PUBLIC HEALTH REPORTS

VOL. 48 DECEMBER 29, 1933 NO. 52

EXPERIMENTAL STUDIES ON ACUTE MERCURIAL POISONING

By SANFORD M. ROSENTHAL, *Senior Pharmacologist, National Institute of Health, United States Public Health Service*

Previous attempts, under experimental conditions, to combat acute mercurial poisoning have been largely of no avail. Considerable work with sodium thiosulphate has yielded negative results (Haskell (1); Young and Taylor (2)). Recently Hesse (3) was able to protect a certain percentage of rabbits, rats, mice, and guinea pigs against a fatal subcutaneous dose of mercuric chloride by the use of strontium thioacetate, but Haskell and Forbes (4) showed that in dogs no such antidotal effect could be demonstrated following oral or subcutaneous intoxication. This fact was confirmed by Hesse himself.

We have studied several compounds under various conditions and have obtained one which can be shown, if properly administered, to protect rats and dogs against lethal doses of mercuric chloride.

For such a drug to be of benefit following intravenous administration, it is necessary for it to be comparatively stable in the body, to be of low toxicity, and at the same time to be able to exist in the body in a state which will react with mercury to form compounds of diminished toxicity. Excretion in the urine is desirable, as this may bring about a concentration of the substance in the kidney cells.

Sodium thiosulphate ($Na_2S_2O_3$) has previously been studied in this respect and found inadequate (5). As will be shown here, it is not capable of protecting kidney tissue against bichloride or of forming in the blood stream insoluble compounds with mercury. Other substances which have been used, such as calcium sulphide and sodium hydrosulphite ($Na_2S_2O_4$), while forming insoluble sulphides with great ease in the test tube, are so unstable in the body that they are broken down almost immediately after injection.

THE ANTAGONISM OF MERCURY ACTION AS SHOWN UPON THE OXYGEN CONSUMPTION OF EXCISED RAT TISSUES

Sodium thiosulphate.—The oxygen consumption of tissues *in vitro* was determined with the Warburg micro-respiration apparatus in a manner previously described (6). Rat tissues were suspended in Locke's solution containing 0.03 percent sodium bicarbonate and 0.2 percent glucose. All experiments were run at 37.6° C. in an atmosphere of air.

The behavior of thiosulphate revealed that while no protection was afforded to kidney tissue against the action of mercury, with

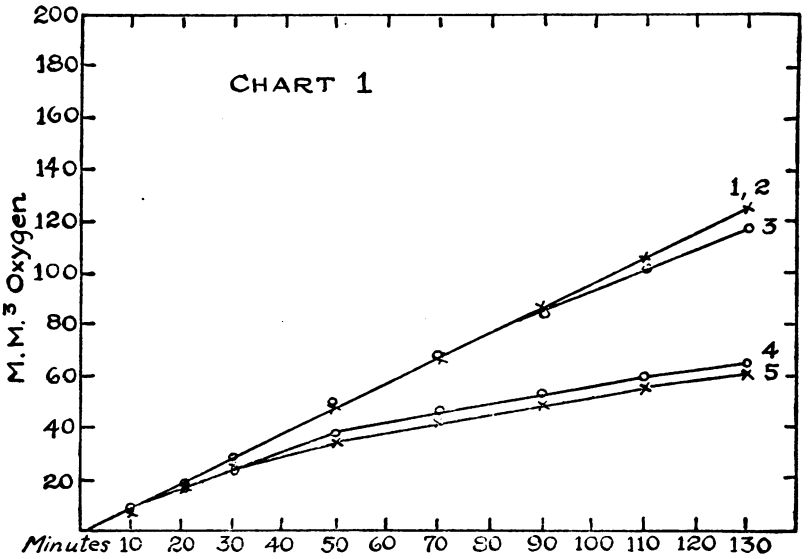

CHART 1.—The ability of thiosulphate to counteract the effect of $HgCl_2$ on rat testes if added before the mercury, but not if added later. Oxygen consumption of 100 mg rat testes in Locke's solution at 37.6° C. Atmosphere=air. Curve 1, testes alone. Curve 2, testes+m/500 thiosulphate. Curve 3, testes+m/500 thiosulphate+m/5000 $HgCl_2$. Curve 4, testes+$HgCl_2$, thiosulphate added in 10 minutes. Curve 5, testes+m/5000 $HgCl_2$.

other tissues its toxic effect can, under certain conditions, be completely antagonized.

Upon the oxygen consumption of rat testes, thiosulphate, when added first in amounts 10 times the molar quantity of the mercury, afforded complete protection against the toxic action of mercury. If the mercury was added first, and the thiosulphate later, no protection was observed (chart 1).

Upon the oxygen consumption of minced rat liver, thiosulphate gave a high degree of protection when added to the tissue either before or 5 minutes after the mercury was added (chart 2).

With the rat kidney, however, no protection could be obtained against the action of mercury, whether the thiosulphate was added before or after the mercury, and even when 20 times the molar

concentration of thiosulphate was used (chart 2). The basis for this lack of protection of renal tissue by thiosulphate is unknown, but it is possible that therein may lie the explanation for the selective nephrotoxic action of mercury.

Experiments on glutathione.—Glutathione, in its reduced state, is a sulphur compound related to cysteine, and also occurrs as a physiological constituent of animal tissues. Voegtlin, Dyer, and

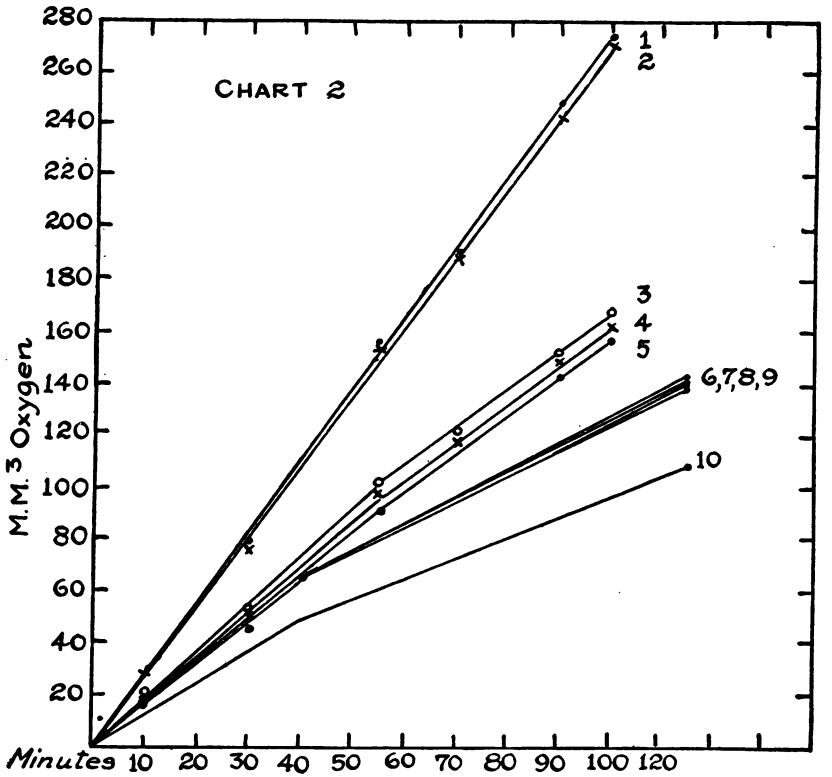

CHART 2.—The antagonism of $HgCl_2$ by thiosulphate on liver tissue, and lack of effect on kidney. Oxygen consumption of 75 mg rat kidney. Curve 1, kidney. Curve 2, kidney+m/250 thiosulphate. Curve 3, kidney+m/5000 $HgCl_2$. Curve 4, kidney+m/5000 $HgCl_2$, m/250 thiosulphate 15 minutes later. Curve 5, kidney+thiosulphate, $HgCl_2$ added 2 minutes later. Curve 6, 100 mg rat liver. Curve 7, liver+m/250 thiosulphate. Curve 8, liver+m/250 thiosulphate, m/2500 $HgCl_2$ added in 2 minutes. Curve 9, liver+$HgCl_2$, thiosulphate added 5 minutes later. Curve 10, liver+$HgCl_2$.

Leonard (7) showed that the toxic action of arsenic could be counteracted by this compound, and further work on its chemical and physiological properties has been carried out in this laboratory (8, 9).

Glutathione is superior to thiosulphate in the protection of rat tissues *in vitro* against mercury action. This was manifested in that protection could be demonstrated when the glutathione was added 10 minutes or longer after the addition of the mercury, and

[1] The crystalline reduced glutathione used in these experiments was prepared by Dr. J. M. Johnson of this laboratory.

further in that this protection also existed for renal tissues. When from 5 to 10 times the molar quantity of glutathione [1] was used, as of mercuric chloride, the protection was almost complete, whether the glutathione was added either before or shortly after the mercury (chart 3). In the interpretation of chart 3, our previous work must be recalled (6) in which it was shown that glutathione, in the presence of renal tissue, slowly underwent oxidation, so that this added oxygen consumption must be taken into account in the experiments on kidney tissue. With other tissues glutathione

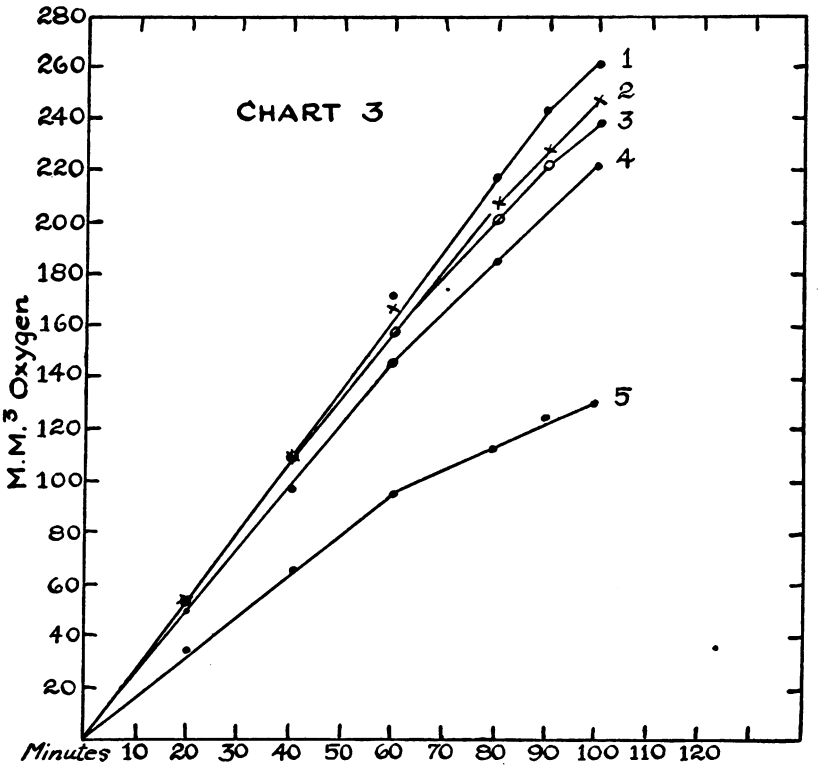

CHART 3.—The ability of SH glutathione to protect kidney tissue against mercury. Curve 1, oxygen consumption of 60 mg of rat kidney+m/500 glutathione. Curve 2, kidney+glutathione, m/5000 $HgCl_2$ in 2 minutes. Curve 3, kidney+$HgCl_2$, glutathione added 10 minutes later. Curve 4. kidney alone. Curve 5, kidney+m/5000 $HgCl_2$. Oxygen requirements of the glutathione=27 mm^3 of O_2.

in similar concentrations is kept largely reduced. In experiments on rat testes, some protection could be demonstrated from glutathione added up to 50 minutes following the bichloride.

