A State-wide Survey of Typhus Fever in Florida*

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DURING the past decade the incidence of murine typhus fever has increased in the United States, until in 1944 a total of 5,338 cases was reported to the various state health departments. It is likely that 1944 was a peak epidemiological year, as the number of reported cases dropped off slightly to 5,167 in 1945 and more markedly to 3,367 in 1946. While it is possible that the increased number of cases reported in recent years may be due in part to better recognition of the disease by clinicians, and in spite of the recent epidemic recession, murine typhus fever still may be classified as an important major preventable disease in the southern United States.

Various investigators,[1-4] have reported that murine typhus is essentially a disease of the most southerly states and of the southernmost portion of these states. An exception to this observation has been noted in the State of Florida where although considerable typhus has been reported, principally in the 4 major cities of the state, the disease did not seem to have had the same widespread prevalence as in the neighboring states immediately to the north.

Accurate knowledge of the true incidence of any preventable disease as well as knowledge of the circumstances under which the disease is contracted are almost indispensable starting points in the orientation of measures aimed at combating disease. For this reason the Florida State Board of Health in cooperation with the Rockefeller Foundation has recently completed a state-wide survey of murine typhus fever in which were investigated all possible known or suspected human cases having their onsets during the years 1944, 1945, and 1946.

METHODS EMPLOYED IN THE SURVEY

Following a preliminary reconnaissance of several months by an epidemiologist, typhus or suspected typhus cases were interviewed by trained lay field investigators working under close medical supervision. An average of 3 lay investigators, supervised by 2 physicians, conducted the survey during the period from July, 1946, to July, 1947. The sources of information leading to the cases were as follows:

Officially reported cases

Positive or suspicious Weil-Felix agglutination reports (titer 1:160 or more) from state laboratories

Information obtained in the field such as verbal reports from physicians or families or neighbors of patients; hospital records; and positive or suspicious reports from hospital or private laboratories

Death certificates

Either the patient or some immediate member of the family who was familiar with the circumstances of the illness was interviewed. Standard case history forms were made out for all interviews,

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in which the following information was obtained: usual personal data to identify and localize the patient; a clinical description of the disease with notes on onset, fever and subjective symptoms, type of rash if present, duration of illness, and more important laboratory findings. Information was also obtained concerning the possible source of infection with notes on places frequented, trips taken, and exposure to rats or fleas during the 3 weeks prior to the onset of illness. Investigators questioned the patient or family as to the presence of rats at the home, place of work, and places frequented, and in most instances personally inspected the place where infection most probably occurred in order to record their own opinion of the apparent degree of rat infestation. At the close of each interview the investigator made note as to his opinion of the probable place of infection.

In all instances diagnostic classification of the case was determined by the medical directors of the survey after consideration of available clinical and laboratory data. Cases obviously not typhus, or in which other diagnoses seemed reasonably certain, were excluded from the series as were cases with negative serology taken at a time when serology would be expected to be positive. Likewise, cases believed to have been infected outside of the state were not included. The diagnosis of typhus was based on the following 3 principal characteristics of the disease:

Constitutional symptoms including chills, fever, sweats, headache, body pains, and malaise sufficiently severe to confine the patient to bed for a period of at least 10 days.

Typical typhus rash, macular or petechial in character, located on the body or extremities or both and appearing on the second to tenth day of illness.

