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A PUBLIC-HEALTH SURVEY OF IOWA

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A public-health survey of a State to-day means much more than a survey of the State health department. The field of public health has expanded to include the work of many agencies, official and unofficial, which operate independently of the health department. To understand this expansion and the necessity for including these other agencies, a brief consideration of public-health evolution is necessary.

Public health evolution.—The first quarantines at Ragusa, Marseille, and Venice in the fourteenth and fifteenth centuries were based on the psychology of fear. They were efforts to prevent the introduction and spread of epidemic diseases. Our first boards of health were born of fear and hope—fear of pestilence and hope that quarantine and isolation would prevent the spread of epidemic diseases. With this origin it was natural that these boards of health should be given unusual police power and definite control of the individual for the good of the community. The early administrative health officers depended upon police power alone, and they were, in effect, policemen.

The epoch-making discoveries of Pasteur, Koch, and others from 1870 to 1890 gave a new impetus to the vigorous application of police power. The demonstration that disease was caused by frail, easily-destroyed germs was responsible for the new vigor which marked the application of quarantine, isolation, and disinfection in the last decade of the past century. With the beginning of the twentieth century came the knowledge of the carrier. It was shown that even if doctors reported all cases under their care there would be as many more uncontrolled. Mild cases, atypical cases, and carriers who had no symptoms whatever could not be controlled by quarantine, isolation, or any other exhibition of police power. This new knowledge made health officers realize that control of the communicable diseases was possible only by the voluntary cooperation of the individual citizen, and that this cooperation could be secured only by education in personal and family hygiene. Public-health education became even more essential to the health officer as his field of work expanded to include noncommunicable diseases and the improvement and conservation of health. Health officers gave up the idea that all public-health work could be done by personnel on the pay roll of the health department. It was obvious that the education of individuals in personal hygiene and the securing of their voluntary help in preventing disease involved the participation of many agencies, official and unofficial, outside the health department.

In the first decade of this century unofficial voluntary agencies undertook public-health activities of great importance and wide scope and boards of education developed plans and procedures in school hygiene. The responsibility for the health of the people was still squarely placed upon the shoulders of the health officer, yet a large part of the work necessary to discharge his obligation had to be done by personnel not under his direct control. The health officer, therefore, evolved from a policeman, vainly striving to stamp out epidemic disease, into a construetive statesman, courteous and persuasive, who could weld together in one machine the forces engaged in public-health activities.

The policy of a health officer to-day.—In discussing the simple fundamentals of public-health administration, omitting details, it is possible to consider the health officer, Federal, State, and local, in general, because not only are the obligations and objectives similar, but the policy of administration in discharging these obligations and attaining these objectives is essentially the same for all health officers, whether their jurisdiction is over a county, a city, a State, or the United States as a whole. A health officer, therefore, regardless of his jurisdiction, must secure the active participation of the organized medical profession, the unofficial voluntary agencies, and the boards of education, and utilize them to carry out certain parts of his comprehensive program which would not otherwise be possible because of lack of funds and personnel in the health department.

The health officer should secure the active participation and support of the organized medical profession by means of a special advisory committee on public health appointed by the medical society. This committee would not conflict with an existing board of health. The official board of health, by law and ordinance, must pass upon all police measures and also upon questions of policy. An advisory public-health committee would advise and approve measures to be carried out by the medical profession not depending upon law and ordinance. The health officer must be enough of a statesman to secure such advice from the medical society and to bring his board of health to approve of such measures.

The health officer can do much to encourage the local medical society to accept its collective obligation, to solve its greatest problem—scientific medical service, including preventive advice and treatment for all the people at a cost within their ability to pay. The furnishing of such facilities for treatment by the medical society will give early preventive and corrective treatment to the preschool child, a field in which at present the health officer is scarcely able to scratch the surface.

No health department now has, nor can it hope to have, sufficient funds to finance all health work. Voluntary health agencies simply add to the total health department budget large sums for public-health work which they are now doing or which should be developed. It is the duty of the health officer to have a complete comprehensive plan for all health activity. He should include these voluntary health agencies in that plan, allotting to them work which he is unable to do and which they are ready and willing to do. It is the custom, where the best utilization of the voluntary agencies is secured, to have a committee of voluntary health agencies, with representatives of every agency engaged in any public-health activity.

The health officer will find that in the promotion of the health of school children a considerable part of his work will be done for him by the board of education. The amount of work done by boards of education in this field varies in the cities. In a survey of 98 of the largest cities of the United States it was found that 23 had organized the work under the health department and 57 under the department of education, and 18 had some joint arrangement between the health and education departments. There is a third factor in cities, viz, the parochial schools. This complex situation calls for the qualities of statesmanship which a good health officer should possess. He must accept what is being done and dovetail it in with his own child-hygiene program. The main objective is to get the work done, and the matter of who shall do it is of lesser importance.

With the experience of the past three decades, it is not a difficult matter to set down on paper an outline of organization in detail of a State health department with the major divisions it should possess. Iowa's failure to organize earlier in such a manner is not an unmixed calamity, as modern reorganization can now be effected, and profit can be had from the experience and mistakes of other States.

Much more important, and also more difficult, is the scheme of organization which will afford a sound foundation for such a department, by welding together in a comprehensive whole all the public-health activities of the State, official and unofficial.

To organize the department in detail, with all its divisions and sections, without some sound method of utilizing in a joint program all the other official and unofficial agencies, is comparable to building a fine structure on a foundation of sand.

I shall, therefore, make this report in two sections, as follows:

Section I.—Organization of the department with the objective of including all public-health work now being done within the State, official and unofficial, in a comprehensive program. The correlation of these other official and unofficial agencies, and the coordination of their work with the department of health will afford the sound foundation necessary for the proper reorganization and development of the department itself.

Section II.—The reorganization of the department of health into the divisions necessary to enable it to discharge its obligations and function properly in the enlarged program.

Section I.—Organization of Outside Agencies

In formulating a plan for utilizing all agencies engaged in public-health activities outside of the department of health in a comprehensive joint program with a single direction, it is necessary to study carefully the work and potentialities of three factors, viz:

1. The organized medical profession.
2. The State educational authorities.
3. The unofficial health agencies.

THE ORGANIZED MEDICAL PROFESSION—THE STATE MEDICAL SOCIETY

The following are the two greatest defects in public-health administration to-day:

1. The failure to more than scratch the surface in the most important field of public health, viz, the hygiene of the preschool child.
2. The lack of properly organized local health units to apply, locally, the policies of the State health department.

Adequate supervision of the preschool child in any considerable percentage of the total children can be secured only by the activity of the individual practicing physician.

Laudable efforts are made through parent-teacher associations, baby welfare stations, and public-health nurses, but the percentage of children reached is small. We must have a healthy public opinion demanding examination of the preschool child, with a county medical society establishing facilities to aid the practicing physician in responding to this demand.

In order to get for the preschool child early diagnosis, preventive advice and treatment, and correction of defects, we are compelled to focus as our primary objective upon the greatest problem confronting the medical profession to-day, viz: "How can adequate medical, surgical, and preventive advice and treatment be made available, within easy reach of all citizens, at a cost within their ability to pay?"

The layman has been educated and now knows that diseases can be prevented or their hazard minimized by early diagnosis and treatment. The average citizen, for financial reasons, does not consult a doctor until he is definitely ill, and very often postpones calling the doctor until he is confined to bed. It is not the cost itself, but the lack of definite knowledge of what that cost may be. More important still, in smaller cities and towns there is an absolute lack of clinics and out-patient departments. Many careless statements and inaccurate generalizations are made in regard to the cost of medical care. In the larger cities clinics and out-patient departments have developed independently of the medical society as a unit. For this reason the trite statement is often heard that the poor in large cities and the rich anywhere can secure the best medical service, but that for the intervening classes such treatment is not available.

The cost of the best medical care, where available, is worth what is paid for it. The cost has not increased in greater proportion than the cost of other services; but medical and surgical diagnostic and treatment facilities have been elaborated to include many new procedures, worth their cost, which were not included years ago. The greatest problem is not the cost but the absence of facilities for modern diagnosis and treatment at a definite known cost.

It is the collective obligation of the organized medical profession to solve this great problem. The American Medical Association has recognized this collective obligation, and every county medical society is urged to accept its problem and discharge its obligation. In the large cities the problem is complicated by group clinics, industrial clinics, and other installations outside the control of the medical society. In the smaller cities the situation is less complex and the solution less difficult. Difficult or easy, the solution should come from the medical society. The demand for these services is based upon sound public opinion and must be satisfied by some agency. Protracted delay in grappling with this problem, seizing the initiative, and establishing such facilities can result only in makeshift clinics established by institutions and agencies independent of the organized profession or by quacks and charlatans. The installation of pay clinics by the medical society, or with the seal of its approval, gives the individual citizen valuable aid in avoiding the so-called clinic of the quack and charlatan.

The pay clinic either with a fixed rate or a sliding scale is a response to the demand of public opinion. The organized medical profession has been reluctant to take any steps to respond to the demand. Such clinics have been established by individuals or groups of doctors, in connection with hospitals or medical colleges, or by endowments or foundations. Unfortunately, this insistent public demand has been capitalized by quacks and fakers who often establish clinics with elaborate and very impressive equipment.

The development of facilities for early diagnosis and early treatment by the organized medical profession at a known cost is, frankly, socialization of the practice of medicine. Such socialization is inevitable. It rests with the profession whether it shall seize the initiative and satisfy this demand or stand passively by and be compelled to submit to the process while it is carried out by outsiders.

State medicine may not come as a result of inactivity of the organized profession, though it is always a menace; but a gradual evolution, a haphazard growth in which the organized profession is inactive and inarticulate, will produce a chaotic condition which may be even worse than State medicine.

The county medical societies must provide out-patient departments or clinics where examination, early diagnosis, and treatment of ambulatory cases can be made. Usually there is a small hospital which can be equipped and expanded for this purpose. It should be organized on a business basis, dividing the clientele into the following classes:

1. Indigents, to be paid for by the county.
2. Those unable to pay full fees, but who can pay something, according to income.
3. Those able to pay full fees.

A county medical society which organizes for public-health work by establishing facilities for early diagnosis and treatment and by fostering a full-time county health unit, will be rendering its greatest contribution to public service. Without active participation by the local medical society as a unit, county health work is extremely difficult and generally a failure.

Enthusiastic workers who are poor waiters often attempt county public-health organization without this active participation by the county medical society. Such efforts are doomed to failure. You can not build successfully and permanently in advance of public opinion, and the most important factor in public opinion in public-health progress is the collective dictum of the medical society. If this active participation of the county medical society can not be secured, then attempts to organize in that county should be deferred until public opinion brings about the desired change of attitude. No public-health work should be initiated in any county except through the direct approval and action of the medical society as a unit.

These facts bring to the State medical society tremendous responsibilities and duties. It is through the initiative of the State society that these activities of the county medical societies will be begun and carried to fulfillment.

In accepting the solution of this great problem as its collective obligation, the State medical society pledges itself to stimulate and assist the county medical societies in discharging this obligation as rapidly as the local units are able to establish these facilities.

It is not sufficient to have the best, most modern equipment and technical skill, in one or two large centers in a State. It becomes the duty of the State medical society to arrange for the distribution of such equipment and technical skill by decentralization, by the establishment in county seats of such facilities where they are available and within easy reach of every citizen.

The fact that the problem is difficult and calls for executive ability, statesmanship, and energetic, collective action, does not alter the fact that it is the problem of the State medical society. It is not expected that the State medical society can achieve the ideal immediately, but many county medical societies are ready now; and following the example of these, within 10 years every county in the State could be so organized.

Incidentally, the improvement in facilities for practice in county seats would tend to solve another of the pressing problems, namely, the poor distribution of new graduates. The graduate of a modern, "class A" medical school to-day is accustomed to use the latest technique, methods and equipment for early diagnosis and treatment. He knows he will not find facilities for such practice in the small towns. He therefore avoids the county towns and crowds the large cities. If the practice of medicine could be made attractive in county towns by the establishment of modern facilities for early diagnosis and treatment by the county medical society, the young graduate would be very glad to practice in such towns.

I have conferred with the officers and leaders of the State medical society, with many local doctors in counties, and with the other leaders of medical thought in Iowa, and I have not encountered a single person who has not been sympathetic to the suggested policy of the organized medical profession.

With this assurance, the Iowa State Medical Society is going to be asked to make a formal declaration of policy, accepting this great problem as their collective obligation and pledging themselves to bring about the desired activity of county medical societies as rapidly and as thoroughly as possible.

STATE EDUCATIONAL AUTHORITIES

Chief among the State educational authorities which include public-health activities in their work are the following:

1. The State university at Iowa City.
2. The State college at Ames.
3. The State teachers college at Cedar Falls.

The public-health activities of the State university at Iowa City may be considered a part of its legitimate function of education. In no instance, in so far as I could determine, is there any activity which does not belong in the category of public-health education. These activities should not only be continued but should be expanded far beyond their present possibilities, which are limited by inadequate appropriations.

The college of medicine receives appropriations which enable it to do the laboratory work, and bacteriological, serological, and water analyses for the State department of health. This arrangement should continue, for reasons of economy and lack of housing facilities, in the State department of health. This item will be further discussed in Section II.

The line of demarcation between the fields of activity of the university and the State department of health in maternal and child hygiene is clear. The work of the State department of health is administrative as befits the authority charged by law with the prevention of disease and the promotion and conservation of health. The work of the university is educational solely.

The following agreement was drawn up and signed by the commissioner of health, the dean of the medical school and the director of the extension division:

Inasmuch as there has been much discussion during the past two years in regard to overlapping and duplication in the departments concerned, the following proposed basis of relationship between the State university of Iowa and the State department of health has been formulated to clarify their distinctive and common spheres of activities in maternal and child hygiene.

FUNCTIONS OF THE STATE UNIVERSITY OF IOWA IN RELATION TO MATERNAL AND CHILD HYGIENE

1. Direct instruction of students of medicine, dentistry, nursing, welfare work, and education. Intramural instruction.
2. Indirect educational program for physicians, nurses, dentists, and welfare workers through extramural instruction.
3. Studies in all fields of health and disease relating to children and mothers, research, contributions to knowledge, investigative work; for example, the work of the child welfare research station.

FUNCTIONS OF THE STATE DEPARTMENT OF HEALTH IN RELATION TO MATERNAL AND INFANT HYGIENE

1. Control of communicable diseases.
2. Registration of births.
3. Organization and guidance of local units for administrative enterprises; for example:
    A. Promotion of plans to have every child receive periodic examination.
    B. Promotion of plans to insure a sanitary supply of milk.
4. Sanitary laws—inspection and enforcement.
5. Immunization against diseases.

COMMON FIELDS OF ACTIVITY OF THE STATE UNIVERSITY OF IOWA AND THE STATE DEPARTMENT OF HEALTH, PREFERABLY TO BE COORDINATED AND COOPERATIVE

1. Publications.
2. Health education of a popular character covering the field of maternal and child welfare.

This agreement outlines fairly and clearly the limits of each field.

Splendid work is now being done by giving courses to doctors in obstetrics and pediatrics. The course consists of lectures. No clinics are held, and the work is purely in the nature of postgraduate instruction. These courses are extremely valuable in maternity and infant hygiene, and the appropriation to the university for such work should be increased.

A very fine piece of public health educational work is being done under the dean of the dental school. The bureau of dental hygiene gave 310 talks to an aggregate audience of over 17,000—dentists, teachers, nurses, pupils, and parents—and visited 220 communities. This is very effective public-health education. It should be continued and expanded to larger proportions.

Very valuable research work is being done in child development and parent education, and summer courses are given by the extension division. The research station was established in 1917 and is the coordinating center for such work at the three State institutions, the State University, the Iowa State College, and the State teachers college. Nutrition, mental hygiene, and other phases of this work are of great interest to the State health department. There are other educational activities, legitimate functions of the extension division, of keen interest to the health department. For these reasons some means must be devised for keeping the department of health in touch with these phases of public health education work.

Medical colleges have one tremendously important duty and function in relation to public-health administration. It is the establishment of an adequate and more effective system of teaching preventive medicine and hygiene to the undergraduate medical students. The present practice varies in different colleges. Most schools have either a professor of preventive medicine or some one delegated to give lectures on this subject. In regard to adequacy and effectiveness, the major defect is a lack of practical demonstration. Teaching consists of didactic lectures, the material for which is found in any textbook on hygiene. What is needed is a close affiliation with a health department, where the student can see preventive medicine in actual practice. The student will remember much from actual demonstrations, but lectures alone are often ideal soporifics, in view of the fact that they produce sleep and have little after effect.

The desirability and need for this more adequate teaching of preventive medicine is obvious for many reasons. It is essential in his own interest that the student be adjusted to the change of accent in the practice of medicine from curative to preventive; but there are two very definite reasons why the public-health administrator desires this improvement in teaching:

1. There will be graduated to enter practice a body of young doctors who will understand the objectives and efforts of the health officer and will therefore be sympathetic and helpful.

2. Health officers at present are recruited from the practicing medical profession by political appointment. Their only knowledge of preventive medicine upon their first appointment is the instruction they have received in medical college. This has either been entirely neglected or consisted of a few lectures with no actual demonstration of public-health work. These men have to learn something entirely new, and in the process of learning will make many costly mistakes.

Some years ago it was hoped that postgraduate schools of public health would cover the need of trained health officers. This dream has not been realized. Our new appointees are not postgraduates in public health; they are ordinary practicing physicians, and appointees will continue to be such under our political system of government. Their training must come from actual experience in a health department or by short courses, and this is greatly facilitated by having a foundation acquired by an adequate undergraduate course in preventive medicine.

Just as the State department of health is vitally interested in the teaching of preventive medicine to the undergraduate medical students, the dean of the medical college is especially desirous of having the course in preventive medicine and hygiene made practical by demonstrations of applied preventive medicine as practiced by health departments. For this reason a model county health department should be established in Johnson County so that its work can be used for demonstration purposes in teaching preventive medicine to students.

The model health department in Johnson County is also necessary for postgraduate instruction for health officers and nurses, in summer courses, and during the regular school year.

The dean of the college of medicine is keenly interested in the problem of unequal distribution of doctors. He therefore is also interested in the wider distribution of high-grade medical service, by establishing centers with modern facilities and equipment in county seats. He can assist in this decentralization and, by making the small town more attractive for modern practice, secure a better distribution of the young graduates.

The dean of the medical college can, by means of public-health education activities of the university, assist in educating the public to demand early diagnosis and preventive and corrective treatment from the physicians for children from 1 to 6 years old. He can also render tremendous service by undergraduate and postgraduate instruction in preparing the doctors to respond to that demand.

The Iowa State College of Agriculture and Mechanic Arts is doing public-health work in several fields. This work in no way conflicts with, but on the contrary is very helpful to, the State department of health. Work in connection with production of milk, tuberculosis of cattle, undulant fever, examination and research in industrial wastes, and other fields should be continued and expanded by larger appropriations. Some means can be devised for correlating this work with the general public-health work of the State without disturbing its location or curtailing its activity.

State teachers colleges and normal schools have a wonderful opportunity for real service by more adequately teaching child hygiene to teachers. The lack of training in the practical application of child hygiene methods is a real handicap to public-health work in the schools. The need is most apparent in teachers of the first to the sixth grades and in the schools of the small city or county. In these situations it is not uncommon for one public-health nurse to be carrying an overload of 8,000 pupils. If the teachers are trained, they understand and are helpful; and in spite of the overload a creditable result is often obtained. The teacher is a very intelligent possibility in public health. She teaches hygiene and health habits and observes the children through the entire school day. Her training in hygiene is, therefore, one of the vital essentials in the health of the school child. Presidents of teachers' colleges have made very creditable efforts in many States to give good courses in health education. They have good textbooks and excellent instruction of a didactic type. With one or two exceptions, the same defect occurs which was charged to the teaching of preventive medicine in medical colleges, viz, too little practical demonstration of applied child hygiene. To correct this defect it is necessary to have a doctor and nurse trained in child hygiene on the faculty, and to have an arrangement with the city or town in which the college is located by which the city schools are used by the doctor and nurse to demonstrate to the students, in groups, the practical work of child hygiene.

The State teachers college at Cedar Falls is fortunate in its president, Professor Latham, who is thoroughly alive to the importance of adequate teaching of child hygiene to teachers. He is anxious that this teaching be made as practicable as possible, and to this end the State health department should organize Blackhawk County with a model county health department. This model health department could then be used for practical demonstration purposes to make the teaching of applied child hygiene to teachers more effective.

THE UNOFFICIAL HEALTH AGENCIES

The origin of unofficial voluntary health agencies and their development into great public health machines was due to two things: First, the restriction of official health work to an attempt to control communicable disease by police power alone; and, second, the demand of public opinion, based upon new medical knowledge, that new methods be tried, methods independent of police power and based largely upon education. The impatient desire to expand public-health work to include all diseases and to attack the communicable diseases directly by education of the individual citizens was a response to the seeming unwillingness of official health departments to expand and utilize other methods than those based on police power. The health officers were not unwilling to expand, but it was impossible to secure funds from official sources for untried methods, the efficiency of which had yet to be demonstrated.

The greatest contribution of the unofficial voluntary agencies was the demonstration in the first decade of this century that educational methods were effective in the prevention of disease and the reduction of death rates and that such methods were legitimate weapons for the use of official health departments. Thus, as pioneers, voluntary health agencies have been of great help to official health departments in demonstrating the value of new procedures and in financing these demonstrations when funds for such purposes could not be secured by the official health department.

These two separate movements advancing side by side, the expansion of official health departments and the development of voluntary health agencies, were bound to conflict, and at first there was misunderstanding, distrust, and antagonism. In the second decade much of this conflict had disappeared; and in the last decade the policy of unofficial health agencies in their relation to health departments has been so clearly defined, understood, and accepted that there is to-day no reason for conflict. This clarification of policy was brought about by conferences of health officials with the heads of the great national unofficial health agencies. It is now clearly understood that an unofficial health agency is an auxiliary of the duly constituted health authorities, with freedom of action in untilled fields, and the obligation to turn over to the health department any legitimate public-health activity whenever the health department can secure the funds to carry on the work. The voluntary health agency has another obligation; it is that when the health officer has a comprehensive program of public-health activity it shall accept and agree to carry out such parts of that program as are within its power. And so to-day the proper utilization of the voluntary public-health agencies depends upon the health officer himself. They increase the total budget for public health far beyond the amount which the health officer can secure by official appropriations.

The Iowa Tuberculosis Association has a record of splendid achievement in public-health work in Iowa. It has, with its local units, a budget of about $125,000 annually. Because of the lack of funds and the consequent lack of personnel in the State health department, the Iowa Tuberculosis Society has had to carry, single-handed, a very heavy load. It has been active in chest clinics in conjunction with county medical societies and in assisting the bureau of dental hygiene of the University of Iowa and the oral hygiene committee of the State Dental Society in oral hygiene. It has furnished the services of Miss Countryman to the State department of health to supervise public-health nursing in the State and has been active in very effective popular public-health education.

The work of the organization would be even more valuable and effective if there were a better development of the State department of health in child hygiene and if more full-time county health units could be installed. This splendid organization does not receive from the seal sale the total which it should. With better organization in the State and county health departments, and with more active participation by the medical societies, the receipts from the seal sale could be doubled.

This, like similar organizations, should not and does not receive any money from the State legislature, but all official agencies and the organized medical profession should give their hearty support and indorsement so that the receipts from seal sales might be brought up to at least $250,000.

The Iowa Heart Association is financed by Christmas seal funds and the Iowa Tuberculosis Association rendered great assistance to the heart association in holding clinics, distributing literature, and other public health education work in heart disease.

NECESSITY FOR A PUBLIC-HEALTH ADVISORY COUNCIL

In the foregoing pages the principal agencies outside the health department which are doing or should be doing health work have been considered. How can the work of these various agencies be included in a general program and coordinated with the work of the official State health department?

Public health in its broad modern sense includes not only the activities of the State department of health, but the activities of these other official and unofficial agencies as well. One of the most effective ways of incorporating these activities in a comprehensive state-wide program of public health is to give them representation in some form of joint council, committee, or board.

State boards of health could be used to afford representation to these other agencies, but as a matter of fact are seldom so used.

In two States, Alabama and South Carolina, the State medical society is in effect the State board of health and so functions by means of a committee. Eleven States require all member of the board of health to be physicians, and 21 other States specify that a certain number of the board members must be physicians.

Massachusetts, New York, Connecticut, Ohio, Maine, and West Virginia have a public-health council, which functions chiefly as an advisory body to the commissioner of health, who is the executive head of the department. Even in the States where the executive power is vested in the board, it is the modern custom to delegate this power to the commissioner or State health officer, the board acting as an advisory council on matters of law, regulation, and policy.

With these facts in mind it is fair to assume that members of a State board of health should be appointed and hold their office by virtue of their ability to contribute technical or scientific advice or because they could coordinate with the work of the board activities of organizations which they represent.

The presence of physicians on the board partially carries out this idea, provided they are carefully selected for their qualifications or that they represent the organized profession.

The composition of the Iowa State Board of Health does not secure the desired result indicated above in either particular. The governor, the secretary of state, the treasurer of the State, the auditor of the State, and the secretary of agriculture are members ex officio. These are busy officials with neither the time nor the technical training necessary to make them useful on a board of health.

