Usefulness of Communicable Disease Reports

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IN ANY discussion of routine morbidity reporting there is always the casual observer of morbidity data who proclaims, "I don't know anything about reporting procedures, but the data are no good!" The question may be raised, "No good for what?"

Routine morbidity reporting of communicable diseases has been maligned by the perfectionist who calls for the same precision in these data as in those derived from an experiment in which the variables can be controlled. Even with the problem of bias removed in an experiment and despite the investigator's most careful efforts, he will get variations in his results that, for want of more precise knowledge, he labels experimental error. And with everything under rigid control, the data are still imperfect.

Every measurement is an imperfect datum, and every investigator has the problem of judging the extent of error and of keeping the interpretation within these limits. Interpretation of morbidity data must be guided by use of collateral evidence obtained from field investigations and epidemiological studies.

Our system of notification of individual case reports is a haphazard complex of interdependence, cooperation, and good will among physicians, nurses, county and State health officers, school teachers, sanitarians, laboratory technicians, secretaries, and clerks. It is a rambling system with variations as numerous as the individual diseases for which reports are requested, and as numerous as the interests and individual traits of the administrative health officers, epidemiologists, and statisticians in the 48 States and the several Federal agencies concerned with the data. It is a system that depends on persuasion, education, and, in some instances, alarm. And the variables cannot be eliminated by regimentation and fiat.

In spite of the inaccuracies of the resultant data, morbidity reports are indispensable for immediate recognition of a disease situation which requires public health action. They are time-tested in determining areas and trends of disease; and they are important in administrative planning of long-range programs and in providing the raw material for epidemiological research. These broad objectives of the notifiable disease system, while well known, are often not considered adequately.

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This paper was presented June 17 at the 2d Conference on Public Health Statistics, School of Public Health of the University of Michigan, Ann Arbor.

Essential for Public Health Action

The notification system is essential for the control of the rare and serious disease. Immediate knowledge of a case is needed for the epidemiological follow-up that will protect the community. For such diseases as smallpox and plague, a report of when and where a particular case develops is of paramount importance. And the system has proved effective. No community has been caught wholly unaware in recent years in an outbreak of these rare diseases. But the possibility of an outbreak cannot be disregarded.

The diseases listed in the international quarantine regulations, while rare in this country, are problems of concern throughout the world, especially since modern transportation facilities provide an opportunity for transmission of disease from one country to another in a few hours or days. According to the 6-month report issued by the Public Health Service Division of Foreign Quarantine on world prevalence of quarantinable diseases for the period ended December 31, 1951, plague is suspected in all South American, African, and Asian ports and in the Mediterranean ports of Spain, France, Greece, Italy, Malta, and Turkey. All countries are considered potentially infected with smallpox with the exception of Canada, the islands of St. Pierre and Miquelon, Iceland, Greenland, the west coast of Lower California, Cuba and the Bahama Islands, the Canal Zone, the Bermuda Islands, Aruba, Çuracao, and ports under the control of the United States. Cholera is reported by Burma, India, and East Pakistan. Yellow fever is reported in Africa, jungle yellow fever in South American areas, and epidemic typhus in Afghanistan, Ethiopia, Yugoslavia, and Ecuador, with some few cases reported from other areas in South America and the Near East.

The protection of our communities depends on immediate notification of the occurrence of these diseases so that, once a diagnosis is made, proper measures may be instituted. The mass immunization against smallpox in New York City a few years ago is a case in point (7). For 20 years the city had not had an outbreak, and universal vaccination had been a standard recommendation for much longer. But in March 1947, a merchant living in Mexico, who traveled to New York City by bus, fell ill, was admitted to a city hospital, and died within a few days. The diagnosis was smallpox. Twelve cases developed from the initial case, two ending in death. The duration of immunity induced by vaccination varies considerably so that a vaccinated community may not be presumed to be an immune one. In this outbreak, the merchant had been successfully vaccinated in childhood. The introduction of smallpox into a community such as New York City could engender a sizable epidemic. As a result of prompt notification of the smallpox outbreak and efficient epidemiological follow-up, the decision was reached to undertake immunization or re-immunization of the New York City population. In addition the Public Health Service traced the route of the bus to determine whether additional foci of infection had developed in other States. Certainly, individual case reports at such a time are indispensable.

