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DEVELOPMENT OF THE NATIONAL MARITIME QUARANTINE SYSTEM OF THE UNITED STATES

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Quarantine is one of the oldest of the general preventive measures applied for the protection of the public health. Long before man had discovered the causes of communicable disease and the manner of spread, observation and experience had led him to apply the first principle of prevention—isolation of the sick. In the Old Testament there are to be found accounts of crude application of quarantine practice in the isolation of persons afflicted with leprosy for the protection of others from the disease. These early procedures were somewhat harsh, however, as compared with modern methods, for they frequently involved banishment from a city and sometimes death for the afflicted.

The history of quarantine is closely interwoven with that of the development of commerce, public health, and preventive medicine. Official measures providing for the detention and isolation of travelers are said to have been enacted as early as the reign of the Emperor Justinian, A. D. 542, although Dr. J. M. Eager, of the United States Public Health Service, has pointed out [1] that neither the Codex of Justinian nor other official decrees of that time pertaining to the regulations of maritime matters contain anything on the subject of sanitation. In fact, in the Middle Ages, when contagious diseases became prevalent it remained for the individual city or country to make such provisions for control as it deemed necessary.

Some sort of detention procedure was employed in the Orient as early as the seventh century. Quarantine in the modern sense, however, may be said to have originated in Italy in the fourteenth century as the result of the invasion of Europe by plague from the Levant. It has been reported that from A. D. 5 to A. D. 1500, plague appeared in Europe more than sixty times, bringing terrific loss of life. These destructive visitations led the Italian cities, at that time the centers of

[1] The early history of quarantine: Origin of sanitary measures directed against yellow fever. Yellow Fever Bulletin No. 12, U. S. Public Health Service, March 1903. By J. M. Eager. An extensive bibliography of original sources, especially Latin and Italian, of early quarantine history is given by Dr. Eager at the end of his report.

commerce between Europe and the Orient, and dependent upon that trade for their prosperity, to institute the enforcement of drastic regulations to prevent the importation of plague by incoming vessels. As early as 1348 Venice had appointed commissioners of health, and her example was followed in the same year by Florence, in 1374 by Lombardy, and in 1399 by Milan.

In 1485 Venice adopted the rule that all vessels coming from infected ports should be detained for a period of 40 days, during which time they must lie in the harbor without intercourse with land or other vessels. This period of detention explains the association of the word "quarantine" with such sanitary procedure. Some historians suggest that the time limit adopted by Venice was decided upon as a penance in keeping with the ecclesiastical period of Lent. At the time of the establishment of quarantine in Venice in 1485, it is said that it was the Lenten season; and for want of a more scientific reason, for many years "quarantine" meant 40 days' detention.

With the development of the science of epidemiology and the knowledge that 40 days' detention was not necessary, the term has dropped its original temporal significance, the time depending upon the periods of incubation and communicability of the disease in question. For many years applicable specifically to the detention of infected or suspected vessels, the word "quarantine" in the modern sense applies also to restrictions imposed upon exposed persons and on commercial intercourse, by land as well as by sea, and to plants and animals, in preventing the introduction and spread of communicable diseases.

Another word of interesting quarantine history and early origin that retains a place in quarantine parlance and marks an advance toward more humane consideration of the afflicted, is "lazaretto," signifying a quarantine building or hospital for the detention of diseased persons, especially those having a contagious disease. During the periods of the crusades, leprosy became dispersed throughout Europe, resulting in the establishment of isolation stations, or "leper houses." These isolation stations were called "lazarettos," from the Italian "lazzaro," leper, and Lazarus, the beggar of the 16th chapter of St. Luke.

Although Venice may be considered the pioneer city in the establishment of quarantine, modern practice probably owes an equally large debt to Marseilles, for it was there that the first model quarantine station of the Old World was developed. One of the most important features of modern quarantine practice, and one that greatly relieves the restrictions on commerce involved in the application of quarantine measures, is the bill of health. Marseilles required that all incoming vessels be provided with a bill of health (a health pass, or "patente") filled out by a responsible official at the port of departure. This bill of health was required to give information regarding health conditions

in the countries and cities from which the ship came and of those at which she touched during the voyage. These bills of health were astonishingly modern in their nature. There were four kinds:

1. *Patente nette*, when the health of the port of departure was entirely satisfactory.

2. *Patente touchée*, when the ships came from infected ports but no cases of illness existed there at the time of departure.

3. *Patente soupconnée*, when a malignant epidemic prevailed at the port of departure or caravans had arrived there from plague areas.

4. *Patente brute*, when plague was present at the port of departure and the ship had on board merchandise from an infected port.

In addition to the bills of health, the ships themselves, the passengers, the crews, and the cargo were all subject to careful inspection.

For a long time maritime quarantine measures were directed solely against plague; and with the partial disappearance of the "Black Death" from the civilized world, regulations began to be less strictly enforced. With the appearance of yellow fever in Spain at the beginning of the nineteenth century and the arrival of cholera in Europe in 1831, and in America in 1832, there was a revival of interest in the subject and a demand for more stringent precautions, and these two diseases were made quarantinable.

The fundamental object of maritime quarantine, to prevent the introduction and spread of disease, and the fundamental purpose of the methods employed, to limit and destroy the infection, are the same now as they were in the earlier days of quarantine practice, but the procedures in use today have become rationalized through the acquisition of knowledge regarding the etiology and epidemiology of disease. Modern procedures of disinfection have developed from crude oddities of the past, such as the use of fire, exposure to air, the dew of night, and the vapors of aromatic substances called "perfumes." In early quarantine the element of time was important in the "process of purification," especially with reference to exposure to air, and that is so in quarantine practices today.

Some of the disinfection procedures employed against yellow fever in the South as recently as the beginning of the present century were no less ludicrous, nor more effective, in the light of later knowledge, than were many of the strange practices of several centuries ago. Yellow fever patients were isolated—a sound procedure, but ineffective without the control of the mosquito; but the more onerous efforts of the quarantine officers were directed at the disinfection of infected vessels by fumigation with sulfur and subjecting all articles and materials to bichloride solution. Lack of accurate scientific knowledge regarding the transmission of yellow fever was more than exceeded by the zeal and thoroughness in applying this disinfectant; and everything on board that was considered possible to be contaminated was subjected

to it—beds, bedding, furniture, pianos, and even rock ballast—much to the discomfiture and disgust of the captain of the vessel. Huge tanks of bichloride were set up on the dock or on the deck of the ship, and the solution was pumped wherever needed. It is said that even the rock ballast was sometimes dipped in the solution stone by stone, but more frequently a less tedious method was employed. At the time, such procedures and enthusiasm in applying them were commendable, but they became obsolete after Walter Reed's epochal experiments in 1900–1902.

Quarantine measures have undergone a gradual evolution in the past century, and procedures have become uniform throughout the world. Many changes have been necessary because of the development of knowledge in the sciences of medicine and sanitation, and in the etiology and epidemiology of communicable diseases. International uniformity in procedure has been brought about largely through various international sanitary conferences and the adoption of international sanitary codes by the important maritime nations of the world. The following may be considered the important principles of modern quarantine established by the international sanitary conventions:

1. Obligatory notification, between the powers, of the occurrence of quarantinable and other epidemic diseases.
2. Quarantine regulations applied only against infected areas.
3. Preventive measures carried out before the departure of a vessel from an infected port.
4. Medical inspection of individuals on board during voyage and proper treatment of suspicious cases.
5. Preventive measures at the port of entry dependent upon conditions in individual cases, such as medical inspection of passengers and crew, and inspection of vessel, statements in the bill of health, the time elapsed from time of departure and time of arrival, the occurrence of quarantinable disease on board or of suspicious cases, and similar conditions.

It is only in recent years that the quarantine system of the United States has become completely nationalized. During the greater part of our national history quarantine remained a local function, exercised by State and municipal authorities. The manner in which the Federal Government gradually assumed control and the time at which the important stations were acquired constitute an important chapter in the history of the United States Public Health Service.

The first quarantine in the American colonies of which a definite record is available was that in Massachusetts in 1647,[2] although there is some evidence for the belief that New York, under Dutch rule, made

[2] Winthrop, John: History of New England, vol. 2, p. 313. Cited by Susan Wade Peabody in Historical Study of Legislation Regarding Public Health in the States of New York and Massachusetts. J. Inf. Dis., Supp. No. 4, February 1909.

one such attempt to prevent the introduction of disease by quarantine in the same year.[2]

In both Massachusetts and New York, the first quarantine was performed upon order in council. According to Peabody,[3] "John Winthrop, in his contemporary history of those early days, tells that in 1647 there was 'a great mortality, that in Barbadoes there died six thousand, and in Christopher, of English and French, near as many, and in other islands proportionable. The report of this coming to us by a vessel which came from Fayal, the court published an order * * *.'" As this order was probably the first quarantine regulation on the North American continent, it is of interest to reproduce it here in the original wording and spelling, in full:[3]

For as much as this Court is credibly informed yt ye plague, or like greivos infectious disease, hath lately exceedgly raged in ye Barbadoes, Christophers, and other islands in ye West Indies, to ye great depopulatg of those, it is therefore ordred, yt all our own or othr vessels comeg from any pts of ye West Indies to Boston harbor shall stop and come to an anchor before they come at ye Castle, undr ye poenalty of 100£, and that no pson comeing in any vessell from the West Indies shall go a shore in any towne, village, or farme, or come within foure rods of any othr prson, but such as belongs to the vessels company yt hee or shee came in, or any wayes land or convey any goods brought in any such vessels to any towne, village, or farme aforesaid, or any othr place wthin this jurisdiction, except it be upon some island where no inhabitant resides, without licence from ye councell, or some three of them, undr ye aforesaid poenalty of a hundred pound for evry offence.

In 1699 the city of Philadelphia, with a population of about 4,000, was visited by a "pestilential fever" which raged with unusual virulence. It is said to have "carried off six, seven, and sometimes eight a day, for several weeks together, there being few if any houses free from sickness."[4] It is thought that the disease was probably yellow fever, although it was called "Barbadoes distemper" and was believed to have been brought into the colony from the West Indies. In the same year William Penn, the Proprietary of the Colony, arrived from England, his second visit after a period of absence of 15 years. During this visit Penn promulgated numerous important laws, among which was a law relating to quarantine. The occurrence of the epidemic of "Barbadoes distemper" and the prevalent opinion that it had been imported "in a ship or other sea vessel from the island of Barbadoes" gave rise to the enactment of what is probably the first quarantine law passed by a legislative assembly in this country. This act, entitled, "An Act to prevent Sickly Vessels coming into this Government," was passed at a General Assembly at New Castle in 1700. It reads as follows:[5]

Whereas, It hath been found, by sad experience, that the coming and arriving of unhealthy vessels at the ports and towns of this province and territories, and

[3] Records of the Colony of Massachusetts Bay in New England, vol. 2, p. 237. Quoted by Peabody, loc. cit., p. 41.

[4] Third National Quarantine and Sanitary Convention, New York, 1859, p. 278.

[5] Third National Quarantine and Sanitary Convention, New York, 1859, p. 280.

the landing of their passengers and goods, before they have lain some time to be purified, have proved very detrimental to the health of the inhabitants of this province: *Be it therefore enacted, by the authority aforesaid*, That, from and after the publication hereof, no unhealthy or sickly vessels, coming from any unhealthy or sickly place whatsoever, shall come nearer than one mile to any of the towns or ports of this province or territories without bills of health; nor shall presume to bring to shore such vessels, nor to land such passengers or their goods at any of the said ports or places, until such time as they shall obtain a license for their landing at Philadelphia, from the Governor and Council, or from any two justices of the peace of any other port or county of this province or territories, under the penalty of ONE HUNDRED POUNDS for every such unhealthy vessel so landing, as aforesaid, to the use of the Proprietary and Governor; and that suitable provision be ordered by the Governor and Council for their reception, if they be permitted to land or come on shore.

One of the earliest records, if not the first instance, in America of the actual detention of a vessel on account of sickness, involving the application of quarantine procedure, was that of 1728, in which two "sickly" vessels arrived in the Delaware River from Bristol, England. One of the vessels, which was in "good condition," was allowed to enter, but the other, the *Dorothy*, had on board cases of "malignant fever," and it was "*Ordered*, that the *Dorothy* come not nearer than one mile to any of the towns or ports of this province," that no goods, passengers, or sailors were to be landed, and that provision be made to care for the persons sick on board.

In Massachusetts, legislation on the subject of quarantine dates back to 1701, when a law was enacted having reference particularly to smallpox, but including in its provisions protection from other diseases. In 1736 arrangement was made by the colony for acquiring Rainsford Island for a permanent quarantine establishment; and some time between 1736 and 1757 a detention hospital was built. In 1799 the responsibility for the enforcement of quarantine was transferred to the Boston Board of Health, which was established by an act of the legislature of that year.

New York was the next colony to protect her citizens against the importation of disease by regulations governing communication with infected vessels and those suspected of being infected. It was not until 1758, however, that the colonial legislature of New York enacted a quarantine law; and later, in 1784, this law was reenacted by the State legislature. This act, according to Judge Birdseye, of the New York Supreme Court, in 1856, "contains the germ of our present quarantine system; and the provision in section #3, for the appointment of a physician to inspect all vessels which may have on board, or which may be suspected of having on board, any person or persons infected with a contagious distemper, is probably the earliest provision of law in the State for the selection of a person to perform the duties of the present health officer of the port of New York."

The first provision for a health officer in New Orleans was made and quarantine activities were inaugurated in that city in 1818 in accordance with a legislative enactment entitled, "An Act to establish a Board of Health and Health Officer, and to prevent the introduction of malignant, pestilential and infectious disease into the city of New Orleans."

By 1859 several other large seaboard cities of the United States, either through municipal ordinances or by legislative enactments, had instituted quarantine regulations varying in their provisions and restrictions according to locality and opinions of the authorities under whose administration they were adopted. While such regulations differed materially in uniformity as to the time of detention of vessels, the extent of sanitary measures to be observed, and the severity of isolation, they were all modeled upon the laws previously established in other large port cities.

The lack of uniformity in quarantine procedures was soon recognized as a serious fault in the system, and conferences of boards of health and other representative organizations were called, at which not only this matter was discussed but even the very effectiveness of quarantine itself was questioned. The first conference in the United States for the discussion of a uniform system of quarantine regulation was that held in Philadelphia in 1857, attended by delegates from boards of health, boards of trade, and medical societies. Representatives from nine States on the Atlantic seaboard were in attendance. This conference was occasioned by the occurrence of yellow fever in Bay Ridge during the preceding year. Other similar conferences followed in 1858 and 1859. The following were included in the resolutions of the conference:

6. The present quarantine regulations, in operation in most of our States, are inefficient, and often prejudicial to the interests of the community.

19. With a view to procure an uniformity in Quarantine regulations throughout the several ports of the United States, the assemblying of another and probably several Conventions similar to the present one, will be required.

Nothing was actually accomplished by these conferences in the matter of securing uniform quarantine regulations. The States and cities continued to operate their own quarantine stations and to enforce their own laws until the passage by Congress of the organic quarantine act of 1893, although supplemental national quarantines, as mentioned later, were established on the Atlantic and Gulf coasts under the act of 1878.

Before 1878, however, the Federal Congress had already passed laws relating to quarantine, in 1796, 1799, 1832, and 1866, but these acts merely extended Federal aid in the enforcement of local regulations. A very early act of May 27, 1796, authorized the President to direct revenue officers and officers commanding forts to aid in the execution

of the laws of the States. This law was repealed by the act of February 25, 1799, which provided that any quarantine established by, or in conformity with the health laws of, any State should be observed by the collectors of customs and all other officers of the revenue, by masters of revenue cutters, and by military officers. An act of July 13, 1832, gave the Secretary of the Treasury authority for one year to employ additional boats and officers, if necessary, to enforce the quarantine laws of any State or the regulations made pursuant thereto. By resolution dated May 26, 1866, Congress went a little further than it had gone in previous enactments in authorizing Federal quarantine activities and planted the seed of a national quarantine system. This resolution authorized the Secretary of the Treasury "to make and enforce quarantine regulations to prevent the introduction of cholera into the country", and directed revenue officers and officers commanding revenue cutters to aid in the enforcement of such quarantine. This was an emergency measure, however, and the authority granted by it expired on the first Monday in January 1867.

These early laws were based on the assumption that quarantine was a local function, and that action by the Federal Government should be merely for the purpose of assisting State or municipal authorities, although the resolution of Congress of 1866 showed an awakening sense of Federal responsibility and marked the incipiency of a national system. An epidemic of cholera in 1873 aroused new interest in the subject of quarantine, and the Secretary of the Treasury issued a general circular the following year, on September 8, 1874, calling attention to the provisions of the act of 1799, which apparently had been neglected for some years. In this circular, officers of the Marine Hospital Service and customs officers were directed to inform themselves fully regarding local health laws and regulations and to give prompt assistance in enforcing them. The Supervising Surgeon General of the Marine Hospital Service, in his annual report for 1875, said:

> In the absence of uniformity in the regulation of quarantine upon the Atlantic and Gulf coasts, a circular letter was issued by the Hon. Secretary of the Treasury September 8, 1874, defining the duties of United States officers with reference to quarantine and the public health as provided by section 4792 of the Revised Statutes, a law which, though dating as far back as February 25, 1799, had until the past year been practically a dead letter.
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> The several officers of the Marine Hospital Service and of the Customs were, by the circular, directed to inform themselves fully as to local health laws, and the regulations based thereon and in force at their respective ports and stations; and strict compliance with such laws, and prompt assistance in the enforcement of the same, when requested by competent authority, were enjoined under the section of the statutes above cited.
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> The immediate object of the circular was, obviously, in the direction of protection and improvement of the financial interests of the country, to prevent, so far as possible, the interruption of commercial intercourse, with the consequent

stagnation of business and loss of revenue * * *; but the applicability of the measure was broader than this, and its operation conducive to the public health * * *.