There are five members appointed by the governor, all doctors, not more than one from each congressional district. These may or may not be able to contribute advice on preventive medicine or public-health administration, depending on the care with which they are selected.

The responsibility for the health of all the people is placed by law on the State board of health and its executive, the commissioner of health. It is the commissioner's primary duty to formulate a comprehensive plan of public health for the State which will include activities now carried on by other departments of the State government, by the organized medical profession, and by unofficial voluntary agencies.

It is obvious, therefore, that in formulating such a plan and carrying it out, the commissioner would be greatly assisted by having the executives or authorized representatives of these other departments or agencies as members of his board, or of a public-health council.

Legislation can be enacted which would change the composition of the State board of health by providing for representation upon that board of the agencies doing public-health work. Pending such legislation, the governor should appoint a special public health advisory council for the purpose of coordinating all State public health activities in one comprehensive plan. This council should consist of the following, designated by the governor:

1-5. Five members of the Iowa State Medical Association. (To be designated by the board of trustees of the State medical society.)
6. Chairman, oral hygiene committee, State dental society.
7. Dean of college of medicine, University of Iowa.
8. Professor, hygiene and preventive medicine, University of Iowa.
9. State superintendent of public instruction.
10. The president, Iowa State Teachers College.
11. Professor of hygiene, Iowa State College of Agriculture.
12. President, State veterinary society.
13. President, Iowa State Tuberculosis Association.
14. Director, extension division, University of Iowa.
15. Director, extension division, Iowa State College of Agriculture.

It should be understood that the commissioner of health should be a member of this council, and should preside over its meetings as chairman of the council.

Section II.—Internal Organization of the Department

The department of health will be considered as it now functions, then will be taken up the divisions it should have, and finally the minimum of a well-balanced department, organized into divisions, will be presented in budget form.

With the exception of a public-health engineering division, which is separated from the rest of the department, being housed on the fourth floor of the State capitol, and the State laboratories at Iowa City, all the miscellaneous activities of the State board of health are inextricably crowded together in an old frame dwelling house on the margin of the capitol grounds. That results of any value were secured was a tribute to the ability, amounting almost to genius, of the late commissioner, Dr. Henry Albert. Not only is expansion impossible in these quarters, but valuable records are in danger in what is a veritable fire trap. Therefore it is essential that proper quarters be provided at the earliest possible moment.

Plans have been made for a new State office building in which adequate quarters for the department of health are provided. This building is only in the blue-print stage and may not be available for four or five years. In the meantime, the need for adequate quarters is so urgent that the board of control should rent and furnish to the department, quarters in some office building pending construction of the new State office building.

Within the past year a beginning was made in developing a division of communicable diseases by the employment of an epidemiologist.

The mixture of heterogeneous activities connected with licensing the so-called professions adds to the confusion in the cramped space of what is really a general office. Of these licensing activities the Iowa Health Department is burdened with the most diversified list.

The list includes the following:

1. Medicine and surgery.
2. Dentistry and dental hygiene.
3. Nursing.
4. Pediatry.
5. Osteopathy.
6. Osteopathy and surgery.
7. Chiropractic.
8. Optometry.
9. Cosmetology.
10. Embalming.

The fees for these various licenses more than pay the cost to the State, but fees go into the general treasury and are not held by the department of health. Consequently a registrar at $2,400, a stenographer at $1,200, and two part-time clerks are paid out of health department appropriations when their time is given to licensing work. This work is only indirectly connected with health, and at some time in the future it will be transferred to a special division created for the purpose. At present it is a confusing factor and takes up considerable time of the commissioner.

Another activity added to the department by act of legislature is really supervision of nursing education. It is in no sense a public-health activity, but allots $3,000 salary to a nurse who visits and recommends classification of nurses training schools and other work in raising standards of nursing education.

The following is the budget appropriated for the department for the fiscal year ended June 30, 1930. It is divided roughly into three divisions—administration, communicable diseases, and public-health engineering.

DIVISION OF ADMINISTRATION

Director (commissioner of health)	$5,000
Chief clerk	2,000
Secretary to commissioner	1,500
Registrar of licensure	2,400
1 bookkeeper	1,200
2 stenographers	2,400
2 clerks, part time	800
1 nursing education supervisor	3,000
1 lecturer	3,600
1 assistant registrar of vital statistics	2,000
3 clerks at $1,200	3,600
Travel	2,500
Travel lecturer	1,500
	31,500

DIVISION OF COMMUNICABLE DISEASES

Director (deputy commissioner)	$4,000
1 epidemiologist	3,600
1 morbidity clerk	1,500
1 stenographer	1,200
1 antitoxin clerk	1,200
1 janitor clerk	1,200
1 part-time public health nurse, tuberculosis	2,000
Travel epidemiologist	1,800
Tuberculosis—travel per diem, tuberculosis consultants for clinics and printing	2,000
Contingent fund	4,000
Biologics	5,000
	27,500

DIVISION OF PUBLIC HEALTH ENGINEERING

Director	$3,600
1 assistant engineer	2,100
1 assistant engineer	2,000
1 junior engineer	1,800
1 chemist	2,400
1 stenographer	1,200
2 part-time inspectors	900
Travel	6,000
Laboratory equipment	1,000
Stream pollution equipment	$625
Motor transport	900
	22,525

SUMMARY

Division of administration	31,500
Division of communicable diseases	27,500
Division of public health engineering	22,525
Total	81,525

In considering the total budget appropriated for the health department for health work, it is fair to deduct from that total the following:

Registrar for licenses and clerical	$4,400
Salary nursing education supervisor	3,000
	7,400

Therefore, if we deduct $7,400 from $81,525, it leaves as the real appropriation for public-health work in Iowa the meager sum of $74,125.

In 1925 the per capita appropriation by State legislatures for health departments was 15 cents or more in six States—Delaware, Florida, Maryland, North Carolina, Massachusetts, and Rhode Island; it was 5 cents or more per capita in 38 States; in 10 States, the appropriation was less than 5 cents per capita, and Iowa was at the bottom of the list with only 2.4 cents per capita. The average for the 48 States was 9 cents. An increase in Iowa to 5 cents per capita should therefore be a very reasonable suggestion. This would give an annual appropriation of $125,000.

I shall use this modest, reasonable sum as a basis for the minimum total appropriation and consider a budget of this total divided into the necessary divisions in proportion to their importance and the dividends that may be expected from such expenditures in life saving, disease prevention, and health promotion.

I deem it wise to request the minimum of 5 cents per capita instead of the larger sum which Iowa should appropriate, because any reasonable legislature, in the face of the figures, would be inclined to grant this sum at the first request. After reorganization is effected and results are apparent, larger appropriations more nearly approaching the average in other States will follow. The present appropriation has been raised slightly from 2.4 cents in 1925 to almost 3 cents in 1930, and so the increase to 5 cents suggested is a very small sum for a purpose of such paramount importance as health.

DIVISION OF ADMINISTRATION

In the central office of most State health departments there is placed the clerical work incident to the administration of the department. This activity has to do with records and files, personnel and accounts, purchasing, etc. It is usually classed as a bureau or division of administration, although various other titles are used. In some States certain functions ordinarily discharged by special divisions are carried on in the division of administration. In 22 States, including Iowa, all department activities in public-health education are placed in this division. In departments not completely organized, new activities are often carried in this division until they grow sufficiently to warrant creation of a special division.

The amount of money spent and the percentage of the total department budget, therefore, varies greatly in the States. In the large, well organized departments, a smaller percentage of the total appropriation is spent for administration than in the States incompletely organized.

Probably not more than 15 per cent of the total should be spent for administration. Well organized States such as Massachusetts, Ohio, Alabama, and Maryland, spend less than 10 per cent for administration, while incompletely organized States such as Wyoming, Vermont, Maine, Arizona, and Iowa spend more than 40 per cent of the total appropriation for administration. This is because the total appropriation is low and, as indicated above, many activities are carried in this division which are charged to special divisions in other States.

On a per capita basis Iowa spends less for health than any other State in the Union. With increased total appropriation and better organization by forming the necessary new divisions, Iowa, instead of spending 40 per cent of the total, would allot probably less than 15 per cent for administration.

The division of administration will probably for some years be obliged to carry activities which have not developed sufficiently to warrant a special division. Such public health education activities as the department is able to undertake will have to be handled by the commissioner in his general office. He can have a committee of the proposed public health council to advise with him and correlate other public health education work with his. This committee should include:

The superintendent of public instruction.
The dean of the college of medicine, University of Iowa.
The director, extension division, University of Iowa.
The director, extension division, Iowa State College (Ames).
The executive secretary, Iowa Tuberculosis Association.
The president State teachers college, Cedar Falls.

The collective amount of public health education by organizations represented by the above committee is enormous. If the commissioner can coordinate and encourage expansion of this educational work on sound lines, he will achieve much more than he can by attempting to secure large sums for public-health education.

DIVISION OF VITAL STATISTICS

While the personnel engaged in vital statistics is small, it is a clean-cut unit and should be made an independent division with more space and one additional clerk.

DIVISION OF COMMUNICABLE DISEASES

Control of communicable diseases is the oldest activity of health departments. The first boards of health were created for the purpose of preventing and suppressing epidemics.

Advances in knowledge of epidemiology and preventive medicine have made possible standardization of procedure and method so that control of these diseases in the States more advanced in public health work has become a matter of routine. Maternity and child hygiene and other newer and less developed activities have assumed greater importance and urgency with most administrators, although the control of communicable diseases is far from satisfactory and still a major problem in all departments.

Twenty-five States have well organized divisions with one or more full-time epidemiologists employed. In 12 States there is no special activity other than such part of his time as the State health officer can give. Iowa was in the latter class until this year, when a full-time epidemiologist was employed.

A department properly organized, with a proper sense of proportion and a reasonable amount of total appropriation, would probably allot not more than 10 per cent of this total to communicable-disease control. Before the development of child and maternity hygiene and county full-time health departments, there was a tendency to overemphasize communicable diseases. A keener sense of values now prevails and larger sums are now allotted to maternity and child hygiene, county health organization, and other activities which promise greater dividends in health promotion and disease prevention.

In a small, growing department, venereal diseases and tuberculosis are best handled in the communicable-disease division. Even in the larger, more highly developed States, the trend is toward reducing these activities from division rank to sections in the communicable-disease division. In Iowa these activities, tuberculosis and venereal diseases, can be handled effectively by one full-time man, either the director of the division of communicable diseases or an epidemiologist subordinate to him.

DIVISION OF LABORATORIES

The laboratory situation is somewhat complicated because the laboratories are housed in the college of medicine at Iowa City and appropriations for their maintenance are made direct to the university.

They consist of three units, each well equipped and with adequate trained personnel. To duplicate these three units, bacteriological, serological, and water-sewage laboratories would be folly at this time. The personnel alone would cost over $25,000 per year, supplies and equipment $6,000 more, so that over $30,000 would be necessary for running expenses, without considering the cost of rented quarters and installation of equipment similar to that which now exists at the university.

A schedule of salaries and current expenses to do the work of the department now done by the university would be as follows:

Director	$5,000
1 chief bacteriologist	2,700
1 assistant bacteriologist	1,800
1 assistant serologist	1,320
1 media technician	1,620
1 technician bacteriologist	1,200
2 technicians at $960	1,920
2 water analysts	3,280
3 attendants	2,880
3 stenographers and clerks	3,000
Total salaries	24,720
Supplies and equipment	6,000
Total	30,720

To carry this work the university receives an appropriation of $14,550 for the bacteriological laboratory and $17,250 for hygiene and preventive medicine. It uses all of the bacteriological laboratory appropriation and a considerable part of the hygiene and preventive medicine appropriation to perform this work. A fee of 50 cents for each Wassermann examination enables them to avoid a deficit. Fees are also charged for water examinations, but these go directly into the State treasury. This arrangement should be continued until proper quarters to house the entire department of health are available in the proposed new State office building. It should be understood that this is a temporary arrangement, that these laboratories are an integral part of the department of health, and that they should be transferred to the department of health when that department is ready for them.

This arrangement should be continued temporarily for reasons of economy and expediency. There are certain disadvantages which can be partially obviated. The professor of preventive medicine and hygiene of the college of medicine should be appointed, with the consent of the university, as director of the laboratory division of the State department of health. He would then be an official of the department and could ensure prompt service and reports to the department. A part of his salary, at least one-half, should be paid by the department of health as soon as funds are available.

The system of collecting fees is bad in principle and does not work well in practice. As soon as additional funds are available, all fees should be abolished and only free service rendered.

DIVISION OF PUBLIC-HEALTH ENGINEERING

This division is now well organized and is doing creditable work as a smooth-running unit. Its budget now is $22,500. The director and his first assistant are underpaid. A large amount of work is done under the State stream pollution laws. It would be wise policy to separate to some extent the stream-pollution work, which directly affects public health, from that which is done to protect fish life, or for esthetic reasons, and the energies of the division should first be concentrated upon its primary objective, the prevention of disease. It is good policy and saves money for the State to have the engineers do work for other departments of the State government. It avoids the cost of setting up duplicating machinery; but this work must be secondary to the primary disease-prevention function and should be financed from other funds than those appropriated for public health.

It would seem advisable to have a stream-pollution board created by act of legislature, consisting of the commissioner of health, the conservation of fish and game commissioner, and other officials directly interested in phases of stream pollution other than health. This board could apply the law in such cases, leaving executive action in cases affecting health in the hands of the commissioner of health. Such a board could also secure the financing, from funds other than those of the health department, of projects not affecting the public health.

In so far as possible, milk-control work should be initiated and when funds are available, a system of inspection of pasteurizing plants put in effect. Milk production activities are now exercised by the dairy and food division, department of agriculture. The supervision of milk production on the farm belongs to the department of agriculture; but in marketing milk to the consumer, the disease menace is the concern of the health authorities. Milk epidemics have occurred and in some instances from milk alleged to have been pasteurized.

In the correction of faulty design of plans or careless operation, the engineering division has a useful function.

DIVISION OF CHILD HYGIENE

The greatest possibilities for prevention of disease and the promotion and conservation of health lie in the division of child hygiene. This division should be the most important division in any health department. Forty-two States have child hygiene divisions in their health departments. Iowa, with five other States, has no child hygiene division in the health department. Because of this lack, Federal funds under the Sheppard-Towner Act were matched with funds of the University of Iowa. The work done by the university medical school was largely educational and covered maternity and infancy only. Federal aid has been discontinued and a new start must be made by creating a division of child hygiene in the department of health.

In order to avoid too many divisions, public health nursing, as in many other States, should be a section in the child hygiene division. There are over 200 public health nurses in Iowa. Their supervision by a central authority is essential to obtain the best uniform practice. The department of health has been unable to furnish this leadership and supervision. The Iowa Tuberculosis Association has been doing this work for the department and has even loaned a very competent nurse part time to the department to exercise this supervision.

This supervision is an official function and can be exercised by any unofficial body only temporarily. A competent nurse should be placed on full-time duty in the child hygiene division of the health department to act as an assistant director of child hygiene and State supervisor of public health nurses.

DIVISION OF COUNTY HEALTH WORK

With the responsibility for the health of the State as a whole, it becomes a matter of vital importance to the State health department as to what type of organization exists and what shall be the local unit of organization. In the New England States the local unit is the town or township. This unit of government was a necessity in the days of bad roads and difficult communication. Where every township has a board of health, it means that these boards are merely nominal and function only where State personnel is in almost daily contact with them. In small States with good roads a system of State district health officers with liberal use of other State personnel makes the best of a bad situation for public health resultant from using the township as a unit.

The county is the logical unit of government in most States of any size, and the trend toward organization of county health boards with full-time health officers is very decided. The county health board is almost as bad as the township board if the county health officer is not a full-time official.

Experience has proved that the best type of organization in a State such as Iowa is to organize and develop county health departments with a full-time county health officer in charge. In 1915 there were only a dozen county health departments organized on such a basis, while to-day there are over 500 full-time county health officers operating.

It is much better to develop full-time county units even if the response is slow, than to build up a large State machine which would destroy local initiative for the sake of gaining a temporary advantage. Except in the New England States and in Illinois, Wisconsin, and one or two others the county is the only unit functioning on a statewide basis that has the power to levy and collect taxes and to make expenditures for public health.

The permissive county health law passed by the Iowa Legislature in 1929 now makes possible the organization of Iowa county health departments with a full-time county health officer in charge. This makes it necessary for the State department of health to have a division of county health work. No additional funds for health work can be secured before 1931, but an officer of the United States Public Health Service has been detailed for one year to assist the State in organizing full-time county health units. The greatest progress in Iowa's health history will be made in the next five years because of the possibilities of county health organization provided the legislature votes a modest sum for county health work.

PROPOSED HEALTH DEPARTMENT BUDGET FOR THE NEXT LEGISLATURE

ADMINISTRATION DIVISION

Commissioner	$5,000
Chief clerk	2,400
Secretary	1,500
Stenographer	1,200
Bookkeeper	1,200
Janitor clerk	1,200
Travel expense, general	3,000
Registrar of examinations	2,400
Stenographer	1,200
2 clerks, part-time	800
	21,100

VITAL STATISTICS DIVISION

Assistant registrar	$2,400
Stenographer	1,200
4 clerks, at $1,200	4,800
	8,400

LABORATORY DIVISION

Director, part salary	$3,500
	3,500

(All other salaries paid by the university.)

COMMUNICABLE DISEASE DIVISION

Director	$4,500
Epidemiologist	4,000
Morbidity clerk	1,500
1 stenographer	1,200
1 biologics clerk	1,200
1 janitor clerk	1,200
Travel epidemiologist	1,800
Tuberculosis	4,000
Contingent fund	4,000
Biologics	6,000
	29,400

PUBLIC-HEALTH ENGINEERING DIVISION

Chief engineer	$4,500
1 assistant engineer	3,000
1 assistant engineer	2,000
1 junior engineer	1,800
1 chemist	2,400
1 stenographer	1,200
2 part-time inspectors	900
Travel	6,000
Laboratory equipment	500
Motor transport	600
	22,900

CHILD HYGIENE DIVISION

Director	$4,500
Assistant director, supervisor of nurses	3,600
2 public-health nurses	4,800
1 stenographer	1,500
Travel	6,000
	19,800

COUNTY HEALTH WORK DIVISION

Director	$4,500
Assistant director	3,600
2 public-health nurses	4,800
1 stenographer	1,500
1 clerk	$1,200
Travel	6,000
	21,600

SUMMARY

Division of administration	$21,100
Division of vital statistics	8,400
Division of laboratories	3,500
Division of communicable diseases	29,400
Division of public health engineering	22,900
Division of child hygiene	19,800
Division county health work	21,600
Total budget	126,700

SUMMARY AND CONCLUSIONS

Briefly, the chief recommendations are four—two in Section I and two in Section II. There are many minor changes suggested, and matters of detail have purposely been omitted; these will be cared for automatically by establishing the four fundamental recommendations in Section I.

Section I—Outside agencies.—1. Formal declaration of policy by the State medical society accepting the following problem as their collective obligation and pledging themselves to bring about the desired activity of county medical societies as rapidly and as thoroughly as possible.

Problem: How can adequate medical, surgical and preventive advice and treatment be made available, within easy reach of all citizens, at a cost within their ability to pay?

2. The appointment of a special public health advisory council by the governor for the purpose of coordinating all public health activities in the State in one comprehensive public health plan.

Section II—Organization of the department.—1. The establishment of a division of child hygiene in the State department of health.

2. The establishment of a division of county health work in the State department of health.

The two chief recommendations following Section I will afford the sound foundation for a comprehensive joint plan, and the two recommendations following Section II will furnish the State department of health with the necessary machinery for carrying out such a plan in detail.

It has been the writer's guiding principle not to disturb activities already developed, by transfer to other departments, but to accept these developments as assets, leaving them in situ and devising means for their utilization by the creation of a special public health advisory council. This is consistent with the statement, made earlier, that it matters little by whom the work is done. The important thing is to have it well done by some agency. One of the common defects of State health departments is a lack of contact between the center

(State health department) and the periphery (local health units). This can be remedied in two ways:

1. By building up a big State machine, with liberal travel allowance to maintain frequent contact; and

2. By developing local units in strategic points and ultimately in every county which will maintain constant touch with the central body, the State department of health.

For reasons already explained, the first method, so far as Iowa is concerned, would be a great mistake. It would kill local initiative the very thing we must encourage and develop if we hope for permanent success.

The second method, development of full-time county health departments, is the only one that should be considered. There are many counties which are ready and anxious to begin such organization. I should not be surprised if seven or eight counties were so organized within a year. With such a beginning, showing examples of method and cost, other counties will follow rapidly, provided the organized medical profession justifies the faith reposed in them by energetically attacking their problem and actively participating in county health organization.

EXPERIMENTAL STUDIES OF WATER PURIFICATION

IV. Observations on the Effects of Certain Modifications in Coagulation-Sedimentation on the Bacterial Efficiency of Preliminary Water Treatment in Connection with Rapid Sand Filtration

By H. W. Streeter, *Sanitary Engineer, United States Public Health Service*

B. Observed Effect of Certain Modifications in the Conditions of Coagulation

The first section of this report [1] dealt with the results of a series of observations, made at the experimental water purification plant of the Public Health Service at Cincinnati, on the effects of the bacterial efficiency of coagulation-sedimentation produced by variations in the nominal period of sedimentation ranging from 3 to 12 hours. In the second section of the paper, here presented, it is proposed to describe some observations, made at the same experimental plant, of the effects on bacterial efficiency resulting from certain modifications in the conditions surrounding the coagulation process as ordinarily practiced in connection with rapid sand filtration. These observations will be discussed under the following three headings:

(1) The relative bacterial efficiencies of single-stage and double-stage coagulation.

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[1] See Public Health Reports, vol. 45, No. 27, July 4, 1930, pp. 1521-1536.

(2) Relative bacterial efficiencies observed coincidently with variations in the pH of the coagulation reaction.

(3) Relative bacterial efficiencies observed with varying amounts of coagulant added to the raw water.

RELATIVE BACTERIAL EFFICIENCIES OF SINGLE-STAGE AND DOUBLE-STAGE COAGULATION

In the purification of highly turbid river waters such as are found in the great Mississippi River Basin, the advantages of double-stage preliminary treatment of such waters prior to their filtration have been recognized for many years. As originally developed in the design of the Louisville and Cincinnati filtration plants, this kind of treatment consisted of a primary stage of plain sedimentation, in large basins providing two or three days of retention, followed by a secondary stage of coagulation-sedimentation in smaller basins of a few hours' capacity. The primary stage was intended mainly to serve as a means for removing the coarser suspended matter more readily capable of subsidence, thereby reducing the burden imposed on the coagulation process and incidentally effecting economies in the amounts of coagulants required.

More recently, at a number of plants originally equipped with primary plain sedimentation basins, coagulation has been added to this primary stage of treatment, thus providing two separate stages of coagulation-sedimentation in series with each other. The purpose of this modification has been mainly that of increasing the bacterial efficiency of filtration plants treating highly polluted raw waters, such as are found in some zones of the Ohio River and, secondarily, of aiding in the clarification of such waters during periods of high turbidity.

In order to observe simultaneously the relative efficiencies of single-stage and double-stage coagulation, as applied to the same raw water, and, in addition, to compare the results obtained from the single and double stage treatment under approximately parallel conditions with respect to sedimentation period and amount of coagulant added, a series of experiments, covering a period aggregating about eight weeks, was undertaken in the autumn of 1926.

In these experiments the same basin arrangement was used as in the Series A observations described in the preceding section of this report (see Table No. 1), the first stage of sedimentation having a nominal period of 3 hours and the second one of 6 hours, the total period for water passing through both stages being 9 hours. In all these tests approximately two-thirds of the total amount of coagulant added to the water was introduced prior to the first stage, and the remaining one-third was added between the first and second stages, this procedure being in line with current practice in double-stage coagulation.

The averages of the results of the experiments, divided, first, into two series, "A" and "B," according to the total amounts of coagulant added to the water, and further subdivided into three groups according to the numbers of raw-water bacteria occurring on different days, are given in Tables 4 and 5, the former being based on the 24-hour 37° C. agar counts and the latter on the *B. coli* index data. The

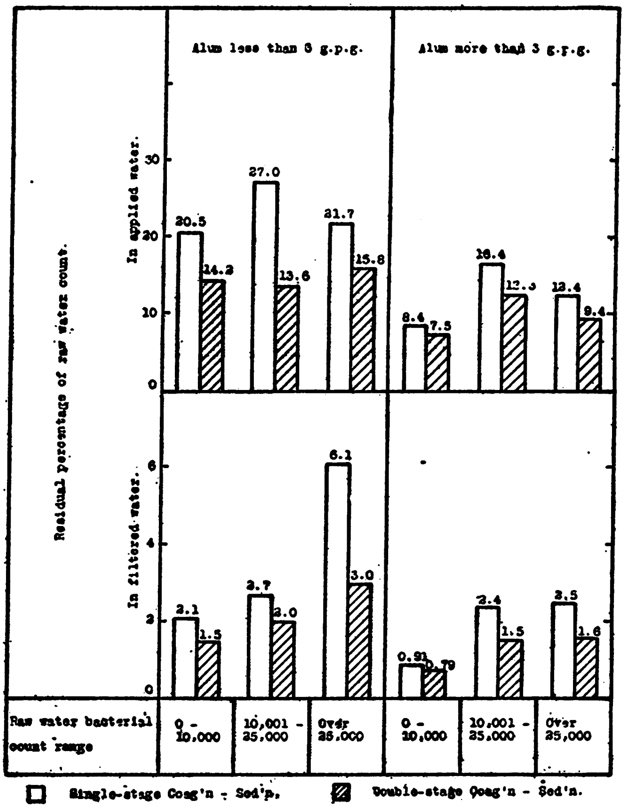

FIGURE 7.—Comparative residual percentages of raw-water bacterial counts (24 hours, 37° C.) observed in applied and filtered effluents, with single and double stage coagulation-sedimentation, respectively, corresponding to raw-water counts falling within specified ranges. (Plot of data given in Table 4)

comparative residual percentages of bacteria observed in the "applied" and "filtered" waters with single and double stage treatment, respectively, as given in these two tables, are illustrated graphically in Figures 7 and 8.