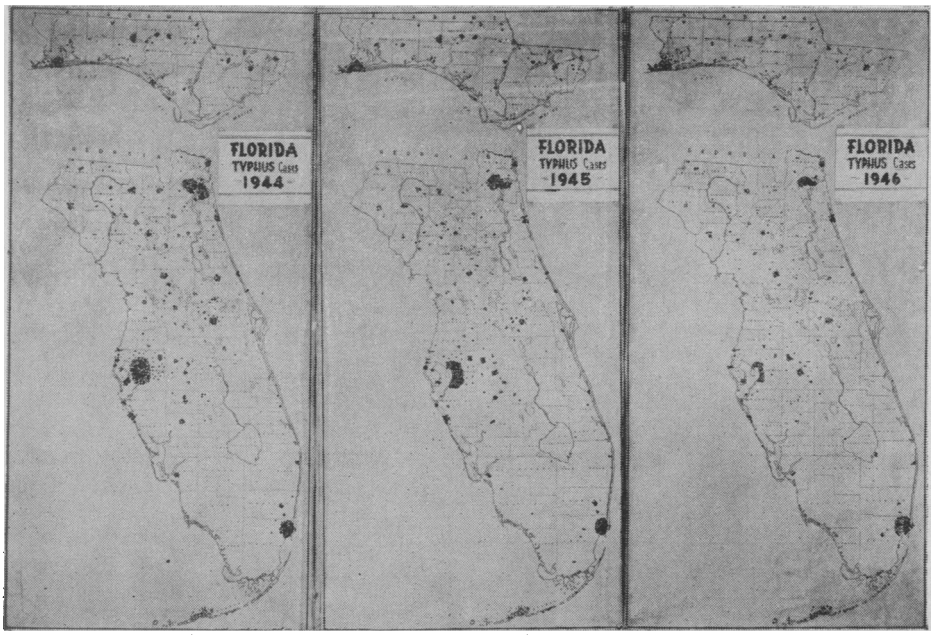
Weil-Felix agglutination tests. Titers of 1:160 were considered as suggestive of rickettsial infection and titers of 1:320 or more were considered as diagnostic.

Patients having constitutional symptoms, typical rash, and Weil-Felix titers of 1:160 or more; those having constitutional symptoms without rash but with titers of 1:320 or more; and those having constitutional symptoms, typical rash but no serological examination were classified as cases of typhus. Patients with constitutional symptoms, no rash, and titers of only 1:160 and patients with constitutional symptoms only were classified as suspected cases.

Due to the rather extended period of time included in the survey as well as to wartime movement of population, it was not possible to locate a considerable number of persons for interview. Of a total of 3,072 cases or suspected cases 2,055 were interviewed. In calculating the incidence of the disease, cases officially or verbally reported as typhus by physicians and others have been included irrespective of whether they could be reached for interview, as experience revealed that only a small portion of these cases would not be classified as typhus.

A total of 1,337 cases with positive or doubtful Weil-Felix reports from state and private laboratories were investigated in the course of the survey. Of this group of cases 1,038 had titers of 1:320 or more. In correlating clinical and laboratory findings there were 5 per cent of these 1,038 cases in which the diagnosis of typhus was not considered clinically justified. In the cases considered as typhus clinically, the diagnosis was substantiated by the history of a typical typhus rash in 62 per cent of the group, while in 33 per cent there was no history of a rash having been observed. Among a smaller group of 299 cases in which a titer of 1:160 was the maximum observed, 27 per cent were not believed to have had typhus. This percentage was considerably higher than in the previous group; nevertheless, there were 73 per cent of this group who were believed to have had the disease and 44 per cent in which the diag-

MAP 1



nosis was confirmed by the presence of a typical typhus rash. The inclusion of cases with 1:160 titers but which were not investigated epidemiologically, therefore, seemed to lend more accuracy to the series than their exclusion. As the number of these cases was small, it did not greatly affect the various totals and percentages obtained in the survey.