The Supervising Surgeon General went on to say that this combination of national and local effort might seem to be all that should be desired in the direction of a national system of quarantine were it not for the fact that many States had laws of arbitrary quarantine detention.

In the same annual report of the Supervising Surgeon General there appeared a letter from Dr. James S. Herron, Surgeon, in charge of the Marine Hospital patients at Pensacola, Fla, who had had some experience in quarantine matters, especially in relation to yellow fever. Dr. Herron said: "It is the almost universal opinion here that in order to make quarantines effective and equal in their operation they [quarantine activities] should all be conducted by the [Federal] Government."

In 1874 Surgeon Heber Smith [6] stated, with reference to the yellow fever epidemic of 1873, that, "so long as quarantine is a matter controlled by State caprice or fear, there is nothing to prevent the introduction of this or any other disease into a community * * *"; and in the same report Surgeon Reilly said: "In order to insure an effectual quarantine, the Surgeon in charge should be an officer of the Army, Navy, or Marine Hospital Service."

The first permanent Federal quarantine legislation was the act of April 29, 1878, entitled "An act to prevent the introduction of contagious or infectious diseases into the United States." This law directed the Surgeon General of the Marine Hospital Service to prescribe regulations relating to vessels or vehicles coming into United States ports from foreign ports or countries where any contagious or infectious disease was present, or conveying persons or merchandise affected with any infectious or contagious disease, and charged the Surgeon General with the execution of the provisions of the act. It was expressly stipulated, however, that these "rules and regulations shall not conflict with or impair any sanitary or quarantine laws or regulations of any State or municipal authorities * * *." It might seem that this provision limited the Federal regulations definitely to local laws and rules, but the Attorney General held that the law did not mean that Federal action was so limited. He stated:

The only limitation is that the Federal regulations must not interfere with the State laws * * *. Suppose the [quarantine] period named by him [the State health officer] is deemed too short. It is in my opinion clearly competent under the acts of Congress above quoted to prescribe a longer period, both for persons and

[6] Annual Report of the Marine Hospital Service, 1874.

cargo, the regulations carefully providing that the Federal jurisdiction should attach upon the expiration of State action.[7]

Under this act, officers of existing State or municipal quarantine systems, or such systems subsequently established, were authorized to act as officers or agents of the national quarantine system and were clothed with all the powers of United States officers for quarantine purposes. It was also provided that if quarantine should be considered necessary at other ports, the medical officers of the Marine Hospital Service should perform such duties in the enforcement of the quarantine rules and regulations as might be assigned to them by the Supervising Surgeon General.

The increasing necessity for the extension of powers of the Federal Government in preventing the introduction of contagious diseases into the United States and their spread from one State to another resulted in the passage of the basic act of February 15, 1893, which, with amendments thereto, is still in force and gives authority for the greater part of the present domestic and foreign (maritime) quarantine regulations. This act established a national system of quarantine designed primarily to supplement and assist the various local authorities in the establishment and enforcement of proper laws; but it also provided that State officers might surrender local stations to the Secretary of the Treasury, who was authorized to receive and pay for them if he considered them necessary to the United States for quarantine purposes; and the quarantine stations established by this act were to be used to prevent the introduction of all quarantinable diseases. It may be that the authority for a national quarantine system is contained, at least by implication and broad interpretation, in the Federal Constitution, but nationalization of quarantine was actually accomplished by allowing the States to surrender their quarantine functions from time to time as they realized the advantages of the national system. Gradually the local stations were surrendered by the States, the last two, those at New York and Baltimore, Md., having been acquired by the Federal Government in 1921.

The act of 1893 places upon the Surgeon General of the Public Health Service all duties relating to maritime quarantine and the administration of quarantine regulations. For the first time provision was made for quarantine regulations to prevent the introduction of contagious diseases other than cholera, yellow fever, smallpox, and plague. The act also provides that vessels sailing from a foreign port for any United States port must obtain a bill of health from a consular officer or from a medical officer detailed for that purpose. Authority is given for the detail of medical officers of the Public Health Service to American consulates abroad for the purpose of furnishing information and giving bills of health. The law gives the President

[7] 20 Op. Att. Gen., 474.

authority to prohibit the introduction of persons and property from such countries or places as he may designate and for such period of time as he may deem necessary.

By an act of Congress of 1891 the medical inspection of immigrants was added to the duties of the Public Health Service, and this duty has remained as an important function of the Service in assisting in the administration of the immigration laws and as an additional precaution in the prevention of the introduction of dangerous communicable diseases from abroad. An act of Congress had been passed in 1882 restricting the admission of defectives.

An act of 1917 provided for the physical and mental examination of all arriving aliens by the United States Public Health Service and the detail of medical officers of the Service to foreign countries in connection with the examination of aliens destined for the United States. Later acts have extended the provisions relating to alien seamen, bills of health, fees charged vessels at quarantine stations, and other matters.

The basic quarantine law of 1893 has been extended from time to time by amendments and by new legislation enacted for the purpose of making more effective the administration of national quarantine. An act of 1906 provided for the selection of suitable locations for and the establishment of such quarantine stations near the coast or border of the United States as may be necessary to prevent the introduction of yellow fever, and for acquiring sites by purchase or condemnation proceedings. It also authorized the examination of established State and local stations with a view to obtaining transfer by purchase or surrender of title to the Federal Government. An act of 1926 extended the quarantine laws relating to foreign commerce to include aircraft and thus brought air travel under the application of Federal quarantine laws and regulations.

Before acquiring any of the State or municipal quarantine stations, the Federal Government had established certain Atlantic and Gulf national quarantines, under the authority of the Act of 1878, the first three being those on Ship Island, near Gulfport, Miss., on Blackbeard Island, Sapelo Sound, Ga., and at Norfolk, Va., at the entrance to Chesapeake Bay. These were the first quarantine stations owned and operated by the Federal Government.

In 1879 the quarantine functions of the Marine Hospital Service were transferred by Congress to the National Board of Health, created by an act of Congress of that year, and these duties were performed by that Board until 1883, when they were turned back to the Marine Hospital Service. The National Board of Health was abolished in 1893.

The reversion of quarantine functions to the Marine Hospital Service was accompanied by the transfer of the quarantine facilities, including the property and equipment, at the three stations previously men-

tioned, the steam hospital boat *Benner* at Norfolk, Va., supplemented in the same year by the hospital steamer *John M. Woodworth*, and also some boats, barges, and disinfectant equipment on the lower Mississippi River.

The appropriation act of 1883 provided for the maintenance of Federal quarantine "at points of danger." In that year, Federal quarantine activities were undertaken at Pensacola, Fla., upon request of the Governor of the State and the Pensacola Board of Health, and were conducted in cooperation with the local board of health.

Although the method of transmission of yellow fever was not known in 1883, defensive quarantine measures in accordance with the best practice of the times was assiduously applied, and the Supervising Surgeon General stated in his annual report of that year [8] that "it may be fairly claimed for the Service that the introduction of yellow fever in the cities of the Gulf Coast has been prevented during the season since July 1, 1883, up to the date of this report, by reason of the maintenance of such quarantines."

In 1884 the Delaware Breakwater quarantine station, on Cape Henlopen at the entrance to Delaware Bay, was opened by the Federal Government, and the Norfolk station was located on leased property on Fisherman's Island, just off Cape Charles, Va. The other three stations were on Government reservations. By this year four national quarantine stations were owned and being operated by the Federal Government, and were providing sanitary defenses for the Atlantic and Gulf ports.

Federal control of quarantine seems also to have been early appreciated on the West Coast, for, during the summer of 1884, a request was made by the Governor of California for the establishment of Federal quarantine in that State. The Treasury Department offered to provide an inspector and a temporary boarding station in San Francisco Bay, as Federal funds for a complete and permanent station were not available. The authorities of San Francisco, however, while willing and ready for the establishment of a permanent station, declined the proffer of temporary assistance.

Recommendations were made by the Supervising Surgeon General in his annual reports of 1885, 1886, and 1887 for the establishment of a quarantine station on the Pacific Coast, in San Francisco Bay, for which a suitable site was selected, in 1886, on a portion of the Government reservation on Angel Island. In 1888 Congress authorized and made appropriation for the construction of quarantine stations at San Diego and San Francisco, Calif., and at Port Townsend, Wash.

Operation of the San Diego (Calif.) and Port Townsend (Wash.) Federal quarantine stations was begun in 1889, and in that year

[8] Annual Report of the Marine Hospital Service, 1883, p. 47.

construction had commenced on the buildings at the San Francisco station, and an appropriation of $30,000 had been made for a boarding steamer at the latter station.

The national quarantine station which operated for a time on one of the Dry Tortugas, off the southwest coast of Florida, has an interesting though comparatively brief history which merits special comment. In the summer of 1887 an epidemic of yellow fever occurred at Key West, Fla. In January of that year the Marine Hospital Service had recommended the establishment of a national quarantine station at or near Key West, with adequate facilities for handling infected vessels for the protection not only of Key West but of the entire southern coast and the inland States as well. On this recommendation a bill to provide such a station was introduced in the Senate on February 22, 1887, but was not reported out by the Committee to which it was referred. In the following year, on August 1, 1888, an act was passed authorizing the establishment of the station and appropriating $88,000 for the purpose. By permission of the Secretary of War, in 1889, the station was located on Garden Key, one of the Dry Tortugas group of small coral islands, about 10 acres in area and approximately 65 miles west of Key West.

A large part of this Key was, and still is, occupied by Fort Jefferson, formerly an Army post, of especial historical interest because Dr. Samuel A. Mudd was imprisoned here between 1865 and 1869, after his conviction and sentence to life imprisonment by a military commission for surgical services given John Wilkes Booth, the assassin of President Lincoln, and alleged complicity in his attempted escape. During a yellow fever outbreak on the island in 1867, Doctor Mudd volunteered to serve as fort physician and gave heroic service, exposing himself to every possible risk. He contracted the disease and narrowly escaped death. For these services he was pardoned in 1869 by President Johnson.

The station on the Dry Tortugas, for a long time called the Key West quarantine station, was opened early in 1889, and for 11 years was the main reliance of the Marine Hospital Service for the treatment of infected vessels along the southern coast from Brunswick, Ga., to Mobile, Ala. Early in 1900 the islands in this group were transferred by Executive Order to the Navy Department for use as a naval base and coaling station, but on strong representation by the Surgeon General of the Marine Hospital Service regarding the need for the station during the approaching summer season, permission was expressly given in the Naval Appropriation Act for the fiscal year 1901 for it to continue operating until the end of the "quarantine close season," November 1, 1900. The same act provided an appropriation of $125,000 for the establishment of national quarantine stations on

Fleming Key, approximately one-half mile north of Key West, and on Mullet Key, in Tampa Bay. The latter station was later constructed. The situation regarding South Atlantic and Gulf quarantine was further relieved in 1901, when the Florida State quarantine stations were turned by the State over to the Federal Government.

By Presidential proclamation dated January 4, 1935, the Dry Tortugas group of keys was included in the Fort Jefferson National Monument "for the preservation of Fort Jefferson and the historic and educational interest contained in such area."

By 1892 Federal quarantine activities were being conducted at eight national maritime quarantine stations, namely, Cape Charles, Va., Delaware Breakwater, Del., Blackbeard Island, Ga., Key West (Dry Tortugas), Fla., Chandeleur Island (transferred from Ship Island in 1889), near Biloxi, Miss., San Diego and San Francisco, Calif., and Port Townsend, Wash.

In the following years other Federal quarantine stations were added, either through acquisition of State and local stations or through original establishment. By 1919 the Federal Government was in administrative charge of all maritime quarantine in the United States and territorial and insular possessions, with the exception of a few small stations administered by the Texas State quarantine service. These latter stations were acquired in 1920, although actual title did not pass until later.[9]

The administration of some of the larger eastern quarantine stations was turned over to Federal control by the respective States or cities several years prior to transfer of title to sites and physical properties. In most instances these were acquired by the Federal Government through purchase.

The New Orleans station near the mouth of the Mississippi passed from State to Federal control by purchase in 1907, though transfer of title was not completed until 1909. The quarantine functions of the Boston station were transferred from local to Federal administration in 1915, while title was not acquired until 1917. The New York City quarantine station was administered for several years by a Public Health Service officer, appointed by the Governor of the State, but was not actually acquired by the Federal Government until 1921. The Public Health Service assumed control and operation of the Baltimore station through lease in 1918, and it was purchased by the Federal Government in 1921.

The nationalization of maritime quarantine has thus been achieved by the voluntary surrender to the Federal Government of quarantine

[9] Annual Report of the Surgeon General, U. S. Public Health Service, 1920 (pp. 125, 126), and subsequent years.

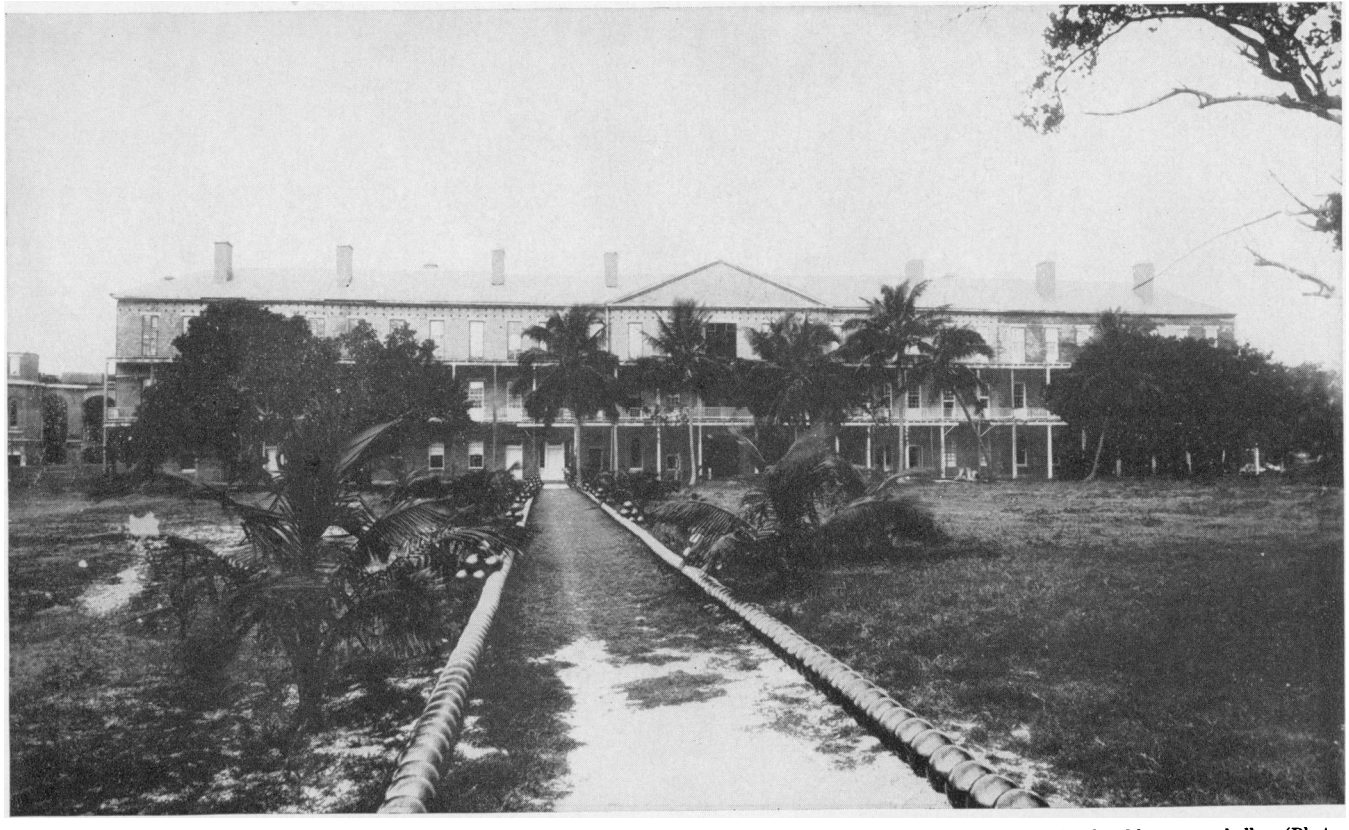

FIGURE 1.—Quarters for officers and attendants, office, kitchen, and dining room for the Dry Tortugas Quarantine Station. The walk is bordered by cannon balls. (Photograph taken about 1887.)