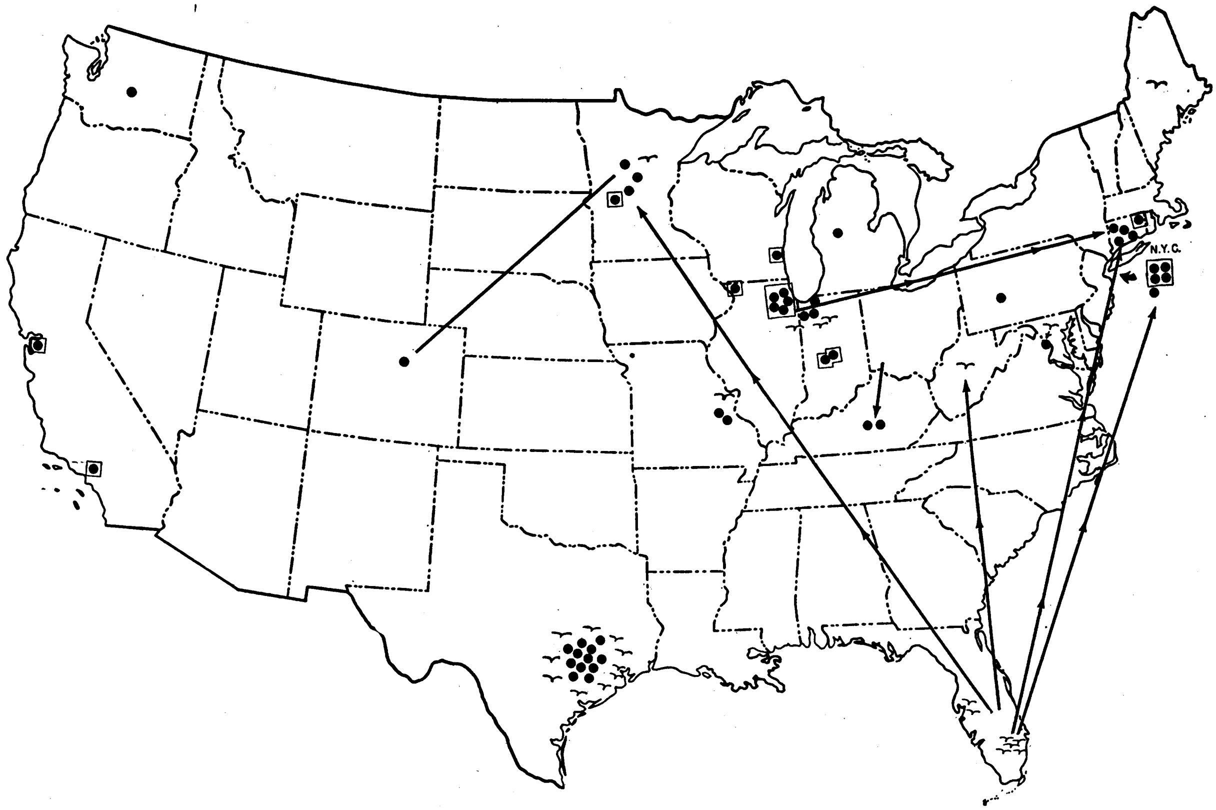
Leprosy has world-wide distribution, and there are areas in the United States where the disease has been recognized over a period of years. The greatest number of persons with leprosy admitted to the National Leprosarium at Carville, La., resided in Louisiana, Texas, and California at the time of admission. In those areas, the physicians frequently consult local public health authorities for diagnosis and advice on subsequent treatment or isolation. Knowledge of these cases is gained from two sources: notification to public health authorities by the physician and subsequent systematic clinical study of contacts. The control of this disease depends on continued notifications to health officials of individual cases as they are recognized.

Location of Disease Areas

For diseases of relatively low incidence, reported case data provide information for location of pinpoint areas where further epidemiological understanding of the disease may be gained through field investigation. During the thirties, outbreaks of psittacosis, transmitted for the most part by psittacine, gallinaceous, and columbian birds, resulted in quarantine regulations affecting the importation and transportation of such birds as parrots and parakeets. After the disease incidence had been low for many years, the quarantine regulations were eased in December 1951 permitting freer transportation of psittacine birds from State to State. The change in regulations removed many of the "black market" aspects of traffic in these birds, and epidemiological follow-up was facilitated.

