RICKETTSIAL DISEASES IN JAPAN AND KOREA

PUBLIC HEALTH AND WELFARE TECHNICAL BULLETIN

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Introduction

The two rickettsial diseases that are well recognized and established are the typhus fever group and the Tsutsugamushi fever group. These diseases can be differentiated by specific serological reactions, using highly purified antigens.

GROUP I - TYPHUS FEVER

1. LOUSE-BORNE TYPHUS: -- "epidemic typhus," "European typhus," "shirami typhus" (shirami--"louse" in Japanese), "hashin chibusu," (eruptive typhus-Japanese) are synonyms in this area.

Louse-borne typhus is an acute infectious disease caused by Rickettsia prowazeki and usually characterized by sudden onset of headache, continuous fever of 12-14 days duration which ends by rapid lysis, and the appearance of a macular exanthematous rash on the 4th to 6th day.

All the prefectures in Japan and all of the provinces of southern Korea reported cases during the 1945-46 season. The majority of cases in Japan were located in and about the Tokyo-Yokohama area, the Osaka-Kobe area, and the prefectures of Aomori and Hokkaido.

a. Clinical Course--Incubation period is 8 to 12 days after the Rickettsia prowazeki has gained entrance into the body by way of breaks in the skin or inhalation. Onset is usually sudden with a severe headache and fever. However, it may be preceded by general malaise, weakness, mild headache and elevated temperature. During the period of invasion, there are chills or rigor followed by fever, loss of appetite, severe headache, neuro-muscular pains, and back ache. The temperature rises rapidly as high as 102°F to 105°F (38.9° to 40.6°C). At first there is a relative bradycardia which becomes proportional to the fever as illness continues. The face is flushed. The patient is apathetic. There may be a slight dryness of the throat and tongue. The spleen is often palpable and tender.

The skin eruption usually appears by the fifth day as round or oval,

pink erythematous macules first in the axillary areas and the base of the neck. The chest, back, and abdomen become involved and the eruption may spread to the extremities. In severe cases, it may become hemorrhagic. At this time there is usually a cough which is loose. Rales that are sibilant and sonorous are often present over both lungs. The conjuctive are injected. The tongue is dry, coated, and fissured. Deafness is a frequent complaint.

During the second week the fever remains high but irregular. In the seriously ill the pulse rate rises in proportion. The pulse is poor in quality. The blood pressure may drop sharply. Incoherence, delerium, or coma may develop. (In fatal cases such conditions may become worse with muscular twitching, dehydration, and incontinence of urine and feces).

After 10-12 days there is a marked remission of the temperature. It returns rapidly to normal during the end of the second week and in the third week. The signs of mental confusion, deafness, etc., clear rapidly. The general weakness may persist for weeks.

In fatal cases death probably occurs from neurological involvement although azotemia and pneumonia may be the important factors.

b. Complications:--Secondary bacterial bronchopneumonia, parotitis, otitis media, gangrene of the extremities (toes), and pressure sores are the chief complications.

c. Diagnosis:--

(1) Differentiation-- A tentative diagnosis (suspect case) is based on the clinical picture. Louse-borne typhus must be differentiated from murine typhus, scrub typhus, typhoid fever, relapsing fever, malaria and small pox.

(2) Serological Differentiation:

	Weil-Felix			Complement Fixation	
	OX-19	OX-2	OX-K	Louse	Murine
Louse-borne typhus	xxx	x	-	xxx	-
Murine Typhus	xxx	x	-	-	xxx
Scrub Typhus	-	-	xxx	-	-

(a) Weil-Felix reaction is used to show the presence of agglutinins in rising titer for proteus OX-19 in serum taken from the patient as soon as the disease is suspected and at 2 to 5 day intervals until the diagnosis is established.

(b) Complement fixing anti-bodies usually appear after the second week. A highly purified specific antigen makes the test very specific. This test is necessary to differentiate between cases of epidemic typhus and murine typhus and in previously vaccinated individuals.

(3) Animal Inoculation: 30 cc of whole blood is withdrawn in early febrile period. Separate the serum and grind the clot. Suspend the material in 10 cc of normal saline and inoculate 2 male guinea pigs with 5 cc each of the suspension intraperitoneally. The temperature of the animals should rise on 12th day. Pass 10% brain suspension on 3rd febrile day to two male guinea pigs using 1 cc suspension intraperitoneally. The temperature should rise in 6-7 days. In rats typically there is no febrile reaction to louse-borne strains of typhus. In contrast to murine typhus, louse-borne typhus seldom produces a scrotal reaction in guinea pigs or rats.