RESULTS OF THE SURVEY

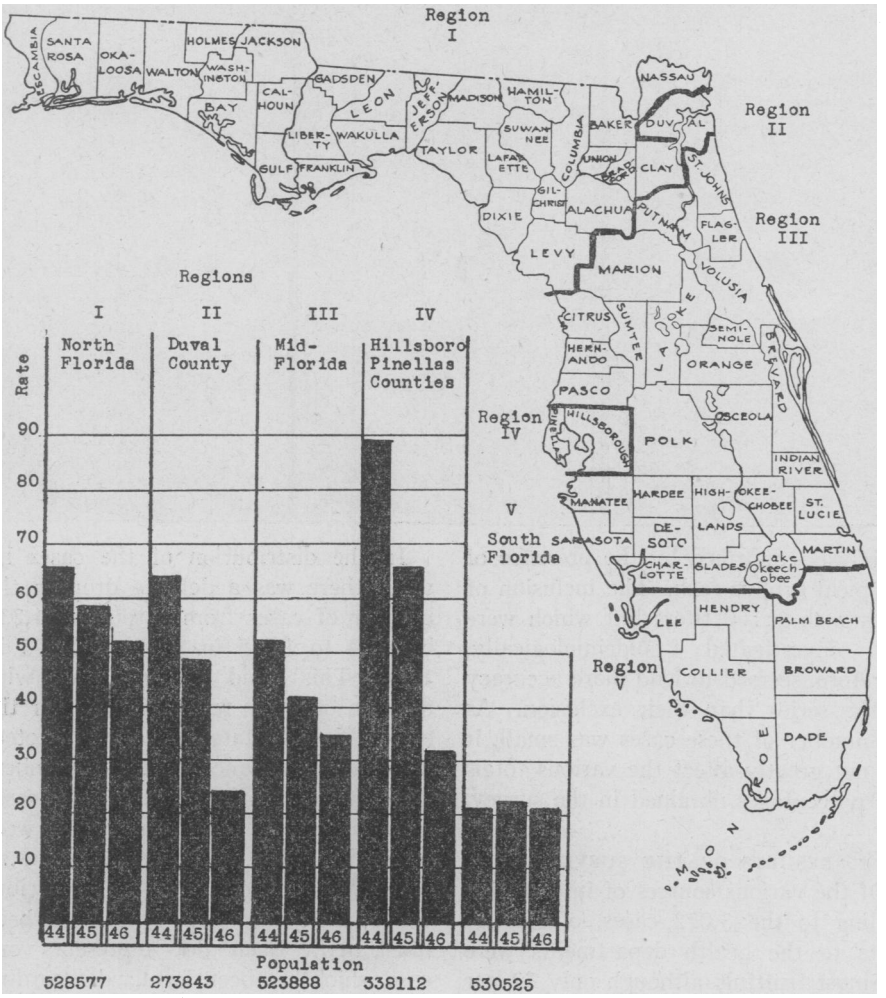
Of the various sources of information leading to the 3,072 cases, official reports to the health departments were the most fruitful; although only 37 per cent of the cases had so been reported. An almost equal number of cases, 34 per cent, were discovered by the investigation of positive or suspicious reports from the state laboratories. The remainder of the cases were found in the field with the exception of a very small number, 1 per cent, found through the investigation of the death certificates of persons who had been reported as dying of typhus but had not been reported as having the disease.

In the distribution of the cases by years there was a definite drop in the number of cases from a total of 1,234 in 1944 to 1,045 in 1945, and 793 in 1946. This trend was in accord with data on officially reported cases for the entire United States, as above quoted, but was at variance with the numbers of previously officially reported cases for the state for these years which were respectively 496, 380, and 420 cases.

On Map I the geographical distribution of the cases for the 3 years has been illustrated. Each dot represents one case which has been localized according to probable place of infection, when such could be determined or if this was not possible according to the place of residence. Little change in geographical distribution from year to year is evident. While it is apparent that cases are grouped in certain localities, there still is a widespread scattering of cases in almost all regions of the state. By and large, the distribution of cases follows almost exactly the distribution of the population.

Chart I
Typhus Fever Yearly Attack Rates per 100000 Population in Different Regions during 1944, 1945, 1946.

STATE OF FLORIDA



The State of Florida extends through a wide range of latitude and consequently has certain climatic variations in different regions. For this reason the yearly indices of the disease have been analyzed separately for 3 principal regions of the state which have been illustrated on the map contained on Chart I. Northern Florida has essentially a "southern" climate characterized by long hot summers but broken by a moderate winter season with fairly frequent frosts. Southern Florida has a climate almost tropical in nature with very rare winter frosts. The climate of mid-Florida ranges between those of the northern and southern regions. Throughout the state the winter months are relatively dry while the summer is characterized by high humidity and heavy rainfall. In addition to the above regions, data were also analyzed apart for

Duval County located in northern Florida and for Hillsborough and Pinellas Counties in mid-Florida. In these 3 counties extensive programs of typhus control have been carried out during the period covered by the survey. In the rest of the state control measures have been too limited in scope to have had any appreciable influence upon the incidence of the disease.