Early in January 1952, the National Institutes of Health of the Public Health Service reported the virus had been isolated from a bird that had died in Florida. Then followed reports of human cases from different parts of the country. What did the widely scattered and apparently sporadic cases of psittacosis

Figure 1. Reported human psittacosis cases in relation to avian source, 1952.



mean, if anything? By piecing together the evidence gained from the description of psittacosis cases published as epidemic reports with some of the early findings made by an epidemic intelligence officer of the Public Health Service, the data became meaningful. Figure 1 indicates schematically how birds transported to Connecticut and to Minnesota from an infected Florida aviary were incriminated in human cases of psittacosis. A case developed in a Colorado visitor to the Minnesota family owning the infected parakeet. Birds grown locally in Chicago were incriminated in Chicago cases and in a Connecticut case. A Washington, D. C., case was attributed to a bird grown in Maryland where another infected bird was discovered. The outbreak in Texas was among turkey pickers, and the Kentucky cases were attributed to infected birds acquired in "neighboring States." Further epidemiological follow-up revealed the presence of infected birds with no associated human cases, and some additional human cases were uncovered which could not be traced to specific sources of infection.

Until about 1930, Rocky Mountain spotted fever was recognized only in the western portion of the United States. Since that time, increasing numbers of cases have been reported from the eastern portion of the United States, and entomologists, particularly, have been concerned with the distribution and natural history of ticks that carry the rickettsiae. Figure 2 shows the distribution of reported cases of Rocky Mountain spotted fever, by county, for the years 1945–50. The concentration of the disease along the eastern seaboard is apparent and the value of a simple spot map of reported cases is obvious. Entomologists and epidemiologists find such maps useful in selecting areas for study.

Murine typhus fever has been a disease of public health importance in this country for almost two decades. It has some characteristics similar to Rocky Mountain spotted fever, and there is possibility of error in differentiating the two diseases. But the differential diagnosis is aided by recognition of the distinct differences in their geographic distribution. Rocky

Mountain spotted fever is concentrated along the eastern seaboard and western sections of the country. Typhus, however, is concentrated in the Gulf States. Although there may be errors in the reports of the two diseases, especially in the overlapping fringe areas, the salient fact of two distinct areas of major concentration is provided by reported morbidity data.

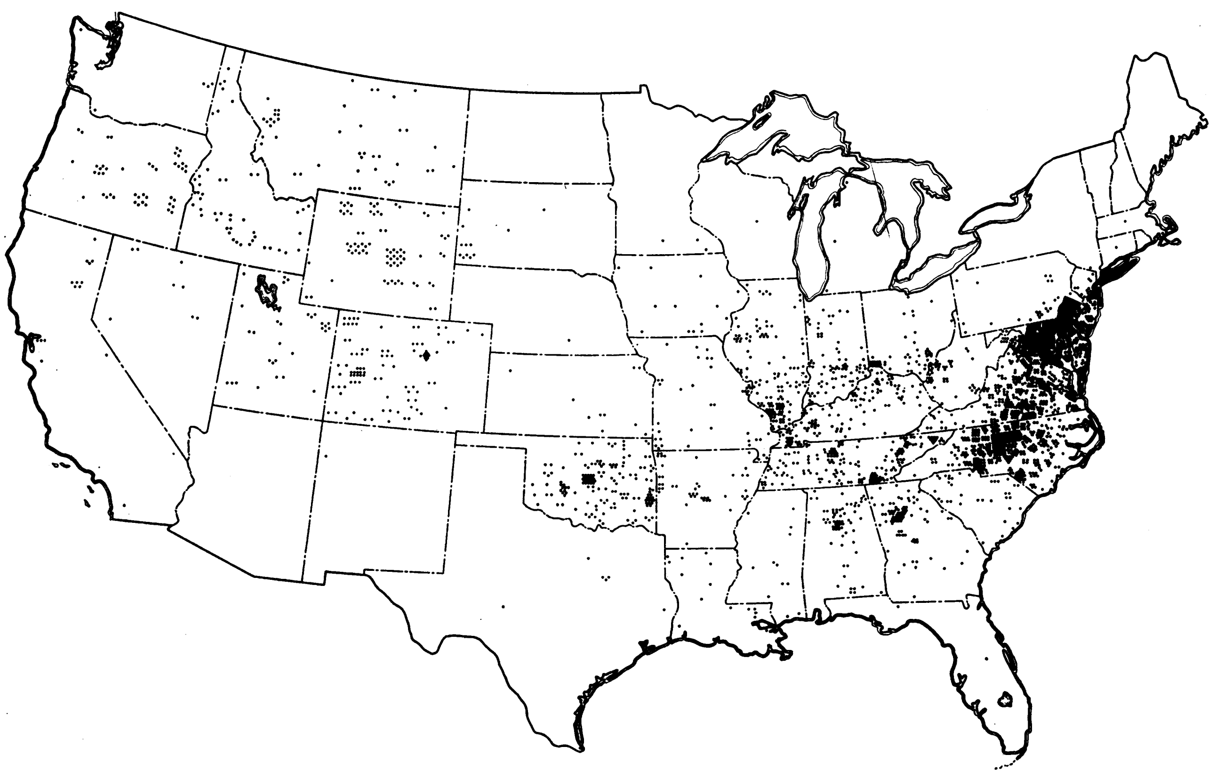
From 1932 to 1940, murine typhus cases for the United States and for the 10 southern States from which the great majority was reported showed a general upward trend which may be attributed to better recognition of the disease rather than to increased incidence.