Formaldehyde sulphoxylate (*$NaHSO_2 \cdot CH_2O \cdot 2H_2O$, rongalite, formopone.*)—Sodium formaldehyde sulphoxylate is a product formed by the union of sodium hydrosulphite ($Na_2S_2O_4$) and formaldehyde. The ensuing product is a powerful reducing agent which, however, is considerably less toxic than either of its components, and at the same time is much more stable in the animal organism. We have

recrystallized formaldehyde sulphoxylate from the technical product according to the following method supplied us by Dr. A. E. Sherndal, of Metz & Co.:

Two hundred grams are dissolved in 90 cc of water by gentle heating to 70° C. If the solution is not alkaline to litmus, add some sodium carbonate. There should be a formaldehyde odor to the solution. Filter through a hot suction funnel and cool down the filtrate in ice water. When all of the crystals have

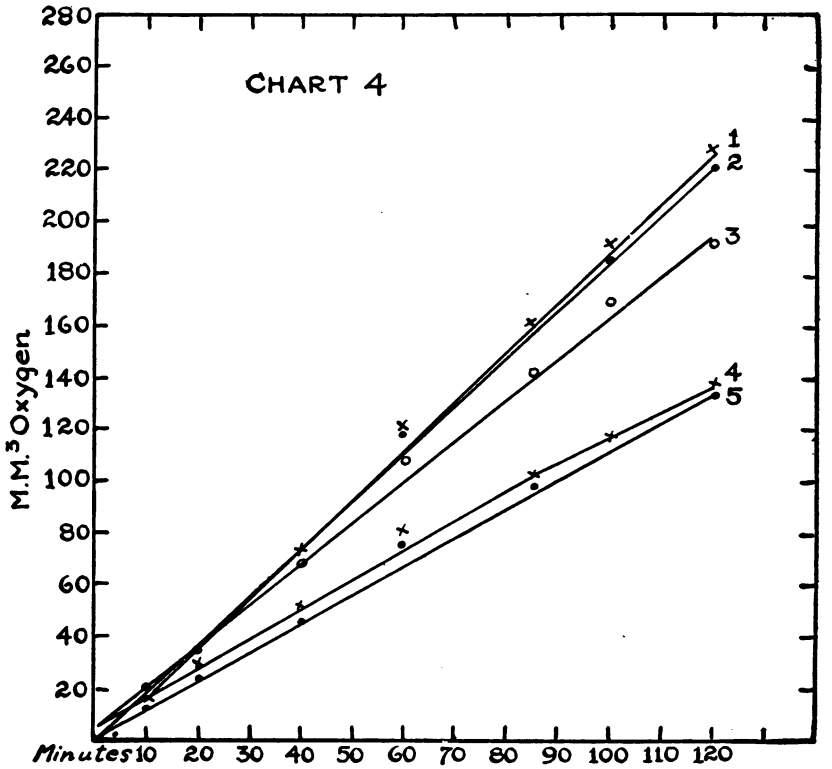

CHART 4.—The ability of formaldehyde sulphoxylate to afford protection to kidney tissue against a subsequent addition of $HgCl_2$. Curve 1, 50 mg rat kidney+m/250 sulphoxylate. Curve 2, kidney alone. Curve 3, kidney+sulphoxylate, m/5000 $HgCl_2$ added in 3 minutes. Curve 4, kidney+$HgCl_2$, sulphoxylate added in 15 minutes. Curve 5, kidney+m/5000 $HgCl_2$. Similar results were obtained with 100 mg of rat testes.

precipitated, filter them off on a suction funnel, wash once with a small amount of cold water, and press out as dry as possible.

We have sealed these crystals in ampoules with the exclusion of air and found them stable for a period of weeks, at least. While the copper sulphate titration is the standard method of assay, we have found simple iodine titration of the aqueous solution after the method of Elvove (14) sufficiently accurate to detect deterioration. One hundred milligrams of the moist crystals dissolved in water should consume from 23 to 26 cc of 0.1 normal iodine, dependent on the amount of moisture.[2]

[2] We are indebted to Metz & Co., Merck & Co., and Diarsenol Co., for a supply of the sulphoxylate.

The ability of sulphoxylate to alter the reducing power of tissues and of the gastro-intestinal tract will be made the subject of another communication. Some results pertinent to the present investigation will be described in a later section of this paper.

Upon the oxygen consumption of rat testes and kidney, sulphoxylate afforded protection against mercury bichloride if the sulphoxylate was added first. No appreciable protection was observed if the sulphoxylate was added from 15 to 45 minutes following the mercury. The molar concentrations employed (m/250) were 20 times those of mercury. In these concentrations the sulphoxylate alone did not alter the oxygen uptake of the tissues, as shown in the control vessels set up for such determinations (chart 4). It is likely that in these *in vitro* experiments the protection afforded the excised rat tissues is largely concerned with the formation of insoluble mercury compounds, although we were unable to detect precipitates in the presence of the suspensions of tissue.

THE ABILITY OF THIOSULPHATE AND GLUTATHIONE TO PROTECT SUBCUTANEOUS TISSUES AGAINST THE ACTION OF MERCURY

Another example of the ability of thiosulphate to protect certain tissues was shown in the prevention of the local inflammatory action of mercury when injected subcutaneously. When two hundredth molar bichloride of mercury was injected under the skin of the shaved ear of an albino rabbit, marked inflammation and local ulceration occurred. When this concentration of bichloride in tenth molar thiosulphate solution was used, slight or no inflammation and no ulceration followed. Equal volumes of the solutions of twice the desired strength were mixed immediately before injection, and no precipitate could be observed. Three injections of 0.1 cc each were made into each ear of 2 rabbits, 1 ear being employed as a control for the mercury alone. The same experiment was performed on two dogs with the injection of 0.3 cc at each site. Practically complete protection was also present in these animals.

Protection of subcutaneous tissues could also be demonstrated when a mixture of two hundredth molar bichloride of mercury and tenth molar glutathione (neutralized) were injected subcutaneously into the ears of rabbits and dogs. No precipitate could be seen when the solutions were mixed shortly before their injection. The technique employed was the same as with thiosulphate, and the results were essentially similar.

Because of the fact that sulphoxylate, when added to mercuric chloride in even very dilute solutions, results immediately in a heavy precipitate, it was not feasible to demonstrate an antagonism by subcutaneous injection.

ANTIDOTAL ACTION FOLLOWING THE SYSTEMIC ADMINISTRATION OF MERCURIC CHLORIDE TO ANIMALS

Sodium thiosulphate.—The minimum lethal dose of mercuric chloride when injected intravenously within 2 minutes' time into albino rats (Buffalo strain) was found to be 0.28 cc of a m/400 solution per 100 g of body weight. With this amount, 13 of 15 rats died in from 1 to 7 days, with an average time of 3.3 days. With a dose of 0.2 cc of m/400 bichloride per 100 g, there were no deaths in 7 rats (table 1).

It was soon found that the weight of the rats was an important factor in bichloride toxicity, as the susceptibility of the animals increased with weight. The age factor as shown by MacNider (10) may be important here. As far as possible, rats below 150 g weight were employed in the following experiments:

Six rats, from 128 to 138 g, were injected intravenously with 0.4 cc of n/10 thiosulphate per 100 g (57 times the molar quantity of mercury) immediately before the injection of a lethal dose of bichloride. All of these animals died (table 1). On autopsy the kidneys presented a gross appearance typical of mercurial nephritis. These results are consistent with the absence of protection afforded excised kidney tissue in the studies dealing with oxygen consumption.

In view of the several investigations with negative results previously reported on the use of thiosulphate in mercurial intoxication in dogs (1, 2, 5), no further work with this compound was done upon them.

Glutathione.—Confirmatory of the results obtained on the oxygen uptake of rat tissues, glutathione proved an effective antidote for mercury intoxication in rats, even when injected subsequent to an intravenous injection of mercury.

TABLE 1.—*Intravenous toxicity of $HgCl_2$ to rats; the ability of glutathione injected intravenously to protect rats against a lethal dose of $HgCl_2$; the ability of sulphoxylate to protect rats if injected prior to the $HgCl_2$; the lack of effect of sodium thiosulphate*

Number of rats	Average weight	$HgCl_2$	Antidote	Effect	
				Survived	Died
7	163	0.20 cc n/400 per 100 g intravenously	None	7	0
3	153	0.28 cc n/400 per 100 g intravenously	do	0	3
5	138	do	do	0	5
7	111	do	do	2	5
6	131	do	Thiosulphate, 0.4 cc n/10 per 100 g before Hg.	0	6
5	137	do	Glutathione, 0.4 cc n/10 per 100 g before Hg.	3	2
7	118	do	do	7	0
5	119	do	Glutathione, 0.4 cc n/10 per 100 g ½ hour after Hg.	4	1
7	118	do	do	7	0
10	193	0.32 cc n/400 per 100 g intravenously	None	0	10
10	178	do	Sulphoxylate, 1 g per kilogram 25 minutes after Hg.	0	10
7	135.5	0.30 cc n/400 per 100 g intravenously	None	0	7
7	145	do	Sulphoxylate, 1 g per kilogram before Hg.	5	2

One group of 5 rats, weighing from 122 to 142 g, was injected intravenously with 0.4 cc of n/10 glutathione (freshly neutralized) per 100 g immediately before the injection of a lethal dose of bichloride. Three of these animals survived. In another group of 7 rats, weighing from 112 to 130 g, similarly treated, all survived (table 1).

Two groups of rats were injected intravenously with a similar quantity of glutathione in one half hour following the injection of the mercury. In one series of 5 rats weighing from 108 to 124 g, 4 survived. In another series of 7 rats, weighing from 112 to 130 g, all survived (table 1).

An attempt to establish the minimum lethal dose of bichloride of mercury by mouth to rats revealed that these animals could tolerate such large doses that it was considered too irregular a method to employ. Five groups of 5 rats each were used, and from 20 to 70 mg of bichloride per kilogram were introduced into the stomach through a catheter. Only 1 or 2 of each group succumbed to doses above 30 mg per kilogram.

Because of the difficulty of obtaining sufficient amounts of glutathione, experiments on dogs are incomplete.

The minimum lethal dose of bichloride when injected intravenously into dogs has been established as 4 mg per kilogram body weight (4). We have employed this dose in 8 dogs, with 7 of the 8 succumbing in an average of 4.4 days.

Two dogs were given an intravenous injection of 0.45 g of freshly neutralized reduced glutathione (100 times the molar concentration of bichloride) per kilogram just before the injection of 4 mg of bichloride per kilogram. The animals died 12 and 14 hours later (table 2). Conclusions drawn from these experiments must be modified by the fact that the sample of glutathione was not highly purified and by the obvious paucity of material. The experiments of Hesse, for instance, with strontium thioacetate, on rats, guinea pigs, and rabbits, indicate that an optimum dose existed, beyond which much less or no protection against mercury was afforded.

It may be that with a larger number of animals and with varying doses of glutathione, some protection can be shown; but with the evidence at hand it must be concluded that while glutathione affords an extraordinary degree of protection against mercuric poisoning in rats, it behaves similarly to strontium thioacetate in that it is ineffective in dogs. Glutathione may be rapidly broken down when injected into dogs, as Abderhalden (11) was unable to recover any from the urine of dogs following the subcutaneous injection of 1 g.

The above evidence is somewhat strengthened by the results with cysteine. Two dogs were injected with 0.23 g (100 times the molar quantity of mercury) of freshly neutralized cysteine hydrochloride per kilogram just before the intravenous injection of mercury,

and both animals died, one in 14 hours and the other in 3 days (table 2). Cystine, the oxidized state of cysteine, is known of itself to produce kidney lesions when injected into or fed to animals.