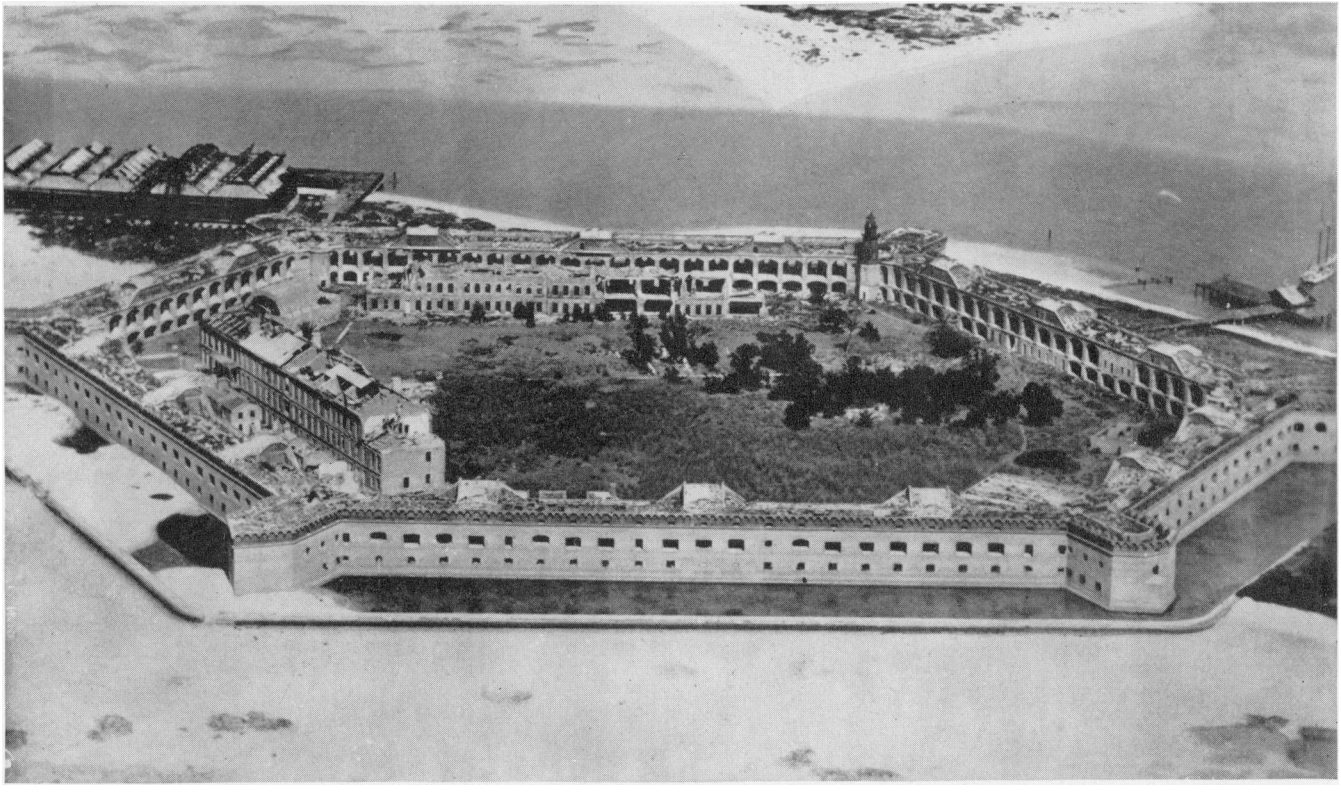

FIGURE 2.—Old Fort Jefferson as it looks today, showing moat partly filled by sand which has drifted in through breaks in the sea wall.

activities and stations first established by the States and cities and by original Federal establishment. For a time a confusing tri-power system obtained, in which the quarantine functions were performed by city, State, and Federal governments. It was soon realized, however, that national quarantine was essentially a national function and that the Federal Government could best develop and maintain uniform and standardized procedures.

In recent years the United States Public Health Service has made considerable progress in improving and modernizing both stations and floating equipment, has acquired many new and more convenient sites for stations, and has replaced old buildings with modern construction, while other stations have been improved by repairs and additions to buildings. As the result of lessened danger of the importation of disease owing to improved conditions of maritime shipping and international sanitary conventions, and in consequence of expanded facilities at large key stations centrally situated with respect to port areas from which fumigation apparatus and crews may be rapidly and promptly dispatched, the fumigation and detention facilities are being abandoned at certain small stations where the necessity for these quarantine procedures is infrequent.

By 1940 the Federal Government, through the United States Public Health Service, was conducting quarantine activities at 52 ports in continental United States, 33 stations in territorial and insular possessions, at 41 airports of entry, in the Panama Canal Zone, and at 17 border stations. In addition, quarantine functions were being performed at other stations and at 41 American consulates in foreign countries in connection with immigration activities.

The floating equipment used in connection with maritime quarantine consists of approximately 50 quarantine vessels ranging in size from 100-foot Diesel-electric cutters to 40-foot gasoline and Diesel-driven launches.

On February 1, 1937, an important advance in quarantine procedure was made by the adoption of "radio pratique" at the port of New York, and for the first time in the history of quarantine in the United States passenger vessels from a foreign port passed quarantine without stopping for inspection. By this procedure permission to enter and dock is granted by radio to a certain class of vessels which, because of their known safe health status, are not required to undergo inspection at the quarantine station. It is believed that the plan for radio pratique adopted by the Public Health Service offers the maximum of safety to our ports while imposing the minimum burden of

expense on shipping incident to delay at quarantine. It has now been extended to four other ports in the United States, Boston, Mass., Miami, Fla., San Francisco and Los Angeles, Calif.

The increase in international airplane travel in recent years has created a new danger from imported disease that is of especial importance. The rapidity of such means of transportation brings the flight time from infected areas within the incubation period of certain quarantinable diseases, especially yellow fever and possibly Asiatic cholera. Airplanes may also bring infected mosquitoes into this country unless preventive measures are applied. It has been found necessary, therefore, to adopt and apply quarantine measures with respect to air traffic, especially that from South America and the Orient. In 1935 the Government of the United States became signatory to an international sanitary convention regarding aerial navigation, similar to the international sanitary conventions governing travel by land and sea.

Quarantine protective measures do not relate exclusively to persons, animals, and insects. Dangerous communicable diseases may also be imported by bacteria cultures and infected plants, and cases of anthrax occurring in the United States have been traced to the use of shaving brushes of foreign origin which carried the spores of infection. Under authority of an Executive Order in 1930, quarantine regulations were promulgated governing the importation of birds of the parrot family to prevent the introduction of psittacosis. In 1938 protective regulations were adopted governing the importation of bacteria, viruses, and other organisms or agents that cause disease, and of living insects, animals, or plants new or not widely prevalent in the United States and capable of carrying or transmitting any contagious or infectious disease.[10] And in 1939 existing quarantine regulations were amended to provide stricter control over the importation of shaving brushes designed to give greater protection against the danger from the introduction of anthrax infection.

The important quarantine and associated work of the Public Health Service at the present time includes medical inspection of vessels, passengers, and seamen, and of airplanes, crews, and passengers arriving at ports in this country and its insular possessions, medical examination of intending immigrants at ports of departure, medical examination of alien passengers and seamen under the immigration laws, the institution of isolation and detention measures when necessary, and the fumigation of vessels. As a result of the application of these protective measures, in recent years there has been

[10] The Department of Agriculture administers the plant quarantine act passed in 1912 to prevent the introduction and spread of plant diseases and destructive insects.

FIGURE 3.—A 100-ft. Diesel-electric boarding vessel, 750 h. p., speed 12 knots, used at the New York Quarantine Station.

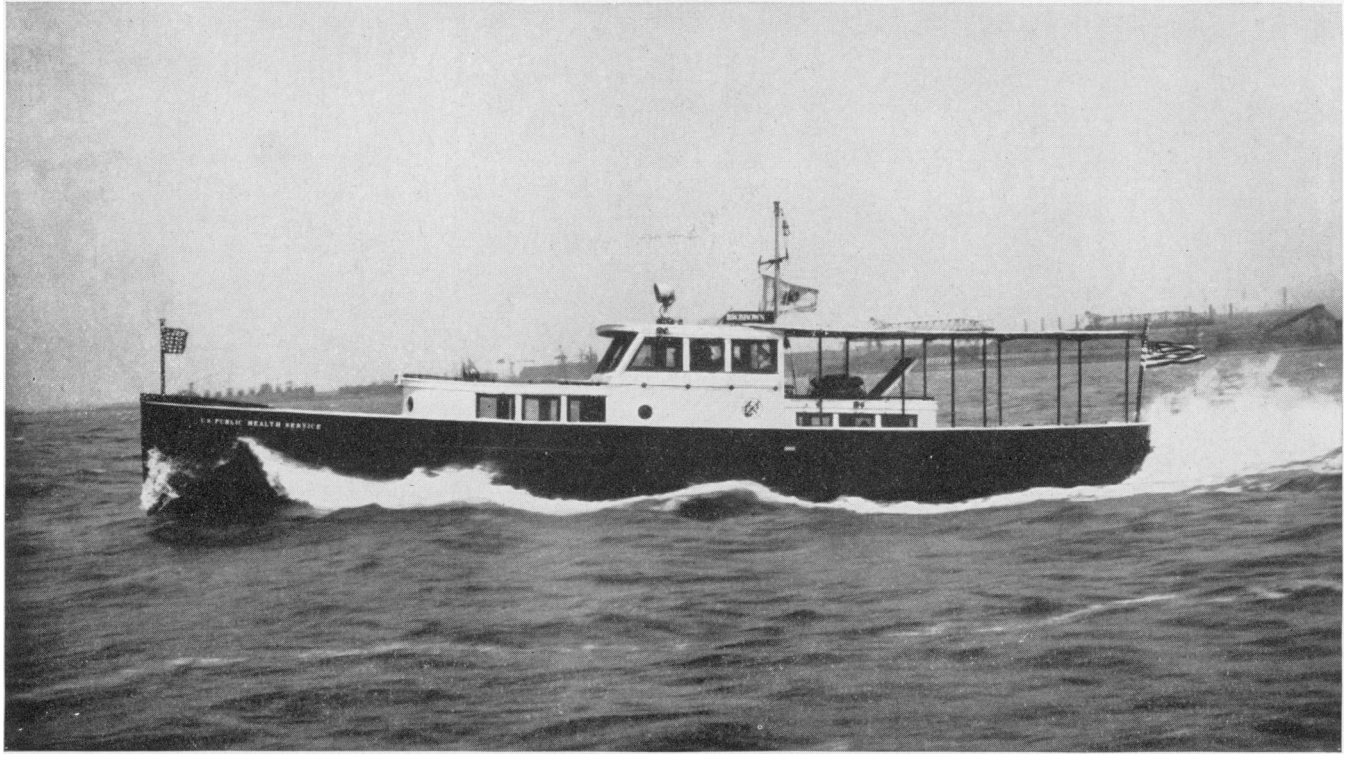

FIGURE 4.—A 60-ft. twin screw Diesel boarding vessel, 350 h. p., speed 12 knots, used in southern waters for ship-to-shore service, removing disabled or sick seamen from ships not entering port.

FIGURE 5.—The U. S. Public Health Service Quarantine Station in New Orleans, La.

FIGURE 6.—Passengers arriving in the United States by airplane are examined to prevent the introduction of quarantinable disease.

no instance of the importation into the United States of any quarantinable disease. Frequently vessels have arrived at quarantine stations with a quarantinable disease on board, but effective measures taken at these stations by the medical officers of the Public Health Service have prevented the disease from spreading into the United States. It is well within the memory of the older officers of the Public Health Service, however, that conditions were quite different, when the lines of defense against the importation of dangerous diseases were less tightly drawn, when the quarantine regulations of the States and cities lacked uniformity in requirements and in enforcement, and when, because of the lack of an effective barrier, cholera, plague, smallpox, and yellow fever constituted a constant menace to the public health of the United States.

Although recent years have witnessed great changes in the concepts of the functions of public health services and unparalleled advances in public health methods and administration as a result of the expansion in the fields of activity designed to provide greater national health protection, the prevention of the importation of disease is still an important function of a national public health service. While the danger of importing disease has been greatly lessened by various factors of modern life, such as increase in our knowledge of prevention of disease, facilities for obtaining prompt information regarding the world prevalence of disease, improvement in the sanitary condition of vessels, increase in the number of vessels carrying ships' doctors, and the salutary effects of international sanitary conventions relating to international commerce, the continuation of the barrier of quarantine is necessary. A dangerous communicable disease may still occur in passengers or crew en route, carried aboard in the incubation period, or, with modern rapidity of transportation, it may even reach a United States port before clinical symptoms become clearly manifest; some vessels are still found rat-infested to a dangerous degree; and many vessels and airplanes come direct to our ports from areas where cholera, typhus fever, smallpox, and yellow fever prevail.

For these reasons present quarantine activities and facilities will probably not be further curtailed. In fact, more stringent measures may be required in the future as the result of disordered world conditions. In the balance of public health, prevention still outweighs cure, with respect to the introduction of disease from abroad as well as to the control of disease within our borders.

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STUDIES ON DENTAL CARIES

IX. THE PREVALENCE AND INCIDENCE OF DENTAL CARIES EXPERIENCE, DENTAL CARE, AND CARIOUS DEFECTS REQUIRING TREATMENT IN HIGH SCHOOL CHILDREN [1]

By HENRY KLEIN, *Dental Officer*, and CARROLL E. PALMER, *Passed Assistant Surgeon, United States Public Health Service*

INTRODUCTION

In approaching the practical problem of providing children with effective reparative services for dental caries, it becomes of some utility to recognize that the yearly rate of development of carious defects affords a quantitative estimate of the amount of treatment required each year. Furthermore, the difference between the yearly rate of treatment and the yearly incidence of new defects may be made to serve the function of defining quantitative adequacy of dental services for caries. According to this concept, quantitatively adequate service becomes established when the annual rate of treatments coincides with the annual incidence of carious defects. It follows from this definition that the presence of unfilled but fillable carious lesions represents tangible and positive evidence of inadequate care. Likewise, devitalized teeth in the mouth and teeth extracted because of extensive caries must be interpreted in the main as evidence of the deleterious end results of inadequate service.

In a recent publication [2] the dental status of a representative grade school population was described in terms of the perspectives given above. From this study, it was shown that carious lesions arise in elementary school children at a rate approximating 1.3 affected perma-

[1] From the Division of Public Health Methods, National Institute of Health.

The preceding papers of this series are as follows:

I. Dental status and dental needs of elementary school children. By Henry Klein, C. E. Palmer, and J. W. Knutson. Pub. Health Rep., 53: 751-765 (May 13, 1938).

II. The use of the normal probability curve for expressing the age distribution of eruption of the permanent teeth. By Henry Klein, C. E. Palmer, and M. Kramer. Growth, 1: 385-394 (1937).

III. The measurement of post-eruptive tooth age. By C. E. Palmer, Henry Klein, and M. Kramer. Growth, 2: 149-159 (1938).

IV. Tooth mortality in elementary school children. By J. W. Knutson and Henry Klein. Pub. Health Rep., 53: 1021-1032 (June 24, 1938).

V. Familial resemblances in the caries experience of siblings. By Henry Klein and C. E. Palmer. Pub. Health Rep., 53: 1353-1364 (Aug. 5, 1938).

VI. Caries experience and variation in the time of eruption of the teeth. By Henry Klein and C. E. Palmer. Child Development, 9: 203-218 (1938).

VII. Sex differences in dental caries experience of elementary school children. By Henry Klein and C. E. Palmer. Pub. Health Rep., 53: 1685-1690 (Sept. 23, 1938).

VIII. Relative incidence of caries in the different permanent teeth. By J. W. Knutson, Henry Klein, and C. E. Palmer. J. Am. Dent. Assoc., 25: 1923-1934 (1938).

The tenth paper of the series has also been published:

X. A procedure for the recording and statistical processing of dental examination findings. By Henry Klein and C. E. Palmer. J. of Dent. Research, 19: 243-256 (1940).

[2] Klein, Henry, and Palmer, C. E.: The dental problem of elementary school children. The Milbank Memorial Fund Quarterly, 16: 267-286 (1938).

nent tooth surfaces per child per year while the rate of placement of fillings was found to be of the order of 0.2 filled permanent tooth surfaces per child per year. This more than sixfold disparity between the incidence of need for fillings and the rate of provision of care by fillings was shown to result in the prevalence at examination of an average of 0.1 remaining roots, 0.3 nonvital and extracted permanent teeth, and more than 2.6 permanent tooth surfaces having one or more unfilled carious defects, per grade school child.

It is the purpose of the present paper to describe findings on these several aspects of the caries problem in a group of children attending high school and covering the age range from 13 to 19 years.

MATERIAL AND METHODS

Data for the present paper were derived from dental examinations of 1,841 children attending the high schools of Hagerstown, Md., and of five nearby communities.[3] The number of children examined and details of the age and sex distributions are given in table 1. The examinations, carried out by a dental officer of the United States Public Health Service,[4] were made with mirror and explorer. The observations were called out in code by the examiner to a dental assistant who recorded the information on a form especially designed to facilitate subsequent analysis of the data by punch card machine methods.[5] The records included observations on the number of teeth erupted, unerupted, missing because of extraction, having only remaining roots, with unfilled caries, filled, and/or hypoplastic. These items were noted where indicated for each of the permanent and deciduous teeth and tooth surfaces.[6] The analysis was designed to provide information on the prevalence and incidence of caries experience, dental care in the form of fillings, carious defects without evidence of fillings, and dental defects which had terminated in complete tooth destruction.

TABLE 1.—*Number of high school children examined, by specified age and sex groups*

Item specified	Age (last birthday)							
	13	14	15	16	17	18	19	All ages
Number of boys	5	142	242	193	172	74	27	855
Number of girls	15	189	268	252	183	74	5	986
Number of both sexes	20	331	510	445	355	148	32	1,841

[3] Williamsport, Boonsboro, Clearspring, Hancock, and Smithburg.

[4] Dr. John F. Cody, second year dental interne.

[5] A detailed description of the methods developed for the collection and analysis of the data is given in a recent report: Klein, Henry, and Palmer, C. E.: Studies on dental caries. X. A procedure for recording and processing dental examination findings. Journal of Dental Research, 19: 243-256 (1940).

[6] Since only 88 deciduous teeth were present in the mouths of the 1,841 children, the dental findings given in the present paper concern only the permanent teeth (see appendix table).