On referring to these tables and charts, it will be noted that, with two exceptions in the *B. coli* series, the indicated efficiency of removal, both of plate-growing bacteria and of *B. coli*, was consistently greater in the effluent of the second stage of treatment than in that of the first stage. This result would be expected, in view of the longer period of sedimentation to which water passing through the two stages was

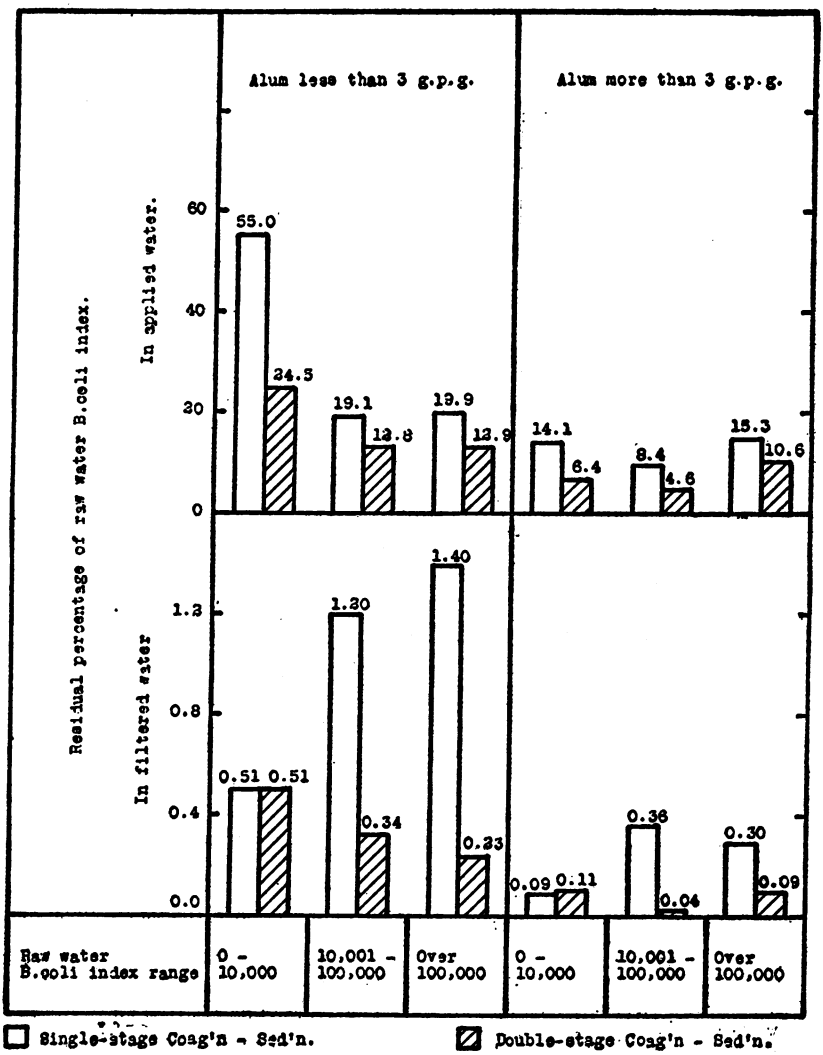

FIGURE 8.—Comparative residual percentages of raw-water *B. coli* observed in applied and filtered effluents, with single and double stage coagulation-sedimentation, respectively, corresponding to numbers or raw-water *B. coli* falling within specified ranges. (Plot of data given in Table 5)

subjected, together with the fact that before entering the second stage, it received an additional quantity of coagulant, amounting to about 50 per cent of that introduced initially.

TABLE 4.—*Comparative average bacterial counts, 24 hours, 37° C., in applied and filtered effluents, with single and double stage coagulation-sedimentation, respectively, corresponding to raw-water counts falling within specified ranges*

A. ALUM LESS THAN 3 G. P. G.

Raw-water count range	Stages of coagulation[1]	Alum, g. p. g.	Turbidity: Raw, p. p. m.	Turbidity: Applied: P. p. m.	Turbidity: Applied: Per cent of raw	Bacterial count, 24 hours, 37° C.: Per c. c.: Raw	Per c. c.: Applied	Per c. c.: Filtered	Per cent of raw: Applied	Per cent of raw: Filtered
0-10,000	S	2.1	190	15.0	7.9	7,060	1,450	150	20.5	2.1
	D	2.1	190	5.0	2.6	7,060	1,000	104	14.2	1.5
10,001-25,000	S	2.2	212	41.0	19.3	15,600	4,210	419	27.0	2.7
	D	2.2	212	16.0	7.5	15,600	2,120	316	13.6	2.0
Over 25,000	S	2.7	348	48.0	13.8	66,300	14,400	4,030	21.7	6.1
	D	2.7	348	19.0	5.5	66,300	10,500	1,990	15.8	3.0

B. ALUM GREATER THAN 3 G. P. G.

Raw-water count range	Stages of coagulation[1]	Alum, g. p. g.	Turbidity: Raw, p. p. m.	Turbidity: Applied: P. p. m.	Turbidity: Applied: Per cent of raw	Bacterial count, 24 hours, 37° C.: Per c. c.: Raw	Per c. c.: Applied	Per c. c.: Filtered	Per cent of raw: Applied	Per cent of raw: Filtered
0-10,000	S	3.8	331	8.0	2.4	7,340	616	67	8.4	0.91
	D	3.8	331	3.6	1.1	7,340	550	58	7.5	.79
10,001-25,000	S	3.7	270	7.0	2.6	13,900	2,280	336	16.4	2.4
	D	3.7	270	4.3	1.6	13,900	1,710	214	12.3	1.5
Over 25,000	S	4.0	226	9.0	4.0	48,400	6,020	1,220	12.4	2.5
	D	4.0	226	4.3	1.9	48,400	4,540	760	9.4	1.6

[1] S=Single-stage coagulation-sedimentation; D=double-stage coagulation-sedimentation.

TABLE 5.—*Comparative average B. coli indices in applied and filtered effluents and single and double coagulation-sedimentation, respectively, corresponding to raw-water indices falling within specified ranges*

A. ALUM LESS THAN 3 G. P. G.

Raw-water index range	Stages of coagulation (*)	Alum, g. p. g.	Turbidity: Raw, p. p. m.	Turbidity: Applied: P. p. m.	Turbidity: Applied: Per cent of raw	B. coli index: Per 100 c. c.: Raw	Per 100 c. c.: Applied	Per 100 c. c.: Filtered	Per cent of raw: Applied	Per cent of raw: Filtered
0-10,000	S	2.1	173	23.0	13.3	8,640	4,750	44	55.0	0.51
	D	2.1	173	6.0	3.5	8,640	2,120	44	24.5	.51
10,001-100,000	S	2.2	242	38.0	15.7	38,500	7,360	460	19.1	1.2
	D	2.2	242	15.0	6.2	38,500	4,940	132	12.8	.34
Over 100,000	S	2.6	331	42.0	12.7	1,880,000	374,000	26,400	19.9	1.4
	D	2.6	331	17.0	5.1	1,880,000	242,000	4,300	12.9	.23

B. ALUM GREATER THAN 3 G. P. G.

Raw-water index range	Stages of coagulation (*)	Alum, g. p. g.	Turbidity: Raw, p. p. m.	Turbidity: Applied: P. p. m.	Turbidity: Applied: Per cent of raw	B. coli index: Per 100 c. c.: Raw	Per 100 c. c.: Applied	Per 100 c. c.: Filtered	Per cent of raw: Applied	Per cent of raw: Filtered
0-10,000	S	3.6	287	9.0	3.1	8,650	1,220	7.6	14.1	0.09
	D	3.6	287	4.0	1.4	8,650	550	9.6	6.4	.11
10,001-100,000	S	3.8	337	6.5	1.9	42,100	3,540	150.0	8.4	.36
	D	3.8	337	3.7	1.1	42,100	1,930	16.0	4.6	.04
Over 100,000	S	4.0	226	8.7	3.8	336,000	51,400	1,020.0	15.3	.30
	D	4.0	226	4.3	1.9	336,000	35,600	310.0	10.6	.09

* S=Single-stage coagulation-sedimentation; D=double-stage coagulation-sedimentation.

In the foregoing connection, evidence as to whether administration of the coagulant on a "split feed" basis, as in the double-stage treatment, yielded higher bacterial efficiencies than did the addition of the total amount prior to the first stage, is afforded by a comparison of the figures given in Tables 4 and 5, with a coagulant dosage less than 3 grains per gallon, with corresponding results given in Tables 1 and 2, respectively, as derived from observations made with the same period of sedimentation (nine hours) and with approximately the same average numbers of bacteria in the raw water. Such a comparison is permissible, as all the conditions, including the average amounts of coagulant added, were approximately the same in the two series of observations, with the single exception of the method of applying the coagulant. In the series given in Tables 1 and 2, all the coagulant was added prior to the first stage, whereas in that given in Tables 4 and 5 it was divided as above described.

The results of such a comparison, which are given in Table 6, indicate that the divergence between the bacterial efficiencies obtained with the two different methods of adding the coagulant was so small as to show no well-marked gain in efficiency resulting from the use of the split-feed method of coagulation, a slight advantage in favor of the single-feed method being evidenced, in fact, by the preponderance of lower bacterial residuals observed in this series.

TABLE 6.—*Comparison of residual percentages of raw-water turbidity and bacteria observed in the applied and filtered effluents, after single-stage and double-stage coagulation-sedimentation, respectively, but with the same total period of sedimentation (nine hours) in each case, and with approximately the same average numbers of raw-water bacteria*

[Comparison of figures given in Tables 1, 2, 4, and 5]

PLATE COUNTS (24 HOURS, 37° C.)

Stages of coagulation	Average raw-water count	Per cent of raw water: Turbidity in applied	Bacterial count in—: Applied	Bacterial count in—: Filtered
Single	7,030	2.0	13.4	2.0
Double	7,060	2.6	14.2	1.5
Single	12,900	5.9	22.0	1.9
Double	15,600	7.5	13.6	2.0
Single	65,800	4.4	11.0	2.4
Double	66,300	5.5	15.8	3.0

B. COLI INDEX

Stages of coagulation	Average raw-water count	Per cent of raw water: Turbidity in applied	Bacterial count in—: Applied	Bacterial count in—: Filtered
Single	8,520	2.6	20.2	0.36
Double	8,640	3.5	24.5	.51
Single	33,900	4.2	15.3	.26
Double	38,500	6.2	12.8	.34
Single	775,000	4.2	12.7	.31
Double	1,880,000	5.1	12.9	.23

The foregoing observations would appear to signify that, in the case at hand, the greater bacterial efficiency resulting from double-stage coagulation-sedimentation was due more largely to the longer sedimentation period and to the larger total amount of coagulant used than to the division of the coagulation process into two separate stages. The slight superiority shown by single-stage sedimentation, when preceded by the addition of approximately equal amounts of coagulant and carried over the same nominal period of time, suggests, in fact, that the increased time during which the water treated was subjected to the influence of the entire mass of coagulant added to it represents a small advantage of this method over double-stage treatment, all other conditions being the same. Although this conclusion may seem at variance with that which might appear to follow from recent experience with double-stage coagulation at a number of full-scale filtration plants along the Ohio River, where a marked improvement in over-all bacterial efficiency has resulted from adoption of the double-stage method of treatment, the two conclusions may be reconciled to a large extent by noting that, in the instances cited, the addition of a primary stage of coagulation has been accompanied by the introduction of a longer period during which the water treated has been subject to the action of subsidence under the influence of a coagulant. Under these circumstances, an improvement in efficiency such as that observed, from a comparison of the relative performance of a plant before and after double-stage coagulation was instituted, would be expected, in view of the results of the foregoing experiments.

RELATIVE BACTERIAL EFFICIENCIES WITH VARIATIONS IN THE pH OF THE COAGULATION REACTION

In the recent literature of water purification increasing recognition has been given to the importance of hydrogen ion concentration as a factor in the speed and effectiveness with which the coagulation of water is accomplished. In this connection the studies of Theriault and Clark,[2] Miller,[3] Hatfield,[4] Baylis,[5] Wagner and Enslow,[6] Catlett,[7] and others, have been of fundamental value in defining the optimum zones of pH[8] within which precipitation occurs in water treatment and in pointing out some of the physical and chemical conditions modifying the phenomenon.

As regards coagulation with salts of aluminum, which are most widely used in water purification, Hildebrand, Blum, and other investi-

[2] Pub. Health Rep., vol. 38, p. 181.
[3] Pub. Health Rep., vol. 38, p. 1895.
[4] Jour. Ind. & Eng. Chem., vol. 14, p. 1038.
[5] Jour. Am. W. W. Assoc., vol. 10, p. 365 (May, 1923).
[6] Jour. Am. W. W. Assoc., vol. 9, p. 373 (May, 1922).
[7] Jour. Am. W. W. Assoc., vol. 11, p. 887 (July, 1924).
[8] It is customary to express the hydrogen ion concentration in terms of the reciprocal of the logarithm of such concentration: thus,

$$pH = \log \frac{1}{(H^+)}$$

gators have shown that aluminum hydroxide is precipitated to some extent at pH 4.0 and most completely precipitated at pH 6.5 to 7.5, being completely dissolved at pH 10.0 or 11.0.[9]

Theriault and Clark, working with water of low and varying buffer strengths, found that the optimum zone for alum coagulation falls between pH 5.0 and 6.0, centering around 5.5, and that the width of this zone increases with the buffer strength of the water treated. Catlett confirmed this finding in a study of the relatively soft waters of North Carolina. Miller showed that the pH zone in which aluminum is precipitated most completely is dependent on the acid ions present and that a definite relation exists between the amount of anion per gram of "floc" and the anion concentration of the solution in which precipitation occurs.[10]

From the work of the foregoing investigators, Ellms [11] concludes that the successful coagulation of water with alum requires (1) a certain minimum quantity of aluminum ions, (2) an anion of high coagulating power, and (3) such an adjustment of the concentration of hydrogen ions as will produce the optimum conditions for floc formation. He also notes that "flocs" obtained from the precipitation of iron salts do not dissolve at higher pH values; hence less careful adjustment of the hydrogen ion concentration is required in this case.

During part of the year 1926 a favorable opportunity existed, in connection with the experiments recorded in this paper, for observing the comparative bacterial efficiencies of coagulation-sedimentation under varying conditions of pH, with all other conditions held approximately constant except the bacterial content of the raw water, which was not subject to control within narrow limits. In addition to routine observations covering the middle ranges of pH, such as ordinarily occurred in the operation of the experimental plant, two series of controlled tests were made, in which the pH of the coagulation reaction was adjusted to embrace values ranging from 5.4 to 7.3. In one series, divided into several "runs" each covering a period of a week, the pH was increased daily by an amount sufficient to carry the observations for a given week over a predetermined range. In the other, occupying several weeks, the pH was held constant throughout each week and changed from week to week.

The results obtained from the former of the two series were not satisfactorily clear-cut, owing to lag effects produced by the daily changes made in the pH. When combined with the results of the

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[9] Ellms, J. W.: Water Purification, 2d edition, p. 427.

[10] Buswell, A. M.: Chemistry of Water and Sewage Treatment. Am. Chem. Soc. Monograph Series, pp. 166–168.

[11] Ellms, J. W., loc. cit., p. 430.

other series, and with those of the longer period of routine observations, they served a useful purpose, however, in supplementing tests made at the more extreme ranges of pH. For analysis, all of the material obtained from the two series of experiments was combined with that of the routine observations.

The statistical treatment given the combined material consisted of classifyng the daily results, first, according to variations in pH and, second, according to variations in the bacterial content of the raw water, in order to determine the extent to which each of these two factors, considered separately, might influence the efficiency of bacterial removal. The primary classification consisted of separating the material into groups according to pH values falling into the

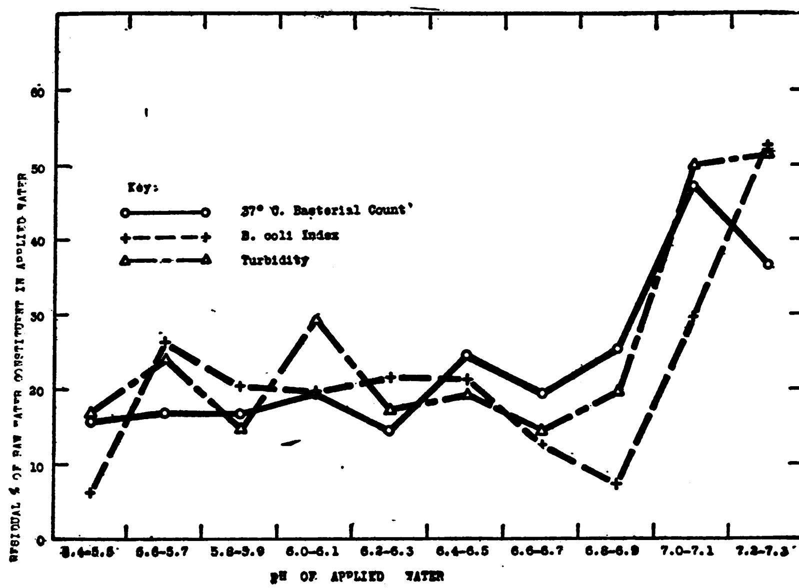

FIGURE 9.—Relation between pH of coagulation reaction and residual percentage of turbidity and bacteria in applied water

ranges, 5.4–5.5, 5.6–5.7, etc., up to a maximum range of 7.2–7.3. Each one of these groups of data was further divided into three subgroups according to raw-water bacterial counts falling within the ranges, 0–2,500, 2,500–10,000, and over 10,000. All of the results falling into each primary group and each subgroup were averaged separately and tabulated.

The results of the primary separation of the data according to pH values are given in Table 7 and illustrated graphically in Figure 9, in which the residual percentages of turbidity, 37° C. bacterial counts and *B. coli* observed in the applied water (i. e., after coagulation-sedimentation) have been plotted against the corresponding pH values of the same water. The general trends of the three curves are very similar, indicating that changes in pH affected in approximately the same degrees the removal of turbidity and the two classes of bacteria enumerated. All three curves, with minor fluctuations, follow a fairly level trend up to the pH range 6.8–6.9, where they show a sharp upward break. It thus would appear that the efficiency of removal was not influenced markedly by variations in pH between values of 5.4 and 6.9, but fell off decidedly with pH values exceeding 6.9.

TABLE 7.—*Average residual percentages of turbidity and bacteria observed in applied water, coincidentally with pH values falling within specified ranges (April 1, 1925–March 31, 1926)*

Applied water, pH range	Number of tests	Temperature	Alum, g. p. g.	Lime, g. p. g.	Turbidity		Per cent of raw, applied	Agar, 37° C.		Per cent of raw, applied	B. coli index		Per cent of raw, applied
					Raw	Applied		Raw	Applied		Raw	Applied	
5.4–5.5	1	16.4	2.39	-------	142	24	16.9	2,430	387	15.9	4,600	280	6.1
5.6–5.7	3	12.4	2.29	0.44	157	39	24.8	3,200	541	16.9	5,500	1,440	26.2
5.8–5.9	8	18.8	2.89	-------	124	18	14.5	5,700	945	16.6	17,500	3,530	20.2
6.0–6.1	16	22.9	2.94	.87	51	15	29.4	7,740	1,500	19.4	24,800	4,870	19.6
6.2–6.3	36	15.7	2.64	.66	105	18	17.1	8,080	1,170	14.5	15,700	3,400	21.6
6.4–6.5	52	16.0	2.25	.89	110	21	19.1	5,720	1,390	24.3	23,900	5,050	21.2
6.6–6.7	47	20.8	1.77	.81	138	20	14.5	12,100	2,320	19.2	61,900	7,740	12.5
6.8–6.9	20	11.8	1.83	.77	91	18	19.8	3,370	850	25.2	34,500	2,440	7.1
7.0–7.1	5	6.9	1.82	.80	20	10	50.0	569	269	47.3	3,660	1,090	29.8
7.2–7.3	6	15.7	2.16	.65	31	16	51.7	2,000	728	36.4	2,240	1,180	52.7

A somewhat different picture is presented by the more amplified results of subclassifying the 37° C. plate count data according to raw-water bacterial counts, as shown in Table 8 and, graphically, in Figure 10. In referring to this chart, the general trend of the uppermost plot (raw-water count 0–2,500) and, to a less extent, of the middle plot (2,500–10,000) is upward from the lowest pH range, 5.4–5.5. The trend of the lowest plot (raw-water count greater than 10,000) hardly can be regarded as significant in this connection, as the observations for this group covered only a limited middle range of pH values. It also is noteworthy that the effect of bacterial density in the raw water on the efficiency of bacterial removal is shown very clearly by the relative positions of the three plots, the efficiency being consistently greater with higher bacterial densities.

Although the observations thus recorded did not cover a sufficient range of pH values to show well-defined maxima and minima with respect to removal efficiencies, they indicated quite clearly that the efficiency both of turbidity and of bacteria removal was diminished very decidedly when the pH value of the reaction approximated 7.0 or above, within the limits of the experiment, and that the efficiency of bacterial removal tended to approach a maximum at the lower ranges limited by 5.4 to 5.5. In the latter connection, it is of interest to note again the conclusion of Theriault and Clark [12] that the most effective coagulation in their experiments occurred at pH values centering around 5.5.

[12] Loc. cit.

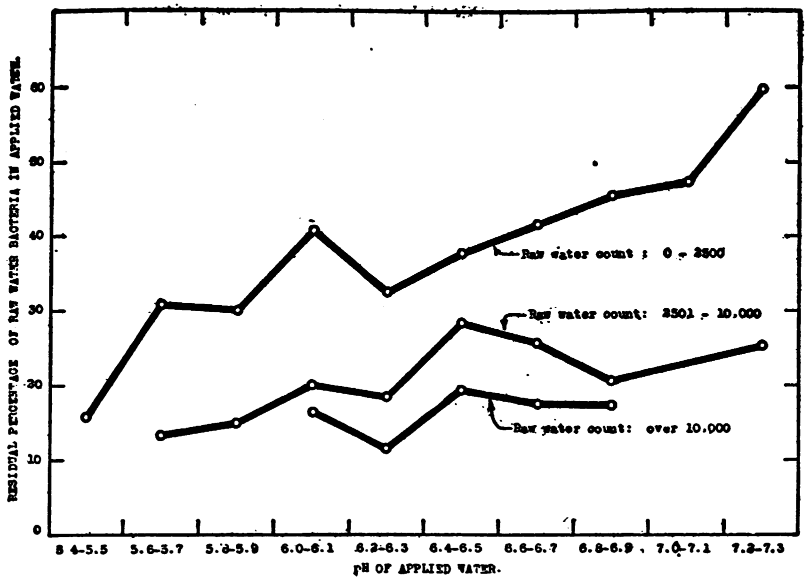

FIGURE 10.—Relation between pH of coagulation reaction and residual percentages of raw-water bacteria observed in applied water, corresponding to averages of numbers of raw-water bacteria falling within three specified ranges. (Plot of data given in Table 8)

TABLE 8.—*Data of Table 7 further classified according to raw-water bacterial counts falling within each range of pH values*

[Bacterial counts, 24 hours, 37° C.]