Formaldehyde sulphoxylate.—Some pharmacological characteristics of this compound will be later reported in greater detail. Some of the experiments bearing upon the present problem may be summarized as follows:

The toxicity is quite low. Intraperitoneal injections of 1 g (10 percent solution) per kilogram into rats daily for 3 to 4 weeks produced no visceral changes and no symptoms, except that in some cases there was less rapid gain in weight than in control animals. There was evidence of severe local pain for 2 or 3 minutes at the site of the intraperitoneal injection. The single intravenous injection of 1 g per kilogram of body weight into rats, guinea pigs, rabbits, and dogs (10 to 20 percent solution) if administered slowly (2 to 4 minutes) was attended by no symptoms and no after effects that we have observed.

When given by mouth in doses up to 1 g per kilogram to rats and rabbits, no symptoms were observed except slight diarrhea in rats, which cleared up by the following day.

The stability of sulphoxylate in the body is shown by the following experiments:

When 1 g of sulphoxylate per kilogram is injected intravenously into rats or rabbits, it can be demonstrated in the blood serum for at least 5 hours after the injection. Sulphoxylate can be detected in the serum in 2 ways: (1) To 2 drops of serum add an excess of ammonium sulphate crystals and then 1 drop of a dilute solution of sodium nitroprusside. A green color results. (2) The second method is based on the great ability of sulphoxylate to reduce mercuric salts to insoluble black mercurous compounds and metallic mercury. To approximately 0.5 cc of undiluted serum (in a small test tube) add 2 or 3 drops of a 0.2 percent aqueous solution of mercuric chloride. Normally no precipitate results; but after the above-stated dose of sulphoxylate a precipitate is formed which turns black and settles to the bottom of the tube. In rabbits this reaction was still positive 5 hours after the injection but negative the next day. A sample of serum allowed to stand in an open test tube at room temperature for several days still gave a strongly positive reaction.

Following the intravenous injection of 1 g of sulphoxylate per kilogram into rabbits, the nitroprusside test on the urine was strongly positive for at least 10 hours later, but negative the next day. Tests upon the feces and lower intestinal contents were negative.

When rats were fed through a catheter 1 g of sulphoxylate (10 percent solution) per kilogram, nitroprusside tests for sulphoxylate 1 hour after administration were positive throughout the gastrointestinal tract as far as the rectum. The feces of another rat were strongly

positive 3 hours after administration. Tests on the urine of rats and rabbits made up to 6 hours after the oral dosage were positive. In dogs with bichloride poisoning that were given by mouth 0.5 to 1.0 g sulphoxylate per kilogram, the liquid stools were strongly positive for sulphoxylate 1 hour later. While sulphoxylate is less stable in acid solution than in alkaline, evidence that only a small proportion would be destroyed by the gastric acidity was demonstrated in that a 1 percent solution made up in 0.1 normal hydrochloric acid and kept at 37.6° C. showed 92 percent (by iodine titration) still present after 1½ hours, 80 percent after 3 hours, 73 percent after 5½ hours, and 57 percent in 23 hours.

If solutions of mercuric chloride and sulphoxylate are mixed in a test tube, a precipitate forms which rapidly blackens with the formation of mercurous compounds. Since no black precipitate is obtained with lead acetate, this action is not due to the presence of sulphide ions. Upon standing, the reduction may be shown to proceed as far as the formation of metallic mercury (12). Precipitates can be detected in aqueous solutions of sulphoxylate of 1 part in 300,000 when a few drops of 1 percent bichloride are added. Likewise a precipitate can be observed when a few drops of 1 percent sulphoxylate are added to 1 to 80,000 bichloride.

In the test tube sodium thiosulphate does not form a precipitate with mercuric chloride except in fairly high concentrations, and in animals no such precipitating action could be demonstrated in the serum 15 minutes after the intravenous injection of 1 g of thiosulphate per kilogram.

Experimental studies on the antagonism of mercuric poisoning by sulphoxylate in rats also conformed with the results obtained upon excised rat tissues. Protection of rats from an *intravenous* injection of bichloride occurred only if the sulphoxylate had been administered previously.

A dose of bichloride slightly larger than the M.L.D. was used and the one group of available rats was heavier than those previously employed, so that the test was more severe for the sulphoxylate. Ten rats averaging 178 g in weight received intravenously 0.32 cc of n/400 bichloride per 100 g. Twenty-five minutes later they were injected with 1 g of sulphoxylate per kilogram. All animals died, on an average, in 3 days. Ten control rats of an average weight of 193 g died, on an average, in 2.3 days.

Seven rats averaging 145 g in weight received an injection of 1 g of sulphoxylate per kilogram just before the injection of 0.3 cc of n/400 mercuric chloride. Five of the seven rats survived. Of 7 control rats, with an average weight of 135.5 g, all died, on an average, in 4.4 days (table 2).

TABLE 2.—*The ability of sulphoxylate injected intravenously to protect dogs against a lethal intravenous injection of $HgCl_2$; the lack of effect of glutathione and cysteine*

Weight	$HgCl_2$	Antidote	Effect
Kg			
13.0	4 mg per kg intravenously	None	Dead in 1 day.
15.5			Dead in 10 days.
10.0			Dead in 4 days.
8.0			Survived.
10.5			Dead in 4 days.
8.0			Do.
8.0			Dead in 5 days.
14.0			Dead in 3 days.
7.0	4 mg per kg intravenously	Glutathione, 0.45 g per kg before Hg	Dead in 12 hours.
7.7			Dead in 14 hours.
7.0	4 mg per kg intravenously	Cysteine, 0.23 g per kg before Hg	Do.
13.6			Dead in 3 days.
10.0	4 mg per kg intravenously	Sulphoxylate, 0.7 g per kg just before Hg.	Survived.
10.5			Do.
12.0			Do.
18.0			Do.
6.0			Do.

Experiments on dogs revealed that protection could be afforded from a lethal intravenous dose of bichloride if preceded by an injection of sulphoxylate. It was also possible to save a high percentage of dogs from a lethal oral dose of mercury if proper sulphoxylate therapy was instituted an hour or more after administration of the bichloride. All dogs were kept under observation for at least a week before use in the following experiments.

Five dogs were injected intravenously with 0.7 g of sulphoxylate (40 percent solution) per kilogram and shortly afterward were given intravenously 4 mg of bichloride per kilogram. All animals survived. Of 8 control animals receiving bichloride alone, 7 died (table 2).

Our observations were next extended to the treatment of dogs following the oral administration of bichloride. The fatal dose by mouth for dogs is stated by Hesse (13) to be 35 mg per kilogram of body weight. Haskell and Forbes (4) place it at 20 mg per kilogram in fasting dogs that have received morphine to prevent vomiting.

Eight dogs from whom food was withheld for 18 hours were given 20 mg of morphine sulphate per kilogram subcutaneously, to prevent vomiting, and in approximately one half hour 20 mg of bichloride of mercury (1 percent solution) per kilogram by stomach tube, washed in with twice the volume of water.. To 4 of the dogs was given intravenously 0.5 g of sulphoxylate (20 percent solution) per kilogram 17 to 34 minutes after the mercury, and again at 4½ hours after. To the control dogs were given intravenously 3 cc of 0.8 percent sodium chloride per kilogram approximately 4 hours after the mercury. Three of the four control animals died. None of the treated dogs died (table 3).

TABLE 3.—*The protective action of sulphoxylate injected intravenously subsequent to an oral dose of 20 mg of $HgCl_2$ per kilogram to dogs*

Weight	$HgCl_2$	Antidote	Interval after $HgCl_2$	Effect
Kg				
9.3	20 mg per kilogram by mouth.	0.8% NaCl, 3 cc per kilogram intravenously.	4¼ hr	Died in 3 days.
12.5			4 hr	Survived.
20.7			3¾ hr	Died in 30 hours.
16.0			4¼ hr	Died in 14 days.
8.0	20 mg per kilogram by mouth.	Formaldehyde, sulphoxylate 0.5 g per kilogram intravenously.	30 min. and 4½ hr	Survived.
11.6			20 min. and 4½ hr	Do.
11.1			34 min. and 4½ hr	Do.
9.0			17 min. and 4½ hr	Do.

Because of the depression produced by the above dose of morphine, an attempt was made to reduce the dosage to 10 to 15 mg per kilogram, but in some dogs this proved insufficient to produce quiescence and a further dose was required. It was also found more satisfactory to wait an hour after the morphine was given before administering the mercury. The animals were carefully watched for vomiting following oral administration of bichloride.

Three dogs received 35 mg of mercury per kilogram by mouth, followed by an intravenous injection of 0.5 g sulphoxylate (20 percent solution) in 30, 32, and 75 minutes; one dog survived. Three control dogs received a similar volume of salt solution (2.5 cc per kilogram) approximately 30 minutes after the mercury, with no survivals (table 4).

TABLE 4.—*Less beneficial effect of sulphoxylate given intravenously following a larger oral dose (25 to 35 mg per kilogram) of $HgCl_2$ to dogs*

Weight	$HgCl_2$	Antidote	Interval after $HgCl_2$	Effect
Kg				
12.5	35 mg per kilogram by mouth.	0.8% NaCl, 2.5 cc per kilogram intravenously.	½ hr	Died in 2 days.
14.0				Died in 1 hour.
24.0				Died in 3 days.
12.0	----do----	Sulphoxylate 0.5 g per kilogram intravenously.	32 min	Died in 4 days.
12.0			30 min	Died in 3 days.
11.4			75 min	Survived.
7.0	25 mg per kilogram by mouth.	----do----	70 min. and 5 hr	Died in 3 days.
14.0			60 min. and 6 hr	Died in less than 20 hours.
6.3			33 min. and 6 hr	Survived.

Seven dogs received 25 mg of bichloride per kilogram by mouth in the usual manner. Three of these animals were treated with two intravenous injections each of 0.5 g of sulphoxylate (20 percent) per kilogram. Two of the three died (table 4). Of four control dogs injected with equivalent volumes of salt solution at approximately the same intervals after the mercury, all died (table 5).

Of those animals that died following the administration of sulphoxylate by the intravenous route alone, histological examination of the kidneys by Dr. J. G. Pasternack, of this laboratory, revealed a strik-

ing difference between them and the control animals treated with salt solution. While the control animals showed extensive degenerative changes typical of acute mercurial nephritis, the treated animals showed only vascular congestion, and in some cases cloudy swelling and focal round cell infiltration.

On the other hand, it was found in both control and treated animals that the mucous membrane of the stomach and upper portion of the small intestine showed extensive necrotic changes, in most cases presenting on gross examination a black surface of necrotic tissue.

In view of previous experiments showing that no appreciable amounts of sulphoxylate could be found in the alimentary canal following its intravenous injection, it was believed that the gastrointestinal damage produced locally by the bichloride might be an important factor in the death of those animals receiving only intravenous therapy.

Accordingly, 18 other dogs, after the usual preparation, were given 25 mg of bichloride per kg by mouth. Twelve of these animals received 0.5 gm sulphoxylate (10–20 percent solution) per kg intravenously, and at the same time 0.5 to 1.0 gm per kilo (5 percent solution) through stomach tube, from 1 to 1½ hours following the mercury. Nine of these 12 animals survived and seemed to escape the toxic effects of bichloride, except some gastrointestinal inflammation, with diarrhea, and in some cases bloody stools, for several days. This represents injury which occurred prior to the therapy. The stools shortly after the treatment take on a dark greyish-brown color, which is due to the presence of the reduced mercury, and give a positive test for sulphoxylate.

Of the three treated animals that succumbed, two died in so short a time that kidney damage could not be responsible for the death. One (19 kg) died in 11 hours and showed at autopsy one lung partly consolidated and filled with a bloody serous fluid, while the other lung was normal; aspiration into the lung was an important factor in this fatality. The second dog (6.6 kg) was found dead the following morning (within 18 hours). Autopsy revealed extensive necrosis of the gastric mucosa and inflammation throughout the intestinal mucosa, while the kidneys histologically showed only diffuse cloudy swelling and vascular engorgement. The third dog (20 kg) lived for 8 days but refused all food during this time. Bloody stools and elevation of the blood nonprotein nitrogen were present during this period. Autopsy, however, showed no significant renal lesions on gross and histological examination. Pregnancy of about 1 month's development was found to be present.