After 1940 there was a sharp rise in the number of cases reported in the United States. Typhus distribution in 1944 suggested increased incidence in the endemic area rather than a marked extension of the disease into new areas. In corroboration, during this period larger numbers of typhus cases were recognized in the teaching hospitals of the endemic area. And in field studies, cases confirmed by laboratories exceeded those reported to local health authorities. The number of reported cases began declining in 1946, and these figures are in line with field evidence. The decline since 1948, however, is difficult to interpret since, with the introduction and wide use of antibiotics, recognition of the disease has been obscured, but the 1951 distribution of residual murine typhus is in the same general areas as during the period of its highest incidence (fig. 3).

Determination of Trends

Diphtheria is such an old story that we look at the declining rate of incidence with a feeling of satisfaction and complacency. Looking at the reported case data, we find that the morbidity rate for the United States dropped from 30.8 per 100,000 in 1935 to a rate of 2.6 in 1951. State rates for 1951 show that this is not the complete story on the reduction of the disease in the United States (fig. 4). Although the over-all rate was 2.6, a group of southern and western States had rates twice this figure. Whether these rates reflect differences in reporting procedures, immunization practices,

Figure 2. Rocky Mountain spotted fever cases, 1945–50.



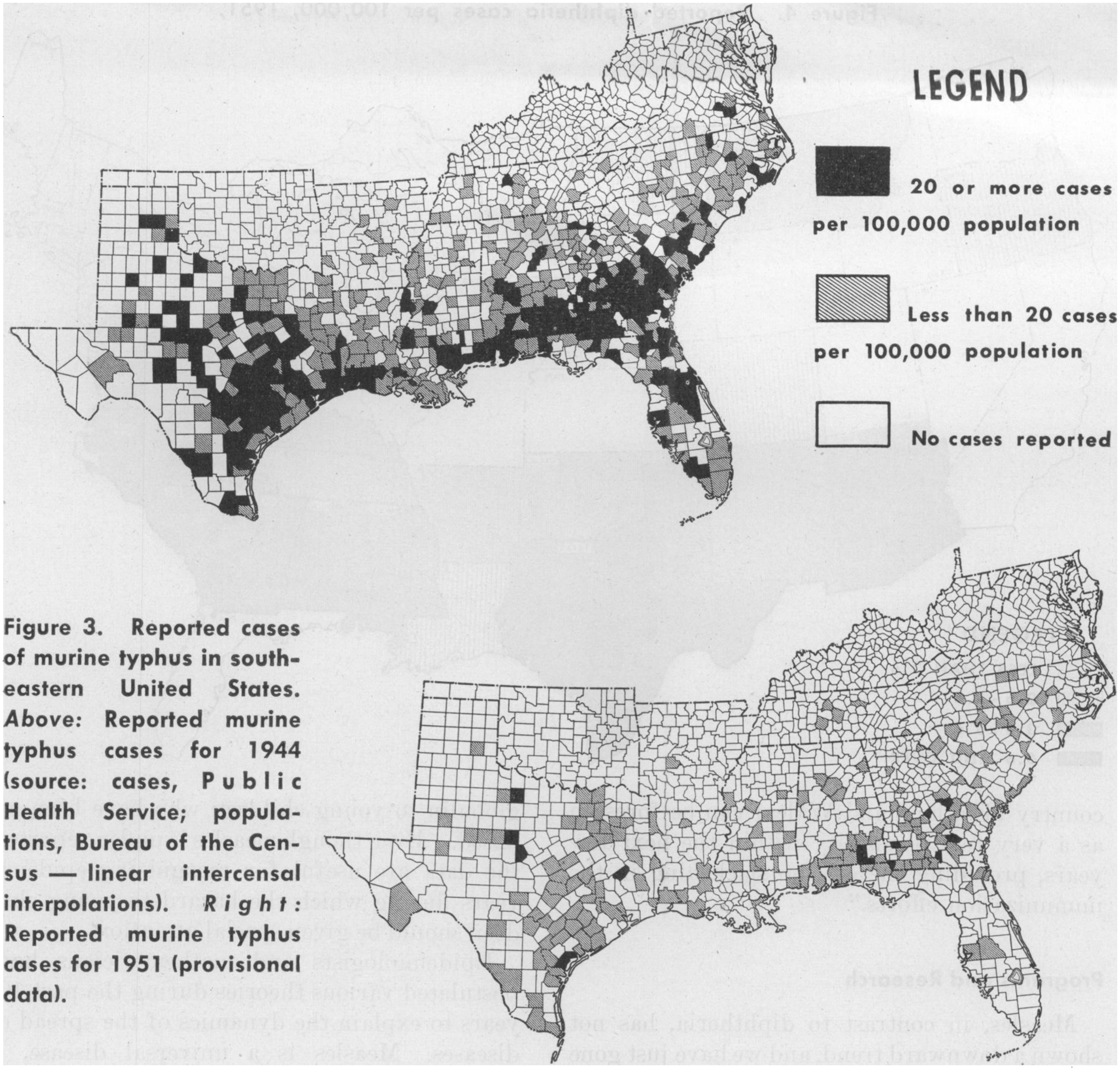