Applied pH range	Raw-water count range	Number of tests	Temperature	Alum, g. p. g.	Lime, g. p. g.	Turbidity: Raw	Turbidity: Applied	Turbidity: Residual, per cent	Bacterial count per c. c.: Raw	Bacterial count per c. c.: Applied	Bacterial count per c. c.: Filtered	Per cent of raw: Applied	Per cent of raw: Filtered
5.4-5.5	0- 2,500	1	16.4	2.39		142	24	16.9	2,430	387	8	15.9	0.33
5.6-5.7	0- 2,500	1	15.3	2.04	1.03	79	48	60.8	1,690	522	62	30.9	3.7
	2,501-10,000	1	15.3	2.25		228	39	17.1	5,920	774	86	13.1	1.5
5.8-5.9	0- 2,500	3	17.3	2.78		137	20	14.6	1,670	502	53	30.0	3.2
	2,501-10,000	5	19.6	2.95		116	16	13.8	8,120	1,210	118	14.9	1.5
6.0-6.1	0- 2,500	5	17.9	2.52	.86	73	24	32.9	1,310	536	70	40.9	5.3
	2,501-10,000	8	25.5	3.17		36	10	27.8	6,150	1,230	157	20.0	2.6
	Over 10,000	3	24.2	3.02		55	14	25.5	23,500	3,850	298	16.4	1.3
6.2-6.3	0- 2,500	18	12.6	2.30	.64	88	20	22.7	1,580	513	42	32.5	2.7
	2,501-10,000	9	14.0	2.60	.74	156	20	12.8	4,640	854	57	18.4	1.2
	Over 10,000	9	23.8	3.35		89	13	14.6	24,500	2,810	283	11.5	1.2
6.4-6.5	0- 2,500	16	10.1	2.23	.87	88	18	20.4	1,470	556	44	37.8	3.0
	2,501-10,000	24	16.8	2.08	.96	103	22	21.4	4,720	1,340	106	28.4	2.2
	Over 10,000	12	22.3	2.60		152	20	13.2	13,400	2,610	269	19.5	2.0
6.6-6.7	0- 2,500	12	11.3	1.90	.74	45	19	42.2	1,430	595	14	41.6	.98
	2,501-10,000	12	20.9	1.56	1.13	105	20	19.0	5,390	1,390	52	25.8	.96
	Over 10,000	23	25.7	1.80		204	20	9.8	21,200	3,700	298	17.5	1.4
6.8-6.9	0- 2,500	13	8.6	1.82	.75	32	17	53.1	1,000	457	7.5	45.7	.75
	2,501-10,000	6	16.4	1.57	.90	234	25	10.7	4,790	992	63	20.6	1.3
	Over 10,000	1	26.5	3.42		4	4	100.0	33,400	5,750	790	17.2	2.4
7.0-7.1	0- 2,500	5	6.9	1.82	.80	20	10	50.0	569	269	5.5	47.3	.97
7.2-7.3	0- 2,500	4	11.5	1.94	.67	31	18	58.0	968	577	21	59.7	2.2
	2,501-10,000	2	16.4	2.62	.57	30	12	40.0	4,070	1,030	155	25.3	3.8

RELATIVE BACTERIAL EFFICIENCIES OBSERVED WITH VARYING AMOUNTS OF COAGULANT ADDED TO RAW WATER

It has been generally recognized since the early days of water purification that within certain limits the efficiency of removal of suspended matter and bacteria by rapid sand-filtration processes is influenced very considerably by the density of floc formed by the coagulant added to the raw water prior to sedimentation and filtration. For this reason it was considered as an important part of these experiments to observe the extent to which the bacterial efficiency of the various stages of treatment was influenced, if at all, by the addition of various amounts of coagulant.

The comparative observations herein recorded were made principally during a period of three years, extending from October, 1924, to September, 1927, inclusive, both in connection with the routine operation of the experimental plant and on several special occasions, when experiments occupying short-test periods of about a week, in each case, were made with the single object of ascertaining the extent to which the bacterial efficiency of the plant was affected by variations in the coagulant density. During the years 1928 and 1929, up to the time at which the operation of the experimental plant was discontinued, a few short series of tests were made, in parallel, with different amounts of coagulant [13] added to the raw water. These latter tests were not sufficiently extensive, however, to yield results of any material value, except to confirm, in certain respects, those of the longer series made during the years 1924–1927.

In making the special observations extending over weekly test periods, the usual procedure consisted in varying the alum dosage in three stages, generally in the direction of an increase, holding the dosage constant at each stage for about one-third of the week (i. e., two days) and maintaining all other conditions of the treatment as nearly constant as practicable throughout the entire week. Although the turbidity and bacterial content of the raw river water remained fairly constant throughout each test week, its uniformity in these respects was disturbed occasionally by the effects of local rains, which sometimes caused sudden increases in both of the constituents designated. Changes of this character doubtless caused irregularities in the general trend of the results, as the efficiency of purification, and notably that of preliminary coagulation-sedimentation, is influenced very considerably by the density of turbidity and bacteria in the raw water.[14]

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[13] The coagulant used throughout these experiments was ordinary basic aluminum sulphate, such as ordinarily is designated as "filter alum." This material was purchased on standard specifications conforming to those of the American Water Works Association.

[14] See p. 1606; also Public Health Bulletin No. 172, Figure 25, p. 102, and conclusion (3), p. 227; also Reprint No. 1114 from the Public Health Reports, Oct. 1, 1926, p. 15.

TABLE 9.—*Relations between amounts of coagulant and bacterial efficiency*

[Summary of averages of six weekly experiments in 1926]

Week	Alum g. p. g.[1]	Turbidity		Bacteria per c. c.—37° C.				B. coli index per 100 c. c.				Residual per cent of raw water							
												Turbidity		Bacterial count			B. coli index		
		Raw	Applied	Raw	Applied	Filtered	Chlorinated	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
Apr. 26–30	1.6	69	29	918	466	11	0.7	7,750	1,000	8	1.3	42.1	0	50.8	1.2	0.076	12.9	1.0	0.017
	2.2	97	22	2,030	158	19	.3	19,000	663	3.7	.0	22.7	0	7.8	.9	.015	3.5	.019	.0
	2.7	169	23	2,720	270	1.9	.4	16,700	3,020	6	.0	13.6	0	9.9	.07	.015	18.1	.036	.0
May 3–8	.5	22	15	12,000	8,680	3,140	245	6,620	5,500	168	2.3	68.2	0	72.3	26.2	2.0	83.2	2.5	.035
	.9	26	19	10,700	4,540	544	22	16,800	5,380	8	.3	73.0	0	42.4	5.1	.21	32.0	.048	.002
	1.7	39	20	2,840	623	14	1	29,100	3,140	19	1.0	51.3	0	21.9	.50	.03	10.8	.07	.003
June 14–19	.5	303	47	8,560	1,700	268	...	37,700	6,030	480	...	15.5	...	19.9	3.1	...	16.0	1.3	...
	2.6	116	8	6,870	1,180	69	...	40,000	2,380	24	...	6.9	...	17.2	1.0	...	6.0	.06	...
	3.7	75	7	13,950	1,120	91	...	70,000	4,000	70	...	9.3	...	8.0	.65	...	5.7	.10	...
June 21–25	[2] .5	403	203	203,000	129,000	15,900	...	3,800,000	400,000	55,000	...	49.7	...	63.6	7.8	...	10.5	1.4	...
	2.2	243	15	149,000	59,500	22,300	...	1,000,000	850,000	55,000	...	6.2	...	40.0	15.0	...	85.0	5.5	...
	[2] 3.3	113	12	146,000	42,000	14,900	...	1,000,000	700,000	70,000	...	10.6	...	28.8	10.2	...	70.0	7.0	...
June 28–July 3[3]	.4	28	8	51,800	32,500	7,290	...	438,000	438,000	8,880	...	28.6	...	62.8	14.1	...	100.0	2.0	...
	2.4	36	5	26,500	9,250	2,610	...	550,000	179,000	1,000	...	13.9	...	34.9	9.8	...	32.5	.18	...
	4.1	72	6	45,900	8,200	3,900	...	700,000	40,000	7,000	...	8.3	...	17.9	8.5	...	5.7	1.0	...
July 6–9	[2] .4	5	3	132,000	37,600	8,080	...	1,000,000	775,000	10,000	...	60.0	...	28.5	6.1	...	77.5	1.0	...
	[2] 2.4	5	2	84,900	32,500	982	...	5,500,000	325,000	3,250	...	40.0	...	38.3	1.2	...	5.9	.06	...
	4.4	8	4.5	64,500	27,200	2,930	...	1,900,000	325,000	3,250	...	56.3	...	42.2	4.5	...	17.1	.17	...

[1] Alum dosage maintained at each given average amount during approximately one-third of each weekly test period.
[2] Based on results for 1 day only.
[3] Repetition of test of June 21–25.

The results of six fairly typical experiments, each extending over a period of a week, are given in Table 9, in the form of averages for each 2-day period in which the amount of coagulant added to the raw water was maintained nearly constant. On comparing the residual percentages of raw-water turbidity and bacteria with the average amounts of alum, it will be noted that, with a few exceptions, probably due in some cases to disturbances such as those above noted, and in others to lag effects resulting from changes in the alum dosage, an increase in the amount of coagulant added was accompanied by an indicated gain in the efficiency of turbidity and bacterial removal, not only after coagulation-sedimentation, but also, to a somewhat less well-marked extent, after filtration.

More satisfactory evidence on these points was afforded, however, by a statistical analysis of the combined results of the routine and special observations extending over the 3-year period, October, 1924, to September, 1927. In compiling these figures the daily average results obtained during the period in question were classified successively in accordance with variations in three different factors, namely, (*a*) alum dosage, (*b*) raw-water turbidity, and (*c*) raw-water bacterial content. The method followed consisted (1) in dividing the observations into four groups according to amounts of alum added to the raw water falling within the ranges, 0–2, 2–3, 3–4, and over 4 grains per gallon; (2) in subdividing each one of these groups into three subgroups according to raw-water turbidities falling within the ranges, 0–10, 11–100, and over 100 parts per million; and (3) in further subdividing each one of the 12 groups thus obtained into another series of subgroups according to raw-water bacterial counts (24 hours, 37° C.) falling within the ranges 0–2,500, 2,501–5,000, 5,000–10,000, and over 10,000, or according to raw-water *B. coli* indices falling within the ranges, 0–5,000, 5,000–10,000, 10,000–50,000, and over 50,000. The figures thus obtained were totaled and averaged arithmetically into a series of group averages, which afforded an index of the quality of effluent produced at each stage of treatment under any given condition with respect to alum dosage, raw-water turbidity, and raw-water bacterial content, within the limiting ranges defined.

Although the observations thus classified covered a period aggregating 382 test days, the number of observations falling into the smallest of the three successive classification groups was so low in some cases as to make the trend of the data very irregular. For this reason it was considered advisable to recombine the data into two series, both classified primarily according to alum dosage. One series, then, was subclassified according to raw-water turbidity and the other according to raw-water bacterial content, or *B. coli* index, falling within the ranges above specified. From this procedure two series of group averages were obtained, one showing the effect of varying amounts of coagulant on the quality of effluent produced from raw water of low, medium, and high turbidity, respectively, and the other the corresponding effect on the quality of effluent produced from raw water of different ranges in bacterial content.

The results of the subclassification according to raw-water turbidity have been summarized in Tables 10 and 11, the former showing the bacterial quality of effluents expressed in terms of the 37° C. plate count and the latter the corresponding quality in terms of the *B. coli* index. In Tables 12 and 13 the results of the corresponding subclassification according to raw-water bacterial content have been summarized in a similar manner. In Tables 10 and 11, sections "D," the data originally subclassified according to raw-water turbidity, have been recombined irrespective of turbidity, so as to show the relation observed between alum dosage and bacterial efficiency, regardless of raw-water turbidity or bacterial content.

TABLE 10.—*Relation between amounts of alum added to raw water and efficiency of bacterial removal, as observed within various ranges of raw-water turbidity*

[Bacterial counts, 24 hours, 37° C.]

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average bacterial count per c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
A. RAW-WATER TURBIDITY: 0-10										
0-2	2	1.5	10	10,900	4,250	313	51.0	39.0	2.9	0.47
2-3	10	2.7	5	8,350	2,880	112	18.4	34.5	1.3	.22
3-4	6	3.3	5	12,900	2,440	232	12.7	18.9	1.8	.10
Over 4	0									
B. RAW-WATER TURBIDITY: 11-100										
0-2	76	1.5	42	10,100	3,320	321	24.0	32.9	3.2	0.24
2-3	42	2.3	48	9,840	2,750	431	39.0	28.0	4.4	.40
3-4	44	3.4	35	10,200	1,510	140	4.5	14.8	1.4	.04
Over 4	4	4.4	68	2,230	298	4	1.1	13.4	.18	.05
C. RAW-WATER TURBIDITY: OVER 100										
0-2	53	1.6	296	10,500	1,520	217	14.0	14.5	2.1	0.13
2-3	91	2.5	275	9,630	1,800	349	8.7	18.7	3.6	.09
3-4	47	3.4	239	7,830	883	52	4.5	11.3	.66	.06
Over 4	7	4.5	236	4,040	251	11	.9	6.2	.27	02
D. ALL TURBIDITIES (COMBINED)										
0-2	131	1.6	144	10,300	2,590	279	21.0	25.2	2.7	0.20
2-3	143	2.5	190	9,600	2,150	356	19.5	22.4	3.7	.20
3-4	97	3.4	132	9,230	1,260	103	5.1	13.7	1.1	.06
Over 4	11	4.4	175	3,110	268	9	1.0	8.6	.30	.03

Table 11.—*Relation between amounts of alum added to raw water and efficiency of B. coli removal, as observed within various ranges of raw-water turbidity*

A. TURBIDITY: 0-10

Alum range, grains per gallon	Number of results	Average alum added, g.p.g.	Average turbidity, p.p.m.	Average B. coli index per 100 c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	2	1.5	10	32,500	30,300	550	2.7	93.3	1.70	0.008
2-3	10	2.7	5	43,700	13,400	19	2.3	30.7	.04	.005
3-4	6	3.3	5	122,000	11,200	174	1.1	9.2	.14	.001
Over 4	0									

B. TURBIDITY: 11-100

Alum range, grains per gallon	Number of results	Average alum added, g.p.g.	Average turbidity, p.p.m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	76	1.5	42	42,500	11,700	119	3.2	27.5	0.28	0.008
2-3	42	2.3	48	31,300	8,000	92	5.3	25.6	.29	.017
3-4	44	3.4	35	39,700	5,640	90	.9	14.2	.23	.002
Over 4	4	4.4	68	24,100	2,340	16	1.0	9.7	.07	.004

C. TURBIDITY: OVER 100

Alum range, grains per gallon	Number of results	Average alum added, g.p.g.	Average turbidity, p.p.m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	53	1.6	296	33,700	3,200	184	5.6	9.5	0.55	0.017
2-3	91	2.5	275	23,900	3,510	124	5.3	14.7	.52	.022
3-4	47	3.4	239	19,500	2,080	34	1.9	10.7	.17	.010
Over 4	7	4.5	236	18,300	733	41	.2	4.0	.22	.001

D. ALL TURBIDITIES (COMBINED)

Alum range, grains per gallon	Number of results	Average alum added, g.p.g.	Average turbidity, p.p.m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	131	1.6	144	38,700	8,430	152	4.5	21.8	0.39	0.012
2-3	143	2.5	190	27,400	5,500	107	5.0	20.0	.39	.018
3-4	97	3.4	132	35,000	4,280	68	1.3	12.2	.19	.004
Over 4	11	4.4	175	20,400	1,320	32	.5	6.5	.16	.002

Table 12.—*Relation between amounts of alum added to raw water and efficiency of bacterial removal, as observed within various ranges of raw-water bacteria*

[Bacterial counts, 24 hours, 37° C.]

RAW-WATER BACTERIAL COUNT: 0-2,500

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average bacterial count per c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	14	1.4	131	1,480	417	74.0	1.3	28.2	5.0	0.088
2-3	47	2.5	133	1,630	331	14.0	1.3	20.3	.86	.080
3-4	17	3.4	114	1,900	249	6.5	.9	13.1	.34	.047
Over 4	6	4.6	117	1,780	196	2.9	.8	11.0	.16	.045

RAW-WATER BACTERIAL COUNT: 2,501-5,000

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	37	1.5	78	3,750	906	58.0	1.0	24.2	1.6	0.027
2-3	28	2.5	185	3,650	676	26.0	4.8	18.5	.71	.132
3-4	25	3.4	182	3,570	403	18.0	.8	11.3	.50	.022
Over 4	3	4.3	157	3,860	298	2.7	.8	7.7	.07	.021

RAW-WATER BACTERIAL COUNT: 5,001-10,000

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	30	1.5	196	7,420	1,580	171.0	6.4	21.3	2.3	0.086
2-3	23	2.5	222	7,100	1,450	99.0	5.5	20.4	1.4	.077
3-4	19	3.3	138	7,530	1,090	111.0	1.6	14.5	1.5	.021
Over 4	2	4.2	375	7,440	442	39.0	1.7	5.9	.52	.023

RAW-WATER BACTERIAL COUNT: OVER 10,000

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2	50	1.6	166	19,400	4,950	477.0	26.0	25.5	2.5	0.134
2-3	45	2.4	236	22,900	5,330	626.0	24.0	23.2	2.7	.104
3-4	35	3.4	102	18,000	2,440	210.0	10.0	13.6	1.2	.056
Over 4	0									

TABLE 13.—*Relation between amounts of alum added to raw water and efficiency of B. coli removal, as observed within various ranges of raw-water B. coli index*

Alum range, grains per gallon	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average B. coli index per 100 c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
RAW-WATER B. COLI INDEX: 0-5,000										
0-2	9	1.5	101	2,360	1,430	19.0	0.87	60.6	0.80	0.037
2-3	24	2.5	211	2,820	1,440	6.6	.42	51.0	.23	.015
3-4	11	3.5	241	2,720	958	32.0	.32	35.2	1.2	.012
Over 4	4	4.5	196	3,630	882	1.4	.25	24.3	.04	.007
RAW-WATER B. COLI INDEX: 5,001-10,000										
0-2	49	1.6	198	7,990	3,140	95.0	1.6	39.3	1.2	0.020
2-3	54	2.5	186	7,880	1,960	22.0	1.7	24.9	.28	.022
3-4	37	3.4	147	7,940	2,660	35.0	.38	33.5	.44	.005
Over 4	1	4.8	91	5,500	775	29.0	2.0	14.1	.53	.036
RAW-WATER B. COLI INDEX: 10,001-50,000										
0-2	40	1.5	130	34,200	10,100	165.0	2.1	29.5	0.48	0.006
2-3	36	2.4	191	31,300	8,480	110.0	1.9	27.1	.35	.006
3-4	28	3.4	96	33,100	5,730	74.0	1.8	17.3	.22	.005
Over 4	5	4.2	186	30,200	1,970	69.0	.4	6.5	.23	.001
RAW-WATER B. COLI INDEX: OVER 50,000										
0-2	33	1.6	94	98,300	15,500	173.0	7.3	15.8	0.18	0.007
2-3	29	2.4	177	79,500	10,500	284.0	14.0	13.2	.36	.018
3-4	20	3.4	95	107,000	6,880	129.0	1.5	6.4	.12	.001
Over 4	1	4.9	116	52,800	325	1.5	.5	.6	.003	.001

On referring to Tables 10 and 11 it will be noted that with approximately equivalent average raw-water turbidities the residual percentages of bacteria observed in the applied water, which afford an index of the bacterial efficiency of coagulation-sedimentation, show a fairly regular decrease coincidently with the addition of greater amounts of alum. The extent of decrease in each case is shown graphically in Figure 11, which has been plotted from the applied water residuals in Tables 10 and 11. In Figure 12, plotted from the residuals given in Tables 12 and 13, a similarly regular gain in the bacterial efficiency of coagulation-sedimentation is shown to have occurred coincidently with increases in alum dosage made under approximately equivalent conditions of raw-water bacterial content.

A comparison of the corresponding bacterial residuals observed in the filtered and chlorinated effluents, which are given in the four tables but not illustrated graphically, indicates that the general effect of increasing densities of coagulant on the bacterial efficiency was discernible after filtration and, to a less extent, even after final chlorination of the filtered effluent. It thus appears that a measurable improvement in efficiency was obtainable throughout the entire treatment process by increasing the amount of alum up to densities ranging as high as 4 to 5 grains per gallon, and the general trend of the residuals would suggest that fairly substantial gains in efficiency might be expected with even higher amounts of coagulant than the upper range indicated. This tendency is illustrated by the distinctly

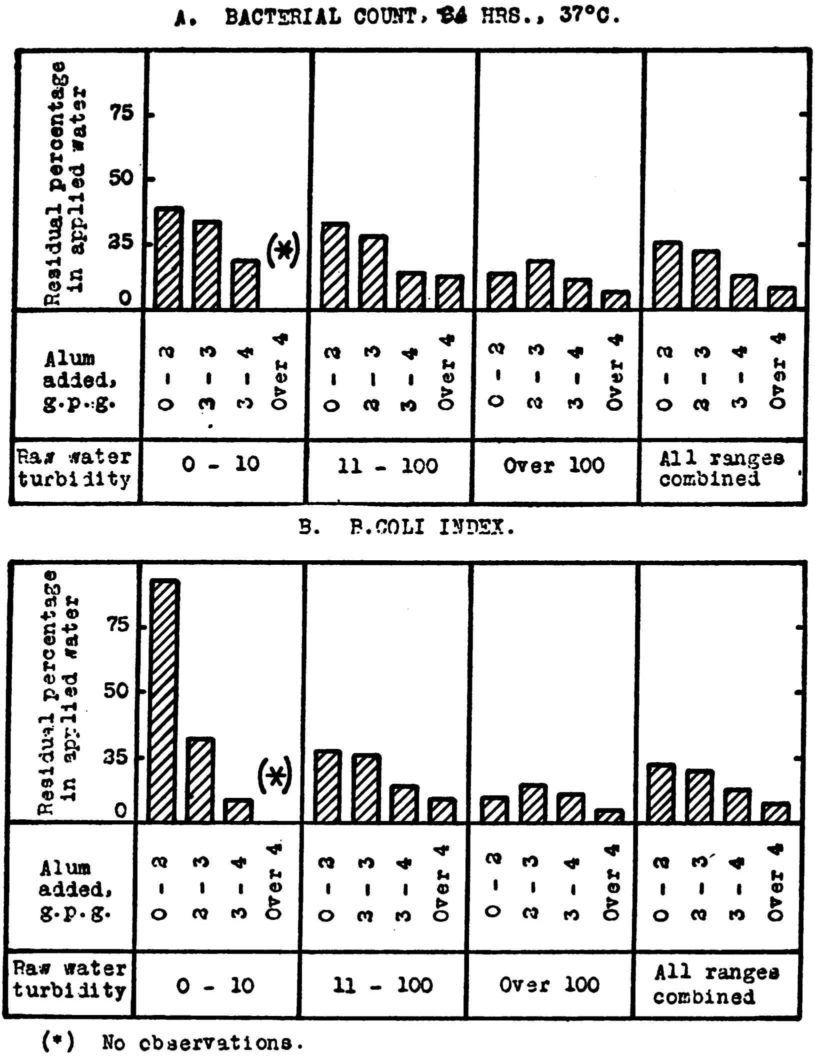

FIGURE 11.—Relation between amounts of alum added to raw water and bacterial efficiency of coagulation-sedimentation, as observed within various ranges of raw-water turbidity. (Plot of data in Tables 10 and 11)

downward trend of the semilogarithmic plots of the combined applied water residuals shown in Figure 13, which are based on the figures given in sections "D" of Tables 10 and 11. In this chart the slope of each plot, which is a measure of the proportionate decrease in the residual percentage of bacteria, remains practically the same with an increase in average alum dosage from 3.4 to 4.4 g. p. g. as with an increase from 2.5 to 3.4 g. p. g., in the next lower range.

For any given range of coagulant density, such as, for example, from 2 to 3, or 3 to 4, grains per gallon, the variations observed in

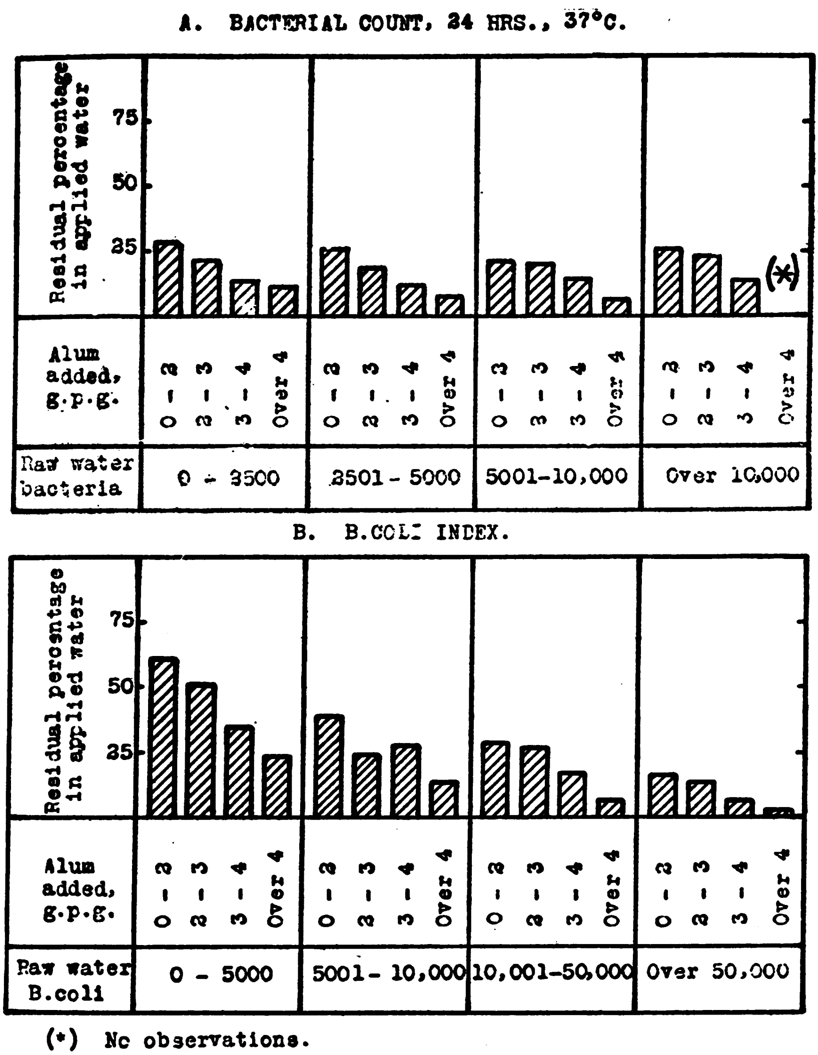

FIGURE 12.—Relation between amounts of alum added to raw water and bacterial efficiency of coagulation-sedimentation, as observed within various ranges of raw-water bacterial content. (Plot of data in Tables 12 and 13)

the bacterial efficiency of coagulation-sedimentation followed about the same general trend as previously noted [15] in connection with the primary series of experiments made during the years 1924 and 1925.