The 6 control animals received 0.8 percent salt solution by mouth and intravenously in equivalent volume to that of sulphoxylate at approximately the same time after the mercury; 5 of the 6 died within

4 days. Another group of 4 dogs received this dose of bichloride by mouth and intravenous salt solution as therapy, with no survivals (table 5).

TABLE 5.—*The protection of dogs against an oral dose of 25 mg of $HgCl_2$ per kg when sulphoxylate is administered both by mouth and intravenously up to 90 minutes after the $HgCl_2$*

Weight	$HgCl_2$	Antidote	Interval after $HgCl_2$	Effect
Kg				
8.2	25 mg per kg by mouth.	0.8% NaCl, 2.5 cc per kg intravenously.	1 hr. 7 min. and 5½ hr.	Died in 4 days.
14.1			1 hr., 6 hr.	Died in 2 days.
8.2			do.	Died in 20 days.
12.1			40 min., 6 hr.	Died in 2 days.
16.0	do.	0.8% NaCl, 2.5 cc per kg intravenously and 5.0 cc per kg by mouth.	1 hr. 7 min.	Died in 4 days.
12.5			1 hr. 5 min.	Survived.
20.0			1 hr. 3 min.	Died in 3 days.
5.7			1 hr. 5 min.	Died in 2 days.
7.0			1 hr. 10 min.	Died in 1 day.
9.0			1 hr. 17 min.	Died in 2 days.
6.6	do.	20% sulphoxylate, 0.5 g per kg intravenously and 1.0 g per kg by mouth.	1 hr. 20 min.	Died during night.
10.5			1 hr. 10 min.	Survived.
7.4			1 hr. 7 min.	Do.
6.7			1 hr.	Do.
18.0			40 min.	Do.
7.4	do.	10% sulphoxylate, 0.5 g per kg intravenously and 1.0 g per kg by mouth.	1 hr. 5 min.	Do.
9.5			1 hr. 10 min.	Do.
19.0			1 hr. 30 min.	Do.
20.0			1 hr.	Died in 8 days.
19.0			1 hr. 15 min.	Died in 11 hours.
7.6			1 hr.	Survived.
8.4			1 hr. 10 min.	Do.

Determinations of blood nonprotein nitrogen were made upon these animals to obtain evidence of functional damage to the kidneys. Results upon the 12 animals treated with sulphoxylate showed in the 9 survivors no elevation of the nonprotein nitrogen throughout the period of observation, which extended up to 8 weeks. Two died before determinations could be made, while the dog that died in 8 days showed marked elevation up to the time of death (chart 5).

Of the 6 control dogs whose nonprotein nitrogen was studied, 4 showed striking increases up to the time of death. The fifth dog died before a determination could be made, while the sixth, the survivor in this group, showed only a slight increase (chart 5). Vomiting, which was not detected, probably occurred in this animal as a basis for the slight toxic effects.

DISCUSSION

The favorable results of sulphoxylate therapy in dogs following oral intoxication with mercuric chloride suggest the usefulness of such treatment in human cases. Intravenous injections have been found to afford protection from kidney damage, while oral administration, by the reaction with the unabsorbed mercury to form insoluble and less toxic compounds, can undoubtedly give some local protection and also inhibit further absorption of mercury. The evidence obtained from rats and rat tissues indicates that after the mercury has combined with the cell protoplasm, no benefit is obtained from the use

of sulphoxylate. Considerable time is no doubt required after an oral dose of mercury before the full damage to the kidneys occurs. The length of time beyond that established by our experiments after which sulphoxylate therapy will be of benefit, remains to be determined.

Our experiments have established the low toxicity of sulphoxylate to animals. While small amounts are injected intravenously into human beings as an impurity in neoarsphenamine (up to 25 percent (14)), the injection into human beings of doses comparable to those employed in our animals has not heretofore been attempted. Because of the fact that strong solutions are irritating when injected subcutaneously, it cannot be administered in this manner.

We have had occasion up to the time of this report to try this therapy in only one human case.[3] This case is reported here primarily

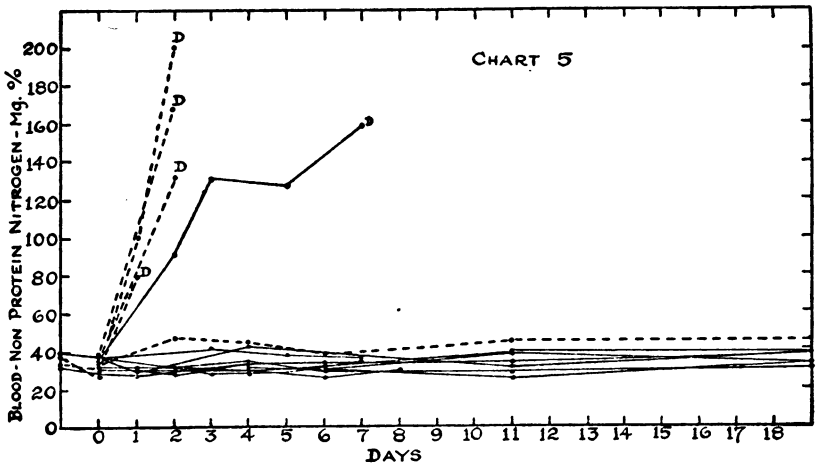

CHART 5.—The ability of sulphoxylate to protect dogs from kidney damage following $HgCl_2$. The non-protein nitrogen in the blood of 5 control dogs and of 10 dogs treated with sulphoxylate; all received a lethal dose of $HgCl_2$ (25 mg per kilo) by mouth. Interrupted lines, control dogs receiving 0.8 percent NaCl as treatment. Continuous lines, dogs treated with sulphoxylate.

to demonstrate that large doses of sulphoxylate can also be tolerated by human beings without ill effects.

A man (C. L.), age 26, weight 52 kg (114 pounds), took four ½-gram tablets of mercuric chloride with suicidal intent. Vomiting did not occur until approximately 1½ hours later, and treatment was instituted at the hospital approximately 2 hours after the bichloride had been taken. His stomach was washed with 5 percent sulphoxylate. The washings showed considerable quantities of the dark gray reduced mercury. Three hundred cc of 5 percent sulphoxylate were left in the stomach; 250 cc of 10 percent sulphoxylate were then administered intravenously, the injection being slowly given over a period of 40 minutes. Vomiting occurred toward the end of the

[3] Since this was written we have treated 5 additional acute cases. All recovered without renal or intestinal lesions.

injection, due either to the treatment or to the mercury. A sample of blood was taken 20 minutes after the injection. The serum showed a strongly positive nitroprusside test for sulphoxylate; and upon the addition of 0.2 percent mercuric chloride, a grayish black precipitate was immediately formed. Following the therapy the patient had no symptoms other than abdominal discomfort. During the next day bloody stools were passed. Recovery was uneventful, with no albumin appearing in the urine and no elevation of the blood nonprotein nitrogen.

While the question of most suitable dosage in human beings remains to be established, we would suggest in the average case the following technique: Oral therapy of 10 to 15 g by stomach tube as described above, followed by 10 g of sulphoxylate as a 5 or 10 percent solution given intravenously, allowing at least 15 minutes for the injection, and a repetition of an intravenous dose of 5–10 g in 3 hours. The solutions for intravenous injection should be freshly prepared, and the sulphoxylate for this purpose should be a purified and recrystallized product. Sodium formaldehyde sulphoxylate can be obtained from manufacturers of neoarsphenamine.

It is not possible at present to say whether subsequent therapy will be of benefit in delayed symptoms of acute poisoning, or whether it will be of benefit in cases of chronic mercurialism.

In view of the ability of dilute solutions of sulphoxylate to reduce rapidly mercuric chloride to insoluble and less toxic mercurous compounds and to metallic mercury, its beneficial action in acute intoxication may be explained by its stability in the body and by the fact that intravenous injections confer upon the body fluids the power strongly to reduce mercuric salts. Thus it can persist unchanged throughout the alimentary canal following oral doses; it can remain for several hours in the blood following intravenous injections, in amounts capable of rapidly reducing added mercuric chloride; it can appear unchanged in the urine in considerable quantities, indicating that a concentration of this substance occurs in the kidney cells.

The observation that sodium thiosulphate can antagonize the action of mercury upon some tissues only under certain conditions and that it can afford no protection to kidney tissue should serve to delineate more clearly its field of use in the treatment of mercurialism.

SUMMARY

The ability of certain compounds to influence the toxicity of mercuric chloride has been studied by measuring the oxygen consumption of excised rat tissues. Sodium thiosulphate protected the rat testes against the action of mercury if added before the mercury, but not at all if the mercury was added first. With the liver, protection was observed when the thiosulphate was added either before or just after

the mercury. With the kidney, no protection could be observed in any case, whether the thiosulphate was added before or after. Injected along with bichloride subcutaneously into rabbits' ears, thiosulphate prevented the local inflammatory reaction of bichloride. Injected intravenously into rats, thiosulphate did not protect against a subsequent lethal injection of mercury.

Glutathione was able to counteract the toxic action of bichloride on the oxygen consumption of rat tissues, including kidney, when added either before or up to one-half hour after the addition of mercury. Glutathione prevented the local inflammatory reaction of bichloride when injected subcutaneously along with it. Glutathione saved 10 of 12 rats when injected intravenously previous to a lethal dose of bichloride. Eleven of twelve rats were also saved when the glutathione was injected one-half hour after the bichloride. Glutathione did not protect two dogs when injected previous to a lethal intravenous dose of bichloride. Similar results were obtained upon two dogs with cysteine.

Formaldehyde sulphoxylate counteracted the effect of mercuric chloride on the oxygen consumption of rat tissues if added before the bichloride, but not if added subsequently. Likewise, on rats injected intravenously with fatal doses of bichloride, 5 of 7 were saved if sulphoxylate was injected previously, but none of 10 if injected 25 minutes following the mercury.

Upon dogs the following results with sulphoxylate were obtained:

Five dogs received an intravenous injection of sulphoxylate prior to the injection of a fatal dose of bichloride; all survived. Of 8 control animals, 7 died. Of 4 dogs receiving 20 mg of bichloride per kg by mouth, and 2 intravenous injections of sulphoxylate subsequently (after 17 and 34 minutes, and again after 4½ hours), all survived. Of 4 control animals, 1 survived. Six dogs received 25 to 35 mg of bichloride per kg by mouth and intravenous injections of sulphoxylate subsequently. Two of these animals survived, while none of six controls survived. Twelve dogs received 25 mg of bichloride per kg by mouth and both oral and intravenous doses of sulphoxylate 40 to 90 minutes later; 9 of the 12 survived. Of a total of 10 control dogs receiving this dose of bichloride and intravenous and oral salt solution as therapy, 9 died. Nonprotein nitrogen determinations made subsequent to the intoxication on the treated dogs showed no elevation in 9 of 10 animals, while marked rises occurred in the control animals.

One human case of bichloride poisoning received intravenously 0.5 gm of sulphoxylate per kilogram of body weight and approximately 15 grams by stomach tube with no ill effects. Recovery without renal damage occurred in this case.