Figure 3. Reported cases of murine typhus in southeastern United States. *Above:* Reported murine typhus cases for 1944 (source: cases, Public Health Service; populations, Bureau of the Census — linear intercensal interpolations). *Right:* Reported murine typhus cases for 1951 (provisional data).

population differences, or peculiarities of various strains of diphtheria is a problem for investigation, but specific morbidity rates enable recognition of a problem and provide the point of departure. The occurrence of diphtheria challenges our health services to locate and eliminate the residue of diphtheria in this country.

In England and Wales, the diphtheria morbidity rate in the 1930's was well over 100 cases per 100,000. In 1940, the English (*5*) began an intensive immunization program with the goal of immunizing at least 75 percent of the children before they reached their first birthday. A dramatic drop in reported cases followed (fig. 5). From 1944, the English have been able to show two sets of data, original, or preliminary, and final notifications. The latter include corrections resulting from amendments of diagnosis made either by notifying practitioners or by the infectious disease hospitals. Conclusions based on either set of data indicate that incidence of the disease is reaching a low point and that within the short span of 10 years rapid progress has been made toward its eventual eradication. In fact, the British in the March 1952 issue of their *Monthly Bulletin of the Ministry of Health and the Public Health Laboratory Service* state, "the situation is now being reached . . . where the eradication of diphtheria as an indigenous disease in this