[15] See Reprint No. 1114 from the Public Health Reports, Oct. 1, 1926, II. Preliminary Review of Primary Experiments.

In order to show this trend more clearly than is readily apparent in Tables 10, 11, 12, and 13, a cross-tabulation of the same data has been made in Tables 14, 15, 16, and 17. From these tables Figures 14 and 15 have been drawn, showing graphically the variations in residual percentages of bacteria in the applied water coinciding with changes in raw-water turbidity (fig. 14) and in the density of raw-water bacteria (fig. 15), for each respective range in alum dosage.

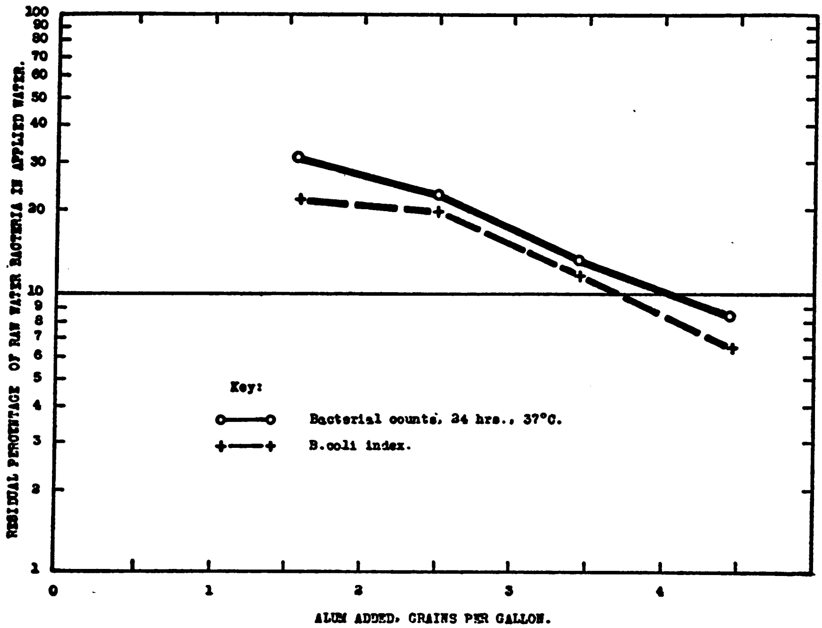

FIGURE 13.—Relation between amounts of alum added to raw water and residual percentages of bacteria observed in applied water, for all observations combined. (Plot of data given in Tables 10 and 11, Sections "D")

TABLE 14.—*Relation between raw-water turbidity and efficiency of bacterial removal, as observed within various ranges of alum added to raw water*

[Bacterial counts, 24 hours, 37° C.]

A. ALUM ADDED: 0-2 G. P. G.

Raw-water turbidity range, p. p. m.	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average bacterial count per c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-10	2	1.5	10	10,900	4,250	313	51.0	39.0	2.9	0.47
11-100	76	1.5	42	10,100	3,320	321	24.0	32.9	3.2	.24
Over 100	53	1.6	296	10,500	1,520	217	14.0	14.5	2.1	.13

B. ALUM ADDED: 2-3 G. P. G.

Raw-water turbidity range, p. p. m.	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-10	10	2.7	5	8,350	2,880	112	18.0	34.5	1.3	0.22
11-100	42	2.3	48	9,840	2,750	431	39.0	28.0	4.4	.40
Over 100	91	2.5	275	9,630	1,800	349	8.7	18.7	3.6	.09

TABLE 14.—*Relation between raw-water turbidity and efficiency of bacterial removal, as observed within various ranges of alum added to raw water*—Continued

C. ALUM ADDED: 3-4 G. P. G.

Raw-water turbidity range, p. p. m.	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average bacterial count per c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-10	6	3.3	5	12,900	2,440	232	12.7	18.9	1.8	0.10
11-100	44	3.4	35	10,200	1,510	140	4.5	14.8	1.4	.04
Over 100	47	3.4	239	7,830	883	52	4.5	11.3	.66	.06

D. ALUM ADDED: OVER 4 G. P. G.

0-10	0									
11-100	4	4.4	68	2,230	298	4	1.1	13.4	0.18	0.05
Over 100	7	4.5	236	4,040	251	11	.9	6.2	.27	.02

TABLE 15.—*Relation between raw-water turbidity and efficiency of B. coli removal, as observed within various ranges of alum added to raw water*

A. ALUM ADDED: 0-2 G. P. G.

Raw-water turbidity range p. p. m.	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average B. coli index per 100 c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-10	2	1.5	10	32,500	30,300	550	2.7	93.3	1.70	0.008
11-100	76	1.5	42	42,500	11,700	119	3.2	27.5	.28	.008
Over 100	53	1.6	296	33,700	3,200	184	5.6	9.5	.55	.017

B. ALUM ADDED: 2-3 G. P. G.

0-10	10	2.7	5	43,700	13,400	19	2.3	30.7	0.04	0.005
11-100	42	2.3	48	31,300	8,000	92	5.3	25.6	.29	.017
Over 100	91	2.5	275	23,900	3,510	124	5.3	14.7	.52	.022

C. ALUM ADDED: 3-4 G. P. G.

0-10	6	3.3	5	122,000	11,200	174	1.1	9.2	0.14	0.001
11-100	44	3.4	35	39,700	5,640	90	.9	14.2	.23	.002
Over 100	47	3.4	239	19,500	2,080	34	1.9	10.7	.17	.010

D. ALUM ADDED: OVER 4 G. P. G.

0-10	0									
11-100	4	4.4	68	24,100	2,340	16	1.0	9.7	0.07	0.004
Over 100	7	4.5	236	18,300	733	41	.2	4.0	.22	.001

Table 16.—*Relation between bacterial content of raw water and efficiency of bacterial removal, as observed within various ranges of alum added to raw water*

[Bacterial counts, 24 hours, 37° C.]

A. ALUM ADDED: 0-2 G. P. G.

Raw-water bacterial count range	Number of results	Average alum added, g. p. g.	Average turbidity, p. p. m.	Average bacterial count per c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-2,500	14	1.4	131	1,480	417	74	1.3	28.2	5.0	0.088
2,501-5,000	37	1.5	78	3,750	906	58	1.0	24.2	1.6	.027
5,001-10,000	30	1.5	196	7,420	1,580	171	6.4	21.3	2.3	.086
Over 10,000	50	1.6	166	19,400	4,950	477	26.0	25.5	2.5	.134

B. ALUM ADDED: 2-3 G. P. G.

0-2,500	47	2.5	133	1,630	331	14	1.3	20.3	0.86	0.080
2,501-5,000	28	2.5	185	3,650	676	26	4.8	18.5	.71	.132
5,001-10,000	23	2.5	222	7,100	1,450	99	5.5	20.4	1.4	.077
Over 10,000	45	2.4	236	22,900	5,330	626	24.0	23.2	2.7	.104

C. ALUM ADDED: 3-4 G. P. G.

0-2,500	17	3.4	114	1,900	249	6.5	0.9	13.1	0.34	0.047
2,501-5,000	25	3.4	182	3,570	403	17.5	.8	11.3	.49	.022
5,001-10,000	19	3.3	138	7,530	1,090	111.0	1.6	14.5	1.5	.021
Over 10,000	35	3.4	102	18,000	2,440	210.0	10.2	13.6	1.2	.057

D. ALUM ADDED: OVER 4 G. P. G.

0-2,500	6	4.6	117	1,780	196	2.9	0.8	11.0	0.16	0.045
2,501-5,000	3	4.3	157	3,860	298	2.7	.8	7.7	.07	.021
5,001-10,000	2	4.2	375	7,440	442	39.0	1.7	5.9	.52	.023
Over 10,000	0									

Table 17.—*Relation between B. coli content of raw water and efficiency of B. coli removal, as observed within various ranges of alum added to raw water*

A. ALUM ADDED: 0-2 G. P. G.

Raw water B. coli index range	Number of results	Average alum added, g.p.g.	Average turbidity, p.p.m.	Average B. coli index per 100 c. c.				Per cent of raw in—		
				Raw	Applied	Filtered	Chlorinated	Applied	Filtered	Chlorinated
0-5,000	9	1.5	101	2,360	1,430	19.0	0.87	60.6	0.80	0.037
5,001-10,000	49	1.6	198	7,990	3,140	95.0	1.6	39.3	1.2	.020
10,001-50,000	40	1.5	130	34,200	10,100	165.0	2.1	29.5	.48	.006
Over 50,000	33	1.6	94	98,300	15,500	173.0	7.3	15.8	.18	.007

B. ALUM ADDED: 2-3 G. P. G.

0-5,000	24	2.5	211	2,820	1,440	6.6	0.42	51.0	0.23	0.015
5,001-10,000	54	2.5	186	7,880	1,960	22.0	1.7	24.9	.28	.022
10,001-50,000	36	2.4	191	31,300	8,480	110.0	1.9	27.1	.35	.006
Over 50,000	29	2.4	177	79,500	10,500	284.0	14.0	13.2	.36	.018

C. ALUM ADDED: 3-4 G. P. G.

0-5,000	11	3.5	241	2,720	958	32.0	0.32	35.2	1.2	0.012
5,001-10,000	37	3.4	147	7,940	2,660	35.0	.38	33.5	.44	.005
10,001-50,000	28	3.4	96	33,100	5,730	74.0	1.8	17.3	.22	.005
Over 50,000	20	3.4	95	107,000	6,880	129.0	1.5	6.4	.12	.001

D. ALUM ADDED: Over 4 G. P. G.

0-5,000	4	4.5	196	3,630	882	1.4	0.25	24.3	0.04	0.007
5,001-10,000	1	4.8	91	5,500	775	29.0	2.0	14.1	.53	.036
10,001-50,000	5	4.2	186	30,200	1,970	69.0	.4	6.5	.23	.001
Over 50,000	1	4.9	116	52,800	325	1.5	.5	.6	.003	.001

On referring to Figures 14 and 15, a general tendency is noted toward a progressive decrease in the applied water bacterial residuals coincidently with increase in raw-water turbidity and in raw-water bac-

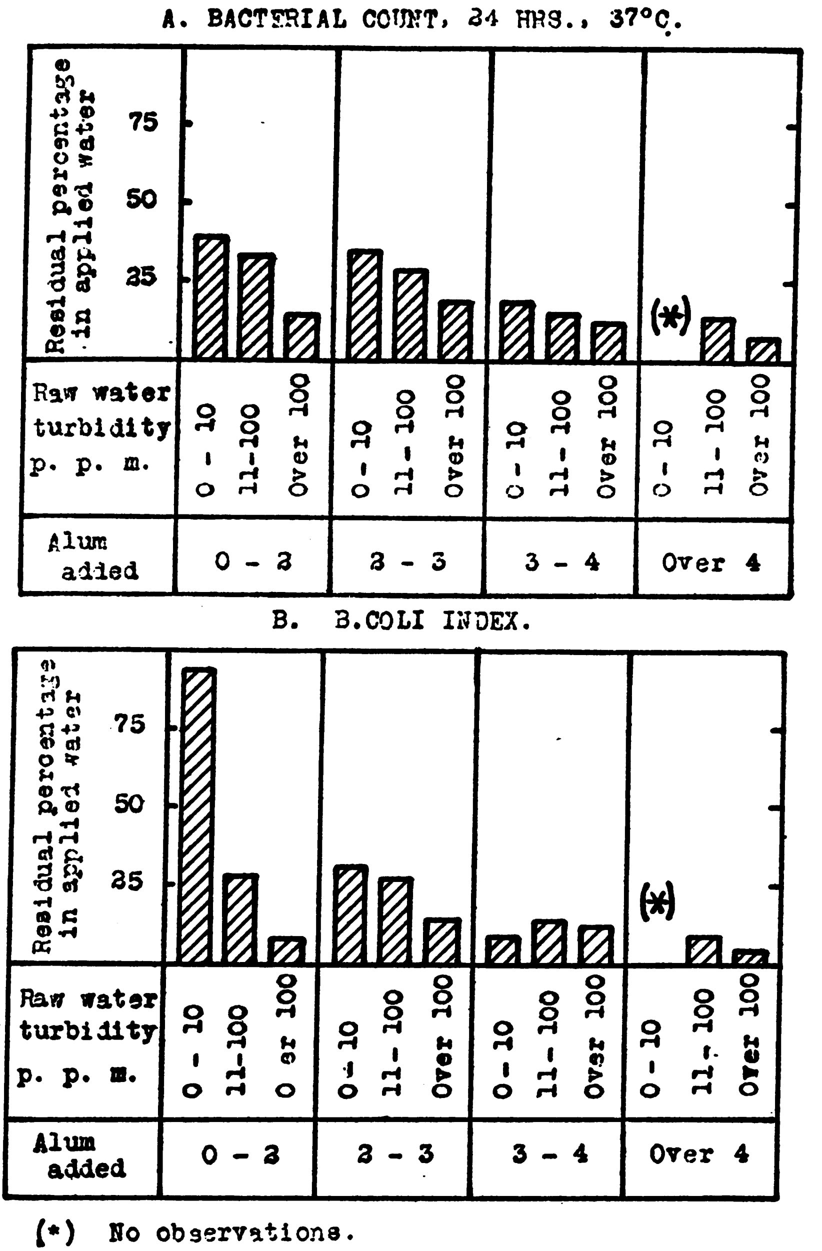

FIGURE 14.—Relation between raw-water turbidity and bacterial efficiency of coagulation-sedimentation, as observed within various ranges of alum added to raw water

terial content, though an exception is apparent in the residuals based on the 37° C. plate count in Figure 15, which do not show any well-marked trend either downward or upward. With this exception, the tendency shown toward an increased bacterial efficiency of coagulation-sedimentation with increased turbidity and bacterial content of the raw water is similar to that previously observed in connection with these studies.

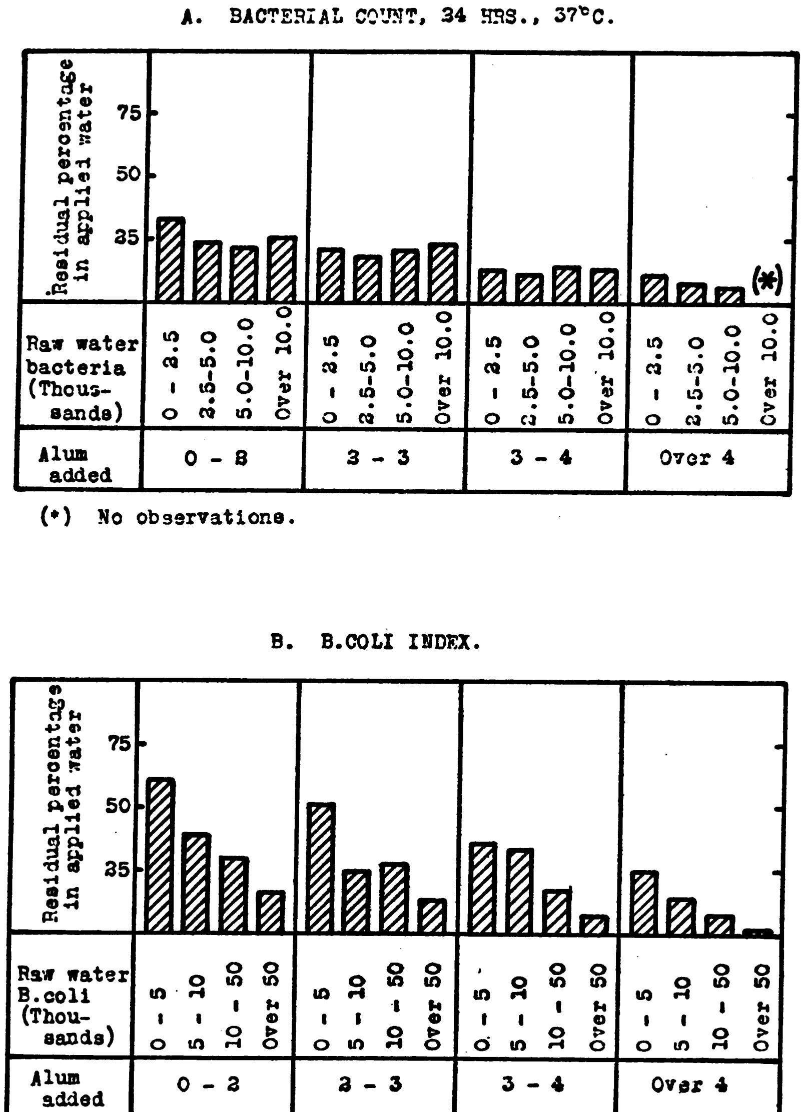

FIGURE 15.—Relation between bacterial content of raw water and bacterial efficiency of coagulation-sedimentation, as observed within various ranges of alum added to raw water. (Plot of data in Tables 14 and 15)

In Tables 14, 15, 16, and 17 a marked degree of irregularity is shown in the trends of the residual percentages of bacteria observed in the filtered and chlorinated effluents, in contrast to the fairly consistent downward trends of the corresponding residuals in Tables 10, 11, 12, and 13. In so far as these observations are concerned, it thus is indicated that the bacterial efficiency of coagulation and sedimentation, though affected to a measurable degree, as a separate process, by variations in raw-water turbidity and bacterial content, is influenced, when combined with filtration, to a very considerably greater extent by changes in the amount of coagulant added to the raw water than by differences in its turbidity or bacterial content. This indication suggests very strongly that in the routine operation of rapid sand filtration plants the greater over-all bacterial efficiency usually experienced coincidently with increases in raw-water turbidity and bacteria

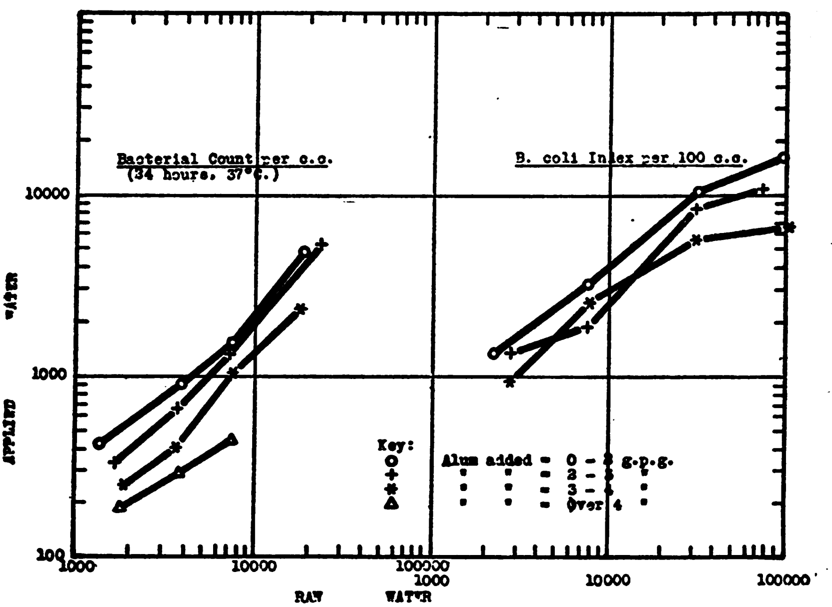

Figure 16.—Relation between bacterial content of raw and applied waters, with varying amounts of alum added to raw water. (Plot of data given in Tables 16 and 17)

content probably is due in no small measure to the use of larger amounts of coagulant at such times, though the concurrent influence of turbidity and bacterial density on the efficiency of the prefiltration stage of treatment doubtless also is an important factor in most cases.

Aside from considerations of bacterial efficiency, the data tabulated in Tables 16 and 17 show that an increase in the density of coagulant resulted in the production of an applied water of better quality, all other conditions being approximately equal. The relationship thus observed is indicated in Figure 16, in which the raw and applied water averages given in the two tables have been plotted against each other on logarithmic scales. With a single exception (in the *B. coli* plots), an improvement in the quality of the applied water coincidently with the use of larger amounts of alum is consistently shown.

Summary and Conclusions

The experimental studies recorded in this paper have been concerned with the effects of variations in (*a*) the period of sedimentation, (*b*) the method of applying coagulant to the raw water, (*c*) the pH of the coagulation reaction, and (*d*) the density of coagulant added to the raw water, on the bacterial efficiency of coagulation-sedimentation as a preparatory treatment of water for rapid sand filtration and, incidentally, on the efficiency of the entire process of rapid sand filtration.

The experiments were carried out during portions of the three years, 1926, 1927, and 1928, at a fully equipped experimental rapid sand water filtration plant of 160,000 gallons daily capacity, designed to typify, as nearly as possible, current large-scale practice in this process of water purification, but with certain additional features incorporated in the plant for experimental purposes.

The results of the study yielded the following main conclusions:

(1) Substantial gains in the bacterial efficiency of coagulation-sedimentation resulted from prolongation of the nominal sedimentation period up to 8 or 9 hours, and measurable gains with periods up to 12 hours.

(2) Variations in the pH of the coagulation reaction from 5.6 to 6.9 produced little effect on the efficiency of coagulation-sedimentation. The efficiency became sharply diminished, however, with pH values exceeding 7.0 and slightly improved with pH values approaching 5.5.

(3) The bacterial efficiency of double-stage coagulation, with two separate stages of sedimentation, was consistently greater than that of single-stage coagulation with one stage of sedimentation. The observations indicated, however, that with the same total amount of coagulant and the same total period of sedimentation, little if any difference was observable between the results shown by double-stage and single-stage coagulation when carried out in conjunction with two separate stages of sedimentation.

(4) A fairly consistent relation was shown between the amounts of coagulant added to the raw water and the resulting bacterial efficiency, both of coagulation-sedimentation and of this stage in conjunction with filtration. This relationship was found to hold irrespective of raw-water turbidity or bacterial content, though it was more apparent when the turbidity and bacterial numbers were higher. Measurable gains in efficiency were shown with increases in coagulant density ranging up to 5 grains per gallon.

A general conclusion reached from the foregoing series of experiments was that the bacterial efficiency of rapid sand filtration processes can be increased very materially by means of longer periods of sedimentation and larger amounts of coagulant than ordinarily are used in current water purification practice. The economical limit of sedimentation appears to be reached somewhere between 8 and 12 hours, with little gain in efficiency beyond the upper limit of time stated.

COURT DECISION RELATING TO PUBLIC HEALTH

Protection of public water supply from contamination by unlawful bathing.—(Connecticut Supreme Court of Errors; Harvey Realty Co. *v.* Borough of Wallingford et al., 150 A. 60; decided Apr. 17, 1930.) The plaintiff corporation owned land upon which was a small pond. Water from this pond flowed through a brook to the reservoir and pumping station of the borough of Wallingford. The plaintiff set apart, for use by the public as a park, about 150 feet of the land all around the pond. The land back of this strip was divided into lots for sale. Large numbers of people were invited to come and bathe in the pond and the privilege of bathing therein was offered to the purchasers of the lots not bordering on the pond.

Section 2544 of the General Statutes provided as follows:

> Every person who shall bathe in any reservoir from which the inhabitants of any town, city or borough, are supplied with water, or in any lake, pond, or stream tributary to such reservoir, or who shall cast any filthy or impure substance into such reservoir, * * * shall be fined not more than $100 or imprisoned not more than six months, or both. * * *

The borough, through its water commissioners and superintendent of waterworks, called plaintiff's attention to the statute and also gave public notice that bathing in the pond would be a violation of the statute. Also the State commissioner of health caused notices to the same effect to be placed near the pond.

The plaintiff brought an action for an injunction to restrain the defendants—the borough, the water commissioners, the waterworks superintendent, and the State health commissioner—from interfering with the sale of its land and for damages. The borough filed a counterclaim, asking for an injunction against plaintiff's use of its premises as a pleasure resort or as a rendezvous for swimming, boating, or fishing or in a way that would render the waters unfit for water-supply purposes. The trial court found against the plaintiff in the action brought by it and in favor of the plaintiff on the counterclaim. The conclusions reached by the trial court were that the pond at the borough's pumping station constituted a reservoir within the meaning of section 2544; that the plaintiff's riparian ownership conferred only a

personal and family privilege of bathing in the pond; that the proposed according of the privilege to the public and lot owners who were not riparian proprietors was an unreasonable use; and that, since the pond was entirely surrounded by land owned by the plaintiff, none of the lot owners was a riparian proprietor having, as such, bathing rights in the pond. The plaintiff appealed, but the judgment against the borough on its counterclaim was not appealed from.