A comparison of the yearly attack rates per 100,000 inhabitants for the different regions as illustrated on Chart I reveals that, with the exception of south Florida, the trend of the rates has been somewhat similar. A recession may be noted in the first four regions which is accentuated in Regions II and IV where control measures were carried out. South Florida differs from the remainder of the state in having considerably lower attack rates in which no recession is apparent.

Seasonal curves for Regions I, II, and IV were similar and were characterized by summer peaks occurring in June or July sometimes followed by secondary peaks in November or December. The disease had its lowest incidence in the late winter or early spring, generally in February or March. In Region III, mid-Florida, secondary peaks were more pronounced while in Region V, south Florida, the cases were more evenly distributed throughout the year.

Of a total of 3,072 cases or suspect cases under investigation for the 3 year period included in the survey, it was possible to complete interviews on 2,055 cases. Of the cases interviewed, 85 per cent were considered as typhus according to the criteria previously established. Thirty-eight per cent had all 3 cardinal characteristics of the disease: severe constitutional symptoms, significantly positive Weil-Felix titers, and typical rash. Seventeen per cent had constitutional symptoms and positive Weil-Felix titers but no history of rash, and 30 per cent had typical clinical findings and rash but were without serological

Chart II

Types of Business Houses in Which Infection was Probably Acquired in Cases Where Source of Infection was Attributed to Business Houses.

	Number of Cases	Percent 0 10 20 30 40 50 60 70
Food Handling	367	
Non-food Handling	170	
Total Cases	537	

Occupations of Patients Immediately Prior to Illness.

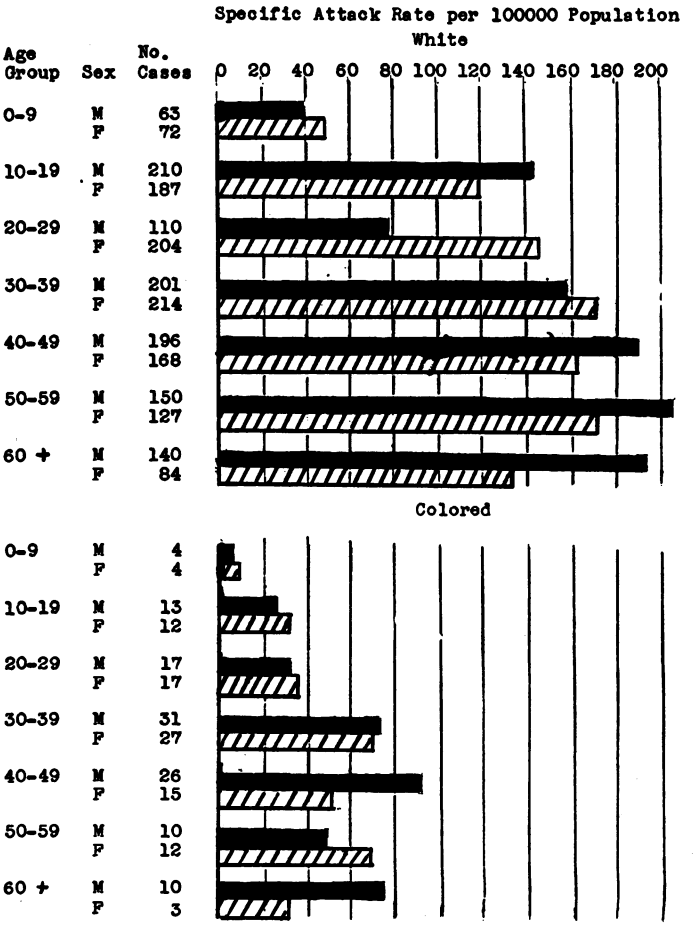
		Number of Cases	Percent 0 10 20 30 40 50 60 70
Employed in Business Establishments	Food Handling	422	
	Non-food Handling	542	
Not Employed in Business Establishments		1073	
Total Cases		2037	

confirmation. Only 15 per cent of the series were classified as suspected typhus in which the diagnosis was believed to be open to question.