The prevalence of caries experience in the permanent teeth is measured in each child in two ways: (*a*) By counting the number of teeth affected, and (*b*) by counting the number of tooth surfaces affected. The first of these provides a measure of the prevalence in terms of teeth, and the second, the surface count, affords a measure of the prevalence in terms of tooth surface area. The prevalence of caries experience (present and past) is defined in this paper as follows: (*a*) Teeth and tooth surfaces with open cavities, (*b*) teeth and tooth surfaces filled, (*c*) teeth with only remaining roots, and (*d*) teeth extracted. In order to convert items (*c*) and (*d*) into terms of tooth surfaces, it is necessary to assign to each tooth having only remaining roots, and each tooth, extracted a value for surfaces involved by past caries. (It is assumed that the condition of these teeth is the result of extensive caries.) Clearly a tooth having only remaining roots has been affected by the carious process on all five surfaces of the crown. In children, it is also evident that extractions usually follow total destruction of the crown surfaces. In many cases, however, tooth devitalization may be effected by penetration of the carious process into the pulp of the tooth from a single surface lesion. A proportion of such teeth form a part of those found extracted. This virulent type of caries may well be equivalent, in intensity, to attack on five separate surfaces. On the basis of these considerations, each extracted tooth and each tooth having only remaining roots is counted as five past carious surfaces. The summation of items (*a*), (*b*), (*c*), and (*d*) for the teeth or for the surfaces, designated by the abbreviation "DMF," gives information on the prevalence of caries experience in the permanent teeth and permanent tooth surfaces.

The derivation of the yearly increment or yearly incidence of each of the several aspects of the caries problem presents a somewhat more complicated task. A direct approach to the measurement of the incidence of particular morbidities (or services) can perhaps best be made through seriatim or longitudinal studies. Thus the incidence of caries experience may be determined by making dental examinations on a given date and again one year later. The number of new carious defects observed to have appeared within the interval of one year provides a measure of the incidence of caries in the group under observation. In order to obtain more representative information, it would be desirable to carry out annual examinations for several years so that average annual incidence rates might be obtained.

In the present study the yearly incidence rates are derived by indirect methods. In order to discuss the application of such methods, it is necessary to consider certain of the constituents making up the caries problem in children. The number of permanent teeth and tooth surfaces observed to be affected by past and present caries experience is constituted at a particular chronological age by all of

the carious lesions which have accumulated each year from the time of eruption of the first permanent tooth until the time of examination. For example, the total caries experience, that is, the DMF permanent teeth or surfaces observed in children 13 years of age, represent the sum total of caries occurring from about age 6 to age 13 years. The total caries experience seen in 14-year-old children is higher than that observed in 13-year-old children when the numbers of individuals being dealt with are large and representative. The difference, or the increment of caries experience, occurring between the two ages may be assumed to represent new caries taking place within the interval between the ages. Similarly, the increment of caries experience observed between any two successive age groups may be considered as new caries experience.

In those instances where caries experience distributes itself along a linear trend with age, the slope of the line fitted to the regression provides a simple averaging mechanism for deriving the value of the yearly incidence of caries. This procedure is used in the analysis of the material in the present paper. The average yearly incidence of dental care in the form of fillings, the incidence of dental defects requiring filling but remaining unfilled, and the incidence of each of the other aspects of the caries problem may be obtained by similar analytical procedures.

FINDINGS

The prevalence and incidence of accumulated caries experience.—The data presented in table 2 provide information on the prevalence of caries (DMF) experience in the high school children. As shown in this table, the total caries experience expressed in terms of the average number of DMF teeth and DMF tooth surfaces per child increases consistently with increase in chronological age. The high school children 13 years of age have an average of 4.8 permanent teeth showing evidence of caries experience, and the average 14-year-old child has 6.1 DMF teeth. At 19 years of age, each child on the average shows 9.3 DMF teeth. The DMF surfaces per child increase from 7.9 at 13 years of age to 11.4 at 14 years and 24.7 surfaces at 19 years.

TABLE 2.—*Number of decayed, missing, and filled (DMF) permanent teeth and tooth surfaces per child, by specified age groups—dental examination of 1,841 children attending the high schools of Hagerstown, Md., and of five nearby communities*

Item specified (permanent teeth)	Age (last birthday)							
	13	14	15	16	17	18	19	All ages
Number of DMF [1] teeth, per child	4.8	6.1	6.7	7.2	7.7	8.7	9.3	7.1
Number of DMF [1] surfaces, per child	7.9	11.4	13.1	14.7	16.5	19.9	24.7	14.5

[1] Decayed, missing, and filled as described in the text.

The relationship between chronological age and the average accumulated caries experience per child is shown graphically in figure 1. Inspection of the plotted points suggests, within a restricted age range covered by these data, that the two variables are related linearly. The slope of the regression line fitted to these data by the method of least squares defines with reasonable precision the way in which caries experience accumulates as chronological age increases. The regression coefficient was found to equal 0.6 for the permanent teeth and 2.0 for the permanent tooth surfaces. Expressed in other terms, this analysis indicates that on the average each unit increase of 1 year on the

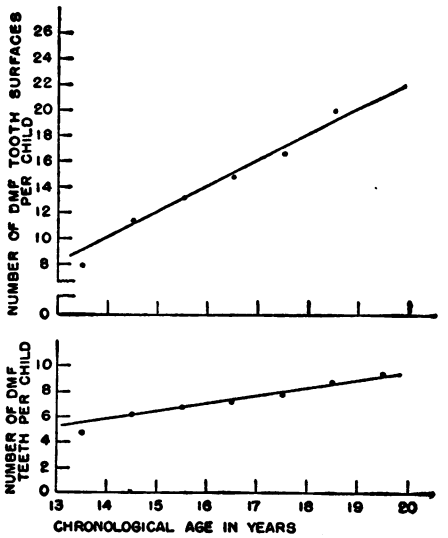

FIGURE 1.—Regression lines showing the relationship between chronological age and the number of decayed, missing, and filled permanent teeth, and tooth surfaces, per high school child.

chronological age scale between ages 13 and 19 is accompanied in the high school children studied by an increment or incidence of 0.6 carious permanent teeth and 2.0 carious permanent tooth surfaces.[7]

The prevalence and incidence of dental care in the form of fillings.— The material presented in table 3 and figure 2 gives information on the prevalence of dental care in the form of fillings in the permanent teeth of the high school children. In general, the average number of filled permanent teeth per child increases with increase in chronological age. The respective slopes of the regression lines fitted to the relations of filled teeth and filled surfaces per child and chronological age were found to equal 0.4 and 0.6. From this analysis, the yearly rate of placement of fillings is estimated at approximately 0.4 perma-

[7] These findings indicate that for each permanent tooth affected by caries, approximately 3 surfaces are involved. This relatively high value for surfaces is in part the result of the fact that the proportion of the caries experience found in the form of teeth completely destroyed by caries (extracted or only with remaining roots) is counted so that each tooth destroyed is considered equal to five surfaces with caries experience.

nent teeth and 0.6 permanent tooth surfaces filled per high school child per year.[8]

The prevalence and incidence of untreated need due to caries.—Untreated needs due to caries are formed in the high school children by open carious cavities, by remaining roots, and by extracted teeth. These aggregations of untreated need are encountered mainly because the incidence of caries proceeds at a rate higher than the rate at which fillings are placed.

TABLE 3.—*Number of filled permanent teeth and tooth surfaces, per child, by specified age groups—dental examination of 1,841 children attending the high schools of Hagerstown, Md., and of five nearby communities*

Item specified (permanent teeth)	Age (last birthday)							
	13	14	15	16	17	18	19	All ages
Number of filled teeth, per child	2.8	2.5	3.0	3.3	4.2	4.4	3.6	3.3
Number of filled surfaces, per child	3.9	3.5	4.1	4.6	6.1	6.4	5.3	4.7

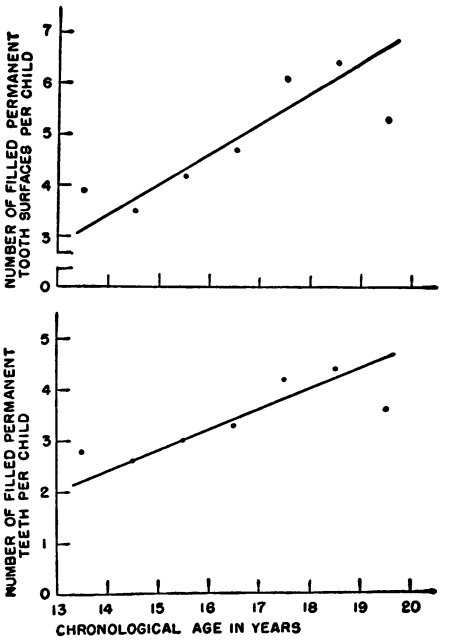

FIGURE 2.—Regression lines showing the relationship between chronological age and the number of filled permanent teeth, and tooth surfaces, per high school child.

The material shown in table 4 reveals certain of the results of the maintenance of disparities between the incidence of caries and the

[8] No account is taken in this analysis of the fact that some teeth may have been filled and then extracted before the time of the examination for the present study. In the age group covered, however, such teeth are probably relatively few in number.

incidence of dental care in the form of fillings. Before proceeding with a description of the data given in this table it is desirable to consider further the several constituents which together make up the untreated need problem in the high school children. It is clear that if carious tooth surfaces were filled as soon as they appeared in the mouth, the need for fillings, that is the number of untreated carious defects needing care, would be approximately zero. It is obvious that the nearly 3 untreated carious surfaces in 13-year-old high school children and the more than 4 carious surfaces in the 14-year-old students represent an accumulation of neglected lesions which have developed during elementary school attendance. Furthermore, the 13- and 14-year-old children entering high schools show, respectively, an average of 0.3 and 0.8 of a tooth extracted or with only remaining roots. It is reasonable to view this accumulation of surfaces needing fillings and of teeth extracted and with remaining roots as evidence of the fact that adequate dental care is not approached in the grade school children destined to attend high school.

TABLE 4.—*Number of permanent teeth and tooth surfaces with one or more untreated carious defects, number of permanent teeth extracted, number of permanent teeth with only remaining roots, and number of permanent teeth extracted and with only remaining roots (M of the DMF count), per child, by specified age groups—dental examination of 1,841 children attending the high schools of Hagerstown, Md., and of five nearby communities*

Item specified (permanent teeth)	Age (last birthday)							
	13	14	15	16	17	18	19	All ages
Number of teeth with one or more untreated carious defects, per child	1.75	2.91	2.97	3.08	2.48	2.70	3.13	2.86
Number of tooth surfaces with one or more untreated carious defects, per child	2.80	4.16	4.41	4.93	4.11	4.51	5.66	4.45
Number of teeth extracted, per child	.25	.76	.93	1.06	1.27	1.80	2.78	1.09
Number of teeth in the form of remaining roots, per child	.05	.08	.12	.15	.15	.21	.16	.13
Number of teeth extracted and in the form of remaining roots, per child	.30	.84	1.05	1.21	1.42	2.01	2.94	1.22

The number of permanent tooth surfaces with one or more carious defects requiring fillings, per child, shown in table 4, are of especial interest. Except for the low rate for the few 13-year-old children and the high rate for the 19-year-old students, the number of permanent tooth surfaces requiring treatment by fillings appears to remain relatively constant. From a study of the rates shown in the last three horizontal rows in table 4 and by reference to the filling rates shown in table 3, it may be noted that the number of tooth surfaces needing fillings tends to remain relatively constant over the high school interval because a proportion of the new need arising each year is treated by fillings, and a part of the need, some of which has been carried over from grade school years, is removed by extraction or becomes extended to form the remaining roots.

Further details of the dental status of the high school children are presented in the appendix table. From these data it may be seen that less than 4 percent of the children examined were found to be free of caries experience. Of the 1,841 children who received the examinations, 1,145, or approximately 60 percent, had one or more filled permanent teeth. It follows, therefore, that about 40 percent of the children showed no evidence of fillings in spite of the fact that less than 4 percent were free of caries experience. A total of 13,035 permanent teeth were found to be affected by caries experience, an average of more than 7 permanent teeth with evidence of caries attack per child. Of such teeth with caries experience, the children on the average had approximately 3.3 filled, 0.1 with only remaining roots, 1.0 missing (extracted), and 2.9 with one or more open cavities. Each child showed on the average more than 14 DMF permanent tooth surfaces. Of these surfaces, approximately 4.7 were filled, 0.6 were missing in the form of remaining roots, 5 were missing in the form of extracted teeth, and 4.5 surfaces showed open cavities. Expressed in other terms, it may be noted that somewhat over one-half of the high school children receive some dental care in the form of fillings in the permanent teeth, that about one-half of the teeth and approximately one-third of the surfaces affected by caries experience are treated by fillings, while close to one-half of the teeth and two-thirds of the surfaces attacked by caries show no evidence of treatment in the form of fillings. Of these latter untreated needs, approximately one-third of the teeth with unattended caries and more than one-half of the tooth surfaces with unattended caries are in a condition beyond therapeusis by fillings, that is, they are extracted or have only remaining roots.

DISCUSSION

An opinion is current in dental thought that the present problem of treating carious defects in the population is much larger than it need be considering the therapeutic potentialities of applied dentistry. The findings presented here support this view quantitatively for one segment of the population, the children attending high school. They show, in explanation of a huge reparative problem, a continued and uninterrupted maintenance of disparity between the disease and the mitigating process, that is to say, between the yearly incidence of initial carious lesions and the yearly rate at which care for those lesions is supplied. Maintaining these disparities by default allows an accumulation of untreated defects and an aggregation of those secondary extensions which develop from continued neglect.

Under present conditions, each year brings a new increment of unattended caries. This means that the average person is destined on

reaching adult age to present a problem of reparative need of an exceedingly complex character.

That the small initial lesions may be cared for by simple fillings is clear. It is also apparent that, if left untreated for some interval of time, the areas requiring filling become significantly larger, and more professional services are required to stop the process and remedy the damage already done. In the case of pulp devitalizations and tooth extractions, the need problem becomes progressively more complex and allows for differences of opinion as to what should be done. Also, as the needs become more complex, there is more chance that economic obstacles to the meeting of these needs may present themselves.

For example, when a carious tooth has progressed to the stage of devitalization, pulp-canal therapy might be recommended. If the expense of this were prohibitive, extraction might be specified. By extraction, another need is created and a removable bridge appliance might be recommended to meet it. Where economic considerations dictate a choice between services, the need for fillings in other teeth might preclude the replacement of the missing tooth. In fine, the problem of dental need obviously increases in complexity and magnitude with increase in the disparity between the incidence of carious defects and the rate of repair of the initial lesions.

In point of attainable objectives, the present treatment problem may be progressively reduced by diminishing the disparity between the incidence of service and of the disease. The basic solution, of course, lies in that at present unknown quantity, the prevention of the initiation of caries. It is generally accepted that no undisputed method is now available for preventing the initiation of carious lesions. Thus it is essential to recognize that even where provision of care equals the incidence of caries, an "irreducible" minimum[9] of carious defects may be postulated to appear each year. Since the lesions must be accepted for the time being as, in the main, unavoidable, it follows that the consideration of practical importance must be the utilization of all the potentialities of reparative dental care.

From the point of view of public health, it is desirable to emphasize that most of the deleterious effects of caries may be avoided and, therefore, the cost of their repair and treatment largely eliminated by finding and filling early carious lesions *at a rate coinciding with the rate at which the lesions appear.*

SUMMARY

Analyses of material collected from detailed dental examination of approximately 1,800 children between the ages of 13 and 19 years

[9] "Irreducible" until such time when the initiation of caries definitely may be prevented. The admittance of these perspectives in the problem would appear to indicate that the ultimate solution of the dental needs problem requires other procedures in addition to those concerned with the filling of carious defects.

APPENDIX TABLE.—*Summary of dental status, by specified age and sex groups—dental examination of 1,841 children attending the high schools of Hagerstown, Md., and of five nearby communities*

Item specified	Boys								Girls							
	Age (last birthday)															
	13	14	15	16	17	18	19	All ages	13	14	15	16	17	18	19	All ages
Number of children examined	5	142	242	193	172	74	27	855	15	189	268	252	183	74	5	986
Number of permanent teeth erupted (excluding third molars)	128	3,906	6,689	5,368	4,785	2,067	756	23,699	416	5,213	7,443	7,005	5,095	2,066	140	27,378
Number of extracted permanent teeth	3	104	212	192	238	129	86	964	2	148	260	278	212	137	3	1,040
Number of permanent teeth in the form of remaining roots	1	14	36	25	27	6	3	112	0	14	23	42	26	25	2	132
Number of extracted permanent teeth and number of permanent teeth in the form of remaining roots	4	118	248	217	265	135	89	1,076	2	162	283	320	238	162	5	1,172
Number of permanent teeth present in the mouth	125	3,802	6,477	5,176	4,547	1,938	670	22,735	414	5,065	7,183	6,727	4,883	1,929	137	26,338
Number of deciduous teeth present in the mouth	2	4	19	7	10	1	0	43	1	17	7	11	7	2	0	45
Number of permanent teeth with one or more untreated carious defects	14	431	841	653	538	211	74	2,762	21	532	672	716	344	188	26	2,49
Number of permanent tooth surfaces with one or more untreated carious defects	26	611	1,283	1,025	884	346	113	4,288	30	767	965	1,169	576	321	68	3,896
Number of filled permanent teeth	6	341	578	604	651	337	99	2,616	50	502	943	851	828	315	16	3,505
Number of filled permanent tooth surfaces	7	484	835	866	980	499	147	3,818	70	668	1,279	1,202	1,182	455	21	4,877
Number of DMF [1] permanent teeth	23	858	1,589	1,401	1,390	664	251	6,176	72	1,151	1,820	1,792	1,353	626	45	6,859
Number of DMF [1] permanent tooth surfaces	48	1,604	3,157	2,826	3,042	1,483	685	12,845	110	2,164	3,520	3,725	2,805	1,459	104	13,887
Number of children with no DMF [1] permanent teeth	0	10	14	2	2	3	0	31	0	9	11	7	3	2	0	32
Number of children with 1 or more DMF [1] permanent teeth	5	132	228	191	170	71	27	824	15	180	257	245	180	72	5	954
Number of children with 1 or more filled permanent teeth	2	77	121	109	110	51	19	489	10	112	167	169	142	51	5	656
Number of children with 1 or more untreated carious permanent teeth	4	113	193	162	135	54	25	686	7	141	182	189	105	52	2	678

[1] Decayed, missing, and filled as described in the text.

attending the high schools of six communities of Maryland indicate that:

1. The incidence of new caries is approximately 0.6 affected permanent teeth and 2.0 affected permanent tooth surfaces per high school child per year.