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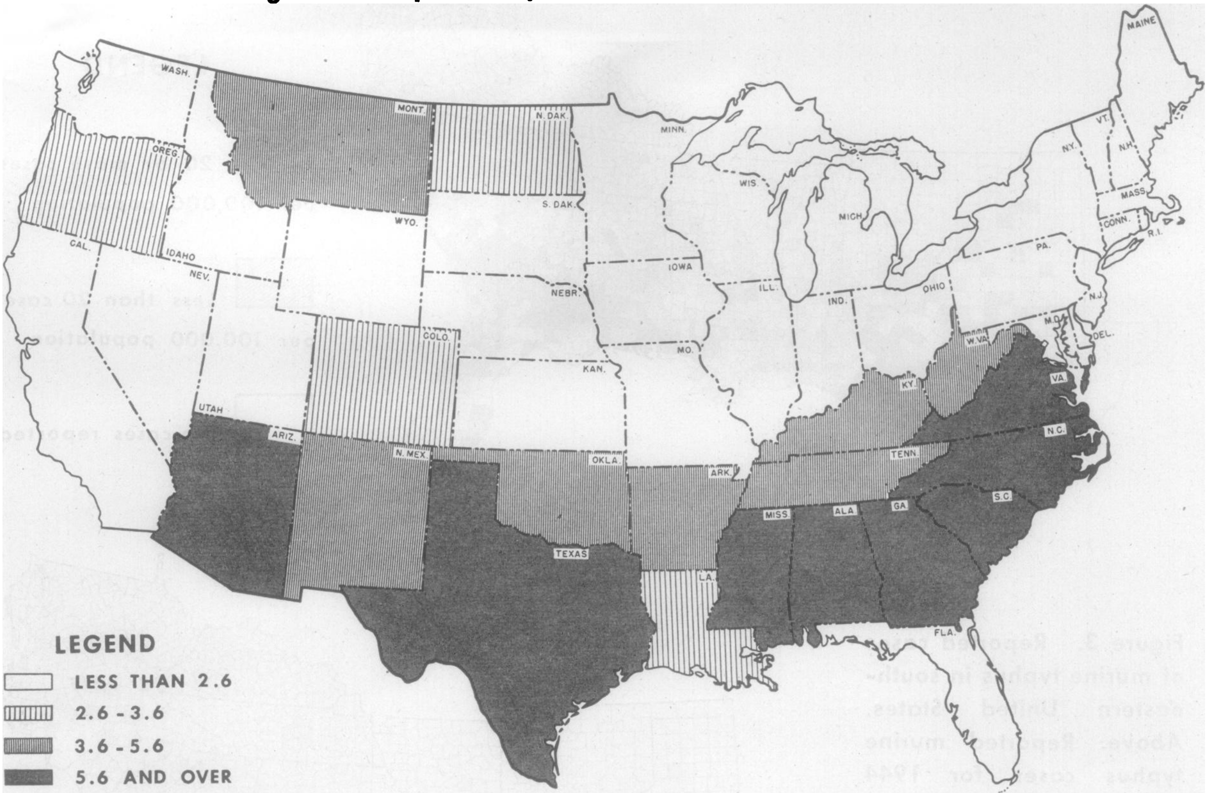
Figure 4. Reported diphtheria cases per 100,000, 1951.



country (England and Wales) can be foreseen as a very real possibility within the next few years, providing there is no slackening in the immunization efforts."

Programs and Research

Measles, in contrast to diphtheria, has not shown a downward trend, and we have just gone through one of the greatest epidemics in the history of the Nation. Why should measles be reported? The question is raised over and over again, and invariably the point is made that there are no control measures for this universal childhood disease. Nevertheless, the use of gamma globulin may minimize or defer the disease in the very young, among whom the great proportion of measles deaths occur. In the United States, among children under 5 years of age, measles accounted for 612 deaths in 1949 and for 7,579 deaths from 1940–49. Two-thirds of the deaths from measles occur in children less than 5 years of age. In a well-ordered health jurisdiction, individual case reports of measles enable follow-up for administration of gamma globulin to young children who have been exposed. Even though measles is under-reported, the data are useful for recognizing epidemic years during which the hazard to young children should be given special attention.

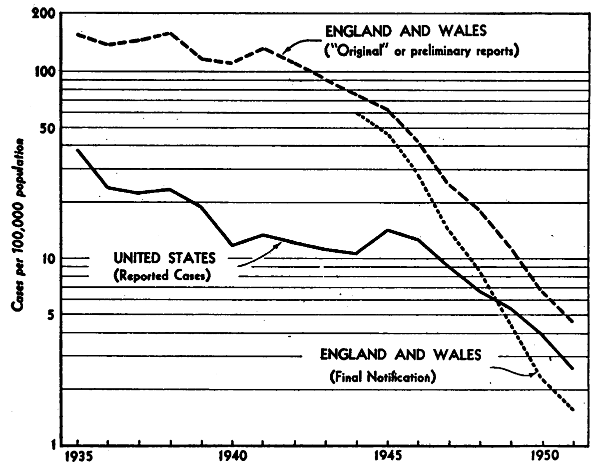
Epidemiologists and mathematicians have postulated various theories during the past 100 years to explain the dynamics of the spread of diseases. Measles is a universal disease, is easily diagnosed, and presumably is caused by a virus that has reached an extraordinarily stable balance with the human race. Measles data have been useful in the study of epidemics and provide a tool for development of mathematical models of crowd infections which may yield an insight into the dynamics of other infectious diseases (*3*, *4*).