In the classification of cases by probable places of infection, cities or towns having a population of 1,000 or more were considered as urban. This division was made in the belief that it would be more useful in planning control measures than the commonly accepted criterion of 2,500 inhabitants. On this basis, of the total population of the state, 2,250,061 persons according to the 1945 census, 1,541,416 or 69 per cent are urban, and 708,645 or 31 per cent are rural dwellers. Seventy-six per cent of the 2,055 cases investigated were believed to have been contracted in urban and 24 per cent in rural localities. These percentages were reflected in the attack rates per 100,000 for urban and rural populations which were 101 and 70 respectively. There were many reasons to believe, however, that with the methods used in this survey rural cases would more likely have escaped discovery than urban ones and that there was no real difference in these attack rates. In the combined urban and rural cases,

CHART III

Comparative Age, Race and Sex Specific Attack Rates per 100,000 Population
(Based on 2,327 cases occurring in 1944, 1945, and 1946)



67 per cent were believed to have been infected in the homes and 28 per cent at places of business, while in 5 per cent of the cases it was impossible to form an opinion as to the probable place of infection.

On the upper portion of Chart II the ratio of the number of cases whose source of infection was ascribed to food handling and non-food handling business establishments has been illustrated. Here it may be noted that the greater portion of the cases were ascribed to food handling establishments. Of these establishments, groceries and restaurants were found to have been the principal offenders, as 47 per cent of the cases believed infected in business houses were attributed to these 2 types of establishments. To other types of food handling establishments 21 per cent of the cases were attributed. Less than one-third of the cases were traced to non-food handling establishments. In many instances the source of rat infestation responsible for infection in non-food handling establishments was believed to be in nearby food handling business houses.

Indication of the probable place of infection necessarily was a matter of the opinion of the investigators. For this reason an analysis of the occupations of the patients immediately prior to illness, as illustrated in the lower portion of Chart II, should be of interest. Here it may be seen that 53 per cent of the patients had not been employed in business. These patients had occupations the nature of which would keep the individual about home the greater portion of his time. Of those employed in business, 27 per cent of the total number of patients were employed in non-food handling businesses of rather widely diversified natures, and only 22 per cent in food handling establishments. These findings substantiated the opinions of the investigators in ascribing 67 per cent of the source of infection to homes.

In Chart III the age, race, and sex specific attack rates per 100,000 of the population have been illustrated. The low incidence of the disease in the 0–9 age group would seem at direct variance from that which would be expected from a disease which was most frequently contracted at home and suggests that typhus fever may not be recognized as readily in this age group as among older persons. The lower rate in the white male 20–29 age group may be explained by the absence of a large portion of this group in military service during the war years. Attack rates in the colored population were lower than the white in all age groups. This, likewise, was contrary to expectation in the case of household infection of the nature of typhus. The colored population commonly inhabits the older and, therefore, more heavily rat infested residential districts.

DISCUSSION

That murine typhus fever has been and still is an inadequately reported disease is the opinion of many public health workers and has been commented on in the literature.[5] While it is true that in 15 per cent of the cases investigated in the present survey the diagnosis of typhus fever could not be considered as completely substantiated, there is reason to believe that by the methods employed all frankly typical cases of the disease were not discovered. Nevertheless, the magnitude of the typhus problem in the state has been indicated to be approximately two and one-half times as large as that shown by the number of officially reported cases. Moreover, epidemiological evidence collected in the survey suggests that in young children and in the colored race cases of typhus, perhaps mild and atypical or even subclinical, are escaping diagnostic detection. In consideration of the large number of febrile exanthemata to which young children are sub-

ject, the greater difficulty of the differential diagnosis in this age group is understandable.

