulo	C			1													
	D			1													
Dahomey: Ouidah Military Camp	C	1															
Gambia: Bathurst	C	3															
	D	2															
Liberia: Monrovia	C			[3] 3	7	1	3	3	3	2							
	D			2	4	1		2	1								
On vessel:																	
S. S. Victoria, at Manaos, from Para, Brazil	C		1														
	D		1														

[1] 29 cases of yellow fever with 14 deaths were reported at Rio de Janeiro during January, 1929, mostly suburban.
[2] Imported.
[3] Suspected cases.

X