2. The incidence of dental care in the form of fillings is approximately 0.4 filled permanent teeth and 0.6 filled permanent tooth surfaces per high school child per year.

3. The average disparity, over the high school interval, between the rates of incidence of caries and provision of care by fillings is shown to account for an average of about one and one-third permanent teeth extracted or with remaining roots per high school child.

4. It is pointed out that the average disparity between the annual rate of development of caries and the annual rate of placement of fillings may be made to serve the function of measuring the quantitative adequacy of dental care received by population groups.

A STUDY OF THE ROLE OF VENTILATING SYSTEMS IN THE TRANSMISSION OF BACTERIA

By J. M. DALLAVALLE, *Passed Assistant Sanitary Engineer*, and ALEXANDER HOLLAENDER, *Biochemist, Division of Industrial Hygiene, National Institute of Health, United States Public Health Service*

The possible spread of infection by means of ventilating systems is a problem which has received little attention. Present day air-conditioning systems often recirculate as much as 90 percent of air once cooled. Air from an infected space may thus be conveyed to a common plenum and redistributed to noninfected areas. In this manner, a ventilating system might become a factor in the spread of disease. The recent work of Wells (*1*) implies this possibility, but, so far as is known, actual quantitative tests with a ventilating system have not as yet been published. Nor can it be stated at this time how potent a force mechanical ventilation is in the spread of disease; but if we accept the important contributions of Wells and others (*1*, *2*) in the field of air bacteriology, ventilating systems must be recognized as a source of possible danger not hitherto appreciated.

In this paper tests made with two different ventilating systems are discussed. Bacteria (*B. subtilis* spores) were introduced at various points in each system.[1] Samples were taken in representative rooms with a special device described by the authors in a previous paper (*2*). The apparatus has been used successfully in a large number of tests and has been demonstrated to be a reliable instrument for sampling

[1] The organisms (*B. subtilis* spores) were introduced by means of a paint spray gun. The gun was carefully regulated to assure a constant fine spray. The organism used is not considered pathogenic and is usually present in outdoor air. Cultures of the spores were prepared in the following manner: *B. subtilis* was grown for a period of 2 weeks on beef-broth agar at 37° C. Slants were shaken with physiological salt solution and the suspension heated to 98° C. for 10 minutes to insure that all vegetating organisms were killed. The suspension was then filtered and diluted with water for use in the spray gun.

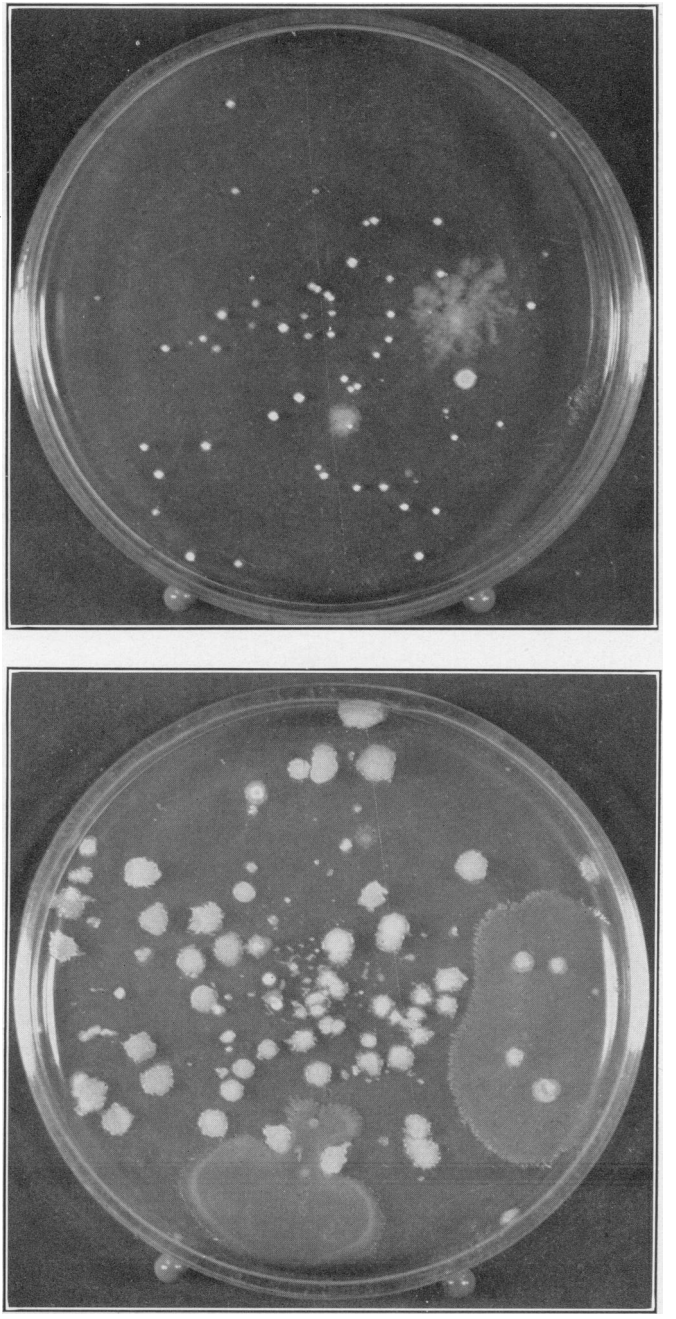

FIGURE 1.—Petri dish cultures obtained with funnel device. (Above) Sample obtained before spraying of bacteria. (Below) Sample obtained after spraying of *B. subtilis* spores (notice diffuse colonies of *B. subtilis*).

the specific organism used (*3*). Briefly, it consists of an inverted glass funnel fitted over a Petri dish containing nutrient agar. Air is drawn through the funnel at a rate of 1 cubic foot per minute by

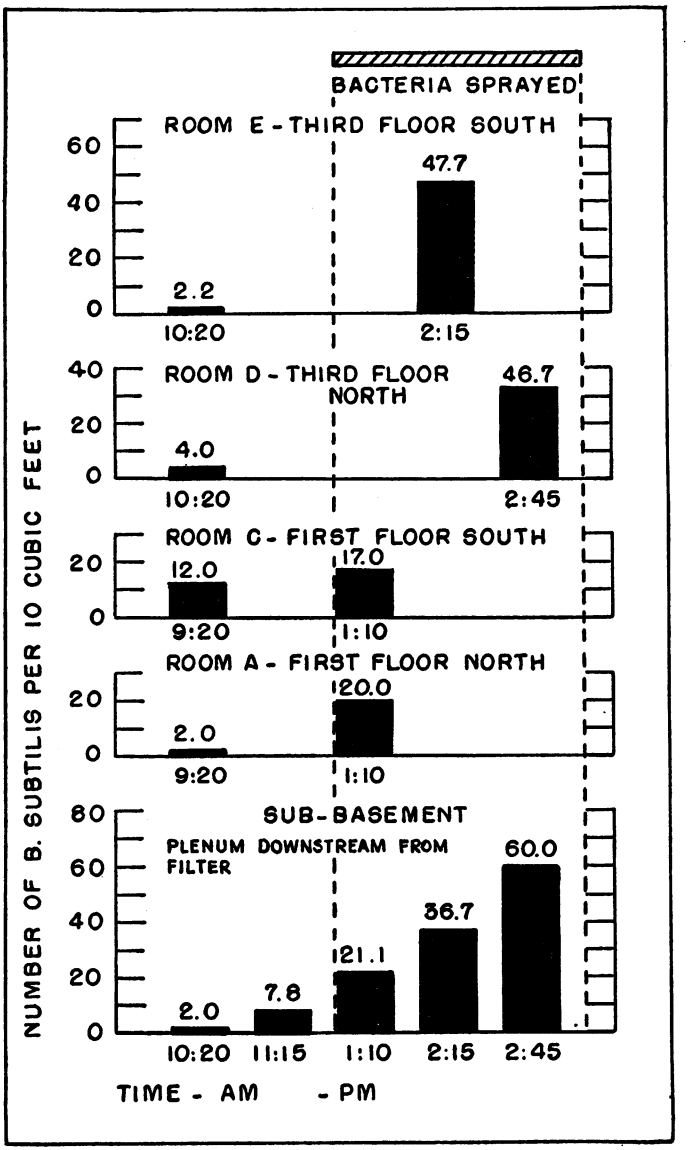

FIGURE 2.—Number of *B. subtilis* per 10 cubic feet of air before and during spraying on different floors of building. Bacteria spread into first floor air intake between 1 and 2:45 p. m.

means of an impinger motor. The air-borne bacteria are then impinged upon the agar contained in the Petri dish. *B. subtilis* can be readily distinguished from other organisms usually found in air.

The plates exposed were cultured at 37° C. for 48 hours on beef-broth agar (15 grams per liter, pH 6.2). The surface cultures obtained in this manner form large and diffuse colonies, as shown in figure 1.

In one of the ventilating systems in which tests were made, *B. subtilis* spores were first introduced beyond the filters and later some distance in front of the filters. Thus, in the first instance the bacteria proceeded through the ventilating system without being filtered, while in the second instance the reverse was true. In the second system, *B. subtilis* spores were sprayed in the return-air register located in the corridor of the first floor, and in another series of experiments spores were introduced in the mixing plenum immediately in front of the filters. Samples were taken in triplicate in parts of rooms ventilated by each system tested. Control samples were taken before and after each experiment. All samples were obtained at the breathing level.

RESULTS OF TESTS

System 1.—Auditorium, 44 by 58 by 14 feet. Ventilation system handles 8,200 cubic feet per minute (14 air changes per hour). Recirculation estimated at 30 percent. System equipped with paper-tissue filter. Air temperature during tests 70° F.

Test 1 [1]

(*a*) Number of *B. subtilis* per 10 cubic feet before introducing spores	None
(*b*) Number of *B. subtilis* per 10 cubic feet during and 15 minutes following the introduction of spores downstream of filter	21. 9
(*c*) Number of *B. subtilis* per 10 cubic feet 1 hour after introducing spores	None

Test 2 [1]

(*a*) Number of *B. subtilis* per 10 cubic feet before introducing spores	None
(*b*) Number of *B. subtilis* per 10 cubic feet during and 15 minutes following the introduction of spores upstream of filter	3. 7
(*c*) Number of *B. subtilis* per 10 cubic feet 1 hour after introducing spores	None

System 2.—Large building equipped with ventilating system having a four-way split. System handled 29,680 cubic feet per minute. Recirculation estimated at 25 percent.

In the first series of tests with this system the spray gun was set near the return-air register on the first-floor corridor.

Samples were taken in the following rooms:

Room	Floor	Volume (feet)	Cubic feet of air supplied per minute
A	1 north	20 x 20 x 10	680
C	1 south	12 x 20 x 10	600
D	3 south	12 x 20 x 10	550
E	3 north	20 x 20 x 10	680

Results of these tests are shown in figure 2.

[1] Average of several samples made at two points in auditorium.

In another group of experiments the spray gun was placed upstream of rotating oil filter in return air-mixing plenum. The fan is located at a level slightly below subbasement floor. Samples were taken in two rooms. Room A, first floor, north, 20 by 20 by 10 feet, with air supply of 680 cubic feet per minute, and room B, second floor, south, 20 by 20 by 10 feet with air supply of 600 cubic feet per minute.

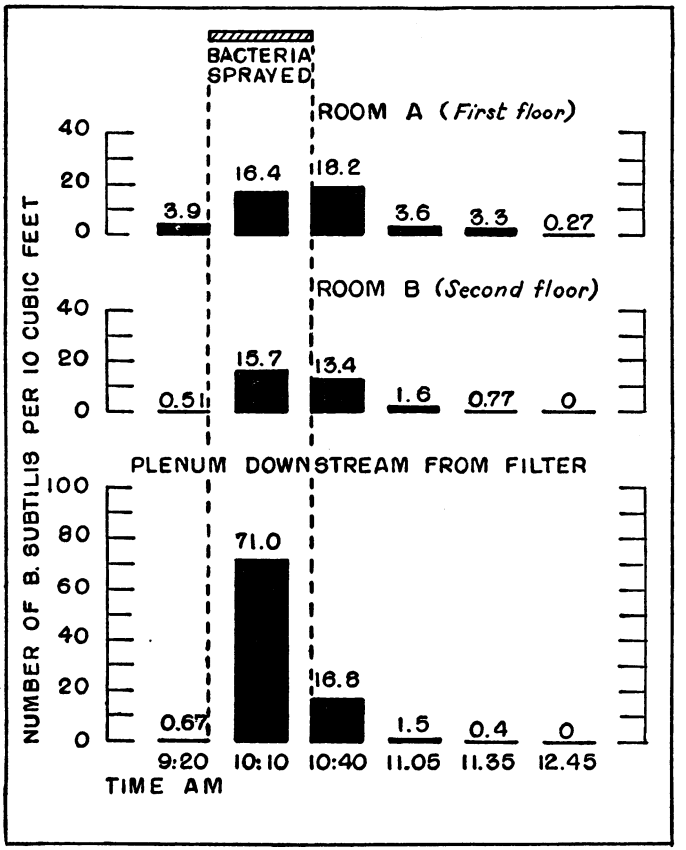

FIGURE 3.—Number of *B. subtilis* colonies per 10 cubic feet of air from samples taken simultaneously on three different floors. Bacteria spread into outside air intake between 9:30 and 10:40 a. m.

Samples in both rooms and in plenum downstream of filter taken simultaneously. Air temperature in rooms 72° F. and in downstream plenum 60° F. Results of tests are shown in figure 3.

DISCUSSION OF RESULTS

It is worth noting that the concentration of spores drops rapidly after spraying has ceased, so that in a relatively short time the bacterial population returns to its normal level. The decrease may be

attributed to the dilution factor, the action of the filter, and loss to surfaces, such as walls, floors, and the like. This loss, however, cannot be regarded as constant since undoubtedly it must vary with humidity and temperature.

It may be mentioned that the technique used has an application in the testing of ventilating systems to ascertain the effectiveness of air distribution in ventilated rooms. Thus, samples may be taken at various points following the introduction of *B. subtilis* spores and their concentration used as an index of air circulation. In making such tests it is important that the spores be prepared by a competent bacteriologist since it is possible that serious consequences may result to persons exposed to heavy concentrations of bacteria of unknown character.

The results given here were obtained under the most favorable conditions for the transmission of bacteria in ventilating systems. Not only were heavy concentrations of *B. subtilis* spores introduced, far in excess of those which would be possible under usual conditions, but also they were sprayed at advantageous points. Nevertheless, the data indicate that bacteria may be spread by a ventilating system, and lead to the conclusion that, especially in crowded spaces with a high degree of air recirculation, the potentiality is such as to merit further study from the public health standpoint.

ACKNOWLEDGMENT

Acknowledgment is given to Assistant Chemist Warren H. Reinhart and to Minor Laboratory Helper Jesse R. Dom, who assisted in the conduct of these tests.

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AMERICAN AZURES IN THE PREPARATION OF SATISFACTORY GIEMSA STAINS FOR MALARIA PARASITES[1]

By M. A. Roe, *Surgeon*, R. D. Lillie, *Surgeon*, and A. Wilcox, *Assistant Technologist, United States Public Health Service*

Hitherto, the most uniformly satisfactory stain for malaria parasites in the thick film technique has been the Giemsa stain furnished by Grübler, compounded from azure I, methylene blue, and eosin (w. g.) of German manufacture. With the interruption of the foreign supply of Giemsa stain, the problem of finding a satisfactory American

[1] From the Divisions of Infectious Diseases and of Pathology, National Institute of Health.

product has become acute, since the substitution of azure I or azure A (which have been considered synonymous terms) of American manufacture has not yielded good results.

It was felt that the problem could be attacked best by examining successively the staining action on malaria parasites of the possible chemical constituents of Grübler's azure I made up in simple combinations with eosin. The constituents in question belong to the group of thiazin dyes, namely, methylene blue, azure B, azure A, azure C, and thionin. Toluidin blue, azure IV (symmetrical dimethyl thionin), and methylene green, also belonging to the series, were examined briefly. Bernthsen's methylene violet was omitted on account of its stated insolubility in the absence of other thiazin dyes.

Spectrophotometric examinations of each dye sample used were made as a further control with the recording spectrophotometrograph of the Washington Biophysical Institute. The absorption spectra were compared with the known data of each dye for identity (*2*, *3*).

Where possible, several different samples of each dye were used. These dyes are tabulated in table 1.