20288°—34——2

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COURT DECISION RELATING TO PUBLIC HEALTH

Order of local manager of health and charity prohibiting sale of unpasteurized milk and cream held invalid where ordinance permitted such sale.—(Colorado Supreme Court; *City and County of Denver et al.* v. *Gibson et al.*, 24 P. (2d) 751; decided July 3, 1933.) Under the provisions of the milk ordinance of Denver it was lawful for licensed dairymen to sell raw milk and cream of a certain standard in Denver. Section 4 of this ordinance authorized the manager of health and charity to formulate such regulations, not inconsistent with the ordinance, as were necessary to procure a standard of milk required by the ordinance. Purporting to act pursuant to such section 4, the manager of health and charity issued an order to the effect that after a certain date it would be unlawful to sell unpasteurized milk or cream. Suit to enjoin the enforcement of this order was brought by persons licensed to sell their dairy products in Denver, and the lower court granted an injunction. The case was taken to the supreme court, which body, in affirming the judgment of the trial court, said that "The conclusion is inevitable that the manager of health and charity assumed a legislative function and promulgated an order in derogation of an existing ordinance." The appellate tribunal quoted with approval the following language used by the trial judge:

* * * The ordinance permits the sale of milk, both raw and pasteurized, and establishes certain specific scientific standards therefor. Can the manager, in

effect, repeal the ordinance by an attempt to "ordain", as he has done by the express terms of the order, that it shall be unlawful to sell milk and cream on and after February 1, 1930, unless the same has been pasteurized, which directly contradicts the express terms of the ordinance? * * * My conclusion in the present case is that * * * the manager of health and charity was and is without power to make and enforce the order mentioned.

DEATHS DURING WEEK ENDED DECEMBER 9, 1933

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

	Week ended Dec. 9, 1933	Corresponding week 1932
Data from 85 large cities of the United States:		
Total deaths	8,565	8,644
Deaths per 1,000 population, annual basis	12.0	12.3
Deaths under 1 year of age	620	607
Deaths under 1 year of age per 1,000 estimated live births (81 cities)	53	51
Deaths per 1,000 population, annual basis, first 49 weeks of year	10.9	11.1
Data from industrial insurance companies:		
Policies in force	67,326,257	69,666,314
Number of death claims	13,845	13,381
Death claims per 1,000 policies in force, annual rate	10.7	10.0
Death claims per 1,000 policies, first 49 weeks of year, annual rate	9.8	9.5

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 Dec. 16, 1933, and Dec. 17, 1932

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 16, 1933, and Dec. 17, 1932

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932
New England States:								
Maine	3	3	15	----	1	----	0	0
New Hampshire	1	1	----	----	12	1	0	0
Vermont	3	2	----	----	59	----	0	0
Massachusetts [1]	26	40	----	10	482	110	1	1
Rhode Island	2	4	----	1	9	----	1	0
Connecticut	10	5	4	13	17	13	0	0
Middle Atlantic States:								
New York	54	49	[2] 28	[2] 45	584	715	3	3
New Jersey	25	41	20	32	99	230	0	0
Pennsylvania	51	92	----	----	327	208	3	2
East North Central States:								
Ohio	65	78	101	644	120	203	3	3
Indiana	65	67	61	1,078	39	24	2	2
Illinois	52	80	11	167	34	54	4	11
Michigan	26	31	4	57	37	271	0	3
Wisconsin	13	13	17	111	161	222	3	0
West North Central States:								
Minnesota	8	6	----	10	8	84	1	3
Iowa [3]	18	27	1	----	30	3	1	0
Missouri	80	26	6	184	112	14	2	4
North Dakota	10	9	2	----	33	120	1	0
South Dakota	22	20	----	17	217	2	0	0
Nebraska	6	35	----	26	13	1	1	1
Kansas	29	28	1	41	43	6	0	2
South Atlantic States:								
Delaware	1	4	----	1	1	1	1	0
Maryland [3]	25	26	20	171	21	6	0	1
District of Columbia	10	5	1	64	25	----	1	2
Virginia	67	39	----	----	87	147	0	0
West Virginia	47	25	14	62	6	88	2	4
North Carolina	60	38	14	192	503	49	2	0
South Carolina [1]	14	12	459	1,446	125	11	0	0
Georgia [1]	35	36	----	3,954	299	----	1	0
Florida	22	23	3	38	----	1	1	1

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 16, 1933, and Dec. 17, 1932—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932
East South Central States:								
Kentucky	60	29	25	2,537	4	----	1	1
Tennessee	44	25	113	3,767	269	5	1	2
Alabama [1]	33	27	47	7,034	114	3	1	2
Mississippi [2]	19	6	----	----	----	----	0	1
West South Central States:								
Arkansas	18	13	32	4,272	294	1	0	0
Louisiana [1]	30	26	11	4,945	1	----	0	2
Oklahoma [4]	70	29	53	2,305	39	2	0	0
Texas [1]	207	104	143	498	193	232	0	0
Mountain States:								
Montana	7	1	5	1,388	2	449	2	1
Idaho	----	5	----	9	10	5	0	1
Wyoming	----	----	----	101	34	17	0	0
Colorado	12	6	----	313	4	8	0	0
New Mexico	10	10	----	8	74	1	0	0
Arizona	5	5	20	174	3	----	0	1
Utah [3]	----	2	2	21	129	----	1	1
Pacific States:								
Washington	6	2	3	1	219	5	0	0
Oregon	1	1	17	769	18	45	0	1
California	32	64	48	1,271	137	27	3	1
Total	1,404	1,220	1,301	37,777	5,048	3,384	43	57

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932
New England States:								
Maine	0	0	10	31	0	0	1	0
New Hampshire	1	0	12	21	0	0	1	0
Vermont	0	0	15	11	0	0	3	0
Massachusetts [1]	0	2	222	360	0	0	3	7
Rhode Island	0	0	17	34	0	0	1	0
Connecticut	0	0	63	63	0	0	0	2
Middle Atlantic States:								
New York	7	1	466	594	0	3	8	8
New Jersey	1	3	146	213	0	0	5	5
Pennsylvania	1	6	418	651	0	0	12	7
East North Central States:								
Ohio	4	2	553	550	2	8	7	21
Indiana	1	0	183	118	4	5	4	4
Illinois	1	0	379	391	3	2	7	11
Michigan	1	0	293	297	0	0	11	6
Wisconsin	1	2	101	84	64	1	0	1
West North Central States:								
Minnesota	0	0	100	73	3	0	2	0
Iowa [3]	0	0	87	47	1	64	4	0
Missouri	0	0	131	76	3	0	1	1
North Dakota	0	2	34	12	0	0	1	0
South Dakota	0	0	11	10	0	1	0	2
Nebraska	0	0	28	50	2	3	5	0
Kansas	0	1	115	88	7	1	5	0
South Atlantic States:								
Delaware	1	0	6	11	0	0	1	0
Maryland [3]	0	0	80	100	0	0	9	7
District of Columbia	0	0	14	12	0	0	1	0
Virginia	0	0	128	78	0	0	16	12
West Virginia	0	0	144	69	0	0	7	5
North Carolina	0	1	131	77	1	0	6	4
South Carolina [1]	0	0	21	13	0	2	6	5
Georgia [1]	3	2	27	22	0	0	11	2
Florida	0	0	5	8	0	0	2	5

See footnote at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 16, 1933, and Dec. 17, 1932—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932	Week ended Dec. 16, 1933	Week ended Dec. 17, 1932
East South Central States:								
Kentucky	0	0	114	40	0	1	5	7
Tennessee	0	2	129	39	2	19	6	12
Alabama [1]	1	0	37	20	0	1	4	0
Mississippi [2]	1	0	25	12	3	1	0	1
West South Central States:								
Arkansas	0	0	15	23	2	2	3	5
Louisiana [1]	1	0	14	12	30	0	15	14
Oklahoma [4]	1	0	47	34	0	4	5	0
Texas [1]	0	0	122	82	12	7	35	6
Mountain States:								
Montana	0	0	15	10	18	0	2	1
Idaho	0	0	8	4	1	1	0	1
Wyoming	0	0	12	13	0	0	0	0
Colorado	0	0	19	25	3	0	8	0
New Mexico	0	0	33	18	0	0	6	1
Arizona	0	0	13	5	0	0	1	1
Utah [3]	0	0	10	25	11	0	0	0
Pacific States:								
Washington	4	0	37	44	2	22	3	0
Oregon	1	0	44	20	9	7	2	2
California	6	3	205	111	8	1	20	8
Total	37	27	4,831	4,701	191	156	255	17

[1] Typhus fever, week ended Dec. 16, 1933, 54 cases, as follows: Massachusetts, 1; South Carolina, 15 Georgia, 22; Alabama, 12; Louisiana, 1, Texas, 17.
[2] New York City only.
[3] Week ended earlier than Saturday.
[4] Exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

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

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
October 1933										
Vermont		2			3			50	0	1
November 1933										
District of Columbia	2	89	3		49	1	0	58	0	17
Indiana	8	507	216		93		3	875	16	7
Maine	1	13	2		9		8	48	0	12
Michigan	6	116	7	4	170		3	1,169	3	39
Minnesota	2	80	2		127		19	301	15	15
Nebraska		39	27		32		5	175	24	5
New Hampshire		3					2	85	0	0
New Jersey	5	117	71	1	130		4	509	0	21
New Mexico	1	42	16	31	99	1	2	102	0	65
North Carolina	10	529	82		896	22	6	840	1	24
Ohio	3	426	256	2	402		16	2,287	4	44
Tennessee	4	310	186	891	574	7	6	539	9	75
Texas	1	1,231	578		71	45	8	881	31	175
Vermont		12			161		3	52	0	0

October 1933	Cases
Vermont:	
Chicken pox	71
Mumps	23
Undulant fever	1
Whooping cough	83
November 1933	
Anthrax:	
Texas	1
Chicken pox:	
District of Columbia	43
Indiana	590
Maine	269
Michigan	1,564
Minnesota	1,124
Nebraska	297
New Jersey	910
New Mexico	28
North Carolina	295
Ohio	2,298
Tennessee	63
Texas	105
Vermont	278
Conjunctivitis:	
New Mexico	5
Dengue:	
Texas	6
Diarrhea and enteritis:	
Ohio (under 2 years)	17
Dysentery:	
Michigan	26
Minnesota (amœbic)	24
Minnesota (bacillary)	2
New Jersey (amœbic)	8
New Mexico	5
Ohio	19
Tennessee	5
Texas	45
Food poisoning:	
New Mexico	1
Ohio	13
German measles:	
Maine	8
Michigan	34
New Jersey	10
New Mexico	11
North Carolina	8
Ohio	17
Tennessee	2
Impetigo contagiosa:	
Tennessee	17
Jaundice, spirochetal:	
Michigan	8
Lead poisoning:	
Ohio	21
Lethargic encephalitis:	
District of Columbia	1
Indiana	3
Maine	1
Michigan	5
Minnesota	5
Nebraska	1
New Jersey	5
New Mexico	1
Ohio	8
Tennessee	5
Texas	9
Mumps:	
Indiana	24
Maine	17
Michigan	284
Nebraska	27
New Jersey	164
New Mexico	21
Ohio	108
Tennessee	41
Texas	25
Vermont	23
Ophthalmia neonatorum:	
New Jersey	3
Ohio	75
Tennessee	1
Texas	1
Paratyphoid fever:	
Michigan	3
Minnesota	2
Ohio	1
Tennessee	2
Texas	3
Puerperal septicemia:	
New Mexico	2
Ohio	5
Tennessee	2
Rabies in animals:	
Indiana	27
New Jersey	12
Rabies in man:	
Ohio	1
Rocky Mountain spotted fever:	
North Carolina	1
Scabies:	
Tennessee	4
Septic sore throat:	
Maine	1
Michigan	59
Nebraska	2
North Carolina	12
Ohio	211
Tennessee	18
Vermont	1
Tetanus:	
Michigan	1
Minnesota	1
Ohio	1
Tennessee	1
Texas	1
Trachoma:	
New Jersey	1
Ohio	2
Tennessee	13
Texas	6
Trichinosis:	
New Jersey	2
Tularaemia:	
Michigan	5
Minnesota	6
Ohio	7
Texas	1
Typhus fever:	
North Carolina	5
Texas	29
Undulant fever:	
Indiana	1
Maine	2
Michigan	4
Minnesota	12
Nebraska	1
New Jersey	1
Ohio	6
Tennessee	2
Texas	11
Vincent's infection:	
Maine	2
Michigan	24
Tennessee	2
Whooping cough:	
District of Columbia	56
Indiana	119
Maine	213
Michigan	834
Minnesota	233
Nebraska	279
New Jersey	485
New Mexico	96
North Carolina	530
Ohio	861
Tennessee	120
Texas	277
Vermont	210