The appellate court held that the judgment of the trial court was correct. Portions of the opinion follow:

* * * A riparian proprietor is an owner of land bounded by a water course or lake or through which a stream flows, and riparian rights can be claimed only by such an owner. They are appurtenant only to lands which touch on the water course or through which it flows and which are used as a whole for a common purpose, not to any lands physically separated from the stream and the land bordering on it, although belonging to the same owner. * * * It is clear that the grantees or contractees, from the plaintiff, of lots separated from and not bordering on Pine Lake can have, of their own right, no riparian privileges in its waters. And any attempted transfer of the right made by a riparian to a nonriparian proprietor is invalid. [Citations.]

Each riparian proprietor has an equal right to the use of the water to drink and for the ordinary uses of domestic life, although such use may in some degree lessen the volume or affect the purity of the water, and this right to such use extends "both to the owner himself and all living things in his legitimate employment." 27 R. C. L. p. 1085. The right includes use of water for drinking, culinary, and other domestic purposes, and for watering of animals. [Cases cited.] The right, being to use "ad lavandum et potandum," logically includes ordinary and reasonable bathing privileges by the riparian owner, his family, and inmates and guests of his household, in the stream or pond as well as in waters drawn therefrom. The trial court states, and the record indicates, that this right of the plaintiff was not questioned or involved in the present action; the proposed extension of the privilege to the plaintiff's grantees of lots and to the general public was the subject of the defendant's objection and notice of intention to resist. * * *

Each riparian owner is limited to a reasonable use of the waters, with due regard to the rights and necessities of other such owners. It is the common right of all to have the stream preserved in its natural size, flow, and purity, without material diversion or pollution. A riparian proprietor has no property in the water itself, but a simple usufruct while it passes along. Though he may use the water while it runs over his land, as an incident to the land, he can not unreasonably detain, divert, or pollute it, unless he has a prior or special right to some exclusive or particular enjoyment. He must use and apply the water in a reasonable manner and so as not to destroy, or render useless, or materially diminish or affect, the legitimate application or use thereof by other riparian proprietors. [Cases cited.]

Application of these rules readily demonstrates that the uses contemplated and threatened by the plaintiff clearly were extraordinary and unreasonable. * * * The conclusions reached by the trial court as to this feature of the case were warranted in law and fact.

* * * The giving of notice of intention to protect the supply by preventing the contemplated injury by promiscuous bathing was not only fair to the plaintiff and prospective purchasers, but a proper means of minimizing damages. [Case cited.] The notices were appropriate, also, to a fulfillment of the duty resting

upon the defendants to adopt such precautionary measures as are reasonably proper and necessary to protect the community served by the water supply from risk of infection.

DEATHS DURING WEEK ENDED JUNE 28, 1930

Summary of information received by telegraph from industrial insurance companies for the week ended June 28, 1930, and corresponding week of 1929. (From the Weekly Health Index, July 2, 1930, issued by the Bureau of the Census, Department of Commerce)

	Week ended June 28, 1930	Corresponding week, 1929
Policies in force	75, 988, 917	74, 459, 453
Number of death claims	12, 967	13, 504
Death claims per 1,000 policies in force, annual rate	8. 9	9. 5

Deaths from all causes in certain large cities of the United States during the week ended June 28, 1930, infant mortality, annual death rate, and comparison with corresponding week of 1929. (From the Weekly Health Index, July 2, 1930, issued by the Bureau of the Census, Department of Commerce)

City	Week ended June 28, 1930		Annual death rate per 1,000, corresponding week, 1929	Deaths under 1 year		Infant mortality rate, week ended June 28, 1930 [2]
	Total deaths	Death rate [1]		Week ended June 28, 1930	Corresponding week, 1929	
Total (65 cities)	6, 714	11. 8	11. 0	611	572	[3] 54
Akron	23			1	5	9
Albany [4]	30	13. 0	17. 3	7	3	153
Atlanta	116	23. 7	14. 7	22	12	233
White	65			6	7	190
Colored	51	(5)	(5)	16	5	254
Baltimore [4]	202	12. 7	11. 4	17	15	58
White	159			11	11	47
Colored	43	(5)	(5)	6	4	97
Birmingham	87	20. 4	13. 4	12	2	112
White	40			5	1	77
Colored	47	(5)	(5)	7	1	166
Boston	161	10. 5	11. 9	14	13	39
Bridgeport	22			2	4	34
Buffalo	135	12. 7	13. 8	7	11	31
Cambridge	31	12. 8	9. 1	3	5	56
Camden	30	11. 6	9. 2	5	2	91
Canton	20	8. 9	4. 5	0	1	0
Chicago [4]	596	9. 8	10. 2	35	64	31
Cincinnati	125			9	12	53
Cleveland	186	9. 6	7. 9	13	14	39
Columbus	70	12. 2	13. 4	6	6	59
Dallas	59	14. 1	10. 8	5	5	
White	43			4	5	
Colored	16	(5)	(5)	1	0	
Dayton	39	11. 0	14. 7	3	7	44
Denver	77	13. 6	15. 4	4	4	42
Des Moines	30	10. 3	11. 0	1	6	17
Detroit	261	9. 9	12. 0	38	45	59
Duluth	17	7. 6	11. 2	1	1	27
El Paso	48	21. 2	16. 8	19	5	
Erie	33			2	3	43
Fall River [4]	19	7. 4	6. 6	4	2	92
Flint	27	9. 5	12. 3	6	3	70
Fort Worth	28	8. 6	9. 2	3	3	
White	20			3	2	
Colored	8	(5)	(5)	0	1	
Grand Rapids	35	11. 1	7. 0	4	1	61
Houston	77			3	8	
White	50			2	7	
Colored	27	(5)	(5)	1	1	
Indianapolis	109	14. 9	12. 3	6	4	45
White	92			6	4	52
Colored	17	(5)	(5)	0	0	0
Jersey City	62	10. 0	10. 1	4	5	35
Kansas City, Kans	22	9. 7	11. 9	2	0	47
White	17			2	0	53
Colored	5	(5)	(5)	0	0	0
Kansas City, Mo	95	12. 7	12. 8	7	11	54

Footnotes at end of table.

Deaths from all causes in certain large cities of the United States during the week ended June 28, 1930, infant mortality, annual death rate, and comparison with corresponding week of 1929—Continued

City	Week ended June 28, 1930		Annual death rate per 1,000, corresponding week, 1929	Deaths under 1 year		Infant mortality rate, week ended June 28, 1930 [2]
	Total deaths	Death rate [1]		Week ended June 28, 1930	Corresponding week, 1929	
Knoxville	23	11.4	9.4	5	3	117
White	18			2	3	52
Colored	5	(5)	(5)	3	0	741
Los Angeles	243			20	15	61
Louisville	69	10.9	13.6	5	7	43
White	51			4	6	40
Colored	18	(5)	(5)	1	1	72
Lowell	24			3	1	71
Lynn	19	9.4	7.4	0	1	0
Memphis	100	27.4	24.1	15	5	179
White	49			7	2	129
Colored	51	(5)	(5)	8	3	270
Milwaukee	110	10.5	7.9	11	20	55
Minneapolis	88	10.1	8.3	5	3	32
Nashville	59	22.0	22.0	7	10	108
White	35			2	5	41
Colored	24	(5)	(5)	5	5	317
New Bedford	20			2	1	51
New Haven	36	10.0	10.3	1	3	19
New Orleans	190	23.1	16.5	20	15	116
White	118			8	6	71
Colored	72	(5)	(5)	12	9	202
New York	1,378	11.9	10.5	128	99	54
Bronx Borough	192	10.5	7.8	13	3	31
Brooklyn Borough	450	10.2	9.4	33	41	35
Manhattan Borough	561	16.7	14.4	64	38	105
Queens Borough	130	7.9	8.2	16	15	46
Richmond Borough	45	15.6	10.7	2	2	37
Newark, N. J	109	12.0	8.6	7	5	37
Oakland	46	8.8	10.1	1	4	12
Oklahoma City	35			8	5	157
Omaha	57	13.3	9.8	2	3	23
Paterson	32	11.5	9.4	3	4	52
Philadelphia	394	10.0	10.5	35	33	52
Pittsburgh	162	12.5	10.1	23	8	84
Portland, Oreg	65			2	5	25
Providence	57	10.4	7.8	5	10	46
Richmond	57	15.3	15.0	8	3	119
White	32			2	1	45
Colored	25	(5)	(5)	6	2	262
Rochester	63	10.0	9.4	6	9	53
St. Louis	263	16.2	11.8	15	14	49
St. Paul	58			6	1	61
Salt Lake City [4]	34	12.8	13.2	2	2	31
San Antonio	74	17.7	14.1	8	11	
San Diego	40			2	2	42
San Francisco	122	10.9	12.0	3	6	21
Schenectady	18	10.1	8.4	1	4	31
Seattle	57	7.8	11.3	3	5	30
Somerville	12	6.1	4.6	0	0	0
Spokane	28	13.4	12.9	1	1	26
Springfield, Mass	29	10.1	10.1	3	1	47
Syracuse	37	9.7	13.1	2	2	25
Tacoma	28	13.2	15.6	5	1	129
Toledo	55	9.2	10.3	8	8	73
Trenton	40	15.0	10.1	1	3	19
Utica	25	12.5	17.0	1	3	28
Washington, D. C	129	12.2	9.5	11	6	64
White	73			4	2	35
Colored	56	(5)	(5)	7	4	124
Waterbury	26			7	0	179
Wilmington, Del	24	9.7	11.8	2	3	45
Worcester	40	10.6	10.6	3	3	39
Yonkers	28	12.0	5.6	2	1	48
Youngstown	30	9.0	9.3	5	3	78

[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 28, 1930, and June 29, 1929

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 28, 1930, and June 29, 1929

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929
New England States:								
Maine	1		2		39	84	0	1
New Hampshire	1				18	75	0	0
Vermont	1				21	1	0	0
Massachusetts	48	67			717	408	6	7
Rhode Island	7	5			25	26	0	0
Connecticut	4	29		1	24	49	0	1
Middle Atlantic States:								
New York	106	275	[1] 5	[1] 7	1,306	586	6	6
New Jersey	74	69	2		838	104	10	3
Pennsylvania	76	133			907	820	10	7
East North Central States:								
Ohio	32	55	10	4	378	878	7	7
Indiana	11	11			123	98	4	0
Illinois	122	155	25	8	285	1,114	5	12
Michigan	58	94	4		530	445	12	53
Wisconsin	5	18	6	5	429	761	2	7
West North Central States:								
Minnesota	11	11	1	3	74	127	0	2
Iowa	3	4			51	52	2	0
Missouri [2]	22	38			57	38	3	8
North Dakota	1	6			9	64	0	
South Dakota	2				46	8	0	1
Nebraska	6	7			30	46	0	1
Kansas	7	13		1	187	337	2	4
South Atlantic States:								
Delaware					3	8	0	0
Maryland [3]	10	24	2	5	25	15	0	0
District of Columbia	6	4			48	13	0	0
West Virginia	3	7	3	12	40	92	1	1
North Carolina	7	21	34		72	12	2	0
South Carolina	5	10	126	89			0	0
Georgia	4	9	9	9	84	21	4	1
Florida	8	5		4	36	12	0	0

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

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 28, 1930, and June 29, 1929—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929
East South Central States:								
Kentucky	3	5			22	20	0	0
Tennessee	3	5	20	5	47	6	1	2
Alabama	9	17	7	8	56	33	2	0
Mississippi	2	7					0	0
West South Central States:								
Arkansas	1	8		11	11	5	3	3
Louisiana	9	8	10	9	8	34	2	2
Oklahoma [4]	19	4	3	3	47	26	0	2
Texas	21	17	6	8	54	68	2	2
Mountain States:								
Montana		1			3	15	0	2
Idaho	2				2	8	1	0
Wyoming	1				38	13	0	0
Colorado	1	4		1	171	13	1	2
New Mexico	3	2			15	11	2	1
Arizona	4	3			48		1	2
Utah [3]	2	3	4	4	68	8	1	2
Pacific States:								
Washington	6	15			250	81	0	3
Oregon		5	1	9	96	87	0	0
California	52	58	26	21	924	96	3	6

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929
New England States:								
Maine	0	0	13	8	0	0	1	10
New Hampshire	1	0	9	8	0	0	0	0
Vermont	0	0	2	3	0	0	0	0
Massachusetts	1	2	112	106	0	0	5	3
Rhode Island	0	0	6	4	0	0	1	1
Connecticut	1	2	20	16	0	0	1	0
Middle Atlantic States:								
New York	4	3	136	150	9	1	14	17
New Jersey	0	0	63	49	0	0	6	8
Pennsylvania	1	0	202	190	0	0	23	31
East North Central States:								
Ohio	3	0	152	128	58	46	7	20
Indiana	0	0	47	47	114	65	2	3
Illinois	3	2	209	203	63	79	13	10
Michigan	1	0	151	165	53	67	4	5
Wisconsin	2	0	65	90	14	14	1	1
West North Central States:								
Minnesota	0	0	36	56	4	7	4	3
Iowa	0	0	17	21	73	22	3	2
Missouri [2]	0	1	29	20	25	16	0	11
North Dakota	2	0	17	21	20	11	1	1
South Dakota	0	0	6	5	19	23	1	0
Nebraska	0	0	8	15	21	28	3	1
Kansas	0	0	26	53	57	44	3	8
South Atlantic States:								
Delaware	0	0	7	0	0	0	0	2
Maryland [3]	0	0	34	30	0	0	7	5
District of Columbia	0	0	7	5	0	0	0	1
West Virginia	0	0		9	15	17	10	8
North Carolina	6	5	13	13	13	0	46	36
South Carolina	1	1	4	4	1	1	60	59
Georgia	0	0	8	9	0	0	40	41
Florida	0	0	1	2	1	0	3	3

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

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 28, 1930, and June 29, 1929—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929	Week ended June 28, 1930	Week ended June 29, 1929
East South Central States:								
Kentucky	0	0	23	31	2	6	10	4
Tennessee	2	2	15	5	3	0	35	36
Alabama	2	3	2	7	0	0	18	46
Mississippi	0	0	4	5	2	1	37	41
West South Central States:								
Arkansas	0	0	4	9	3	5	14	17
Louisiana	8	0	16	10	3	0	21	19
Oklahoma [4]	1	0	16	22	59	34	13	15
Texas	3	1	14	24	27	15	38	11
Mountain States:								
Montana	0	0	5	2	3	6	1	5
Idaho	0	0	1	1	3	9	2	0
Wyoming	0	0	2	6	2	12	0	4
Colorado	1	0	10	7	2	0	2	5
New Mexico	0	0	7	2	1	2	0	2
Arizona	0	0	5	1	4	1	15	38
Utah [3]	0	0	8	13	0	12	1	0
Pacific States:								
Washington	0	0	13	15	31	35	2	4
Oregon	0	0	10	11	21	19	3	1
California	77	3	66	185	41	18	21	11

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

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of monthly State reports is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
April, 1930										
Hawaii Territory	5	31	7	--------	76	--------	3	5	0	10
May, 1930										
Alabama	15	30	171	468	554	113	3	47	25	43
California	13	225	82	6	8,858	12	58	531	259	53
Iowa	13	26	--------	3	1,551	--------	0	248	429	1
Louisiana [2]	11	50	88	113	134	93	11	58	61	93
Massachusetts	33	236	12	--------	6,448	--------	5	947	0	12
Montana	4	4	6	--------	79	--------	1	111	17	8
Nevada	--------	--------	--------	--------	82	--------	0	--------	51	--------
North Carolina	19	94	45	--------	210	326	3	113	47	29
Oklahoma [1]	4	41	105	133	977	72	0	85	362	21
Oregon	1	19	57	--------	420	--------	0	71	106	6
South Dakota	2	15	11	--------	409	--------	0	58	171	--------
Virginia	6	68	785	62	2,505	82	3	104	23	33
Washington	16	28	38	--------	2,807	--------	1	130	221	11
Wisconsin	13	72	47	--------	3,516	--------	1	822	68	11

[1] Exclusive of Oklahoma City and Tulsa.
[2] Diagnosis of leprosy in a case reported in Louisiana in February and published in the PUBLIC HEALTH REPORTS dated Apr. 4, 1930, was not confirmed by later examination.

April, 1930

	Cases
Hawaii Territory:	
Chicken pox	48
Conjunctivitis, follicular	57
Dysentery (bacillary)	1
Hookworm disease	2
Leprosy	7
Mumps	19
Tetanus	3
Trachoma	2
Whooping cough	27

May, 1930

	Cases
Chicken pox:	
Alabama	186
California	1,391
Iowa	227
Louisiana	83
Massachusetts	848
Montana	42
Nevada	19
North Carolina	641
Oklahoma [1]	52
Oregon	198
South Dakota	70
Virginia	579
Washington	344
Wisconsin	1,245
Dengue:	
Alabama	1
Oklahoma [1]	1
Dysentery:	
California (amebic)	4
California (bacillary)	5
Louisiana	8
Oklahoma [1]	10
Dysentery and diarrhea:	
Virginia	730
Food poisoning:	
California	10
German measles:	
California	51
Iowa	1
Massachusetts	1,373
Montana	3
North Carolina	418
Washington	236
Wisconsin	109
Granuloma, coccidioidal:	
California	2
Hookworm disease:	
California	1
Louisiana	200
Impetigo contagiosa:	
Oregon	10
Lead poisoning:	
Massachusetts	4
Leprosy: [2]	
California	2
Lethargic encephalitis:	
Alabama	8
California	3
Louisiana	4
Massachusetts	6
Lethargic encephalitis—Continued.	
Oregon	3
Washington	2
Wisconsin	4
Mumps:	
Alabama	103
California	2,762
Iowa	136
Louisiana	24
Massachusetts	667
Montana	165
Nevada	37
Oklahoma [1]	9
Oregon	128
South Dakota	36
Washington	437
Wisconsin	1,036
Ophthalmia neonatorum:	
California	1
Louisiana	1
Massachusetts	165
Montana	1
Wisconsin	1
Paratyphoid fever:	
California	2
Puerperal septicemia:	
Oregon	1
Washington	1
Rabies in animals:	
California	51
Louisiana	10
Rocky Mountain spotted or tick fever:	
Montana	5
Nevada	9
Oregon	23
Washington	1
Scabies:	
Oregon	4
Septic sore throat:	
Louisiana	2
Massachusetts	19
North Carolina	7
Oklahoma [1]	35
Washington	1
Tetanus:	
California	1
Louisiana	12
Massachusetts	4
Oklahoma [1]	3
Trachoma:	
California	9
Massachusetts	3
Oklahoma [1]	5
South Dakota	3
Trichinosis:	
California	4
Tularæmia:	
California	3
Nevada	3
Virginia	2
Typhus fever:	
Alabama	6
Massachusetts	1
Virginia	4

[1] Exclusive of Oklahoma City and Tulsa.

[2] Diagnosis of leprosy in a case reported in Louisiana in February and published in the Public Health Reports dated Apr. 4, 1930, was not confirmed by later examination.

Undulant fever:	Cases
Alabama	4
California	6
Iowa	13
Massachusetts	1
Montana	1
Oregon	3
Virginia	4
Washington	2

Vincent's angina:	
Iowa	1
Oklahoma [1]	1
Oregon	9
Washington	97

Whooping cough:	Cases
Alabama	161
California	1,088
Iowa	65
Louisiana	39
Massachusetts	1,171
Montana	36
Nevada	17
North Carolina	1,380
Oklahoma	80
Oregon	214
South Dakota	59
Virginia	803
Washington	395
Wisconsin	847

RECIPROCAL NOTIFICATIONS

Notifications regarding communicable diseases sent during the month of May, 1930, by departments of health of certain States to other State health departments

Disease	California	Illinois	Kansas	Massachusetts	Minnesota	New Jersey	New York
Actinomycosis					1		
Chicken pox		1					
Diphtheria							2
Gonorrhea					2		
Measles							2
Meningococcus meningitis					1		1
Paratyphoid fever		1					
Rocky Mountain spotted fever	2						
Scarlet fever						1	
Smallpox	2	8					3
Syphilis			2		3		
Tuberculosis	5	18			23		
Typhoid fever	2	4		1			1

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 95 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 31,660,000. The estimated population of the 88 cities reporting deaths is more than 30,065,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended June 21, 1930, and June 22, 1929

	1930	1929	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	851	1,247	
95 cities	415	677	694
Measles:			
45 States	10,437	7,485	
95 cities	4,047	2,561	
Meningococcus meningitis:			
46 States	111	199	
95 cities	55	84	
Poliomyelitis:			
47 States	105	22	
Scarlet fever:			
46 States	2,011	2,377	
95 cities	883	893	722
Smallpox:			
46 States	995	635	
95 cities	60	55	43
Typhoid fever:			
46 States	412	391	
95 cities	46	49	69
Deaths reported			
Influenza and pneumonia:			
88 cities	440	492	
Smallpox:			
88 cities	0	0	

[1] Exclusive of Oklahoma City and Tulsa.

City reports for week ended June 21, 1930

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

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

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	6	0	0		0	2	15	5
New Hampshire:								
Concord	0	0	0		0	1	0	1
Manchester	0	0	0		0	0	0	2
Nashua	0	0	1		0	5	0	0
Vermont:								
Barre	1	0	0		0	10	0	0
Burlington	0	0	0		0	0	0	0
Massachusetts:								
Boston	50	30	15		0	328	32	13
Fall River	5	2	0		0	1	7	1
Springfield	10	2	0	1	1	6	6	3
Worcester	33	2	0		0	109	0	1
Rhode Island:								
Pawtucket	4	1	0		0	0	0	1
Providence	14	4	1		0	1	0	3
Connecticut:								
Bridgeport	2	4	0		0	3	0	0
Hartford	4	3	0		0	2	0	1
New Haven	12	1	0		0	10	5	2
MIDDLE ATLANTIC								
New York:								
Buffalo	24	10	14		0	14	9	9
New York	216	221	91	8	7	1,161	0	108
Rochester	6	8	3		0	13	1	2
Syracuse	40	3	1		0	35	37	1
New Jersey:								
Camden	5	6	2	1	1	9	0	0
Newark	19	10	24		0	90	8	3
Trenton	3	2	1		0	11	2	1
Pennsylvania:								
Philadelphia	68	50	14	6	2	255	85	28
Pittsburgh	26	15	18		1	120	8	17
Reading	5	2	1		0	3	8	2
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	2	5	2		3	44	8	2
Cleveland	105	23	13		0	7	23	10
Columbus	5	2	2	1	1	69	4	1
Toledo	20	4	3	3	3	23	3	1
Indiana:								
Fort Wayne	4	1	1		0	0	0	0
Indianapolis	8	2	0		0	32	0	9
South Bend	0	1	2		0	2	0	0
Terre Haute	1	0	0		0	33	0	1
Illinois:								
Chicago	83	76	100	1	1	45	97	30
Springfield	3	0	0	1	1	37	1	1

City reports for week ended June 21, 1930—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—continued								
Michigan:								
Detroit	46	38	27	1	0	179	51	19
Flint	8	2	0	-----	0	119	0	6
Grand Rapids	3	1	0	-----	0	3	0	1
Wisconsin:								
Kenosha	1	0	0	-----	0	1	0	0
Madison	1	0	0	-----	-----	5	1	-----
Milwaukee	115	11	2	1	1	21	78	2
Racine	11	1	0	-----	0	16	0	1
Superior	0	0	0	-----	0	0	0	1
WEST NORTH CENTRAL								
Minnesota:								
Duluth	4	1	0	-----	0	13	0	1
Minneapolis	23	11	1	-----	0	19	2	3
St. Paul	32	7	1	-----	0	6	2	4
Iowa:								
Des Moines	2	1	0	-----	-----	3	0	-----
Sioux City	2	1	0	-----	-----	10	0	-----
Waterloo	3	0	0	-----	-----	0	0	-----
Missouri:								
Kansas City	-----	2	-----	-----	-----	-----	-----	-----
St. Joseph	1	0	1	-----	0	0	0	2
St. Louis	34	22	7	-----	-----	52	11	-----
North Dakota:								
Fargo	2	1	0	-----	0	0	5	0
Grand Forks	0	0	0	-----	-----	0	0	-----
South Dakota:								
Aberdeen	1	0	0	-----	-----	64	0	-----
Sioux Falls	0	0	0	-----	-----	4	0	-----
Nebraska:								
Lincoln	8	0	1	-----	-----	1	1	-----
Omaha	1	2	3	-----	0	8	0	5
Kansas:								
Topeka	3	1	0	3	0	17	0	4
Wichita	0	0	1	-----	0	31	1	2
SOUTH ATLANTIC								
Delaware:								
Wilmington	1	1	0	-----	0	1	1	0
Maryland:								
Baltimore	75	16	12	2	1	17	16	16
Cumberland	0	0	0	-----	0	2	0	0
Frederick	0	0	0	-----	0	0	0	0
District of Columbia:								
Washington	23	6	2	-----	0	65	0	5
Virginia:								
Lynchburg	4	0	0	-----	0	17	0	1
Norfolk	0	0	0	-----	0	1	0	3
Richmond	2	2	0	-----	0	6	0	1
Roanoke	3	0	0	-----	0	35	1	2
West Virginia:								
Charleston	2	0	0	1	0	0	0	0
Wheeling	6	1	0	-----	0	8	0	1
North Carolina:								
Raleigh	1	0	0	-----	0	0	0	0
Wilmington	0	0	0	-----	0	0	0	0
Winston-Salem	-----	0	-----	-----	-----	-----	-----	-----
South Carolina:								
Charleston	0	0	0	4	0	2	2	1
Columbia	2	0	0	-----	0	1	4	0
Georgia:								
Atlanta	2	1	2	4	0	18	5	6
Brunswick	1	0	0	-----	0	0	0	0
Savannah	0	0	1	-----	0	7	0	0
Florida:								
Miami	0	1	0	-----	0	2	1	2
St. Petersburg	-----	0	-----	-----	0	-----	-----	0
Tampa	0	1	1	-----	0	26	0	1