TABLE 1

General description of dye			Spectrophotometric data						
Name of dye	Manufacturer or source	Lot number	Given dye content	Log 1/T at maximum at 5γ per cc.	Estimated dye content (percent)	Maximum absorption λ in mμ	99 percent maximum log 1/T		
							Range mμ	Width mμ	Median mμ
Methylene blue	Eimer & Amend	2	----	----	----	----	----	----	----
Do	do	3	----	1.08	88	659.2	655.3–670.9	15.7	663.1
Do	Bausch & Lomb Optical Co.	----	----	.889	85	662.6	653.9–673.1	19.3	663.5
Do	Dr. G. Grübler & Co.	12.13	----	----	----	----	----	----	----
Do	National Aniline Chemical Co.	NA–6	82	.742	----	657.5	653.8–661.3	7.6	657.5
Do	Hartman-Leddon Co.	LA–?	87	1.008	----	660.9	652.1–666.7	14.7	659.4
Azure I	Dr. G. Grübler & Co.	9.24	----	.586	65	653.0	634 –666	33	649.5
Azure B	Army Medical Museum	2	----	.533	60	664.0	647 –661	25	659
Do	do	12.13–24	----	.018	2?	660.0	625 –673	49	649
Do	W. C. Holmes	1926	----	.754	82	654.0	633 –666	34	649.5
Azure B $ZnCl_2$	National Aniline Chemical Co.	3769	----	.598	66	658.0	648 –670	23	659
Azure B Br	do	7724	----	.705	79	660.0	642 –670	29	656
Azure A	do	3513	----	.449	45	634–642	612 –653	42	632.5
Azure A or I	do	NAz–5	90	.900	----	624	606 –640	35	622.5
Azure A or I	do	NAz–6	90	.844	----	624	607 –638	32	622.5
Azure A French	do	8847	----	.680	70	618–624	606 –641	36	623.5
Azure C [1]	Army Medical Museum	11–2–25	----	.490	55	626–628	609 –643	35	626
Do [1]	do	8–1925	----	.493	55	626–632	612 –647	36	629.5
Azure C	do	2–1925	----	.180	20	616–620	606 –631	26	618.5
Do	do	22–9–25	----	.378	40	616–620	605 –633	29	619
Azure I	Harmer Laboratory	----	----	.306	32	614	559 –630	32	614.5
Azure C	National Aniline Chemical Co.	NAc–2	----	.402	45	618	601 –635	35	618
Thionin	Harleco(Ehrlich-Hoyer)	NT–1	----	.473	50?	602–608	595 –612	18	603.5
"Azure II"	Army Medical Museum	151	----	.061	7?	602	592 –614	23	603
Toluidin blue	Providence Chemical Co.	Before 1926	----	----	----	----	----	----	----
Do	Coleman & Bell	CU–1	48	----	----	----	----	----	----
Do	Biosol	162	----	----	----	----	----	----	----
Methylene green	Farbwerke-Hoechst Co.	----	----	----	----	----	----	----	----
Azure IV	Army Medical Museum	1925	----	.482	50	636	616 –650	35	633

[1] Spectrophotometric data indicate a considerable amount of azure A.

The staining characteristics were determined by mixing simple 1:1,000 aqueous solutions, following the old Nocht method for staining malaria parasites. The proportion of 2 moles of the thiazin to 1 of eosin was employed as a starting point. This gives 5 cc. eosin to 4.6 cc. methylene blue, 4.4 cc. azure B or toluidin blue, 4.2 cc. azure A or azure IV, 4.0 cc. azure C, and 3.8 cc. thionin. In addition 5 and 6 cc. quantities of the thiazins were used. The usual dilution called for a total volume of 50 cc. and the pH level was buffered to 7.0 and 7.4. The 1:1,000 solutions were made up on the basis of actual dye content when known; otherwise a dye content was assumed similar to that of known samples of like dating and source.

Characteristic staining effects of thiazin-eosin mixtures on thin film blood preparations for quartan and tertian malaria were found to be as follows: With methylene blue the red cell background is pink to dull pink, parasite nuclei are not stained, and cytoplasm is a medium to a light gray blue with fairly good definition. With Grübler's lot 12.13 and with the Bausch & Lomb sample cytoplasm shows a slightly greenish tinge.

One sample of methylene blue (NA–6) gave a dull purple [2] chromatin stain of fair quality, but it was shown by chloroform extraction and re-solution of the extract that a small quantity of a blue dye giving an absorption maximum of 654 mμ was present, probably azure B ($\lambda = 653$ mμ).

Azure B with eosin gives quite a complete stain. Red corpuscles are pink to orange. Parasite nuclei are bluish purple, sharply outlined, and show individual chromatin granules in old trophozoites. Cytoplasm is clear gray blue and well defined. Schüffner's dots are reddish pink. Grübler's azure I, lot 9.24, is a typical example of this group. The zinc double salt (NAC No. 3769) is somewhat inferior, and one experimental lot (AMM No. 12–13–24) stained very feebly, consistently with its apparently low-dye content and wide absorption band.

Azure A gives a quite complete stain which is definitely inferior in color and detail to azure B. Red corpuscles are greenish to orange gray. Parasite nuclei are a denser and duller purple and less sharply outlined, and chromatin granules are less well shown than with azure B. Parasite cytoplasm is a dull lavender color and generally contrasts rather poorly with red cells. Two samples labeled azure C were indistinguishable from azure A in their staining, and their absorption maxima of about 628 mμ indicate that they probably are actually azure A.

Azure C gives a stain similar to azure A, but of inferior quality. Red cells are dull orange to greenish gray. Parasite nuclei are a vague purple, and contours of chromatin mass are indefinite.

[2] Purple is here defined as a distinctly bluish-red color similar to ecclesiastical or Tyrian purple.

Cytoplasm is a rather pale, dull grayish lavender. Schüffner's dots are stained very faintly.

Azure IV gave a picture intermediate between those of azure B and azure A. Methylene green gave no indication of value as a parasite stain. Thionin failed to stain malaria parasites. Toluidin blue stained red cells dull pink to lavender. Parasite nuclei were stained a faint purple with higher proportions of the thiazin and had no definition. Cytoplasm was dull slaty lavender with fair definition but poor contrast.

Summing up thus far it appears that methylene blue fails to stain parasite chromatin but is a good cytoplasmic stain. Azure A gives a fairly dense but rather vague chromatin stain and an inferior grayish lavender cytoplasm, and azure B gives excellent chromatin and cytoplasmic staining, both in color contrast and detail.

As these findings disagree sharply with the opinion hinted at by MacNeal (*1*) and definitely stated by Holmes and French (*2*), it seemed desirable to check the effects of mixtures of methylene blue with the various azures, especially as it has been suggested that whatever value azure B might have could be duplicated by mixtures of azure A and methylene blue.

Hence, mixtures were made of 5 cc. eosin, 40 cc. buffered water, and 5 cc. of a combination of methylene blue with each of the azures, varying by 0.5 cc. steps from all methylene blue to all azure.

The range of optimum staining fell between 1.5 cc. and 2.5 cc. of the azure to 3.5 cc. and 2.5 cc. of methylene blue. With the best proportions the following stains were obtained with thick films:

Azure A stained the background translucent pink and the nuclei of white cells purple. Parasite nuclei were a rather diffuse light purple, cytoplasm a pale grayish lavender and the outline of parasites vague or fuzzy. With azure B the background was clearer than the above with pinkish tinge, nuclei of white cells were deep bluish purple, parasite nuclei fairly deep red with compact chromatin mass, cytoplasm medium bluish gray, and the outline of parasites fairly sharp.

As was expected from previous work done with the azures on thin films, the staining effect of azure B was better than that of azure A. Although the azure B in itself was a fairly complete stain, the degree of density of cytoplasmic stain and of sharpness of outline was not all that could be desired.

To improve sharpness and density of the parasite stain, simple mixtures of azure B combined with azure A, methylene blue, and eosin were tested in quantities of azure B and azure A 2.5 cc., methylene blue 2.5 cc., and eosin 5.0 cc. The proportions of the azures varied by 0.5 cc. steps from all azure B to all azure A. The combination giving optimum staining effect was azure B 2.0 cc., azure A 0.5 cc., which appeared slightly better than when using azure B alone with

methylene blue. Increasing the amount of methylene blue from 2.5 cc. to 2.7 cc. definitely improved parasite density and sharpness of outline, while further increasing the amount of methylene blue to more than 2.7 cc. overstained the background. (See stain A, table 2.)

In view of the fact that azure B 2.5 cc. and methylene blue 2.5 cc. (without azure A) had previously given quite satisfactory results, the effect of increasing methylene blue to 2.7 cc. with azure B was tested. This mixture gave better results than the previous formula owing to the increased methylene blue, in much the same manner as with stain A (azure A and B mixture). (See stain B, table 2.)

Good results could also be obtained with decreased amounts of azure B to as low as 1.0 cc. if the methylene blue were at the same time increased by the same amount. The amount of eosin may also be lowered to as low as 2.0 cc. or 3.0 cc. with good staining results with thin films, although lower amounts of eosin gave too densely stained a background in the case of thick films. But a slight reduction in the amount of eosin from 5.0 cc. seemed to improve the character of the thick film background, removing some of the excess pink. (See stain C, table 2.)

TABLE 2.—*Formulae of satisfactory synthetic Giemsa solutions*

Name of dye	Stain A			Stain B			Stain C		
	Nocht formula (cc.)	Pure dye weight	Total dye weight	Nocht formula (cc.)	Pure dye weight	Total dye weight	Nocht formula (cc.)	Pure dye weight	Total dye weight
	1:1000 solution	*mg.*	*mg.*	*1:1000 solution*	*mg.*	*mg.*	*1:1000 solution*	*mg.*	*mg.*
Azure B [1] (estimated) 80 percent	2.0	200	250	2.5	250	312	1.7	170	212
Azure A [2] 90 percent	0.5	500	55	0	0	0	0	0	0
Methylene blue [3] 87 percent	2.7	270	310	2.7	270	310	3.4	340	388
Eosin Y [4] 93 percent	5.0	500	537	5.0	500	537	4.9	490	526
Glycerine	--------	50 cc.		--------	50 cc.		--------	50 cc.	
Methyl alcohol	--------	50 cc.		--------	50 cc.		--------	50 cc.	
Total	100 cc. of stain			100 cc. of stain			100 cc. of stain		

[1] NAC No. 7724. [2] NA-6. [3] LA-7. [4] LE-11.

One cubic centimeter of any one of the above stains is diluted to 50 cc. with distilled water buffered to pH 7.0. Stain 45 minutes, rinse 2-5 minutes with water of the same pH, dry and examine.

Reference has already been made to staining mixture formulas in table 2. This table illustrates the method of converting the formulas for aqueous solution mixtures into glycerol-alcoholic solutions. In a 1:1,000 aqueous stock solution, each cubic centimeter contains 1 mg. of dye. If 100 mg. of dye are dissolved in 100 cc. of glycerol-alcohol solution, each cubic centimeter will likewise contain 1 mg. of dye. In this way the formulas for aqueous stock solutions can be directly converted into glycerol-alcohol solutions, correction being made in the amount of dye weighed for actual dye content. Stain mixtures A, B,

and C of table 2 were made up in glycerol-alcohol solutions. Slides were stained in solutions made up of 1 cc. of stain in 50 cc. of buffered water pH 7.0. Results were identical for all practical purposes to those obtained from the corresponding mixtures of aqueous stock solutions.

All three of these solutions are quite satisfactory. Solution A gives a slightly greater chromatin density; C perhaps a deeper cytoplasmic stain; B is intermediate and perhaps a little less satisfactory than either of the others. The lower cost of ingredients, of course, favors formula C. The general effect varies slightly from that of the imported German Giemsa solution but appears to be at least equally good for diagnostic purposes and somewhat better for detailed cytology of the parasite.

SUMMARY

A survey has been made of the various thiazin dyes in regard to their value in staining malaria parasites when used in simple combinations with eosin. It was found that methylene blue stains parasite cytoplasm a desirable blue shade but fails to stain parasite chromatin. Azure B gives an excellent bluish purple chromatin stain with sharp definition of particles and a good, clear blue cytoplasmic stain. Azure A gives a deeper purple chromatin stain with poor definition of particles and a grayish lavender cytoplasm which contrasts poorly with red corpuscles. The other dyes are inferior.

Combinations of azure B and methylene blue varying from 1:1 to 1:4 with appropriate amounts of eosin, and with or without a small quantity of azure A, give very satisfactory parasite staining. Larger amounts of azure A are deleterious.

The Nocht method of using simple aqueous solutions is excellent for studies of Romanowsky staining, affording great facility in variation of composition and giving results directly transferable to glycerine methyl alcohol solutions.

The proper synonym for German azure I is azure B and not azure A, as has been supposed. This erroneous synonymy probably accounts for the poor results hitherto attained with American Giemsa solutions in staining malaria parasites.

Acknowledgments are made to the staff of St. Elizabeths Hospital for quartan malaria material; to the Washington Biophysical Institute for the use of their recording spectrophotometrograph; to B. Caminita, T. W. Allen, and C. C. Jones for technical assistance in the preparation and mensuration of spectrophotometrograms; to the Curator of the Army Medical Museum, Lt. Col. J. Ash, and to Dr. H. J. Conn of the Biological Stain Commission for samples of azures synthesized in the studies of Holmes and French.

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BURNING OLD STORAGE BATTERY BOXES STILL A SOURCE OF LEAD POISONING IN INFANTS AND CHILDREN

Cases of lead poisoning in infants and children caused by the inhalation of lead fumes from burning wooden storage battery cases have been reported in the literature from time to time. A classical description of an epidemic traced to this source was described in the Journal of the American Medical Association in 1933.[1]

Recently, Dr. E. T. Olsen, Medical Director and Assistant Superintendent of the State University and Crippled Children's Hospital of Oklahoma City, Okla., reported to the Surgeon General of the Public Health Service a similar outbreak in Oklahoma City. Four cases were reported, which recovered, and a fifth, a colored child 8 years of age, died of the intoxication. All of these cases were traced to the use of old automobile battery boxes as fuel in wood-burning stoves. The intoxication was manifested by symptoms of gastrointestinal irritation, by anemia, and encephalopathic symptoms. Lead lines were observed at the epiphyses of the long bones by roentgenographic examination and varying degrees of stippling of the red blood cells were noted.

Except for one fatal case not observed by Olsen, it would appear that the most severely affected patients were colored female children 15 and 16 months of age. There was good response to hospital management. "The medication consisted of vitamins, sedatives, iron, high calcium diet, and calcium gluconate grains 7½ three times day."

Although it would seem that the hazard is disappearing because battery boxes are now rarely made of wood, attention is called to the hazard because of its public health implications.

FUNCTIONS BROUGHT TO FEDERAL SECURITY AGENCY BY REORGANIZATION PLAN IV

FREEDMEN'S AND ST. ELIZABETHS HOSPITALS UNDER THE PUBLIC HEALTH SERVICE

Under the authority of the act (Public, No. 19, 76th Cong., 1st sess.) cited as the "Reorganization Act of 1939," approved April 3,

[1] Williams, H., Schulze, W. H., Rothschild, H. B., Brown, A. S., and Smith, F. R., Jr.: Lead poisoning. J. Am. Med. Assoc., 100: 1485–1489 (May 13, 1933).

1939, and in accordance with sections 11 and 12 of Reorganization Plan No. IV, transmitted by the President to Congress on April 11, 1940, the following transfers of institutions and functions were made to the Federal Security Agency:

SEC. 11. *Transfer of certain Interior Department Institutions.*—(a) *Saint Elizabeths Hospital.*—Saint Elizabeths Hospital in the Department of the Interior and its functions are transferred to the Federal Security Agency and shall be administered under the direction and supervision of the Federal Security Administrator. The annual report required to be submitted to the Congress by the Superintendent of the Hospital shall be submitted through the Federal Security Administrator. The annual report required to be furnished to the Secretary of the Interior by the Board of Visitors shall be furnished to the Federal Security Administrator.

(b) *Freedmen's Hospital.*—Freedmen's Hospital in the Department of the Interior and its functions are transferred to the Federal Security Agency and shall be administered under the direction and supervision of the Federal Security Administrator.

(c) *Howard University.*—The functions of the Department of the Interior relating to the administration of Howard University are transferred to the Federal Security Agency and shall be administered under the direction and supervision of the Federal Security Administrator. The annual report required to be furnished to the Secretary of the Interior by the president and directors of the University shall be furnished to the Federal Security Administrator. The Office of Education shall continue to make its inspections of and reports on the affairs of Howard University in accordance with the provisions of existing law.

(d) *Columbia Institution for the Deaf.*—The functions of the Department of the Interior relating to the administration of the Columbia Institution for the Deaf are transferred to the Federal Security Agency and shall be administered under the direction and supervision of the Federal Security Administrator. The annual report required to be furnished to the Secretary of the Interior by the president and directors of the institution shall be furnished to the Federal Security Administrator, and the annual report of the superintendent of the institution to the Congress shall be submitted through the Federal Security Administrator.

(e) *Federal Security Administrator.*—The functions transferred by this section shall be administered under the direction and supervision of the Federal Security Administrator through such officers or subdivisions of the Federal Security Agency as the Administrator shall designate.

SEC. 12. *Transfer of Food and Drug Administration.*—The Food and Drug Administration in the Department of Agriculture and its functions, except those functions relating to the administration of the Insecticide Act of 1910 and the Naval Stores Act, are transferred to the Federal Security Agency and shall be administered under the direction and supervision of the Federal Security Administrator. The Chief of the Food and Drug Administration shall hereafter be known as the Commissioner of Food and Drugs.

Transfer was made effective on June 30, 1940, in accordance with Public Resolution No. 75, Seventy-sixth Congress, third session, notwithstanding the provisions of the Reorganization Act of 1939.