There have been a few objections to notification of poliomyelitis based on the same argument that there are no effective control measures. However, if poliomyelitis were removed from the list of reportable diseases in all States, an informal reporting system would develop overnight. Newspapers, teachers, various business enterprises, hospitals, nurses organizations, and other agenices would collect, pool, and exchange information on the occurrence of the disease, not because these agencies have control measures which they could institute, but because poliomyelitis is a disease of both local and national interest, and that interest will be satisfied with or without an orderly reporting system.

Reported case data on poliomyelitis are essential for determining areas for current field investigations. The National Foundation for Infantile Paralysis in its extensive program of using gamma globulin as a prophylactic agent is depending upon the established reporting system to pinpoint areas in which to conduct its studies. Study of the frequency of occurrence of reported cases for past years by geographic locations, by urban-rural classification, by age, by sex, by population-size groups, by date of onset, by race, and by other categories have all been valuable; and other aspects of the frequencies and distribution of the reported cases are now being examined in an attempt to gain further insight into the behavior of this disease.

For some diseases of poorly defined etiology, it is known in advance that the reported case data will be of no value in appraising the extent of a specific disease problem, but the reported data may lead to a better definition of the components of the disease complex. For years, the term infectious encephalitis has served as a means for the collection of information on a variety of symptomatic conditions. Although heterogeneous, these data have been a starting point for investigation in one area and another. Thus, in the western States, the arthropod-borne encephalitides form an important portion of these data, and in these States there has been increased field study of the epidemiology of viral encephalitides and the ecology of possible vectors, especially in their relationship to the development of irrigated areas and water impoundment projects. On the other hand, in other sections of the country, study of the data has led to the recognition of quite different etiological agents (*1*). In these sections the reported data reflect almost entirely encephalitic conditions following attacks of measles, mumps, influenza, and other diseases. The case report is essential for the

Figure 5. Reported diphtheria cases per 100,000 population, United States and England and Wales, 1935–51.



epidemiological follow-up of the individual case of encephalitis that is needed for long-range study of this complex disease entity. Recent study of the reported data has led to recommendations for revisions and improvement in the international statistical classification of infectious encephalitis reports.

Collateral Evidence Useful

Sometimes morbidity data have been patently in error, and, in the instance of reported malaria data, the error was vividly demonstrated by procedural changes instituted by one State on the advice and suggestion of epidemiologists who suspected a disparity between the number of cases reported and the actual incidence of the disease. The evidence gathered by epidemiologists and other field workers during the past two decades provides the means for an orderly interpretation of the reported data.

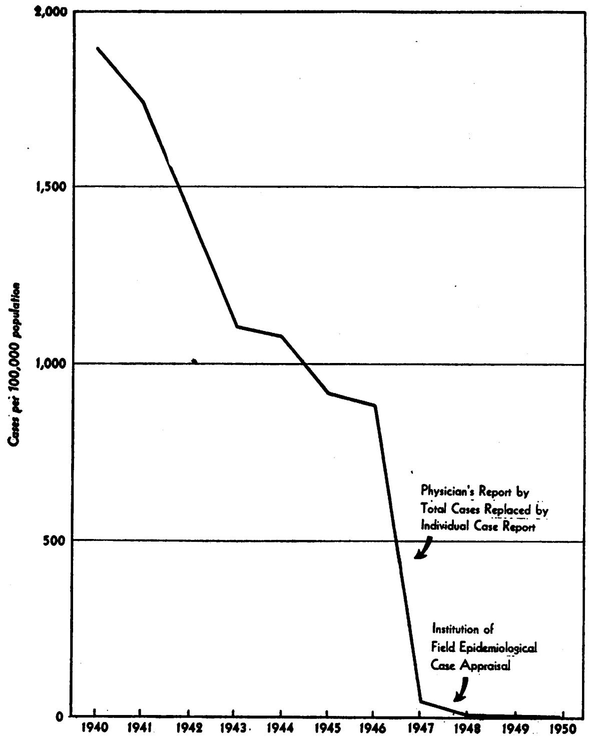
During the thirties, malaria was highly endemic in much of the South, and surveys conducted in malarious areas during that period showed parasite rates of up to 50 percent in children, but the number of cases reported was only a small fraction of those indicated by these rates of parasitism (*2*). Malaria during that decade was clearly under-reported. From about 1938 to 1943, laboratory evidence indicated that the disease declined much more rapidly than shown by the reported figures, and from 1943 to 1947, while malaria was decreasing rapidly in States where eradication programs were in progress, other areas of the country showed an increase resulting from importation of malaria by veterans of World War II.