WEEKLY REPORTS FROM CITIES

City reports for week ended Dec. 9, 1933

State and city	Diphtheria cases	Influenza cases	Influenza deaths	Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths all causes
Maine:											
Portland	0	------	0	0	10	5	0	1	0	3	27
New Hampshire:											
Concord	0	------	0	0	0	0	0	0	0	0	6
Manchester	0	------	0	0	1	3	0	1	0	0	15
Nashua	0	------	0	0	0	3	0	0	0	0	0
Vermont:											
Barre	0	------	0	66	0	0	0	1	0	0	3
Burlington	1	------	0	0	0	1	0	0	0	2	9
Massachusetts:											
Boston	7	------	0	146	29	46	0	6	0	59	217
Fall River	3	------	0	2	2	0	0	0	2	0	25
Springfield	0	1	1	0	3	1	0	0	0	16	36
Worcester	1	------	0	348	9	11	0	1	2	16	49
Rhode Island:											
Pawtucket	0	------	0	0	0	3	0	0	0	0	0
Providence	0	------	0	0	5	9	0	4	0	28	62
Connecticut:											
Bridgeport	0	------	0	5	2	7	0	1	0	2	34
Hartford	1	------	0	1	1	11	0	1	0	2	41
New Haven	0	------	0	0	1	4	0	0	0	2	45

City reports for week ended Dec. 9, 1933—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths all causes
		Cases	Deaths								
New York:											
Buffalo											
New York	37	22	13	29	163	130	0	83	6	101	1,542
Rochester	0		1	0	9	9	0	0	0	7	73
Syracuse	0		0	0	5	4	0	0	0	68	55
New Jersey:											
Camden	2		0	2	4	12	0	2	0	1	36
Newark	1	4	2	3	7	10	0	7	1	25	100
Trenton	0		1	0	5	8	0	0	0	0	40
Pennsylvania:											
Philadelphia	2	14	6	129	66	74	0	24	0	27	551
Pittsburgh	7	4	3	4	19	31	0	4	1	36	146
Reading	0		0	1	5	1	0	0	0	15	33
Ohio:											
Cincinnati	14		1	46	6	26	0	7	0	15	128
Cleveland	9	44	3	1	35	71	0	4	2	78	192
Columbus	5		0	0	7	43	0	1	0	0	83
Toledo	2	1	1	34	6	38	0	7	0	9	80
Indiana:											
Fort Wayne	7		0	0	2	8	0	1	0	0	23
Indianapolis	5		0	1	8	7	0	0	0	18	
South Bend	0		0	0	3	4	0	0	0	3	11
Terre Haute	3		0	9	1	2	0	0	0	0	22
Illinois:											
Chicago	1	5	3	10	76	151	0	38	2	112	746
Springfield	2	2	0	0	2	6	0	0	0	1	20
Michigan:											
Detroit	9	4	5	20	32	62	0	8	0	82	269
Flint	0		0	3	3	27	0	1	0	3	33
Grand Rapids	0		1	0	1	4	0	0	0	0	25
Wisconsin:											
Kenosha	0		0	0	2	17	0	0	0	4	15
Madison	0			1		1	0		0	33	6
Milwaukee	11		0	5	8	20	1	8	0	62	86
Racine	0		0	3	0	8	0	0	0	4	15
Superior	0		0	1	0	0	0	0	0	2	5
Minnesota:											
Duluth	0		1	0	0	3	0	0	0	0	23
Minneapolis	3		0	5	11	12	0	2	1	30	104
St. Paul	0	1	1	1	3	14	0	3	1	19	52
Iowa:											
Des Moines	2			0		31	0		0	0	21
Sioux City	2			0		1	0		0	3	
Waterloo	0			1		0	0		0	6	
Missouri:											
Kansas City	5		1	2	7	30	0	5	0	6	139
St. Joseph	3		0	0	3	2	0	0	0	0	18
St. Louis	22			59	12	23	0	8	4	33	185
North Dakota:											
Fargo	0		0	8	0	0	0	0	0	0	0
Grand Forks	0		0	0	0	0	0	0	0	1	0
South Dakota:											
Aberdeen	0		0	0	0	1	0	0	0	0	0
Sioux Falls	0		0	118	0	0	0	0	0	0	7
Nebraska:											
Lincoln	0		0	1	0	4	1	0	0	1	0
Omaha	2		0	8	2	14	1	0	0	8	52
Kansas:											
Topeka	0		0	0	0	5	0	0	0	5	4
Wichita	0		0	0	5	6	0	3	0	10	34
Delaware:											
Wilmington	0		0	0	2	1	0	2	0	2	30
Maryland:											
Baltimore	6	16	3	2	25	22	0	7	1	53	227
Cumberland	1		0	0	1	6	0	0	0	0	6
Frederick	0		0	0	2	3	0	0	0	0	2
District of Columbia:											
Washington	9	2	0	31	13	17	0	13	2	20	167
Virginia:											
Lynchburg	5		0	0	1	6	0	0	0	0	10
Norfolk	2		0	1	0	9	0	0	[1] 1	0	38
Richmond	7		1	0	6	11	0	3	1	0	53
Roanoke	3		0	0	1	6	0	0	0	0	11

[1] Nonresident.

City reports for week ended Dec. 9, 1933—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths all causes
		Cases	Deaths								
West Virginia:											
Charleston	6		0	0	3	2	0	1	0	0	27
Huntington	6		0	0	0	14	0	0	0	0	0
Wheeling	0		0	0	2	4	0	0	0	0	17
North Carolina:											
Raleigh	1		0	0	1	2	0	0	0	1	23
Wilmington	0		0	0	0	0	0	0	0	0	11
Winston-Salem	6		0	153	4	8	0	2	0	0	20
South Carolina:											
Charleston	0	15	0	2	0	1	0	3	2	6	27
Columbia											
Greenville	1		0	0	3	1	0	0	0	2	10
Georgia:											
Atlanta	12	24	1	3	10	6	0	3	0	3	70
Brunswick	0		0	0	0	0	0	0	0	6	4
Savannah	0	27	0	0	1	2	0	3	3	0	29
Florida:											
Miami	1	1	1	0	0	1	0	2	0	0	30
Tampa	4	2	2	0	3	3	0	0	0	0	32
Kentucky:											
Ashland	2			0		2	0		0	0	
Lexington	2		0	0	1	0	0	2	1	0	15
Louisville	14		0	0	5	17	0	2	0	8	67
Tennessee:											
Memphis	6		2	4	9	13	0	4	0	10	98
Nashville	1		0	12	4	0	0	2	1	0	
Alabama:											
Birmingham	10	2	1	1	4	10	0	3	0	0	61
Mobile	3		0	0	3	1	0	1	0	0	21
Montgomery	1	2		0		1	0		0	0	
Arkansas:											
Fort Smith	2			0		4	0		0	2	
Little Rock	1		0	3	6	6	0	1	0	0	7
Louisiana:											
New Orleans	10	11	5	0	20	11	0	11	4	0	160
Shreveport	1		0	0	1	2	0	1	0	0	19
Oklahoma:											
Tulsa	1			7		1	0		0	0	
Texas:											
Dallas	21	3	3	0	14	5	1	3	2	4	72
Fort Worth	8		1	0	9	15	0	0	0	0	39
Galveston	3		0	0	3	3	0	1	1	0	20
Houston	29		0	0	11	8	0	7	0	0	75
San Antonio	4		1	0	6	6	0	1	1	0	57
Montana:											
Billings	0		0	0	0	0	0	0	0	0	6
Great Falls	0		0	0	0	1	0	0	1	2	10
Helena	0		0	0	0	0	0	0	0	0	5
Missoula	0		0	0	1	0	0	0	0	0	11
Idaho:											
Boise	0		0	0	0	0	1	0	0	0	0
Colorado:											
Denver	3	37	1	3	11	9	0	4	0	37	92
Pueblo	0		0	0	1	0	0	0	0	10	7
New Mexico:											
Albuquerque	0		0	0	1	2	0	2	0	1	10
Utah:											
Salt Lake City	0		0	227	4	6	0	2	2	12	34
Nevada:											
Reno	0		0	0	1	0	0	0	0	0	5
Washington:											
Seattle	0			0	8	5	0	5	0	54	80
Spokane	0	2	2	136	5	2	0	1	0	2	32
Tacoma	1		0	0	2	2	0	1	0	7	25
Oregon:											
Portland	0		0	2	6	20	0	3	0	2	78
Salem	0	2	0	1	0	0	0	0	0	6	0
California:											
Los Angeles	21	24	1	8	26	75	3	27	2	51	354
Sacramento	1		0	16	6	1	0	2	0	1	26
San Francisco	2	4	2	0	10	9	0	9	0	9	195

City reports for week ended Dec. 9, 1933—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Massachusetts:			
Fall River	0	0	1
New York:			
New York	7	4	2
Pennsylvania:			
Philadelphia	0	1	0
Ohio:			
Cleveland	1	1	2
Toledo	1	0	0
Indiana:			
Indianapolis	2	0	0
Illinois:			
Chicago	1	1	0
Iowa:			
Des Moines	0	0	1
Kansas:			
Topeka	1	0	0
West Virginia:			
Wheeling	1	0	0
North Carolina:			
Wilmington	0	1	0
Georgia:			
Atlanta	1	1	0
Washington:			
Seattle	0	0	2
California:			
Los Angeles	1	0	0
San Francisco	0	0	1

Lethargic encephalitis.—Cases: New York, 1; Chicago, 1; St. Louis, 5; Topeka, 1; Richmond, Va., 1; Birmingham, 1; Dallas, Tex., 1; Portland, Oreg., 1.

Typhus fever.—Cases: New York, 1; Charleston, S.C., 1; Atlanta, 3; Savannah, 3; Dallas, 1; Fort Worth, Tex., 1.

Pellagra.—Cases: Baltimore, 1; Washington, 1.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended December 2, 1933.—During the 2 weeks ended December 2, 1933, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada, as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta [1]	British Columbia	Total
Cerebrospinal meningitis					1	1	1	1	2	6
Chicken pox		6	3	423	550	166	128	26	152	1,454
Diphtheria		3	1	56	39	33	1	1		134
Dysentery				1	1		1		1	4
Erysipelas				9	7	2	1		1	20
Influenza		15		13	11				39	78
Lethargic encephalitis							1			1
Measles				112	22		34	1	7	176
Mumps					130	7	1	1	78	217
Paratyphoid fever	1									1
Pneumonia		1			36		5		11	53
Poliomyelitis				1	1					2
Scarlet fever		23	12	163	231	80	12	1	130	652
Smallpox				1						1
Trachoma				1	1	2				4
Tuberculosis	5	2	10	129	77	44	6		47	320
Typhoid fever			4	53	21		1		2	81
Whooping cough		11	3	259	120	154	41	5	23	616

[1] No report was received from Alberta for the week ended Dec. 2, 1933.