On July 1, 1940, the United States Public Health Service was charged with the administration of Freedmen's Hospital and St.

Elizabeths Hospital by the following order promulgated by the Administrator of the Federal Security Agency:

By virtue of the authority contained in section 11 (e) of Reorganization Plan IV made effective June 30, 1940, by Public Resolution No. 75, Seventy-sixth Congress, approved June 4, 1940, the following order is promulgated for the guidance of all concerned:

1. Freedmen's Hospital and its functions shall be administered under the direction and supervision of the Federal Security Administrator through the Surgeon General of the Public Health Service. Subject to the provisions of Agency Orders No. 5 and No. 6, the service facilities of the Public Health Service shall be made available to and utilized by Freedmen's Hospital. The Cooperative Agreement for the Management and Operation of Freedmen's Hospital, executed October 27, 1939, by the Secretary of the Interior, the President, and the Acting Secretary of the Howard University, shall remain in full force and effect.

2. Saint Elizabeths Hospital and its functions shall be administered under the direction and supervision of the Federal Security Administrator through the Office of the Surgeon General of the Public Health Service in accordance with the following conditions:

(a) That Saint Elizabeths Hospital be maintained as a separate unit under the immediate supervision of the Surgeon General of the Public Health Service.

(b) That the rank and the relationship of the Superintendent of Saint Elizabeths Hospital to the Surgeon General and to the administrative divisions of the Public Health Service shall be like that of the Director of the National Institute of Health, except that the Division of Personnel and Accounts of the Public Health Service shall exercise no control over the personnel and fiscal matters of the institution.

(c) Saint Elizabeths Hospital shall be subject to the provisions of all Agency Orders, including Agency Orders No. 5 and No. 6.

FREEDMEN'S HOSPITAL

Freedmen's Hospital, an outgrowth of the Civil War, had its inception in the Freedmen's Bureau, the purpose of which was the care of refugees who came to Washington, D. C., in large numbers during and following the war. The hospital actually dates back to March 3, 1865, when Congress passed "An Act to Establish a Bureau for the Relief of Freedmen and Refugees." Section 2 of that act provided:

That the Secretary of War may direct such issue of provisions, clothing, and fuel as he may deem needful for the immediate and temporary shelter and supply of destitute and suffering refugees and freedmen and their wives and children, under such rules and regulations as he may direct.

In 1865 the hospital facilities were transferred to Campbell Heights, a section now known as Le Droit Park, and in 1908 the hospital was moved to its present location at Sixth and Bryant Streets NW., Washington, D. C. It was not until 1894 that Freedmen's Hospital began to emerge from its poorhouse features and to develop along educational lines.

The hospital buildings and grounds cover an area of four city blocks. Provision is made for both indigent and pay patients. The

hospital has an administrative staff of 7, house staff of 29, and an attending staff of 115. It affords interneships and provides clinical material for the medical students of Howard University. It has a school of nursing.

Freedmen's is a class A institution of 322 beds, 54 bassinets, maintains an out-patient department, and has an emergency and ambulance service and a social service. There is now under construction a tuberculosis annex which will accommodate 150 patients and is expected to be ready for occupancy about January 1, 1941.

The hospital was administered by the War Department until June 30, 1874, when it was transferred to the Interior Department, where it remained until June 30, 1940.

ST. ELIZABETHS HOSPITAL

St. Elizabeths Hospital is a Federal institution, established by an act of Congress of March 3, 1855, for the treatment and cure of persons who may develop any mental or nervous disability while in the service of the Army, Navy, Marine Corps, or Coast Guard, of civilians who are residents of the District of Columbia, and of certain other classes of patients as provided by law. An act of 1852 appropriated $100,000 for the purchase of a site for a Government Hospital for the Insane, and such a hospital was opened for the reception of patients on January 15, 1855.

St. Elizabeths Hospital is recognized by the medical profession as one of the most modern institutions of its kind in the United States. The total number of patients admitted from all sources during the first year of operation was 63. At the present time it has more than 6,200 patients and about 1,850 employees. The total number of patients under treatment during the fiscal year 1939 was more than 7,000.

The hospital facilities are situated on an elevated site of 800 acres, overlooking the Potomac River, the Eastern Branch, and the city of Washington, and comprise 168 buildings. The name of the hospital was taken from the name of the tract of land upon which the hospital is located, known from early history as the "St. Elizabeths Tract."

In addition to psychiatric wards, St. Elizabeths has special medical and surgical departments with modern equipment; X-ray department; ear, eye, nose, and throat clinic; dental clinic; and other clinics that are found in large general hospitals. It also has a modern laboratory adequately equipped to make all necessary tests for the diagnosis and treatment of any medical or surgical condition.

A social service is maintained to supplement the hospital care of patients and as few restrictions as possible are imposed. Where practicable, patients are granted reasonable ground and city parole, they

are allowed visitors, and there are no restrictions regarding mail received. Regular religious services are provided for all faiths. The hospital maintains a large circulating library and reading room, and recreation and entertainment facilities are available to paroled patients. In Hitchcock Hall, a large amusement building, with a seating capacity of 1,300, an orchestra, and large well-equipped stage, moving pictures are presented, vaudeville performances, operettas, and musicals are given, and dances are held for the patients' benefit.

The modern conception of treatment of mentally ill patients at St. Elizabeths is well set forth in the following statements presented in a pamphlet concerning the institution prepared by Dr. Winfred Overholser, superintendent:

> There is no subject upon which the general public and a great majority of patients who are admitted here are more misinformed than on the subject of mental illness and so-called insanity. In order to correct any erroneous impression which a newly admitted patient may have, the following points are stressed:
>
> There is no essential difference between a mental and a physical illness. Many so-called strictly physical illnesses reveal mental symptoms, and many nervous and mental conditions are due in part or entirely to physical causes. The nervous system is the most delicate part of the body structure, and it would, therefore, be entirely unreasonable to expect it to escape an occasional break-down.
>
> There are just as many different kinds of mental diseases as physical ones. Some of them are mild while others are more serious. The symptoms and outcome of each mental illness are correspondingly different. If a mental illness is recognized early and given prompt medical attention, improvement and recovery can be expected just as frequently as in other illnesses.

St. Elizabeths Hospital remained under the administration of the Secretary of the Interior from the date of its establishment in 1855 until June 30, 1940.

Under the Federal Security Agency, recently created and dedicated to social welfare, the Public Health Service, the first Government agency to be charged by law with the hospital care and treatment of a needy group of our population (in 1798), welcomes its new responsibilities. These responsibilities are lightened by the solid development and sound administrative direction and operation of the two institutions. To continue the excellent services rendered by them in the past, and to further development in the future as may be dictated by new practices and new needs, the Public Health Service pledges its every aid.

COURT DECISION ON PUBLIC HEALTH

Action to recover damages for trichinosis.—(United States Circuit Court of Appeals, 6th Circuit; *Troietto* v. *G. H. Hammond Co. et al.*, 110 F.2d 135; decided March 13, 1940.) An action was brought to recover damages resulting from illness alleged to have been caused by the plaintiff eating pork infected with *Trichinella spiralis.* The de-

fendants, who were claimed to have negligently sold the meat in violation of the Ohio statutes, were a wholesale meat company and a firm of retail grocers. There was evidence that the plaintiff, a boarder, at the request of his landlady, purchased on her account some fresh pork and beef at the retail grocers; that this meat, which was ground and made into balls, was fried in oil for from 6 to 8 minutes and then served; that the persons, including the plaintiff, who ate the meat later became ill; and that the attending physician diagnosed the illness as trichinosis.

The statutes of Ohio penalized the sale of diseased, corrupted, adulterated, or unwholesome provisions without making the condition thereof known to the buyer and prohibited the sale of an adulterated article of food, it being stated that food was adulterated if it consisted wholly or in part of a diseased, decomposed, putrid, infected, tainted, or rotten animal.

The trial court, at the conclusion of the plaintiff's testimony, directed a verdict in favor of the defendants on the grounds that the sale of the pork under the circumstances was neither negligent nor violative of the State statutes and that the negligence that the court inferred on the part of the landlady, in failing properly to cook the meat, which directly contributed to plaintiff's injury, should be imputed to him because she was either his agent or in a joint venture with him. The court of appeals, however, reversed the judgment of the trial court, being of the opinion that the latter court erred in so directing the verdict. The appellate court said that it was of the opinion that pork that is infected with *Trichinella* is diseased within the meaning of the Ohio law, and that its sale, even when the seller has no knowledge that it is diseased or infected, violates the statute and the seller is negligent in law. "When appellant's testimony was concluded," stated the court, "there was substantial evidence from which the jury could have found that appellant's illness was caused by his eating pork that was infected with trichinella when sold by appellees; and, under Ohio law, the court should have instructed the jury that if they found these facts appellees were negligent in law. * * * If appellees were thus negligent, it appears to be well settled, under Ohio law, that their negligence was the proximate cause of appellant's injury, even though another's negligence may have contributed thereto."

Further, the appellate court said that it was of the opinion that the trial court erred in holding that the landlady's negligence—"if indeed she was negligent"—was imputable to the plaintiff. "There is no evidence," observed the court, "that she was his agent in fact or otherwise; nor do we believe they were engaged in a joint venture."

DEATHS DURING WEEK ENDED JUNE 29, 1940

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

	Week ended June 29, 1940	Corresponding week, 1939
Data from 88 large cities of the United States:		
Total deaths	7,522	7,371
Average for 3 prior years	7,493	
Total deaths, first 26 weeks of year	231,376	229,355
Deaths under 1 year of age	492	519
Average for 3 prior years	533	
Deaths under 1 year of age, first 26 weeks of year	13,232	13,572
Data from industrial insurance companies:		
Policies in force	65,146,174	67,166,768
Number of death claims	11,776	11,326
Death claims per 1,000 policies in force, annual rate	9.5	8.8
Death claims per 1,000 policies, first 26 weeks of year, annual rate	10.3	11.1

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

REPORTS FROM STATES FOR WEEK ENDED JULY 6, 1940

Summary

The incidence of the 9 communicable diseases reported weekly by State health officers remained low for the current week, all except typhoid fever being below the figures for the preceding week, and all except influenza below the 5-year (1935–39) median expectancy. The 1940 totals to date for each of these diseases, except influenza, are also below the medians of the 5-year totals for the corresponding period.

The number of cases of typhoid fever increased from 195 for the preceding week to 215 for the current week, with the largest numbers of cases reported from the South Atlantic and South Central groups of States, Texas reporting 30 as compared with 15 for the week ended June 29, and 28 for the week ended June 22.

The number of cases of poliomyelitis decreased from 79 to 70, with 14 cases reported in California as compared with 36 last week, 15 cases in the State of Washington as compared with 12 last week, and 8 cases in Oklahoma, where no cases were reported for the preceding week.

Of 13 cases of Rocky Mountain spotted fever, 9 were reported in the eastern States.

Of a total of 40 cases of endemic typhus fever, all reported in the southern States, 12 occurred in Georgia, 8 each in Alabama and Texas, and 6 in Florida.

For the current week the Bureau of the Census reports 7,116 deaths in 88 major cities, as compared with 7,522 for the preceding week and with a 3-year (1937–39) average of 7,394 for the corresponding week. The decrease of more than 400 deaths as compared with last week brings the current figure well below the 3-year average. The infant mortality in these cities for the current week is also below that of last week as well as below the 3-year average.

Telegraphic morbidity reports from State health officers for the week ended July 6, 1940, and comparison with corresponding week of 1939 and 5-year median

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39	Week ended		Median, 1935–39
	July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939	
NEW ENG.												
Maine	1	0	0				147	15	21	0	0	0
New Hampshire	0	0	0				0	9	9	0	0	0
Vermont	0	0	0				19	108	41	0	0	0
Massachusetts	0	5	5				824	361	232	0	2	1
Rhode Island	0	0	0				53	55	20	0	0	0
Connecticut	1	0	2		1	1	15	151	78	0	1	0
MID. ATL.												
New York	10	10	27	[1]4	[1]1	[1]1	573	738	1,299	3	4	11
New Jersey	2	6	8	1		2	258	22	262	0	0	0
Pennsylvania	9	7	28				272	85	630	2	5	5
E. NO. CEN.												
Ohio	6	11	11	16	5	2	40	13	246	2	1	2
Indiana [2]	2	6	7	2	4	7	4	4	28	0	0	0
Illinois	8	21	29	5	3	4	150	21	177	1	0	3
Michigan [3]	1	1	6				230	94	260	0	1	1
Wisconsin	0	0	1	5	8	10	643	216	216	0	0	0
W. NO. CEN.												
Minnesota	0	2	1	2	1		27	31	31	0	0	0
Iowa [2]	2	4	3	1			156	101	13	0	0	0
Missouri	0	3	3			11	18	4	16	0	0	0
North Dakota	0	0	0		8	1	3	15	1	0	1	1
South Dakota	4	1	1				3	30	5	0	1	0
Nebraska	1	0	1				7	6	14	1	0	1
Kansas	3	0	5	2			99	12	12	0	1	0
SO. ATL.												
Delaware	0	0	0				1	4	4	0	0	0
Maryland [2 3]	0	4	3	2	3	1	10	17	32	1	0	0
Dist. of Col.	1	0	3				2	47	34	0	0	0
Virginia [3]	2	10	6	25	19		56	128	89	0	2	3
West Virginia [3]	2	3	4	2	1	4	9	4	34	0	0	0
North Carolina [4]	1	3	5	2	1		35	37	37	0	2	2
South Carolina [4]	6	4	3	93	111	53	8	7	14	0	2	1
Georgia [4]	3	11	7	13	4		43	10		0	1	1
Florida [4]	0	0	1		3		9	13	9	0	1	1
E. SO. CEN.												
Kentucky	1	3	3	1	6	3	56	4	45	2	3	3
Tennessee [4]	3	4	5	12	7	8	27	41	41	2	0	3
Alabama [4]	1	9	9	3	4	4	133	39	25	0	0	1
Mississippi [3]	3	6	4							0	2	1
W. SO. CEN.												
Arkansas	0	3	3	4	6	6	12	10	9	0	0	0
Louisiana [4]	1	6	9	9	10	10	3	11	5	1	0	0
Oklahoma	4	1	4	10	4	12	12	8	17	3	0	1
Texas [4]	8	14	14	61	34	60	171	99	86	1	0	0
MOUNTAIN												
Montana	1	0	0		2		31	45	8	0	0	0
Idaho	0	0	0	1			4	7	3	0	0	0
Wyoming [3]	1	0	0				14	18	3	0	0	0
Colorado [2 5 6]	15	8	5	1	10		16	14	36	0	0	0
New Mexico	2	0	2				32	10	10	0	0	0
Arizona	0	2	1	18	27	11	36	2	15	0	0	0
Utah [3]	0	2	1		1		79	46	41	0	0	0
PACIFIC												
Washington	2	3	1				63	519	97	0	0	0
Oregon	3	2	1		3	4	48	34	14	0	0	0
California [4]	16	22	22	17	9	11	136	481	477	2	2	2
Total	126	197	288	312	296	296	4,587	3,746	5,642	21	32	78
27 weeks	7,898	10,424	12,479	166,984	149,771	140,369	212,527	338,261	338,261	970	1,205	3,708

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 6, 1940, and comparison with corresponding week of 1939 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended		Median 1935–39	Week ended		Median 1935–39	Week ended		Median 1935–39	Week ended		Median 1935–39
	July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939		July 6, 1940	July 8, 1939	
NEW ENG.												
Maine	0	0	1	2	4	6	0	0	0	1	3	1
New Hampshire	0	0	0	0	1	2	0	0	0	0	0	0
Vermont	0	0	0	0	1	2	0	0	0	0	1	0
Massachusetts	1	0	1	54	43	74	0	0	0	2	5	2
Rhode Island	1	0	0	4	6	6	0	0	0	0	0	0
Connecticut	0	1	0	20	12	23	0	0	0	0	0	0
MID. ATL.												
New York	0	4	4	170	108	212	0	0	0	6	4	7
New Jersey	0	1	1	65	51	43	0	0	0	2	1	3
Pennsylvania	2	0	0	100	128	131	0	0	0	13	4	12
E. NO. CEN.												
Ohio	3	0	1	105	40	98	0	13	2	8	7	10
Indiana [2]	2	0	1	7	12	27	1	16	3	1	5	7
Illinois	1	0	2	133	78	149	4	2	4	4	7	7
Michigan [2]	1	4	1	67	89	135	0	0	0	2	1	3
Wisconsin	1	0	1	50	57	83	2	1	3	1	0	2
W. NO. CEN												
Minnesota	1	0	0	32	15	39	1	5	5	0	0	1
Iowa [2]	1	0	0	15	16	23	9	20	16	3	3	1
Missouri	0	0	1	12	8	19	0	9	6	5	4	12
North Dakota	0	0	0	4	2	5	0	0	3	1	2	0
South Dakota	0	0	0	2	6	9	4	7	6	0	0	0
Nebraska	1	0	0	8	4	9	0	0	2	0	0	0
Kansas	4	0	0	21	22	25	1	0	0	3	1	5
SO. ATL.												
Delaware	0	0	0	1	2	2	0	0	0	2	0	0
Maryland [2,3]	0	0	0	11	5	12	0	0	0	2	0	4
Dist. of Col	0	0	0	11	3	5	0	0	0	0	0	0
Virginia [2]	2	1	1	8	11	11	0	0	0	12	35	16
West Virginia [3]	2	0	0	10	14	14	1	1	0	5	9	8
North Carolina [4]	1	6	4	18	13	15	0	0	0	4	11	19
South Carolina [4]	0	20	0	1	0	2	0	0	0	14	35	26
Georgia [4]	0	10	3	9	4	4	0	1	0	21	25	25
Florida [4]	1	4	1	1	1	1	0	0	0	4	2	1
E. SO. CEN.												
Kentucky	2	1	1	8	7	12	0	0	1	7	23	23
Tennessee [4]	0	2	2	11	15	13	1	0	0	3	33	29
Alabama [4]	1	2	4	14	9	8	2	0	0	5	6	19
Mississippi [3]	2	1	1	2	7	5	0	0	0	8	12	13
W. SO. CEN.												
Arkansas	0	0	0	3	2	2	0	0	0	8	16	17
Louisiana [4]	0	0	0	4	4	4	0	0	0	12	23	20
Oklahoma	8	3	1	9	4	8	1	6	0	13	20	16
Texas [4]	1	4	2	20	17	17	2	0	2	30	43	43
MOUNTAIN												
Montana	1	0	0	12	6	9	0	5	18	0	3	2
Idaho	1	0	0	5	1	2	0	6	2	0	0	0
Wyoming [2]	0	1	0	5	0	5	0	0	0	0	0	0
Colorado [2,5,6]	0	0	0	2	8	18	1	0	2	0	2	2
New Mexico	0	0	0	1	3	7	0	0	0	3	2	7
Arizona	0	1	1	2	1	4	0	0	0	0	2	3
Utah [3]	0	0	0	6	9	10	0	0	0	0	1	1
PACIFIC												
Washington	15	0	0	19	14	14	1	2	3	4	5	1
Oregon	0	0	0	9	5	7	0	0	3	1	1	1
California [4]	14	18	8	57	53	79	0	13	4	5	4	5
Total	70	84	84	1,130	921	1,550	31	107	112	215	361	426
27 weeks	844	877	877	114,067	111,719	158,823	1,794	8,380	7,466	2,861	4,164	4,245

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended July 6, 1940, and comparison with corresponding work of 1939 and 5-year median—Con.