The reported morbidity figures for 1947 indicate a precipitous decline, and while it would be encouraging to explain the recent drop on the basis of effective malaria control measures, the sequence of events in Mississippi suggests that changes in reporting procedures are a more likely explanation for the accelerated decline. Figure 6 shows the annual reported incidence of malaria in Mississippi from 1940 through 1950. Prior to 1946, the physician's case report in Mississippi, as in some other States, permitted reporting of total number of cases by disease, but not by individual case report. On January 1, 1947, this form was replaced by an individual case report. The decrease in the number of reported cases of malaria is extraordinary—a drop from 881.2 to 44.0 per 100,000 population. A year later in that State a procedure was instituted for field investigations to enable individual appraisal of diagnosis of reported malaria cases, and a second notable reduction in the annual incidence rate resulted—from 44.0 to 5.8 per 100,000. Texas is the only remaining traditionally malarious State whose reporting system does not require identification of the patient in reported malaria cases, and there is no question that malaria is grossly over-reported in that State.

In 1950 field evidence and reported cases pointed to a very low level of malaria in the United States. However, in the spring of 1951 many cases were reported by distinctly non-malarious States such as Colorado, Massachusetts, Michigan, Minnesota, Oregon, and Wisconsin. Epidemiological follow-up indicated that a new problem has been introduced into the national malaria picture. The increased number of malaria cases represented importation of malaria by veterans returning from the Far East. Thus, some changes in reported data may be readily explained by alteration in reporting procedures; in other more important instances, changes in reported data may indicate new and authentic disease problems in areas where they did not exist.

Inherent in the system of reporting diseases are numerous flaws, such as over-reporting,

Figure 6. Annual reported incidence of malaria in Mississippi, 1940–50.



under-reporting, incomplete reports, incomplete coverage, and misdiagnosis, which may result from such factors as the attitude of the private physician toward reporting, incomplete etiological definition of reportable disease entities, variation in clinical diagnosis according to local experience with infectious diseases, variation in follow-up and verification of physicians' reports, variation in use and verification of supplementary reports—school and public health nurses' reports, laboratory reports—and variations in laboratory procedures and the criteria selected for querying physicians for case reports (*6*). Some of the defects may be eliminated gradually through a study of the particular disease in specific areas, but other flaws will probably always remain. Because of these imperfections, errors may be made in interpreting case reports unless they are supplemented by data available from hospitals, military records, medical insurance plans, laboratory and epidemiological investigations, and study of mortality, ecological and demographic data. However, the valuable inferences afforded by analyses of morbidity data are lost to those who would first pursue the will-of-the-wisp of complete and accurate reports as a sine qua non for serious consideration of reported data on acute communicable diseases.

The use of morbidity data in long-range studies and in administrative planning requires finesse and patience. But along with shoe-leather epidemiology, case reports are essential for the control of communicable diseases.

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Shipment of Animal Disease Organisms

Recent instances of illegal movement of animal disease organisms and vectors in interstate commerce have prompted the U. S. Department of Agriculture to warn that "no organisms or vectors shall be imported into the United States or transported from one State or Territory or the District of Columbia to another State or Territory without a permit issued by the Secretary and in compliance with the terms thereof." These terms specify that such shipments must serve the public interest, with ample safeguards provided to protect against the further dissemination of such agents.

Conditions under which restricted organisms and vectors can be moved by permit are explained in the Department's Bureau of Animal Industry Order 381, Part 122, entitled "Rules and Regulations Relating to Viruses, Serums, Toxins, and Analogous Products, and to Certain Organisms and Vectors." All laboratories, research institutions, and others dealing with animal disease organisms and vectors are requested to comply with this order.

Applications for permits shall be made in advance of shipment and each permit shall specify the name and address of the consignee, the true name and character of each of the organisms or vectors involved, and the use to which each will be put. Further information and applications for permits may be obtained from the Bureau of Animal Industry, U. S. Department of Agriculture, Washington 25, D. C.