Ontario Province—Communicable diseases—Four weeks ended November 25, 1933.—The Department of Health of the Province of Ontario, Canada, reports certain communicable diseases for the 4 weeks ended November 25, 1933, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Cerebrospinal meningitis	3	1	Pneumonia		138
Chicken pox	908		Poliomyelitis	3	
Diphtheria	56	3	Puerperal septicemia		1
Dysentery	1		Scarlet fever	449	
Erysipelas	13	1	Septic sore throat	5	
German measles	14		Syphilis	81	1
Gonorrhea	116		Tetanus	1	
Influenza	15	2	Tuberculosis	164	26
Lethargic encephalitis	1		Tularaemia	1	
Measles	77		Typhoid fever	45	1
Mumps	175		Undulant fever	6	
Paratyphoid fever	7		Whooping cough	285	3

JAMAICA

Communicable diseases—Four weeks ended December 2, 1933.—During the 4 weeks ended December 2, 1933, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chicken pox	2	9	Lethargic encephalitis		2
Diphtheria		2	Puerperal fever		2
Dysentery	9	15	Tuberculosis	38	77
Erysipelas		3	Typhoid fever	16	74
Leprosy		1			

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

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

CHOLERA

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended— September 1933 2	9	16	23	30	October 1933 7	14	21	28	November 1933 4	11	18	25	Dec. 2, 1933
China:																			
Canton	C			1															
Hankow	C	2	1	2			1												
	D	1		1	1														
Swatow	C	2																	
Tientsin	C			4															
India	C	8,201	3,517	6,881	7,695	2,901	2,576	2,534	3,427	2,984	2,211	2,091							
	D	4,091	1,555	3,047	3,237	1,315	1,166	1,233	1,502	1,438	1,097	943							
Bombay Presidency	C			3,869	3,604	681	610	532	642	646	407		421	548	352				
	D			1,609	1,436	305	282	259	301	265	199		169	266	175				
Bombay	C	2	1	6	1				1	4	1			3	1				4
Calcutta	C	690	196	77	59	21	28	23	12	9	26	15	11	16	13	11		18	10
Chittagong	C	21	7		1							1							1
Madras Presidency	C			276	923	274	213	182	247	142	142	90	155						
	D			74	338	126	94	79	91	54	46	51	68						
Madras	C													4	1		2	3	61
	D													1	2			2	26
Moulmein	C		3																
Rangoon	C	1	1	2															
Vizagapatam	C	1		4									1						
India (French):																			
Chandernagor	D									2									
Karikal	C									1									
	D									1									
Pondichery	C					1				1									
	D					1				1									
Indo-China (see also table below):																			
Pnom-Penh	C	2	1																
Saigon and Cholon	C			8	2														

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

CHOLERA—Continued

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

Place		Apr. 30–May 28, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended—												Dec. 2, 1933
						September 1933					October 1933				November 1933				
						2	9	16	23	30	7	14	21	28	4	11	28	25	
Philippine Islands: [1]																			
Antique Province	C												9	8	2			6	8
	D												6	10	1			5	6
Bohol Province	C	15	80		1					6	1	28	6	52	35	31	39	68	51
	D	12	38							3	1	12	3	31	21	14	25	41	25
Cebu Province	C		2	90	26	1	9	6	11	12	22	16	15	10	23	18	7	23	15
	D		2	39	20	1	7	4	9	7	14	9	9	4	16	12	4	13	10
Cebu	C		1		1	1		1	2	5	6	6	3	6	1	11	4	1	
	D		1		1	1		1	2	3	2	3	1	2	1	6	1		
Naga	C														9	1	1	7	4
	D														6	1	1	1	3
Iloilo Province	C	1		1										12	1			1	
	D	1		1										11	2			1	
Iloilo	C	1		1											1			1	
	D	1		1											2			1	
Leyte Province	C	22	2		2		1												
	D	20	2		2		1												
Occidental Negros Province	C		19	6	1														2
	D		9	7	1														1
Pampanga Province	C	1																	
	D	1																	
Rizal Province	C	1																	
Samar Province	C	29	7		31					[2] 31	11								
	D	23	5		20					[2] 20	8								
Siam:																			
Bangkok	C	1	1																
Provinces	C	13	28	1															
	D	6	14	1															
On vessels:																			
S.S. Dunana at Madras	D	1																	
S.S. Lauterfels at Calcutta	C	1																	
S.S. Mathura at Calcutta	C	1																	

Place		May 1933			June 1933			July 1933			August 1933			September 1933			October 1933	
		1–10	11–20	21–31	1–10	11–20	21–30	1–10	11–20	21–31	1–10	11–20	21–31	1–10	11–20	21–30	1–10	11–20
Indo-China (French) (see also table above):																		
Cambodia [3]	C	11	14	17	23	31	14	3	1			1						
	D	8	10	9	12	17	6	3	1			1						
Cochin-China [3]	C	5	9	6	4	8	5	6	2	12	3	2	1	1	2	2	5	5
	D	4	8	6	4	8	4	5	2	3	3	2	1	1	2	2	5	3

[1] During the week ended Dec. 16, 1933, cholera was reported in the Philippine Islands as follows: Bohol Province—Calape, 3 cases, 3 deaths; Loon, 8 cases, 5 deaths; Tubigon, 11 cases, 8 deaths. Cebu Province—Liloan, 1 case, 1 death. Oriental Negros Province—Tanjay, 4 cases, 4 deaths.
[2] For 2 weeks.
[3] Reports incomplete.

PLAGUE [1]

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended— September 1933					October 1933				November 1933			
						2	9	16	23	30	7	14	21	28	4	11	18	25
Argentina (see also table below): Cordoba Province	C	8																
Azores:																		
Fayal	C								1									
St. Michaels	C								7									
	D								1									
Bolivia. (See table below.)																		
British East Africa (see also table below):																		
Kenya	C		3	7	13	2	6	3	10	9	16	2			8			
Tanganyika	D	1													1			
Uganda	C	85	53	58	77	18	34	22	21	18	8	22	15					
	D	83	53	58	77	18	28	23	23	17	7	22	14					
Ceylon: Colombo	C		1	2			1						1					
	D		1	2			1						1					
Plague-infected rats				4	1													
China: Manchuria.[2]																		

See footnotes at end of table.

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

PLAGUE—Continued

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended— September 1933 2	9	16	23	30	October 1933 7	14	21	28	November 1933 4	11	18	25
Dutch East Indies: West Java	C	878	793	1,434	899	248	299	289	294	335								
	D	872	789	1,428	898	248	299	288	294	334								
Ecuador. (See table below.)																		
Egypt:																		
Alexandria	C			4	1													
Asyut	C	10	2															
Aswan	C	1																
Faiyum	C		2	4			1	1			1							
	D			1														
Gharbiya	C									3	1			1				
	D									2	1	1		1				
Girga	C			2														
Minufiya	C	1																
Minya	C		4	1						1								
Qena	C				1													
	D				1													
Luxor	C				2													
France: Marseille	C				8													
	D				3													
Plague-infected rats					2											1		
Hawaii Territory: Hawaii Island—Hamakua—Plague-infected rats							1									2		
India	C	2,319	1,411	3,869	6,209	2,151	2,350	2,610	3,133	3,398	3,074	2,941						
	D	1,407	1,231	2,616	3,560	1,331	1,369	1,573	1,747	1,951	1,603	1,546						
Bassein	C	3	1	11	7			2		1								
Plague-infected rats		3	2	2	1													
Bombay Presidency	C			2,448	3,971	1,263	1,424	1,465	1,872	2,045	2,231		1,382	1,309	1,598			
	D			1,493	2,313	852	898	967	1,173	1,227	1,235		895	708	992			
Bombay	C	6	2	1	1	2	1	1	2	1	1	1		1		1		
Plague-infected rats		34	16	5	5			1		2	1				3	3	1	1
Poona	C										176		150	142	61			
	D										118	199	109	101	53			
Madras Presidency	C	23	8	372	867	253	190	183	273	282	231	100	95					
	D	8	6	148	395	136	77	83	111	140	139	56	46					
Rangoon	C	1	1					2			1							1
Plague-infected rats				3	1					2							1	1

Indo-China (see also table below):																			
Pnom-Penh	D	6	3	2	3	2					2								
Saigon and Cholon	C	2		2	3														
Plague-infected rats		3																	
Iraq:																			
Baghdad	C	3	2	7		1	1		1			[3] 1			1	1			
Basra	C			3															
Libya: Gheran	C									10									
	D									3									
Madagascar (see also table below): Tamatave	C				1														
Morocco	C	2		8															
Peru. (See table below.)																			
Senegal. (See table below.)																			
Siam	C		2																
South-West Africa.[4]																			
Syria: Beirut	C		1	2															
Union of South Africa: Orange Free State	C	7																	
United States: California:																			
San Benito County—Plague-infected ground squirrels					8														
Whittier	C				1														
	D				1														
On vessel: S.S. Angkor at Beirut from Marseille	C													1					

Place		May 1933	June 1933	July 1933	August 1933	September 1933	October 1933
Argentina (see also table above)	C			7			6
	D			3			2
Bolivia	C			25	1		
British East Africa (see also table above):							
Kenya	C	4	6	3	13	36	20
Uganda	C			47	91	97	71
Ecuador	C	35				3	
Indo-China (see also table above):							
Cambodia	D	3	5	3	6	16	8
Cochin-China	C	2		2	5	1	

Place		May 1933	June 1933	July 1933	August 1933	September 1933	October 1933
Madagascar	C			133	100		
	D			132	92		
Peru	C	3	5	6	7	8	18
Callao	C					1	7
Senegal:							
Dakar [5]	C	2		57		5	4
	D	1		39		3	3
Tivaouane [5]	C		1		5	2	

[1] Including plague in the United States and its possessions.
[2] In September and October 1933 plague was reported in parts of Manchuria, China, especially between the Ssupingkai-Taonan Railway and the southern line of the Chinese Eastern Railway, also adjacent to the lines of the Ssupingkai-Taonan, Ssupingkai-Tungliao, and Tahushan-Tungliao Railways.
[3] Imported.
[4] 103 cases of plague with 5 deaths were reported in Ovamboland, South-West Africa from Jan. 1 to Oct. 14, 1933. Antiplague measures have been taken.
[5] Incomplete reports.

20388°—34—3

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

SMALLPOX

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended— September 1933 2	9	16	23	30	October 1933 7	14	21	28	November 1933 4	11	18	25	Dec. 2, 1933
Algeria:																			
Algiers Department	C			2												1			
Constantine Department	C			1															
Arabia: Muscat—Oman Sultanate	C		73																
	D		20																
Belgian Congo	C			5		2	2												
	D			1															
Bolivia. (See table below.)																			
Brazil: Porto Alegre (alastrim)	C		6	1	1		1		1	10			1						
British East Africa:																			
Kenya	C	4																	
Tanganyika	C	13	10	6	21	9		16	2	3	12	12	24	4					
British South Africa:																			
Northern Rhodesia	C	2		1	1														
Southern Rhodesia	C	16		1				2											
Canada:																			
British Columbia	C	[1] 1	[1] 1																
Manitoba	C				1														
Ontario	C	[1] 1	[1] 1																
Toronto	C	1																	
Saskatchewan	C	[1] 5	7				[1] 1												
Ceylon:																			
Colombo	C	4	9	6	9											1			
Galle	C	2		1															
China:																			
Amoy	C	3	2																
Canton	C	7													1		1		1
Dairen	C	3	2	3			1					1	1	1	2				
Foochow	C	P	P	P															
Hangchow	C			3	1														
	D			2	1														
Hong Kong	C	19	8	3	1														
Macao	C	4																	
Nanking	C	2	2	2															
Shanghai	C	33	27	22	10	2		1	1	1	2			1	4	1		6	
Swatow	C	10	4									1	1		1				
Tientsin	C		16	2															