City reports for week ended June 21, 1930—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria: Cases, estimated expectancy	Diphtheria: Cases reported	Influenza: Cases reported	Influenza: Deaths reported	Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
EAST SOUTH CENTRAL								
Kentucky:								
Covington	0	0	0	----------	0	1	0	4
Tennessee:								
Memphis	6	0	1	----------	0	0	0	7
Nashville	2	0	1	----------	0	13	0	5
Alabama:								
Birmingham	2	1	0	2	2	25	1	2
Mobile	0	0	0	----------	0	0	0	0
Montgomery	1	0	0	----------	----------	1	0	----------
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith	1	0	1	----------	----------	8	0	----------
Little Rock	0	0	0	----------	0	0	0	0
Louisiana:								
New Orleans	0	5	7	2	1	3	0	4
Shreveport	0	0	0	----------	0	3	2	2
Oklahoma:								
Oklahoma City	0	0	0	1	1	2	0	5
Tulsa	0	0	0	----------	----------	1	0	----------
Texas:								
Dallas	0	3	10	----------	0	7	2	4
Fort Worth	0	1	0	----------	0	0	0	0
Galveston	0	0	0	----------	0	0	0	0
Houston	3	2	2	----------	0	1	0	6
San Antonio	0	2	3	----------	1	0	0	2
MOUNTAIN								
Montana:								
Billings	0	0	0	----------	0	9	1	2
Great Falls	1	0	0	----------	0	1	0	0
Helena	0	1	0	----------	0	0	0	0
Missoula	0	0	0	----------	0	5	1	0
Idaho:								
Boise	0	0	0	----------	0	9	0	2
Colorado:								
Denver	14	8	0	----------	0	115	6	5
Pueblo	2	1	0	----------	0	55	17	2
New Mexico:								
Albuquerque	2	0	0	----------	0	6	2	0
Arizona:								
Phoenix	0	0	0	----------	0	0	0	1
Utah:								
Salt Lake City	12	3	1	----------	0	110	5	4
Nevada:								
Reno	----------	0	----------	----------	----------	----------	----------	----------
PACIFIC								
Washington:								
Seattle	14	3	1	----------	----------	156	37	----------
Spokane	14	2	1	----------	----------	31	0	----------
Tacoma	3	2	2	----------	0	76	0	1
Oregon:								
Portland	3	6	2	1	0	34	7	5
Salem	10	0	0	----------	0	1	1	0
California:								
Los Angeles	36	33	14	15	0	206	59	19
Sacramento	1	2	3	----------	0	23	7	2
San Francisco	15	11	2	----------	0	36	26	2

City reports for week ended June 21, 1930—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
NEW ENGLAND											
Maine:											
Portland	1	3	0	0	0	0	0	0	0	5	22
New Hampshire:											
Concord	0	0	0	0	0	1	0	0	0	0	9
Manchester	1	0	0	0	0	0	0	0	0	0	11
Nashua	0	0	0	0	0	0	0	0	0	0	--------
Vermont:											
Barre	0	0	0	0	0	0	0	0	0	0	2
Burlington	0	0	0	0	0	0	0	0	0	0	11
Massachusetts:											
Boston	44	28	0	0	0	12	2	0	0	47	198
Fall River	2	2	0	0	0	2	1	0	1	4	25
Springfield	4	2	0	0	0	1	0	0	0	6	26
Worcester	6	3	0	0	0	1	0	0	0	9	28
Rhode Island:											
Pawtucket	1	1	0	0	0	0	0	0	0	0	20
Providence	5	6	0	0	0	3	0	0	0	6	56
Connecticut:											
Bridgeport	5	3	0	0	0	4	0	0	0	0	23
Hartford	3	0	0	0	0	3	0	0	0	0	31
New Haven	2	4	0	0	0	3	1	0	0	12	49
MIDDLE ATLANTIC											
New York:											
Buffalo	18	3	0	1	0	6	1	0	0	18	109
New York	146	106	0	0	0	92	12	6	2	100	1,321
Rochester	6	9	0	0	0	1	0	0	0	2	64
Syracuse	4	8	0	0	0	1	0	0	0	53	46
New Jersey:											
Camden	4	1	0	0	0	1	0	0	0	3	34
Newark	16	16	0	0	0	7	0	0	0	35	78
Trenton	2	6	0	0	0	6	1	0	0	0	34
Pennsylvania:											
Philadelphia	54	74	0	0	0	26	3	0	0	22	415
Pittsburgh	20	21	0	0	0	7	0	3	0	34	147
Reading	2	3	0	0	0	3	0	0	0	5	19
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	7	7	2	0	0	11	0	1	0	3	130
Cleveland	26	44	0	4	0	10	2	1	0	75	173
Columbus	4	1	1	0	0	3	1	0	0	9	78
Toledo	7	23	0	4	0	4	0	0	0	1	63
Indiana:											
Fort Wayne	1	2	1	3	0	1	0	0	0	2	23
Indianapolis	5	17	5	3	0	1	0	0	0	17	--------
South Bend	1	3	0	0	0	1	0	0	0	0	13
Terre Haute	1	1	1	0	0	0	0	0	0	1	15
Illinois:											
Chicago	79	160	2	0	0	40	3	2	1	76	608
Springfield	2	0	0	0	0	0	0	0	0	6	23
Michigan:											
Detroit	60	76	1	1	0	28	2	0	1	156	263
Flint	5	15	1	1	0	1	0	0	1	12	30
Grand Rapids	4	12	0	0	0	2	0	0	0	1	41
Wisconsin:											
Kenosha	0	2	0	0	--------	0	0	0	0	6	8
Madison	0	2	0	0	--------	0	0	0	0	11	--------
Milwaukee	17	17	0	0	0	6	1	0	0	52	101
Racine	2	8	0	0	0	0	0	0	0	10	8
Superior	3	0	0	0	0	2	0	0	0	0	7

City reports for week ended June 21, 1930—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST NORTH CENTRAL											
Minnesota:											
Duluth	6	2	0	0	0	0	0	0	0	7	22
Minneapolis	21	7	2	0	0	4	1	0	0	1	97
St. Paul	13	4	0	0	0	2	1	0	0	5	53
Iowa:											
Des Moines	4	2	2	28	...	...	0	0	...	0	27
Sioux City	0	4	1	6	...	...	0	0	...	4	...
Waterloo	1	0	1	2	...	...	0	0	...	1	...
Missouri:											
Kansas City	4	...	0	...	...	...	1	...	...	...	...
St. Joseph	0	4	1	0	0	1	0	0	0	0	23
St. Louis	15	40	1	1	0	8	2	1	0	10	220
North Dakota:											
Fargo	1	0	0	0	0	1	0	0	0	6	7
Grand Forks	0	0	0	1	...	...	0	0	...	0	...
South Dakota:											
Aberdeen	1	0	0	3	...	...	0	0	...	0	...
Sioux Falls	0	0	0	6	...	...	0	0	...	0	...
Nebraska:											
Lincoln	1	8	1	1	...	...	0	0	...	10	...
Omaha	2	5	2	4	0	1	0	0	0	0	54
Kansas:											
Topeka	1	1	0	0	0	2	0	1	0	22	23
Wichita	1	2	0	1	0	1	0	2	0	1	32
SOUTH ATLANTIC											
Delaware:											
Wilmington	2	6	0	0	0	1	1	0	0	5	27
Maryland:											
Baltimore	16	30	0	0	0	8	2	1	1	25	164
Cumberland	0	0	0	0	0	0	0	0	0	0	8
Frederick	0	0	0	0	0	0	0	0	0	0	2
District of Columbia:											
Washington	11	4	1	0	0	13	1	1	1	2	135
Virginia:											
Lynchburg	1	0	0	0	0	0	0	2	0	10	19
Norfolk	1	0	0	0	0	3	0	2	0	0	...
Richmond	1	5	0	0	0	5	1	0	0	2	56
Roanoke	0	0	0	0	0	0	0	0	0	4	14
West Virginia:											
Charleston	0	1	1	0	0	2	1	0	0	2	21
Wheeling	1	1	0	0	0	0	0	0	0	2	14
North Carolina:											
Raleigh	0	0	0	1	0	1	0	2	0	7	11
Wilmington	0	0	0	0	0	0	0	0	0	5	12
Winston-Salem	0	...	0	...	...	...	0	...	...	...	...
South Carolina:											
Charleston	0	0	1	0	0	0	1	0	0	8	18
Columbia	0	1	0	0	0	1	2	2	0	0	12
Georgia:											
Atlanta	3	4	2	0	0	6	3	1	1	5	82
Brunswick	0	0	0	0	0	0	0	0	0	0	4
Savannah	0	0	0	0	0	1	1	1	0	0	35
Florida:											
Miami	0	0	0	0	0	0	0	1	0	0	31
St. Petersburg	0	...	0	...	0	0	0	...	1	...	11
Tampa	0	1	0	0	0	4	1	0	0	1	17
EAST SOUTH-CENTRAL											
Kentucky:											
Covington	0	0	0	0	0	1	0	0	0	0	31
Tennessee:											
Memphis	2	4	0	0	0	3	3	1	0	9	81
Nashville	0	1	1	0	0	3	2	2	0	2	42
Alabama:											
Birmingham	1	4	2	0	0	4	2	5	0	20	63
Mobile	0	1	0	1	0	0	2	0	1	0	25
Montgomery	0	0	0	2	...	...	0	0	...	0	...

City reports for week ended June 21, 1930—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths, all causes
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	0	0	0	0	-------	-------	1	0	-------	10	-------
Little Rock	0	1	0	0	0	6	1	2	1	0	-------
Louisiana:											
New Orleans	3	18	0	0	0	16	3	2	2	6	150
Shreveport	1	2	1	1	0	2	0	1	0	0	30
Oklahoma:											
Oklahoma City	0	2	1	12	0	4	1	0	0	0	39
Tulsa	0	4	0	1	-------	-------	2	0	-------	1	-------
Texas:											
Dallas	2	5	1	1	0	3	2	1	1	4	61
Fort Worth	0	0	2	0	0	0	1	0	0	0	33
Galveston	0	0	0	0	0	2	0	0	0	1	14
Houston	1	1	1	4	0	5	1	0	0	0	75
San Antonio	0	1	0	1	0	4	1	1	0	4	82
MOUNTAIN											
Montana:											
Billings	0	0	0	0	0	0	0	0	0	0	6
Great Falls	0	9	0	0	0	0	0	0	0	0	8
Helena	0	1	0	0	0	0	0	0	0	0	3
Missoula	0	0	0	4	0	0	0	0	0	0	3
Idaho:											
Boise	0	0	0	0	0	0	0	0	0	1	6
Colorado:											
Denver	7	12	0	0	0	8	1	0	0	42	68
Pueblo	1	0	0	0	0	0	0	0	0	0	6
New Mexico:											
Albuquerque	1	0	0	0	0	3	0	0	0	0	-------
Arizona:											
Phoenix	1	0	0	0	0	4	0	0	0	0	21
Utah:											
Salt Lake City	2	1	1	0	0	3	0	1	0	38	32
Nevada:											
Reno	0	-------	0	-------	-------	-------	0	-------	-------	-------	-------
PACIFIC											
Washington:											
Seattle	5	5	1	1	-------	-------	0	1	-------	13	-------
Spokane	3	0	3	4	-------	-------	0	0	-------	9	-------
Tacoma	2	0	2	2	0	2	0	0	0	2	19
Oregon:											
Portland	3	0	7	4	0	2	0	1	0	10	-------
Salem	1	0	0	0	0	0	0	0	0	6	-------
California:											
Los Angeles	22	20	3	8	0	22	2	1	0	25	295
Sacramento	2	3	1	3	0	1	0	1	0	1	27
San Francisco	12	8	0	0	0	13	1	0	0	4	157

Division, State, and city	Meningococcus meningitis: Cases	Meningococcus meningitis: Deaths	Lethargic encephalitis: Cases	Lethargic encephalitis: Deaths	Pellagra: Cases	Pellagra: Deaths	Poliomyelitis (infantile paralysis): Cases, estimated expectancy	Poliomyelitis: Cases	Poliomyelitis: Deaths
NEW ENGLAND									
Connecticut:									
Hartford	0	1	0	0	0	0	0	0	0
MIDDLE ATLANTIC									
New York:									
Buffalo	0	1	0	0	0	0	0	0	0
New York	9	3	4	0	0	0	2	1	0
Pennsylvania:									
Philadelphia	1	0	0	0	0	0	0	0	0
Pittsburgh	3	1	0	0	0	0	0	0	0

City reports for week ended June 21, 1930—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	1	0	0	0	0	0	0	0	0
Cleveland	2	0	0	0	0	0	1	0	0
Indiana:									
Indianapolis	1	0	0	0	0	0	0	0	0
South Bend	1	0	0	0	0	0	0	0	0
Illinois:									
Chicago	5	3	1	0	0	0	0	0	0
Michigan:									
Detroit	9	4	0	0	0	0	1	0	0
Wisconsin:									
Milwaukee	1	1	0	0	0	0	0	0	0
WEST NORTH CENTRAL									
Minnesota:									
St. Paul	1	0	1	1	0	0	0	0	0
Missouri:									
St. Louis	3	0	0	0	0	0	0	0	0
Nebraska:									
Omaha	1	0	0	0	0	0	0	0	0
SOUTH ATLANTIC									
District of Columbia:									
Washington	1	0	0	0	0	0	0	0	0
Virginia:									
Roanoke	0	0	0	0	0	1	0	0	1
North Carolina:									
Wilmington	0	0	0	0	4	1	0	0	0
South Carolina:									
Charleston	1	1	0	0	15	0	0	0	0
Columbia	0	0	0	0	0	3	0	0	0
Georgia:									
Atlanta	2	0	0	0	1	1	0	0	0
EAST SOUTH CENTRAL									
Kentucky:									
Covington	0	2	0	0	0	0	0	0	0
Tennessee:									
Memphis	7	1	0	0	0	0	0	0	0
Alabama:									
Birmingham	1	0	0	0	0	1	0	1	0
WEST SOUTH CENTRAL									
Arkansas:									
Little Rock	0	0	0	0	0	1	0	0	0
Louisiana:									
New Orleans	0	0	0	0	7	3	0	0	0
Shreveport	0	0	0	0	0	0	0	4	0
Texas:									
Dallas	1	1	0	0	2	2	0	0	0
Fort Worth	0	0	0	0	0	2	0	0	0
Houston	0	0	0	0	1	1	0	0	0
MOUNTAIN									
Arizona:									
Phoenix	0	1	0	0	0	0	0	0	0
Utah:									
Salt Lake	1	0	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Spokane	1	0	0	0	0	0	0	0	0
Oregon:									
Portland	1	0	0	0	0	0	0	0	0
California:									
Los Angeles	1	1	0	0	0	0	0	17	3
Sacramento	1	0	0	0	0	0	0	1	0
San Francisco	0	2	1	0	0	2	0	0	0

The following table gives the rates per 100,000 population for 98 cities for the 5-week period ended June 21, 1930, compared with those for a like period ended June 22, 1929. The population figures used in computing the rates are approximate estimates, authoritative figures for many of the cities not being available. The 98 cities reporting cases have an estimated aggregate population of more than 32,000,000. The 91 cities reporting deaths have more than 30,500,000 estimated population.

Summary of weekly reports from cities, May 18 to June 21, 1930—Annual rates per 100,000 population, compared with rates for the corresponding period of 1929 [1]

DIPHTHERIA CASE RATES

	Week ended—									
	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
98 cities	81	135	77	124	77	110	[2] 80	106	[3] 68	112
New England	62	108	51	90	86	72	[4] 36	79	35	74
Middle Atlantic	80	188	71	168	72	148	82	131	81	125
East North Central	117	165	111	155	113	123	129	145	93	165
West North Central	70	100	76	110	51	96	[5] 54	65	[6] 31	87
South Atlantic	49	49	55	41	49	54	[7] 40	64	[7] 34	64
East South Central	27	14	40	7	13	21	13	41	13	34
West South Central	56	46	52	57	41	88	86	84	86	65
Mountain	51	61	43	35	60	61	[8] 35	35	[8] 9	26
Pacific	69	60	78	58	76	56	43	34	54	58

MEASLES CASE RATES

	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
98 cities	1,185	903	932	659	957	734	[2] 838	483	[3] 667	423
New England	1,719	552	1,426	364	1,462	602	[4] 1,401	337	1,048	391
Middle Atlantic	1,150	196	991	183	1,076	169	1,089	143	818	123
East North Central	692	2,286	529	1,597	517	1,827	457	1,152	381	1,010
West North Central	778	1,441	514	1,033	412	1,060	[5] 369	581	[6] 347	504
South Atlantic	875	242	725	298	478	238	[7] 374	242	[7] 387	129
East South Central	641	27	378	55	418	41	182	41	270	41
West South Central	587	430	486	236	123	400	101	209	82	183
Mountain	6,934	313	5,527	252	5,630	192	[8] 3,386	261	[8] 2667	218
Pacific	2,544	529	1,630	398	2,220	408	1,564	384	1,247	352

SCARLET FEVER CASE RATES

	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
98 cities	210	268	186	269	214	209	[2] 193	188	[3] 145	148
New England	288	281	281	269	230	191	[4] 200	204	115	159
Middle Atlantic	215	196	171	193	196	135	155	129	118	100
East North Central	229	449	142	447	296	321	304	322	229	260
West North Central	300	208	209	179	260	165	[5] 242	110	[6] 154	77
South Atlantic	150	159	115	273	156	300	[7] 149	133	[7] 100	73
East South Central	115	137	81	123	108	96	54	75	67	89
West South Central	52	118	15	160	78	76	37	107	105	88
Mountain	292	113	94	96	240	78	[8] 123	70	[8] 202	96
Pacific	113	336	83	246	109	270	113	251	85	210

[1] The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1930 and 1929, respectively.
[2] Barre, Vt., Omaha, Nebr., Winston-Salem, N. C., and Reno, Nev., not included.
[3] Kansas City, Mo., Winston-Salem, N. C., and Reno, Nev., not included.
[4] Barre, Vt., not included.
[5] Omaha, Nebr., not included.
[6] Kansas City, Mo., not included.
[7] Winston-Salem, N. C., not included.
[8] Reno, Nev., not included.

*Summary of weekly reports from cities, May 18 to June 21, 1930—Annual rates per 100,000 population, compared with rates for the corresponding period of 1929—*Continued

SMALLPOX CASE RATES

	Week ended—									
	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
98 cities	20	14	16	9	21	8	[2] 13	16	[3] 10	9
New England	0	7	0	0	0	0	[4] 0	0	0	0
Middle Atlantic	0	0	1	0	1	0	0	0	0	0
East North Central	10	20	13	15	8	17	11	28	8	18
West North Central	108	15	55	15	116	12	[5] 37	12	[6] 31	6
South Atlantic	2	4	9	0	4	2	[7] 8	4	[7] 2	6
East South Central	34	27	34	7	34	14	40	55	20	0
West South Central	11	15	15	19	22	8	22	42	26	4
Mountain	69	35	60	52	112	52	[8] 26	44	[8] 35	61
Pacific	83	75	57	27	68	14	57	46	43	31

TYPHOID FEVER CASE RATES

	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
98 cities	7	8	7	7	8	8	[2] 9	9	[3] 8	8
New England	18	7	11	2	4	7	[4] 9	11	0	4
Middle Atlantic	4	5	3	3	6	5	8	3	4	2
East North Central	5	3	3	3	4	3	4	4	3	4
West North Central	8	8	9	17	9	8	[5] 6	17	[6] 9	19
South Atlantic	11	15	13	19	20	17	[7] 15	11	[7] 19	13
East South Central	27	75	40	34	13	27	27	34	54	55
West South Central	11	11	22	19	37	27	19	19	26	34
Mountain	0	17	9	0	0	0	[8] 9	9	[8] 9	9
Pacific	7	10	9	2	2	12	19	19	7	5

INFLUENZA DEATH RATES

	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
91 cities	6	10	4	7	5	7	[2] 7	6	[3] 4	6
New England	4	7	0	7	0	2	[4] 2	7	2	2
Middle Atlantic	8	8	4	4	4	5	5	4	5	3
East North Central	5	8	4	9	4	6	6	8	4	8
West North Central	0	15	3	3	12	3	[5] 17	9	[6] 0	6
South Atlantic	5	6	4	6	9	7	[7] 2	2	[7] 2	6
East South Central	22	45	37	0	15	22	15	7	15	15
West South Central	8	27	4	12	11	16	27	12	8	16
Mountain	9	9	17	17	9	35	[8] 0	0	[8] 0	0
Pacific	6	6	3	16	3	16	6	6	0	6

PNEUMONIA DEATH RATES

	May 24, 1930	May 25, 1929	May 31, 1930	June 1, 1929	June 7, 1930	June 8, 1929	June 14, 1930	June 15, 1929	June 21, 1930	June 22, 1929
91 cities	103	116	80	105	86	90	[2] 85	86	[3] 72	81
New England	100	121	89	106	73	65	[4] 80	85	69	56
Middle Atlantic	137	129	94	113	106	105	101	98	82	89
East North Central	80	118	54	101	59	96	67	82	53	76
West North Central	83	123	68	120	130	81	[5] 82	54	[6] 81	48
South Atlantic	101	94	82	112	93	67	[7] 72	88	[7] 64	84
East South Central	88	104	110	112	81	60	110	104	133	119
West South Central	88	66	130	66	84	90	107	62	69	82
Mountain	120	139	77	113	129	61	[8] 88	113	[8] 132	78
Pacific	43	82	64	63	40	69	71	60	74	104

[2] Barre, Vt., Omaha, Nebr., Winston-Salem, N. C., and Reno, Nev., not included.
[3] Kansas City, Mo., Winston-Salem, N. C., and Reno, Nev., not included.
[4] Barre, Vt., not included.
[5] Omaha, Nebr., not included.
[6] Kansas City, Mo., not included.
[7] Winston-Salem, N. C., not included.
[8] Reno, Nev., not included.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended June 14, 1930.—The Department of Pensions and National Health reports cases of certain communicable diseases in Canada for the week ended June 14, 1930, as follows:

Province	Cerebrospinal fever	Dysentery	Influenza	Poliomyelitis	Smallpox	Typhoid fever
Prince Edward Island [1]						
Nova Scotia			1			
New Brunswick [1]						
Quebec	1					7
Ontario	1		2		10	9
Manitoba [1]						
Saskatchewan					12	3
Alberta				1		
British Columbia		4			1	2
Total	2	4	3	1	23	21

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

Quebec Province—Communicable diseases—Week ended June 21, 1930.—The Bureau of Health reports cases of certain communicable diseases in the Province of Quebec, Canada, for the week ended June 21, 1930, as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	1	Mumps	53
Chicken pox	84	Poliomyelitis	1
Diphtheria	27	Scarlet fever	64
Erysipelas	3	Smallpox	2
German measles	31	Tuberculosis	54
Influenza	3	Typhoid fever	9
Measles	90	Whooping cough	14

CHINA

Meningitis.—During the two weeks ended June 14, 1930, 6 cases of meningitis, with 3 deaths, were reported in Canton, China.