Whether there is a febrile or scrotal reaction or not, the animals blood should be checked for specific antibodies by the complement fixation test.

d. Prognosis:-- The case fatality ranges from 10% to 60%. Some factors are age, sex, state of nutrition, and presence of partial immunity. The fatality rate is high above the age of 40 and low in children. Neurological symptoms of increasing severity, spreading eruption, elevated pulse rate, hypotension, oliguria, and development of bacterial penumonia indicate poor prognosis. Death rarely occurs before 10th day; usually between 14th and 18th days.

e. Treatment: --

(1) Symptomatic and supportive

(a) Good nursing care and appropriate supportive therapy.

(b) Maintenance of adequate fluid intake (2,000-3,000 daily)

(c) High caloric diet with high protein intake.

(d) Preferable to use penicillin instead of sulfa drugs for treatment of bacterial complications.

(2) Para-amino benzoic acid is given in initial doses of 4 to 8 gm. and maintenance doses every 2 hours (usually 2 gms.) are given to keep the concentration in the blood between 10 and 20 mg. per 100 cc. The drug is given until the patient's temperature returns to normal or below.

When given early this medication tends to shorten the course, ameliorate the symptoms, and decrease the fatality rate.

The drug is not standardized and is not available for general clinical use at present.

f. Immunity:-- Infection confers substantial immunity against the disease, but instances of second and even third attacks have been reported.

g. Vaccination:-- The chances of infection are greatly reduced by vaccination. No proven deaths have occurred in individuals completely vaccinated prior to their infection. The clinical course is much less severe and the duration shortened to such a degree that many cases are erroneously diagnosed as murine typhus.

h. Pathology:-- Gross pathological changes are not distinctive. The rash is usually evident because of its petechial character. Skin necroses or gangrene are occasionally found. There may be symmetrical gangrene of the skin covering the extremities, i.e., blood is usually dark in color. The spleen is slightly enlarged before the second week but tends toward normal size later.

Microscopically there are perivascular infiltrations about arteroioles, small arteries, venules, and small veins. Focal infiltrations, when they are sharply demarcated and are proliferative, form Fraenkel's "typhus nodules" in the skin and brain (cortex, pons, medulla, and basal ganglia). Thrombosis in small vessels and subsequent hemmorhagic manifestations cause the petechiae. Thrombi are rare in large blood vessels. Myocarditis in the acute phase of the disease is indicated by infiltration of the myocardium. There is atrophy of testicular tubules and interstitial orchitis is usually present.

i. Etiology and Transmission

(1) Causal agent is Rickettsia prowazeki, an intracellular parasite found in the circulating blood during the active stage of the disease. At autopsy they may be found in the brain, spleen, bone marrow, etc. Staining with Giemsa gives the organism purplish tint; Machiavello (basic fuchsin) stains reddish. The organisms may be cultivated in the yolk sac of fertile hens eggs or the lungs of mice. Male guinea pigs are suitable laboratory animals.

(2) Transmission is accomplished through infective excrement from human lice (possibly fleas and bed bugs) rubbed into skin abrasions or inhaled particles of this material. The species of lice involved in the order of importance are: Pediculus humanus var. corporis (body louse);

Pediculus humanus var. capitis (head louse): and Pthirius pubis (crab louse).

(a) Life History of the body louse. Lice normally inhabit the under surfaces of clothing next to the skin. In heavy infestations they may be found in the outer layers. The female deposits 3 to 5 eggs daily for 2 to 24 days. Eggs hatch in 7 to 10 days. Nymphs pass through three stages reaching maturity in 14 to 16 days. Mating occurs in 2 to 4 days and egg deposition 2 to 4 days later. The average life of a normal louse is 30 days. Life of infected lice may be shortened. The louse becomes infected only by feeding on infectious blood and becomes infective in 8 to 10 days following an infectious blood meal. Lack of blood meals is fatal to adult lice in about nine days. Newly hatched lice die in 2 days without feedings. A similar history is true for head lice and crab lice.

j. Epidemiology

Occurrence is chiefly between the months of October and late June with the peak in May or June although occasional cases may occur the year round. In 1946 the peak was reached in late March in Japan. The reservoir is still unknown for the interepidemic period; occasional cases, mild, unreported cases or unrecognized cases may be responsible.