Division and State	Whooping cough	
	Week ended	
	July 6, 1940	July 8, 1939
NEW ENG.		
Maine	22	4
New Hampshire	0	2
Vermont	14	36
Massachusetts	84	70
Rhode Island	8	13
Connecticut	26	38
MID. ATL.		
New York	245	413
New Jersey	52	222
Pennsylvania	238	462
E. NO. CEN.		
Ohio	243	103
Indiana [3]	17	86
Illinois	88	229
Michigan [3]	146	121
Wisconsin	88	256
W. NO. CEN.		
Minnesota	39	21
Iowa [3]	63	27
Missouri	36	17
North Dakota	6	15
South Dakota	4	0
Nebraska	9	20
Kansas	50	19
SO. ATL.		
Delaware	4	7
Maryland [2 3]	128	41
Dist. of Col.	3	29
Virginia [3]	69	261
West Virginia [3]	46	9
North Carolina [4]	123	112
South Carolina [4]	22	90
Georgia [4]	37	49
Florida [4]	10	6
E. SO. CEN.		
Kentucky	61	21
Tennessee [4]	62	71
Alabama [4]	16	52
Mississippi [3]	----------	----------
W. SO. CEN.		
Arkansas	37	18
Louisiana [4]	4	12
Oklahoma	17	3
Texas [4]	234	70
MOUNTAIN		
Montana	6	5
Idaho	7	12
Wyoming [3]	17	3
Colorado [3 5 6]	9	51
New Mexico	22	13
Arizona	3	8
Utah [3]	103	55
PACIFIC		
Washington	29	8
Oregon	16	7
California [4]	287	85
Total	2,850	3,272
27 weeks	86,536	105,049

[1] New York City only.
[2] Rocky Mountain spotted fever, week ended July 6, 1940, 13 cases as follows: Indiana, 1; Iowa, 2; Maryland, 4; Virginia, 2; Wyoming, 3; Colorado, 1.
[3] Period ended earlier than Saturday.
[4] Typhus fever, week ended July 6, 1940, 40 cases as follows: North Carolina, 1; South Carolina, 1; Georgia, 12; Florida, 6; Tennessee, 1; Alabama, 8; Louisiana, 2; Texas, 8; California, 1.
[5] Colorado tick fever, week ended July 6, 1940, Colorado, 3 cases.
[6] Tick paralysis, week ended July 6, 1940, Colorado, 1 case.

WEEKLY REPORTS FROM CITIES

City reports for week ended June 22, 1940

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Date for 90 cities:											
5-year average	119	39	17	3,106	355	1,005	12	367	43	1,209	----
Current week [1]	56	27	9	3,189	278	759	0	324	34	1,107	----
Maine:											
Portland	0	----	0	50	0	0	0	0	0	9	27
New Hampshire:											
Concord	0	----	0	0	2	0	0	1	0	0	10
Manchester	0	----	0	0	0	0	0	0	0	0	13
Nashua	0	----	0	0	0	0	0	0	0	0	7
Vermont:											
Barre	----	----	----	----	----	----	----	----	----	----	----
Burlington	0	----	0	0	0	0	0	0	0	0	11
Rutland	0	----	2	0	0	0	0	1	0	0	6
Massachusetts:											
Boston	1	----	0	153	10	28	0	15	0	47	216
Fall River	0	----	0	108	0	1	0	0	0	0	27
Springfield	0	----	0	5	0	4	0	1	0	5	29
Worcester	0	----	0	231	6	3	0	1	0	9	39
Rhode Island:											
Pawtucket	0	----	0	2	0	0	0	0	1	1	15
Providence	0	----	1	84	0	0	0	2	2	4	52
Connecticut:											
Bridgeport	0	----	0	4	2	1	0	1	1	0	38
Hartford	0	----	0	0	1	9	0	2	0	0	30
New Haven	0	----	0	1	0	4	0	0	0	20	18
New York:											
Buffalo	0	----	1	1	2	3	0	6	0	7	147
New York	8	7	0	516	59	179	0	66	4	130	1,373
Rochester	0	----	0	9	2	0	0	1	0	12	71
Syracuse	0	----	0	1	3	10	0	2	0	5	55
New Jersey:											
Camden	2	----	0	0	0	10	0	0	0	0	27
Newark	0	1	1	443	5	21	0	4	0	35	104
Trenton	0	----	0	0	0	1	0	0	0	1	31
Pennsylvania:											
Philadelphia	2	----	0	236	12	45	0	28	3	46	458
Pittsburgh	1	3	2	2	9	14	0	5	0	25	139
Reading	0	----	0	2	0	0	0	1	0	12	19
Scranton	0	----	----	0	----	1	0	----	0	0	----
Ohio:											
Cincinnati	1	----	0	2	5	5	0	6	1	19	131
Cleveland	1	5	1	7	3	29	0	15	1	39	181
Columbus	6	----	0	3	0	4	0	3	1	11	80
Toledo	1	----	0	3	2	17	0	4	0	16	61
Indiana:											
Anderson	0	----	0	0	0	1	0	0	0	3	9
Fort Wayne	0	----	0	5	1	0	0	0	0	4	21
Indianapolis	0	----	0	3	0	1	0	3	0	13	78
Muncie	0	----	0	0	1	0	0	0	0	3	9
South Bend	0	----	0	0	0	0	0	0	0	0	18
Terre Haute	0	----	0	0	0	0	0	0	0	1	13
Illinois:											
Alton	0	----	0	0	1	2	0	0	1	0	10
Chicago	11	----	0	151	22	215	0	26	1	46	662
Elgin	0	----	0	1	0	0	0	0	0	2	6
Moline	0	----	0	11	0	1	1	0	0	0	15
Springfield	0	----	0	0	2	2	0	0	0	5	22
Michigan:											
Detroit	2	----	0	343	9	50	0	14	0	97	235
Flint	0	----	0	1	1	3	0	0	0	5	20
Grand Rapids	0	----	0	11	0	11	0	0	0	23	36
Wisconsin:											
Kenosha	0	----	0	42	0	0	0	0	0	0	9
Madison	0	----	0	39	0	1	0	0	0	3	5
Milwaukee	0	----	0	361	5	21	0	3	0	2	103
Racine	0	----	0	9	0	3	0	1	0	0	9
Superior	0	----	0	43	0	2	0	0	0	0	7

[1] Figures for Barre estimated; report not received.

City reports for week ended June 22, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	------	0	4	0	1	0	0	0	0	22
Minneapolis	0	------	0	1	3	8	0	1	0	7	83
St. Paul	0	------	0	0	1	2	0	0	0	5	48
Iowa:											
Cedar Rapids	0	------	--------	0	-------	0	0	--------	0	0	--------
Davenport	0	------	--------	2	-------	2	0	--------	0	0	--------
Des Moines	1	------	0	5	0	5	0	0	0	0	24
Sioux City	0	------	--------	2	-------	0	0	--------	0	0	--------
Waterloo	1	------	--------	7	-------	0	0	--------	0	1	--------
Missouri:											
Kansas City	0	------	0	2	5	0	0	4	0	1	99
St. Joseph	0	------	0	0	1	0	0	1	0	0	23
St. Louis	0	------	0	2	10	4	0	6	0	12	162
North Dakota:											
Fargo	0	------	0	0	0	1	0	0	0	0	8
Grand Forks	0	------	--------	0	-------	0	0	--------	0	1	--------
Minot	0	------	0	0	0	0	0	0	0	3	4
South Dakota:											
Aberdeen	0	------	--------	0	-------	0	0	--------	0	1	--------
Nebraska:											
Lincoln	0	------	--------	0	-------	1	0	--------	0	0	--------
Omaha	0	------	0	9	1	2	0	0	0	2	48
Kansas:											
Lawrence	0	------	0	0	0	0	0	0	0	0	2
Topeka	0	------	0	30	0	0	0	0	0	1	11
Wichita	0	------	0	0	0	1	0	0	1	5	21
Delaware:											
Wilmington	0	------	0	0	0	2	0	0	1	1	24
Maryland:											
Baltimore	1	2	0	1	15	5	0	9	0	140	190
Cumberland	0	------	0	0	0	0	0	0	0	0	13
Frederick	0	------	--------	0	-------	0	0	--------	0	0	--------
Dist. of Col.:											
Washington	0	------	0	3	7	6	0	8	1	4	158
Virginia:											
Lynchburg	0	------	0	0	0	0	0	1	0	0	12
Richmond	0	------	1	0	2	0	0	1	1	0	42
Roanoke	0	------	0	38	0	0	0	0	0	0	13
West Virginia:											
Charleston	0	------	0	1	1	0	0	0	0	1	13
Huntington	0	------	--------	0	-------	0	0	--------	0	0	--------
Wheeling	0	------	0	1	0	3	0	0	0	0	18
North Carolina:											
Gastonia	0	------	--------	0	-------	0	0	--------	0	1	--------
Raleigh	0	------	0	1	0	1	0	4	0	0	29
Wilmington	0	------	0	0	0	0	0	0	0	0	15
Winston-Salem	0	------	0	0	1	0	0	0	0	0	16
South Carolina:											
Charleston	0	1	0	0	2	1	0	2	0	0	14
Florence	0	------	0	0	1	0	0	0	0	0	13
Greenville	0	------	0	0	1	0	0	1	0	0	10
Georgia:											
Atlanta	0	------	0	6	5	2	0	8	0	2	57
Brunswick	0	------	0	0	1	0	0	1	0	0	3
Savannah	0	------	0	0	2	0	0	3	1	1	27
Florida:											
Miami	0	------	0	1	1	0	0	4	1	0	36
Tampa	0	------	0	14	1	1	0	2	0	2	26
Kentucky:											
Ashland	0	------	0	0	1	0	0	0	0	1	3
Covington	0	------	0	3	0	3	0	1	0	0	8
Lexington	0	------	0	53	1	0	0	1	0	11	15
Tennessee:											
Knoxville	0	------	0	1	0	5	0	0	0	0	17
Memphis	0	------	1	24	4	2	0	4	0	16	71
Nashville	0	------	0	2	5	0	0	2	0	6	41
Alabama:											
Birmingham	0	------	0	3	6	1	0	2	3	1	62
Mobile	0	------	0	0	2	1	0	1	1	0	24
Montgomery	0	------	--------	0	-------	0	0	--------	0	0	--------
Arkansas:											
Fort Smith	0	------	--------	1	-------	0	0	--------	1	0	--------
Little Rock	0	------	0	0	1	1	0	1	0	2	--------
Louisiana:											
Lake Charles	0	------	0	0	1	0	0	0	0	0	5
New Orleans	2	1	1	1	8	4	0	4	4	30	119
Shreveport	0	------	0	0	3	0	0	0	0	0	49

City reports for week ended June 22, 1940—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Tulsa	0	------	0	0	2	1	0	1	0	17	14
Texas:											
Dallas	1	------	0	0	1	1	0	3	1	8	53
Fort Worth	0	------	0	2	1	0	0	2	0	0	38
Galveston	0	------	0	0	0	0	0	0	0	0	12
Houston	1	1	0	4	4	2	0	5	1	6	66
San Antonio	0	------	0	1	5	0	0	7	0	9	63
Montana:											
Billings	0	------	0	0	1	1	0	0	0	0	12
Great Falls	0	------	0	16	0	0	0	0	0	0	10
Helena	0	------	0	0	0	0	0	0	0	0	3
Missoula	0	------	0	0	0	1	0	0	1	0	8
Idaho:											
Boise	0	------	0	2	0	0	0	0	0	0	9
Colorado:											
Colorado Springs	0	------	0	0	0	0	0	0	0	0	10
Denver	6	------	0	9	2	1	0	3	1	7	87
Pueblo	0	------	0	1	1	0	0	1	0	0	7
New Mexico:											
Albuquerque	0	------	0	0	1	0	0	3	1	0	12
Utah:											
Salt Lake City	0	------	0	115	1	0	0	3	0	83	46
Washington:											
Seattle	2	------	0	46	2	3	0	3	0	23	79
Spokane	0	------	0	3	0	2	0	1	0	1	33
Tacoma	0	------	0	2	1	0	0	0	0	0	26
Oregon:											
Portland	1	------	0	16	0	1	0	2	0	15	76
Salem	0	------	------	4	------	0	0	------	0	1	------
California:											
Los Angeles	5	5	0	16	6	13	0	23	2	53	326
Sacramento	2	1	0	1	1	3	0	1	0	16	21
San Francisco	1	------	0	3	5	4	0	2	0	30	146

State and city	Meningococcus meningitis		Poliomyelitis cases	State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
New York:				Nebraska:			
Buffalo	1	0	0	Omaha	0	0	1
New York	1	0	0	Kansas: Wichita	0	0	1
Pennsylvania:				District of Columbia:			
Pittsburgh	1	0	0	Washington	0	0	1
Indiana:				Tennessee:			
Indianapolis	1	0	0	Memphis	0	1	0
Illinois:				Louisiana:			
Chicago	1	1	0	Shreveport	0	1	0
Iowa:				Washington:			
Sioux City	0	0	1	Tacoma	0	0	5
Waterloo	0	0	1	California:			
Missouri:				Los Angeles	0	0	6
St. Louis	0	0	1				

Encephalitis, epidemic or lethargic.—Cases: Bridgeport, 1; New York, 2; St. Louis, 1; Charleston, S. C., 2.
Pellagra.—Cases: Savannah, 1; Birmingham, 1; Los Angeles, 1.
Typhus fever.—Cases: New York, 1; Miami, 1; Mobile, 2; New Orleans, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended June 1, 1940.—During the week ended June 1, 1940, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		1		2	3			1		7
Chickenpox		22	14	170	432	50	19	3	37	747
Diphtheria		1		21	2	2	1	4		31
Dysentery				5	3					8
Influenza		19			15				109	143
Measles	1		3	384	317	261	171	17	160	1,314
Mumps			1	27	267	7	13	1	15	331
Pneumonia		5			25	4	1		4	39
Scarlet fever		8	2	112	89	19	6	20	2	258
Trachoma									4	4
Tuberculosis	2	6	14	107	37			2		168
Typhoid and paratyphoid fever		1	4	20			1			26
Whooping cough		60	12	184	62	24	16		20	378

LATVIA

Notifiable diseases—January–March 1940.—During the months of January, February, and March 1940, cases of certain notifiable diseases were reported in Latvia as follows:

Disease	January	February	March	Disease	January	February	March
Botulism	1		1	Poliomyelitis	1	1	1
Cerebrospinal meningitis	8	2	11	Puerperal septicemia			16
Diphtheria	180	119	111	Scarlet fever	491	493	333
Erysipelas	50	55	60	Tetanus	2	1	
Influenza	127	263	258	Trachoma	55	71	58
Lead poisoning	12	11	5	Tuberculosis	162	246	220
Lethargic encephalitis	1		1	Typhoid and paratyphoid fever	47	40	58
Measles	382	477	601	Whooping cough	98	93	158
Mumps	141	201	227				

YUGOSLAVIA

Communicable diseases—4 weeks ended May 19, 1940.—During the 4 weeks ended May 19, 1940, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	16	5	Paratyphoid fever	6	----
Cerebrospinal meningitis	397	105	Poliomyelitis	1	----
Diphtheria and croup	336	26	Scarlet fever	173	----
Dysentery	15	2	Sepsis	13	5
Erysipelas	131	3	Tetanus	56	18
Favus	5	----	Typhoid fever	169	10
Lethargic encephalitis	2	1	Typhus fever	55	2

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—A cumulative table giving current information regarding the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS of June 28, 1940, pages 1188-1191. A similar table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Cholera

China—Shanghai.—During the week ended June 22, 1940, 1 case of cholera was reported in Shanghai, China.

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