YUGOSLAVIA

Communicable diseases—May, 1930.—During the month of May, 1930, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	36	2	Puerperal sepsis	2	1
Cerebrospinal meningitis	11	7	Rabies	3	3
Diphtheria and croup	338	54	Scarlet fever	1,033	150
Dysentery	19	2	Tetanus	32	20
Glanders	1	1	Typhoid fever	202	24
Leprosy		1	Typhus fever	16	1
Measles	2,041	31			

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		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Week ended— April, 1930			May, 1930					June, 1930			
						12	19	26	3	10	17	24	31	7	14	21	28
China:																	
Canton	C										1	1	1		2		
Manchuria—Dairen	C			1													
Swatow	C												3		3		
India	C	12,350	6,461	5,914	10,817		7,436	15,870									
	D	6,507	3,606	3,371	5,866		4,345	10,403									
Bassein	C					3	1	1	2	3	4						
	D					2	1	1	1	3	2						
Bombay	C				4												
Calcutta	C	138	202	269	354	137	165	165	180	194	175	142	98				
	D	90	110	153	220	85	118	118	93	125	107	83	57				
Negapatam	C	1	12												1		
	D	1	4												1		
Rangoon	C	6	3	3	2				1		5	2	2	1			
	D	5	3	1	2				1		1		2	1			
Tuticorin	C	35	3														
	D	9	1														
India (French):																	
Chandernagor	C	1		4	1	1	2		3	2	2	2					
	D	1		2	3			4	1	1	4	1					
Karikal	C	1		4	12		1										
	D			1	9		1										
Indo-China (see also table below):																	
Pnompenh	C	3	11	9				2		1				5	10		
	D	3	8	7	6						2	2	1	1	4		
Saigon and Cholon	C	1	2	5	14	17	12	19	28	59	40	48	13	17	19		
	D	1	2	4	6	10	10	13	22	43	27	24	7	11	10		
Philippine Islands:																	
Bulacan Province—																	
Malolos	C													1			1
	D													1			
Santa Maria	C																1
Cebu—																	
Bantayan	C													3	8	53	86
	D													3	7	28	43

Barili	C																1
Bogo	C														1	3	1
	D														1	1	1
Cebu	C																1
Madridejos	C																15
	D																8
Medillin	C																1
Santa Fe	C													1			
	D													1			
Iloilo—Miagao	C																1
Leyte Province—Maripipi	C														1	15	20
	D															11	9
Masbate—Cataingau	C																10
	D																3
Manila	C											1					
Negros—																	
Bacolod	C															9	
	D															8	
Cadiz District	C												10	2	10		3
	D												7	1	5		3
Escalante	C													1			
	D													1			
Hays Calatrava	C															3	
	D															2	
La Carlota	C																3
	D																1
La Castellana	C																4
	D																2
San Remigio	C															3	8
	D															2	4
Talisay	C															7	4
	D															7	1
Pampanga Province—																	
Angeles	C															1	
Bacolor	C																1
Rizal—Navotas	C												1				
	D												1				
San Antonio	C														1		
	D														1		
Siam	C	11	3	7	1	8	7	3		12	4	6			1	1	
	D	2		4		6	3	2		10	2	2			1		
Bangkok	C	9	3	2	2	1	5	4	5			6	3	5			
	D	1			1	1	2	1				2	1				
Nagara Pathom	C			1				4	6								
	D			1				2									
On vessel:																	
S. S. at Suva, Fiji Islands	C			1													
S. S. Sutley, at Batavia, from Calcutta	C			1													
S. S. Sassari, at Massoua, from Jeddah	C												1				
	D												1				
On small boat at Port Cebu, from Bantayan Island	C													1			
	D													1			

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

CHOLERA—Continued

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

Place		December, 1929	January, 1930	February, 1930			March, 1930			April, 1930			May, 1930		
				1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31
Indo-China (French) (see also table above):															
Annam [1]	C		1	2	2			52				60		20	3
Cambodia [1]	C	41	147	41	3	46	49	32		18	6		5	31	52
Cochin-China [1]	C	46	177	64	39	21	5	22	55	48			188	224	259

[1] Reports incomplete.

PLAGUE

Place		Dec. 15, 1929-Jan. 11, 1930	Jan. 12-Feb. 8, 1930	Feb. 9-Mar. 8, 1930	Mar. 9-Apr. 5, 1930	Week ended—											
						April, 1930			May, 1930					June, 1930			
						12	19	26	3	10	17	24	31	7	14	21	28
Argentina:																	
Andalgala. [1]																	
Rosario	C		P														
Sante Fe	C		6														
Villa Lia	D			2													
Azores: Ponta Delgada	C	9					1	7									
	D	5						5									
Brazil:																	
Rio de Janeiro	C		1														
	D		1														
Sao Paulo [2].																	
British East Africa (see also table below):																	
Tanganyika	C			7			11	33									
	D						10	10									
Uganda	C	127	82	47	98	27	20	23	47	54							
	D	112	70	43	87	27	19	21	38	48							

Ceylon:																	
Colombo	C	2	4	3	4			1		4	1		1	1			
	D	1	4	3	4			1		3	1		1	1			
Plague-infected rats			1	3	2	2			2					1			
Chile: Antofagasta	C		1	1	1				1								
	D				2				1								
Dutch East Indies:																	
Batavia and West Java	C	286	167	153	124	27	16	20	24								
	D	280	164	150	122	27	16	20	24								
Plague-infected rats			3	3	3		6	2				3	2	3			
Celebes—Makassar	C		1														
	D		1														
Plague-infected rodents		4															
East Java and Madura	C	2															
	D	2															
Java and Madura	D	458	317	296	223	59	40	35	48	28							
Ecuador (see table below).																	
Egypt:																	
Alexandria	C	2	4	1	4			1	1	2	8	3	5	8	6	6	4
	D	3	1		1			1	1			1	2			2	5
Assiout	C	4						7	7	3	9	2	6	4	2	3	
	D	2						3	2		3	1	1		1		2
Assuan	C	2															
Beheira	C		2		4												
Beni Suef	C				4												
Dakahlieh	C	1		8	5	2		1	2	3	1	2	5	1			
	D	1			1						1	1					
Gharbieh	C	2	1					1									
	D	1						1									
Girga	C					1											
Minieh	C											6	1	1	1	4	4
	D												1		1		
Port Said	C					1					1	1		1			1
Greece (see also table below):																	
Patras	C				1											1	
Piraeus	C		1														
Pyrgos	C				1												
India	C	4, 713	4, 814	5, 639	4, 087		343	535									
	D	3, 093	3, 308	3, 940	3, 344		229	517									
Bassein	C		1		3												
	D		1		1												
Bombay	C		1	1	7		4			4	1		1	1			
	D		1	1	5	1	3	4		1	4						
Plague-infected rats		29	28	81	86	20	28	25	35	23	39		19	6			
Madras Presidency	C	336	27	230	157	12	15	9	8								
	D	174	13	140	87	6	8	4	1								
Rangoon	C	3	3	7	3		8		2		1	8					
	D	4	2	6	3		2	1	1	1	1	1					
Plague-infected rats			1	7	3	1	2		1	1	8	1					
India (Portuguese)	D									7							

[1] On Mar. 11, 3 deaths from bubonic plague were reported in Andalgala, Catamarca Province, Argentina, since Feb. 5, 1930.
[2] 21 cases of plague with 8 deaths were reported Jan. 29, 1930, in the State of Sao Paulo, Brazil; 15 of these cases were in the city of Sao Paulo.

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

PLAGUE—Continued

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

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Week ended— April, 1930: 12	19	26	May, 1930: 3	10	17	24	31	June, 1930: 7	14	21	28
Indo-China (see also table below):																	
Pnompenh	C	-	1	-	-	2	-	-	1	1	-	-	2	6	-	-	-
	D	-	2	13	13	2	1	1	-	-	-	1	-	5	1	-	-
Saigon and Cholon	C	1	2	-	1	-	-	-	-	1	-	-	-	1	-	-	-
	D	1	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Iraq:																	
Baghdad	C	2	6	6	7	-	2	-	4	7	11	7	12	12	-	8	4
	D	1	2	1	4	-	-	-	2	3	5	4	6	7	-	5	-
Basra	C	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naudham	C	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Japan: Osaka (vicinity of)—Plague-infected rats		1	7	6	4	1	1	1	-	-	-	-	-	-	-	-	-
Kwang-Chow-Wan	C	-	25	25	7	-	-	-	37	-	20	-	14	-	-	-	-
Madagascar (see also table below):																	
Tamatave	C	4	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	D	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morocco	C	12	4	48	55	14	41	34	32	19	22	18	12	2	-	-	-
	D	-	-	13	18	6	26	12	11	11	14	6	3	4	-	-	-
Nigeria: Lagos	C	15	6	7	13	-	-	-	-	1	1	-	-	1	-	-	-
	D	15	6	7	5	-	-	-	-	1	1	-	-	1	-	-	-
Plague-infected rats		18	44	42	25	3	3	1	-	2	-	-	-	-	-	-	-
Senegal (see table below).																	
Siam	C	11	8	17	16	4	-	1	-	-	-	-	-	-	-	-	-
	D	9	6	13	15	4	-	2	-	-	-	-	-	-	-	-	-
Bangkok	C	1	-	1	5	-	-	-	-	-	1	1	3	-	-	-	-
	D	1	-	1	4	-	-	-	-	-	1	-	3	-	-	-	-
Nagara Pathom	C	6	7	5	1	-	3	2	1	-	-	-	-	-	-	-	-
	D	5	7	6	1	4	3	1	1	-	-	-	-	-	-	-	-
Nagara Rajsima	C	2	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-
	D	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-
Syria: Beirut	C	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	1
Tunisia:																	
Sfax district	C	14	18	22	-	-	-	1	-	17	-	-	4	6	-	-	-
Tunis	C	42	6	5	1	-	-	-	4	-	-	-	-	-	1	-	-
	D	21	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-

Place																	
Union of Socialist Soviet Republics:																	
Kazaks	C	P															
Salsk Region	C													1			
	D													1			
Stavropol Region	C													1			
	D													1			
Union of South Africa:																	
Cape Province	C		1	2	1					P							
	D	7		1	1												
Orange Free State	C	5	15	11	5	1											
	D	1	9	3	3												
Transvaal	C		8	2	1												
	D		3		1												
On vessel:																	
At Rio de Janeiro, Brazil, from Argentina	C		1														

Place		December, 1929	January, 1930	February, 1930	March, 1930	April, 1930	May, 1930
British East Africa (see also table above):							
Kenya	C	54	34				
Uganda	C	216	184	109			
	D	199	155	99			
Ecuador: Guayaquil	C	17	4	2	2	0	
	D	6	2	2		0	
Plague-infected rats		13	4	2	2	0	
Ecuador (outside of Quayaquil)	C	19	4				
	D	5	2				
Greece (see also table above)	C	1				1	
Indo-China (see also table above)	C	10	10	30	27	4	
Madagascar (see also table above)	C	264	282				
	D	248	258				
Ambositra Province	C	111	128	49	25		
	D	96	111	41	20		
Antisirabe Province	C	16	26	22	38		
	D	16	25	22	36		
Itasy Province	C	19	31		4		
	D	16	31		4		

Place		December, 1929	January, 1930	February, 1930	March, 1930	April, 1930	May, 1930
Madagascar—Continued.							
Miarinarivo Province	C	3		25	14		
	D	3		25	14		
Moramanga Province	C	12	22	7	5		
	D	12	21	4	5		
Tamatave Province	C	2	3				
	D	2	1				
Tananarive Province	C	97	88	110	52		
	D	98	83	107	52		
Senegal:							
Baol [1]	C	5			18	24	13
	D	2			8	12	11
Dakar [1]	C	8				2	52
	D	1				2	42
Louga [1]	C			2		33	54
	D					10	27
Thies [1]	C		3		3	12	21
	D				2	9	8
Tivaouane [1]	C		1		11	71	135
	D				8	38	69

[1] Incomplete reports.

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

SMALLPOX

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

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Week ended— April, 1930: 12	April 19	April 26	May, 1930: 3	May 10	May 17	May 24	May 31	June, 1930: 7	June 14	June 21	June 28
Algeria:																	
Algiers	C		6	1	5	1					1		2				
Constantine	C		1														
Oran	C		5		1												
Arabia: Aden	C	1	1	2	3			1									
Bolivia: La Paz.[1]																	
Brazil: Rio de Janeiro	C	1															
British Borneo: Sarawak	C		4	19													
British East Africa (see also table below):																	
Tanganyika	C	27	5	49	103			26	31	33							
	D	5		8	7			10	4	3							
British South Africa:																	
Northern Rhodesia	C				9				1								
	D								2								
Southern Rhodesia	C	33	1	6				66		53		42					
	D	6						1		4		8					
Canada:																	
Alberta	C	16	22	4	10	3	1										
Edmonton	C	15	19	1	4	3											
British Columbia—Vancouver	C	17	16	16	20	8	1	5	3			2	2	1	1		
Manitoba	C	8	6	2	4	2			2			7	3				
Ontario	C	51	63	86	100	17	30	18	12	14	24	24	20	14	10		
Fort William	C		4														
North Bay	C		2	1						1							
Ottawa	C	7	10	11	19	8	4	7	2	3	10	7	5	6		8	
Toronto	C		2									3	1	2	1	1	
Quebec	C	3	11														
Montreal	C		1														
Saskatchewan	C	61	86	76	47	3	10	7	21	20	6	10	3		12		
Regina	C	31								1		3					
Ceylon:																	
Angoda, Western Province	C			10					6								
	D			1					2								
Colombo	C	1	1	3													
	D			2													

China:																	
Canton	C	5	7	11	6		2	1						1			
	D		2	3	2	1	1		1								
Chungking	C	P	P	P		P	P	P	P	P							
Foochow	C	P	P	P			P		P								
Hong Kong	C	102	118	62	38	20	7		1	5	5	2		2	1		
	D	73	109	51	25	11	9	3		4	2	3		1			
Manchuria—																	
Harbin	C	1	3				1										
Kwantung—Dairen	C	1	6	5			1			1		7			11		
Nanking	C	P	P	P	P	P			P	P			P				
Shanghai—																	
Foreigners only	C	7	5	2	2	2	1				1	1			1		
Including natives	D	6	8	7	10	4	3	2	1		1	2	2	1			
Swatow	D	2	3	6	6	2			1	1		1	4	1			
Tientsin	C	2	1	1	2	1			1	1							
Chosen (see table below).																	
Colombia:																	
Baranquilla	C	1		102	2	1											
Buenaventura	C	13		1		7	5	2	1	2		1	1	1			
Costa Rica:																	
Port Limon	C					1	1	2	2				2	2			
San Jose [2]	C				10	7											
Curacao (alastrim)	C				14			1	1	2							
Dahomey (see table below).																	
Dutch East Indies:																	
Belawan Deli	C	1															
Borneo	C		1		185	17	43	20	10								
	D		1		12	16	12	2	1								
Java—																	
Batavia and West Java	C	17	14	14	78	30	25	8	1	1		5	1				
	D	10	7	7	6	6	1	3	1	1			2				
East Java and Madura	C							4									
Sanggi Islands	C	17	25	12	5		43		66								
	D	8			1		2		13	1							
Sumatra	C	1	2		48												
	D				5												
Egypt: Port Said	C		2			1					1						
Great Britain:																	
England and Wales	C	1,005	1,455	1,530	1,700	423	345	353	306	462	324	304	327	237			
Ashton under Lyne	C	3	4	29	15	9	3	4	2	6	3	4	4				
Bradford	C	8	5	2		1			2		1		1				
Cardiff	C				2	1	2										
Leeds	C		6	11	16	1	1										
London	C	480	597	699	710	169	169	129	137	222	138	148	129	130			
London and Great Towns	C	799	1,101	1,156	1,239	308	264	265	229	339	250	235	254	197			
	D		2	5	3	2	1	1									
Sheffield	C				8	1	1										
Stoke-on-Trent	C	12	12	41	122	17	23	33	12	19	9	13	21	3			
Greece: Patras	C	1															

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

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

SMALLPOX—Continued

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

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Week ended— April, 1930: 12	19	26	May, 1930: 3	10	17	24	31	June, 1930: 7	14	21	28
Hedjaz	C	11	11														
India	C	12,789	26,524	36,036	39,329		7,786	8,385									
	D	3,730	6,186	7,710	9,109		1,543	1,779									
Bombay	C	119	342	638	718	143	114	89	84	52	68	58	40	36			
	D	57	164	314	431	88	78	64	44	33	49	44	35	27			
Calcutta	C	88	185	399	361	153	116	122		109	70	52	71	56			
	D	62	130	287	305	124	97	103		94	72	40	52	50			
Cochin	C	234	234	184	291	56	49	58	20	13	8	7	9	4			
	D	20	27	29	35	3	4	6	2	5	1	2		2			
Karachi	C	17	30	38	33	10	9	7	4		6	7	1	5			
	D	11	9	16	47	10	3	2	2	2		1	1	2			
Madras	C	85	105	159	173	55	26	27	25	24	13	15	20	9			
	D	16	16	29	36	6	6	5	10	4	5	6		6			
Moulmein	C	18	65	143	146	10		33		27	29	20	13				
	D	9	18	40	41	4		3		4	6	5	6				
Negapatam	C			1								1					
Rangoon	C	2	7	7	10		1	1	2	2		3	1	1			
	D		4	2	5					1							
Tuticorin	C		3									5					
Vizagapatam	C	2	5	9	69	1		2	3	3	1	1					
	D			1	18	1			1		3						
India (French):																	
Chandernagor	C		3	11	6	4		6		6	2	8	8				
	D			5	2			2		2	4	1					
Karikal	C		3	12	24	8	9	2		6	5	1					
	D		3	8	7	3	3	2		2	1						
Pondicherry Province	C	20	22	52	21	12	1	11		9	13	10	8				
	D	19	19	40	13	11	1	8		7	12	10	7				
India (Portuguese)	C		16	50	38	5	6	15	17	2							
	D			6	2			5	3								
Indo-China (see also table below):																	
Pnompenh	C									1		1	1				
	D		1				1	1						1			
Saigon and Cholon	C	4	3	4	3			4	1	1	1			1			
	D	2	3	2	1		1	3	1		1		1				

Iraq:																	
Baghdad	C	16	7	3		1	2	3	2	1				1			
	D	5	3	1					1	1							
Basra	C			1					1								
Mossoul Liwa	C	80	26	12			22			13		8			1		
	D	3	7	2			3			2		1			1		
Ivory Coast (see table below):																	
Jamaica	C												2				
Japan: Tokyo	C								1								
	D								1								
Macao	D			2	3	1			1	1							
Mexico (see also table below):																	
Jalisco (State): Guadalajara	D	9	9	14	22	6	4	8	2			6	1	4		5	
Juarez	C	3	2	3	2												
	D	2	1	1													
Mexico City and surrounding territory [3]	C	25	30	38	106	36	19	20	24	30	15	17	18				
	D	4	7	21	31	14	8	14	11	6	12	8	6				
Morelos State [4]																	
Progreso	C											1					
	D											1				1	
San Luis Potosi	C			1													
	D			1													
Morocco (see table below).																	
Netherlands: Rotterdam	C	1															
Nigeria (see also table below): Lagos	C	2	5	2	1	1											
	D	1	2														
Persia (see table below).																	
Philippine Islands: Sarangani and Balut Islands [5]	D	40	18	3													
Poland	C	2		2				2	5		1		2				
Portugal: Lisbon	C	6	4	7	7	2	3	3		6		2		1			
Rumania	C		1	1	2												
Siam	C	42		2		2	2	2	2	2							
	D	9	1				2	2									
Somaliland, British: Boales	C	5	35	19	2												
	D	9	8	2	6												
Straits Settlements	C		2		5	2	1		2	1	3	2	5	5			
	D		1		1	1			1		1	1	1	1			
Sudan (Anglo-Egyptian)	C	290	230	79	60	2	9	31			5	13	1	4	8	1	54
	D	65	34	6	5	1		3				1	1				8
Sudan (French) (see table below).																	
Syria (see table below).																	
Tunisia: Tunis	C	20	7	3	3			1	3		1		1				
Turkey (see table below).																	
Union of South Africa:																	
Cape Province	C	P	P	P	P	P		P		P	P						
Orange Free State	C	P	P	P	P												
Transvaal	C	P	P	P	P												
Upper Volta	C			26	2	2		1					1				
Zanzibar	C				13												

[3] During the month of March, 1930, 100 cases of smallpox were reported in Mexico City, Mexico, and surrounding territory.
[4] Newspaper reports of Feb. 4 show an epidemic of smallpox in Ionacatepec, Morelos State, Mexico, and vicinity giving 600 deaths in preceding 2 weeks.
[5] On Feb. 1, 1930, 317 cases of smallpox with 102 deaths were reported to that date in the Sarangani and Balut Islands.

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

SMALLPOX—Continued

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

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Mar. 9–Apr. 5, 1930	Week ended— April, 1930: 12	April, 1930: 19	April, 1930: 26	May, 1930: 3	May, 1930: 10	May, 1930: 17	May, 1930: 24	May, 1930: 31	June, 1930: 7	June, 1930: 14	June, 1930: 21	June, 1930: 28
On vessel:																	
S. S. Tairoa, at Liverpool, from London	C			1													
S. S. Karagola, at Zanzibar, from India	C		4														
S. S. Karagola, at Lourenco Marques, from India	C			1													
S. S. Elysia, at Port Sudan, from Bombay	C						1										
S. S. Naldera, at Port Said	C									1							

Place		December, 1929	January, 1930	February, 1930	March, 1930: 1–10	March, 1930: 11–20	March, 1930: 21–31	April, 1930: 1–10	April, 1930: 11–20	April, 1930: 21–30	May, 1930: 1–10	May, 1930: 11–20	May, 1930: 21–31
Belgian Congo	C	74											
	D	4											
Dahomey	C	19											
Indo-China (see also table above)	C	142	460	434			26	261				173	132
Ivory Coast	C					7							
Sudan (French)	C	17	229	213		200	409	371		150	40	56	178
	D		25	11		18	31	30		6	7	7	18
Syria: Beirut	C	25	70	18	4	8	5	10	2	7			
Taiwan: Taihoku	C			43	31	12	15	10	2				

Place		December, 1929	January, 1930	February, 1930	March, 1930	April, 1930	May, 1930
British East Africa (see also table above):							
Kenya	C	168	12	12	175	174	
Chosen	C		1	4		5	
Mexico: Durango (see also table above)	D	4	12	6	5	4	4
Morocco	C	84	29	74		10	18
Nigeria	C	293					
	D	70					
Persia	C	P					
Turkey	C	883	215	114		3	16
	D	457	66	42			

TYPHUS FEVER

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Week ended— March, 1930: 15	22	29	April, 1930: 5	12	19	26	May, 1930: 3	10	17	24	31	June, 1930: 7	14	21
Algeria:																			
Algiers	C	14	3	4	2	1		3	2	3	2	1	1	2	4	8	2		
Constantine Department	C	2	4	5	2	3		6	4	9	2			4		2	11		
Oran	C		2													3			
Arabia: Aden	C				1														
	D				1														
Bolivia: La Paz.[1]																			
Brazil: Porto Alegre	C	1		2									1						
Bulgaria	C	41		13	9				15				1		5		1		
	D	2		1					1				1				1		
Sofia	C		1																
Chile:																			
Talcahuano	D		1																
Valparaiso	C		1																
China:																			
Manchuria—Harbin	C			1				4	5		20	27							
Shanghai	C				1														
Tientsin	C	1	1																

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

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

TYPHUS FEVER—Continued

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

Place		Dec. 15, 1929–Jan. 11, 1930	Jan. 12–Feb. 8, 1930	Feb. 9–Mar. 8, 1930	Week ended— March, 1930: 15	22	29	April, 1930: 5	12	19	26	May, 1930: 3	10	17	24	31	June, 1930: 7	14	21
Chosen (see table below).																			
Czechoslovakia (see table below).																			
Egypt:																			
Alexandria	C										1								1
Assuan	C	9																	
	D	1																	
Beheira Province	C	7	14	18			2				2		9	21	9	10	17	16	
	D			5									4	4	4	1	1	1	
Cairo	C			1															
Dakahlieh	C	11																	
	D	2																	
Port Said	C		2	1															
Suez	C		1																
Great Britain: Scotland—Glasgow	C													1					
	D													1					
Greece (see table below).																			
Iraq: Baghdad Liwa	C	1						2											
	D	1																	
Ireland:																			
Irish Free State	C	1																	
Ballina—Mayo County	C															2		1	
Dingle—Kerry County	C										3	2							
Shillelagh—Wicklow County	C																	1	
Swinford—Mayo County	C													7	7				
Northern Ireland—Cookstown	C			3															
Latvia (see table below).																			
Lithuania (see table below).																			
Mexico: Mexico City, including municipalities in Federal District	C	6	12	9		2	1	1	2	1		1		2		4			
	D	2	4				1		2	1		1				3			
Morocco	C	6	23	21	4	7	14	13	6	5	3	1	3	6	1	1	1		
	D						4	3	2	1									
Palestine	C			1	1	1	2	2		1				2			2		

Poland	C	61	296	183	69	54	43	61	59	64	53	67	64	45	34	28			
	D	4	21	8	5	2	2	4	4	2	3	6	2	2		1			
Portugal:																			
Lisbon	C											4							
Oporto	C			1		2			1										
Rumania	C	82	241	293	90		95		71										
	D	5	25	23	7		5		1										
Tunisia	C	2		3									2	2	1	1			
Turkey (see table below).																			
Union of South Africa:																			
Cape Province	C	P	P	P	P	P		P	P	P			P	P					
Natal	C	P	1	3				P	P	P	P		P	P					
Orange Free State	C	P	P	P	P	P		P					P	P					
Transvaal	C								P	P	P								
Yugoslavia (see table below).																			

Place		December, 1929	January, 1930	February, 1930	March, 1930	April, 1930	May, 1930
Chosen: Seoul	C	1		17		3	
Czechoslovakia	C		10	2	42	29	
France	C	1					
Greece: Athens	C	6	12	6	3	1	
Latvia	C	2	18		4		

Place		December, 1929	January, 1930	February, 1930	March, 1930	April, 1930	May, 1930
Lithuania	C	5	2	70	62	73	27
	D	1		5	4	4	
Turkey	C	4	2	3	1	3	16
Yugoslavia	C	6	26	33	46	22	16
	D	1	3	5	2	4	1

YELLOW FEVER

	Cases
Brazil:	
Mage, on the Leopoldina Railway, between Rio de Janeiro and Nictheroy, Apr. 22, 1930	2
Campos, Rio de Janeiro Province, May 23, 1930	1
Brazil (continued):	
Para, June 23, 1930	2
Gold Coast, Dec. 21, 1929	1
Liberia, Monrovia, June 3, 1930	1

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