Predisposing factors are those which tend toward an increase in lousiness and an accelerated distribution of lice from person to person. Colder weather causes close crowding of the population and the wearing of more and heavier clothing. Often the individual wears all of his clothes all the time because they are all he possesses. Lowered standards of sanitation and personal hygiene, the mass movement of troops, refugees, repatriates, and the general populace during post-war periods, particularly play major roles in creating ideal conditions for the appearance of an epidemic.

k. Prophylaxis and Control

The ground work which is laid prior to the typhus season is of the greatest importance and when carefully planned and executed, will result in effective control and eventual eradication of the disease.

(1) Procedures prior to the typhus season

(a) American typhus control officers are from the U. S. Military Government Teams and are in overall supervision of typhus control operations.

(b) Civilian typhus control officers:

Civilian public health officials with sound educational background, judgement and experience in public health administration should be selected and designated as typhus control officers in each prefecture (Japan) or province (Korea) and city. They should be relieved of all other unrelated duties. They should be given full authority to call on such municipal, prefectural or provincial agencies as are deemed necessary to carry out their plans effectively. These men should be trained and re-trained by Military Government personnel in methods of typhus control. Instruction should be given to all men appointed for cities and for each prefecture or province. These men should be responsible for training and retraining of all personnel employed for typhus control work; and for publicity and education directed towards the general public; specifically, such groups as:

Medical Associations
Nurses Associations
Physicians and Nurses
Teachers in Public Schools
Block Associations
Neighborhood Associations
Illiterate and poorer classes of people.

(c) Training Programs:

1. Reorganization and Training of Typhus Control Teams.

Case finding teams, sanitary (disinfesting) teams and vaccinating teams should be reorganized for typhus control work not later than 1 November each year. Retraining of old members and training of new members should be accomplished as early as possible. Retraining of all members at regular intervals of two to three weeks should be planned.

All workers of Sanitary Teams and case finding teams should be selected from Prefectural Insect and Rodent Control personnel. For the typhus season they are retrained with emphasis on louse control. Personnel of all teams should be full time, salaried workers and should be trained in all phases of typhus control. If

an epidemic threatens, they can be used as instructors and cadres for other teams. Sufficient transportation for each team should be available and a surplus maintained if the need becomes evident.

2. Training of civilian physicians and nurses.

A training program should be designed to acquaint physicians and nurses with typhus fever and its control. The need for early case reporting and isolation should be stressed. The meetings should be conducted by local medical associations or nurses associations.

3. Training of Block and Neighborhood Association Chiefs (Japan); Voluntary Service Group Heads (Korea)

Such persons should receive training in typhus control procedures and they in turn should inform the inhabitants under their surveillance.

(d) Publicity and Educational Programs

Publicity and educational programs on louse-borne typhus and its control should be instituted in October and continued through May of the following year as part of a well planned public health education program. Each Prefecture (Japan) and province (Korea) should institute continuous programs designed to carry typhus information into every school and every home through the agency of information meetings of teachers (parent-teacher associations), radio, newspapers, magazines, posters, leaflets, kami-shibai, motion pictures, (i.e., an animated cartoon or typhus control), slide films, contests in schools, and circulating exhibits. The danger of typhus should be stressed and people should be told what they as individuals can do to rid themselves of lice without relying on the use of DDT alone. Block and Neighborhood Association Chief (Japan), Voluntary Service Group Heads (Korea) and Red Cross Associations should be utilized to the fullest extent in the educational and publicity programs.

(e) Distribution of Supplies

Early distribution and maintenance of adequate stocks of typhus control supplies to the eight key points in Japan and to the six points in Korea is essential.

1. Available supplies

a. Insecticide, powder, louse (10% DDT in pyrophyllite or talcum)

b. Larvicide, DDT, powder, dusting (10% DDT in talcum)

c. Larvicide, DDT, powder, dissolving (100% DDT)

d. Insecticide, spray, residual effect DDT (5% DDT in kerosene)

e. Pyrethrum emulsion (30X) or 10X)

f. Cresolis compound (Liquor cresolis)

g. Duster, powder insecticide, plunger type, hand operated.

h. Outfit delousing, gasoline engine driven

i. Sprayer, insect, knapsack type, plunger type, cylindrical shape.

j. Sprayer, liquid, insect, continuous spray.