In planning programs for the control or eradication of typhus, knowledge not only as to the case incidence but as to the circumstances under which disease is acquired is desirable for the orientation of control measures and subsequent evaluation of results achieved. Ratproofing of buildings has been used extensively as a method of rat and typhus control. In many respects this method is comparable to permanent drainage measures in malaria control. Like permanent drainage, ratproofing has definite economic limitations and, so far, has been applied principally to urban business establishments. The results of the present survey have shown, however, that business establishments are responsible for less than one-fourth of the cases of typhus in the state. Evidence suggested that 67 per cent of all infections were contracted in homes.

In many cities in the United States DDT dust has been applied to rat infested dwellings and buildings particularly in the poorer residential districts, in an attempt to control typhus by the reduction of fleas on rats. Encouraging reports have appeared in the literature both upon the reduction of flea indices [6] and the reduction of human cases of typhus [7] by this method. So far, however, little has been reported upon the necessary frequency of application of dusting and the duration of its effect, and the economic practicability of the method over a long period of time has not been evaluated.

The problem of the control of rural typhus would appear to be difficult of solution because of the high costs due to long distances involved. The Florida population is essentially urban, as previously defined, and only one-fourth of the cases were found to be of rural origin. Sporadic cases scattered in small towns and cities throughout the state may be considered the same as rural cases, however, from the standpoint of the application of control measures. The relative numbers and locations of these cases may be appreciated by an inspection of Map I.

In evaluating any control measure, the natural epidemiological variations of the disease from one year to the next should be considered. Epidemic peaks and recessions have been noted in nearly every known infectious disease. It would seem likely, therefore, that the same natural variations exist in typhus fever. Apparently in the State of Florida, as in other states which have reported considerable numbers of cases, the disease was receding in 1945 and 1946 from an epidemic peak reached in 1944. Control measures applied during these years would, therefore, appear to have considerably accentuated the decline in the number of cases in the localities where applied but may not necessarily have been responsible for the entire decrease in incidence.

SUMMARY

A state-wide survey of murine typhus fever was conducted in Florida in which were investigated cases or suspected cases of this disease having their onset during the years 1944, 1945, and 1946. Sources of information leading to cases were official reports to health departments, state laboratory records, information obtained in the field, and death certificates. For 2,055 of the 3,072 cases under investigation, standard case history forms were made out by trained lay field investigators who endeavored to ascertain the source of infection in every case interviewed.

By the methods employed the incidence of the disease was determined to be approximately two and one-half times that indicated by numbers of previously officially reported cases. Evi-

dence was adduced which suggested that numbers of cases in young children and the colored race were not being recognized as typhus.

The disease was found to be almost proportionately distributed in urban and rural populations but the actual number of cases in urban populations was considerably higher because of the preponderance of urban dwellers in the state. Twenty-eight per cent of the cases were believed to have been infected in business establishments while 67 per cent were believed to have been infected in homes.

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Canadian Public Health Association

Vancouver, British Columbia, will be host to the Canadian Public Health Association from May 18 to 20 when the association holds its annual meeting in that city. Hotel Vancouver will be headquarters and the center of the sessions.

The meeting is sponsored by the public health workers of British Columbia with the Washington State Public Health Association as co-hosts. Chairman of the conference will be G. F. Amyot, M.D., Deputy Minister of Health for British Columbia and President of the Canadian Public Health Association. The annual meeting of the Washington State Public Health Association will be held on May 17.

Sectional sessions will be held on Tuesday morning, May 18, with general sessions following on Tuesday afternoon and Wednesday morning. Wednesday afternoon will be reserved for relaxation. The final session, Thursday afternoon, will be a panel discussion under the leadership of Carl E. Buck, Dr.P.H., Resident Lecturer in Public Health Practice, School of Public Health, University of Michigan. The Honorable Paul Martin, Minister of National Health and Welfare, will be the luncheon speaker on Tuesday.

Further information can be obtained from the Division of Health Education, Department of Health, Parliament Buildings, Victoria, B. C., Canada.