Chosen. (See table below.)																			
Colombia: Buenaventura	D			1															
Costa Rica. (See table below.)																			
Dahomey. (See table below.)																			
Ecuador. (See table below.)																			
Egypt:																			
Alexandria	C	11												1	2				
Asyut	C			112	109			17		26	6	8	21	5	1				
	D			23	11			3		3	1	1	1	1					
Beheira	C	62	6																
Beni-Suef	C							10	17	4	10	2	1						
	D							4	1	2	1	1							
Cairo	C	10	4	1						1									
Dakahliya	C			4	1														
Faiyum	C			44	18			2		1	1								
Gharbiya	C	93	142	83	39	4		1				1		1	4				
Girga	C			2	2							1	5	3					
Minufiya	C	128	26																
Qena	C			9	25			3	1				13	12	6				
Provinces	C	347	287	499	297	50	32	33		35	18	12	40	25	25				
France. (See table below.)																			
Great Britain:																			
England and Wales	C	91	71	55	32	4	2	6	4	4	3	3		4	1	1	1	6	
London	C	79	51	40	28	3		5	3	3	3	3		4	1	1	1	6	
London and Great Towns	C	82	56	49	31	3	1	5	3	3	3	3		4	1	1	1	6	
Greece (see also table below): Salonika	C	18		8					9										
Guatemala. (See table below.)																			
Honduras: Tegucigalpa	C	7	3																
India	C	33,876	23,631	14,599	7,069	1,765	1,509	1,156	1,377	1,245	1,136	1,107							
	D	9,706	7,008	4,256	1,768	430	345	268	321	261	310	215							
Bassein	C	32	16	9	10	4	1	4	7	3	3	3	2	4	5	3	2	2	4
	D	11	11	8	6	3	1		1	1	3		2	2	1	1	3	1	3
Bombay Presidency	C			1,942	1,029	198	170	174	202	129	130	191	127	151	121				
	D			376	186	40	38	20	46	16	23	14	29	25	22				
Bombay	C	212	88	34	14	1					2		1	1		2		2	3
	D	148	58	25	8	1					2		1	1		2		1	3
Calcutta	C	342	134	59	18	4	2	2	2		1	3		4	1	8		4	9
	D	289	107	49	8	2			1		1	1		1	1	1		3	1
Chittagong	C	1																	
	D	1																	
Cochin	C		2	4		2								1					
Karachi	C	52	19	16	5								2						
Madras Presidency	C			3,571	2,851	621	592	539	548	644	602	540	646						
	D			726	587	114	93	102	100	104	132	106	142						
Madras	C	231	144	234	223	63	33	32	36	45	30	22	13	16	13	7	7	14	14
Moulmein	C		12																
Negapatam	C	7	3	12	21	2	2	3		1		1	4	4	7		3	7	8
Rangoon	C	17	6	4	1	1		3			1					1		1	2
Tuticorin	C				2									1	5			1	
Vizagapatam	C	2	5	14	11				2			1			1			1	

[1] For 2 weeks.

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

SMALLPOX—Continued

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	July 30–Aug. 26, 1933	Week ended—												Dec. 2, 1933
						September 1933					October 1933				November 1933			
						2	9	16	23	30	7	14	21	28	4	11	18	25
India (French):																		
Chandernagor	D			1														
Karikal	C		5							1	1							
	D		5							1	1							
Pondichery	C		129	139	181	57	50	40	24	39	59	25		17	15			
	D		82	73	70	22	25	17	22	18	32	19		12	7			
Indo-China (see also table below): Saigon and Cholon	C			1			1											
Iraq:																		
Baghdad	C	5									1		1				1	1
Basra	C	6	2			4									3			
Japan:																		
Kobe	C			1														
Osaka	C	1																
Tokyo	C	1	2	45														
Mexico (see also table below):																		
Coahuila	C	1	2															
Juarez [2]	C	2																
Mexico, D.F	C	5	5	1	12													
Monterrey	D	2			1										1			
Saltillo	D	2	3															
San Luis Potosi	D	5	1	9	8													
Torreon	D									1		1	1					
Vera Cruz	C													1		1		
	D													1		1		
Morocco. (See table below.)																		
Nigeria	C			675	361			37		76		74						
Nyasaland. (See table below.)																		
Palestine	C			13														
Paraguay: Asuncion	D			3														
Persia	C	89	31	26	20				5	5		8	12	25				
	D	62	62	9	7				6	1		2	1	2	2			
Teheran	C			21	17	2			1		3	2		6				
	D			8	5				1		1		1	2	2			

Peru. (See table below.)																		
Poland	C	2	1	1									1		1			
Portugal (see also table below):																		
Lisbon	C	2	3	5	3			2	1								1	
Oporto	C	2		3	1							2		1	1			
Siam	D			5	1													
Sierra Leone	C	51	6	45	6	[1] 200		[1] 50				[1] 421		[1] 113				
Spain	C			59	29	11	5				4	7			27	13		
Sudan (Anglo-Egyptian)	C	5	1	5			1									14	1	
Syria:																		
Beirut	C	1	6	14	21													
Provinces	C	20	4	9	11	1		3	3	16			18	2	19	14		
Turkey. (See table below.)																		
Union of South Africa:																		
Cape Province	C	P																
Orange Free State	C		P															
On vessels:																		
S.S. Rajputana at Aden	C	1																
	D	1																
S.S. Baron Inchcape at Hong Kong	C	P																
S.S. Fernmoor at Vancouver	C		4															
S.S. Egra at Rangoon from Calcutta	C	1																
S.S. Arracan at Newport	C				1													
S.S. Clan Macquarrie at Suez	C					1												
S.S. Sikh at Madras	C				1													
S.S. Lichtenfels at Suez from Calcutta	C									1								
S.S. Shahjehan at Madras	C							1										
S.S. Rohna at Penang from Madras	C													1				

Place		May 1933	June 1933			July 1933			August 1933			September 1933			October 1933	
			1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20
Dahomey	C	11	1	1		2	1		6	1	1	20	6	1	2	8
	D	2		1		1				1	1	5	1			6
Indo-China (see also table above)	C	149	60	83	54	74		31	20	38	21		44	37	39	20
	D	45	16	36	24	31		6	5	15	3		19	13	15	5

[1] For 2 weeks.

[2] Dec. 18, 1933: 90 cases of smallpox were reported in Juarez, Mexico, with 18 deaths occurring from Dec. 1 to 16, 1933.

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

SMALLPOX—Continued

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

Place		May 1933	June 1933	July 1933	August 1933	September 1933	October 1933
Bolivia	C	28	12	10	12	15	34
Chosen	C	34		3			
	D	14					
Costa Rica	C				2		
Ecuador	C	[3] 1	23	12			
France	C	21					
Greece	C				1		
Guatemala	C	1					
Mexico (see also table above)	C						
Morocco	C	14	10	8	1	2	3
Nyasaland	C	303	248	336	347	318	
Peru	C	6		84	56		
Portugal (see also table above)	C				89	105	
	D				16	27	
Turkey	C		13		8	56	

[3] Imported.

TYPHUS FEVER

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	Week ended— August 1933				September 1933					October 1933				November 1933		
					5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18
Algeria:																				
Algiers Department	C	14	11	7	1	1									1					
Constantine Department	C	120	157	66	3	8		10	2	4	5	1	4	1		4				1
Bone	C	2		1		1												1		
Oran Department	C		1	2						2							1			
Basutoland. (See table below.)																				
Bolivia. (See table below.)																				
British East Africa: Uganda	C	10	7	4		2		2	3	1	5	2			1	1				
Bulgaria	C	8	4	2		2	1					1				3		1		
Chile	C						596	432	408	2,180										
Antofagasta	C		1																	
Santiago	C	134	290	1,112	392				124	282	233	218	214	224	292	343				
Valparaiso	C		1	7			8	5	5	8	11		10	4	8	22	9	5	12	24
China:																				
Hangchow	C				5															
Hankow	C												1							
Harbin	C						8	3												

Nanking	C			1		1								1						
Shanghai	C			1				1				1					1	1		
Tientsin	C			1																
Chosen. (See table below.)																				
Czechoslovakia. (See table below.)																				
Egypt:																				
Alexandria	C	24	17	18	1					1										
Beheira	C	560	569	257	16	21	14	10	7	3	2	4	2	8	5	2	9	9		10
Cairo	C	53	28	9	2	1		1				1								
Dakahliya	C	267	140	82	8	10	19	5	7	2	1	1	3						2	2
Damietta	C		3	3				1	1											
Gharbiya	C	448	591	310	22	10	19	28	11	10	8	9	3	1	1	8			3	5
Minufiya	C			52	4	20	4	8	1	1	2		2	3	5	2	2	2	3	
Qena	C								1			4	4			3			3	2
Provinces	C	1,611	1,591	785	54	63	56	53	20	22	17	25	14	13	12	15	12	14	29	20
Greece. (See table below.)																				
Guatemala. (See table below.)																				
Hungary	C	15	11													5		10		
Iraq: Baghdad	C	2	2	2		1														
Irish Free State:																				
Kerry County—Dingle	C														4			4		
Waterford County—Lismore	C					1														
Latvia. (See table below.)																				
Lithuania	C	31	15	1		8	2	1												
Mexico (see also table below):																				
Mexico, D.F	C	15	9	6		1			2	2	2		10	5	3	6		14	15	10
San Luis Potosi	D												1	1						
Torreon	C						1			1	1								1	
Morocco	C	31	63	14	1	11			1	1				1	1					
Palestine	C		1	20		2		1	1	1			1				4	4		
Persia	C	39	25	21	9	4	2		4	1	3	6	10	8	5	6	1	5		
Peru. (See table below.)																				
Poland	C	378	322	196	27	19	3	7	6	8	12	8	17	17	8	23	18	34	41	21
	D	21	13	11	4		1	1				1		2	1		2	3		2
Rumania. (See table below.)																				
Spain: Madrid	C									1		1		1						
	D										1									
Syria	C	24	21	1		1		1												
Trans-Jordan	C	17	4	2																
Tunisia:																				
Tunis	C										1				2					
Provinces	C	42	65	36																
Turkey. (See table below.)																				
Union of Socialist Soviet Republics. (See table below.)																				
Union of South Africa. (See table below.)																				
Yugoslavia. (See table below.)																				
On vessels:																				
S.S. Chiloe at Antofagasta	C		1																	
S.S. Conte Verde at Bombay from Singapore	C	1																		

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

TYPHUS FEVER—Continued

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

Place		May 1933	June 1933	July 1933	August 1933	September 1933	October 1933
Basutoland	C	233	-----	208	279	259	-----
Bolivia	C	98	71	36	34	99	129
Chosen	C	-----	-----	59	-----	-----	-----
Czechoslovakia	C	31	9	6	1	-----	-----
Greece	C	12	6	5	4	4	-----
Guatemala	C	8	3	1	4	5	-----
Latvia	C	-----	-----	-----	1	-----	-----
Mexico (see also table above)	C	-----	-----	12	19	42	-----
Peru	C	28	23	20	60	-----	-----
Rumania	C	-----	-----	57	22	13	21
Turkey	C	16	13	5	7	9	20
Union of Socialist Soviet Republics	C	2,051	-----	-----	-----	-----	-----
Union of South Africa:							
Cape Province	C	189	124	195	135	141	-----
Natal	C	6	122	23	18	43	-----
Orange Free State	C	15	34	61	140	180	-----
Transvaal	C	1	7	5	3	103	-----
Yugoslavia	C	-----	136	80	33	5	38

YELLOW FEVER

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

Place		Apr. 30–May 27, 1933	May 28–June 24, 1933	June 25–July 29, 1933	Week ended— August 1933				September 1933					October 1933				November 1933	
					5	12	19	26	2	9	16	23	30	7	14	21	28	4	11
Brazil:																			
Ceara State:																			
Lavras	C	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	D	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
St. Matheus	C	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	D	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pernambuco State:																			
Granito	C	-----	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	D	-----	-----	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Novo Exu [1]	C	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	D	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Salgueiro	C	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	D	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

French West Africa:																			
Guinea	C										[2]1								
Niger Territory	C							2	1				2	1					
	D							2					2	[2]2					
Gold Coast	C	2	1							[2]1					[2]1				1
	D									[2]1									1
Ivory Coast:																			
Bouafle	C		1																
Gagnoa	C		[2]1																
	D		1																
Nigeria: Kano	C																	1	
	D																	1	
Senegal:																			
Bakel	C											2			1				
	D														1				
Kaffrine	C														1				
	D														1				
St. Louis	D			[4]1															

[1] 2 cases of yellow fever with 2 deaths were reported in Novo Exu, Pernambuco State, Brazil, during the month of June 1933.
[2] Suspected.
[3] Includes 1 suspected death.
[4] Imported.

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