(f) Mass Vaccination

Ideally all persons should receive an initial two doses of 1 cc each, typhus vaccine 7 - 10 days apart, and a booster dose once every six months. If there is insufficient vaccine for this plan, alternate plans are suggested, dependent on supplies:

1. Vaccination with 1 cc of all persons living in the large centers of population where typhus was epidemic in 1945 - 1946.

2. Vaccination with 1 cc of all persons living in a city "ku" where secondary cases are occurring.

3. Vaccination with 1cc of all persons living in a prescribed area ("zone") where secondary cases are occurring.

4. Vaccination with 1 cc of all commuters holding season tickets. (In cities, as Tokyo, Osaka, etc.)

(g) Vaccination of key personnel

All new persons actively engaged in typhus control operations should receive the full course of the vaccine. Former workers to receive a booster dose of 1 cc vaccine. Special groups of people, i.e., nurses, doctors, hospital and institution personnel, control team members, railway trainmen, street car motormen and conductors, policemen, etc. should receive the full prescribed course of vaccine and a booster dose once every six months.

(h) Disinfesting of possible typhus foci

Routine disinfestation of all persons entering and leaving jails, prisons, vagrant homes, orphanages, homes for poor and aged, infectious disease hospitals and similar institutions should be continued on a year round basis. In addition all persons in these institutions should be deloused once each month (more often if lice continue to be found).

Hand dusters, spray equipment, DDT insecticide powder, residual DDT spray and pyrethrum emulsion should be distributed to each institution.

Steam sterilizers or dry heat chambers should be installed and used in infectious disease hospitals, jails, public baths, etc. for the disinfection of clothing and bedding.

Cells of jails and prisons, isolation rooms of hospitals, public baths (rooms, baskets, etc.,) should be sprayed with DDT residual effect spray to which is added 2% (content) cresolis solution.

Use of a rickettsicidal spray will kill rickettsiae in louse or flea feces in addition to its insecticidal power. If fire hazard is great, Pyrethrum emulsion (30X or 10X) plus 2% cresolis content, using water as the diluent, may be substituted.

(See Rickettsicidal spray program, Addenda 6)

(i) Disinfesting of zones

Although it would be hazardous in the year following an epidemic to establish zones for routine monthly dusting on the basis of concentration of cases during the previous typhus season, such a plan has advantages. Such zones were established at Inchon and at Seoul, Korea in 1944 - 1945.

(j) Permanent disinfesting stations

Disinfesting stations should be established at health centers and operated on a year round basis. A few stations established near crowded railway stations should be established to care for migratory people. Persons would be free to come to such stations for delousing. On entering a disinfesting station, each person should be examined for presence of lice (head or body lice) and if found infested, receive a thorough dusting with DDT powder.

(k) Distribution of Insecticide powder to individuals

In an effort to encourage personal cleanliness ("freedom from lice", the "5th freedom") insecticide dusting powders (DDT or pyrethrum) could be distributed through the health centers to each individual or family living in a ku, particularly those kus where great numbers of typhus cases have occurred.

(l) Typhus Control Teams -(Organization and general duties)

1. Case Finding Teams - ("Checking" and "Roving" teams) Working from--Ku (ward) office, Kenku (school district) office, city health office, town health office, village health office, Health Centers, etc.

a. Organization

Doctor	1	In charge
Nurses	2	Assistant to doctor, vaccination work, take temperatures.
Workers	2	Disinfestation work

b. Duties

Intensive and extensive case finding (hunting) by "roving" teams.

Investigate all reported suspect typhus cases by "checking" teams.

Visit all persons in the neighborhood in an attempt to locate new suspects who may have been contacts of reported cases.

Vaccinate all family or household contacts

of cases with 1 cc typhus vaccine. Take temperatures of all contacts.

Disinfest all family or household contacts as well as patient or corpse. (Clothing, extra clothing, beds, bedding, floors included in dusting procedures.)

Mark house or building to indicate that it is disinfested and quarantined.

Direct that quarantine of house or building must be done within 6 - 8 hours following discovery of case.

Responsible for expeditious removal of all suspect typhus cases to an isolation hospital within 6 - 8 hours after discovery of case.

Reporting of suspect cases, cases or corpses within 2 hours after discovery.

Instruct members of household as to early symptoms and not to bathe or wash clothing for three days.

2. Sanitary (disinfesting) teams

a. Organization

Leader	1	In charge, inspects work, in charge of supplies
Clerk and Inspector	1	Keeps records, inspects work, assists in work.
Workers	4	Performs dusting and spraying.

b. Duties

Arrange itinerary of work based on reported cases.

Responsible for performance of focal dusting, zonal dusting, focal spraying, and zonal spraying and marking of homes processed.

Reporting of any new suspects or new cases found by team members and execution of disinfesting procedures in such instances.

Give disinfesting instructions for family absentees to report for dusting and vaccinations at ku (ward) or Renku office by noon of following day.

Instruct persons not to bathe or wash clothing for three days.

3. Vaccination teams

a. Organization

Doctor	1	In charge
Nurses	2 - 4	Perform vaccination techniques.

b. Duties

Obtain addresses of reported suspect typhus cases.

Responsible for focal and/or zonal vaccination.

Responsible for vaccination of special groups; prisoners, policemen, nurses, doctors, inmates of institutions (orphanages, vagrant homes, old people's homes), railway employees, street (tram) car employees, bus drivers, etc.

Responsible for prompt reporting of any new suspect cases of typhus discovered by or reported to team members.

4. Suggested Additional Sanitary (disinfesting) teams

a. Central Health Office Sanitary (disinfesting) Team.

Organization

Doctor or Nurse	- 1 in charge of team
Inspector	- 1 inspects work, keeps records, etc.
Workers	- 4 perform disinfesting techniques.

Duties

Assist in focal and zonal operations if necessary

Perform disinfesting operations for special groups, i.e., routine disinfesting of migrants in railway stations, (work to be done at night) etc.

b. Disinfesting Station Teams

Organization

Doctor or Nurse	1 in charge (examines clients for lice)
Inspector	1 inspects work, keeps records, and helps examine clients for lice, etc.)
Workers	2 to 10 (dependent upon the size of the station) perform dusting techniques.

Duties

Perform disinfesting operations in special disinfesting stations.

Doctor or nurse responsible for operation of station and work done. Also responsible for screening out of suspect typhus cases.

Inspectors examine persons reporting for treatment for presence of lice.

Disinfesting technicians responsible for application of dust to clothing and heads of persons sent to them by inspectors.

Instruct persons DDT'd not to bathe or wash clothes for three days.

c. Special Disinfesting teams or small groups of trained personnel.

Organization

Nurses or trained personnel from staff of:

Ku-office, Renku, Village town, etc., health office.	Poor Farms
Jails and prisons	Vagrant Homes
Hospitals	Dormitories
Orphanages	Other institutions of various sorts.

Duty

To perform disinfesting procedures within their particular offices or institutions.

Disinfesting the absentees from the focal or zonal dusting procedures.

Routine disinfesting of the inmates (if any)

Routine disinfesting of incoming and outgoing patients, prisoners, orphans, etc.

(2) Procedures when outbreaks of typhus occur

(a) General

When cases of typhus occur, the following control measures should be instituted. Such measures should be modified in accordance with the needs of the local situation.

Control measures should be directed towards two general methods - 1) louse control and eradication of infected lice, 2) the development of active immunity by the use of typhus vaccine. The use of either or both of these methods requires judgement and adaptation of the measures outlined below to suit the problem at hand. In general disinfestation with insecticide powder and spray is a simple procedure but a relatively temporary measure. The chief asset of immunization is its "holding" power. Inoculation with typhus vaccine should therefore be practiced to the fullest extent possible under existing local conditions and availability of vaccine supply.

(b) Definition of Terms

1. Suspect case of typhus fever; any person with elevated temperature and headache of sudden or gradual onset. If the case is known to be suffering from some other cause (boils, severe cold, pneumonia, broken leg or arm, or other definitely recognizable disease) such a case need not be considered a suspect.

2. Confirmed case of typhus fever; a case in whom the Weil-Felix tests, complement-fixation tests, rickettsial agglutination tests, or autopsy findings support the clinical diagnosis. Confirmation is done after the patient has been isolated in the hospital (not in the home)

3. Focal Disinfesting; the application of 10% DDT dust to persons living in the homes of the suspect case and not over 500 persons in an area of 100 meters radius. These 500 will be those persons living next to and around the case. Where 500 or less persons live within 100 meters of the case, then all persons will be dusted in their homes. Do not dust outside 100 meter radius of the case for focal disinfesting.

4. Zonal Disinfesting; the application of 10% DDT dust to persons living in designated areas where several cases have occurred in close proximity to each other in location and time. The size of a zone may vary from one block to an area with a population of 30,000 - 50,000 or more persons. (A 6 man sanitary disinfesting team should be able to thoroughly dust 2000 - 3000 persons in a 5 day period). Disinfesting work is done in the homes and should be carried out simultaneously in all zones.

5. Focal Vaccination; the administration of 1 cc of cox-type typhus vaccine to persons living in the home of the suspect case and to the 500 persons dusted in the 100 meter radius. Available amounts of vaccine will be a limiting factor.

6. Zonal Vaccination; the administration of 1 cc of cox-type typhus vaccine to all persons living in the designated "zone".

7. Spot maps; large maps on which reported suspect cases can be accurately located. Maps of each ku (ward), city, and village should be utilized where typhus occurs. The maps help in judging the concentration of cases, and help to more correctly evaluate where more intensive and effective work must be done.

(c) Operation of typhus control plan.

1. When case is reported personally:

a. A person with elevated temperature and headache:

Reports to: (any one of the following)

Doctor	Chief of block or neighborhood association
Nearest Policeman	
Chief of his dormitory, shop, factory	Red Cross Representative, Health Center (nearest)
Family head.	
Local Health Office Ku (ward) Village, Town.	

2. When case is discovered by: (any one of the following)

Family head	Red Cross Representative
Doctor	Chief of his dormitory, shop or factory
Chief of block or Policeman	

(When discovered by any of the above, the information is transmitted directly to the proper health office, or is sent through a doctor, policeman, messenger or phone at once.)

3. When the case is reported to the local health office by any person, neighborhood or block association chiefs, policeman, doctor, visiting nurse or Red Cross representative:

a. Local Health Office: (Procedure)

Immediately dispatches the local office case-finding team (s) to the address or addresses of "suspect" cases. Case-finding team (s) institutes measures as listed in 4.

Spots case on large scale map of area

Reports Case(s) to city health office

Decides if Zonal disinfesting is necessary

Dispatches Sanitary (disinfesting) teams(s) to the addresses of suspect typhus cases. They perform the following duties:

Complete any disinfesting operations in the home of the patient not done by the case finding team.

Performs Focal disinfesting procedures in the neighborhood of the case.

House to House work

Head, body and clothing of all persons living in each house to be thoroughly dusted with 10% DDT powder ($1\frac{1}{2}$ - 2 oz/ person)

Extra clothing, and bedding dusted with 10% DDT powder.

Focal disinfesting to be done same day as the case is reported.

Repeat disinfesting in 7 and 14 days.

Performs Zonal disinfesting procedures if concentration of cases (secondary cases) appear (for size of zone see definition of Zone in Zonal Disinfesting)

House to House work

Head, body and clothing of all persons living in each house to be thoroughly dusted with 10% DDT powder.

Extra clothing and bedding to be dusted with 10% DDT powder.

Disinfestation of Zone to be completed in 5 days.

Repeat disinfesting in 7 and 14 days.

Dispatches vaccination team(s) to the address of the suspect typhus case.

b. Vaccination team(s) perform the following duties:

Vaccinate any person not vaccinated in the home of the patient by the case-finding team.

Perform Focal Vaccination procedures on all persons living in the neighborhood of the case with 1 cc typhus vaccine (500

persons depending on the concentration of population and the availability of the vaccine)

Performs Zonal vaccination procedures if a concentration of cases develops. Zonal vaccination with 1 cc typhus vaccine to be done only on direction. Size of zone to be as in definition of Zone for Zonal delousing.

4. When a case is reported into any health office by the roving case-team (team in the field), this team initiates the following action at the home of the patient.

a. Doctor

Examines the patient, and classifies the patient as a typhus suspect or not. He does not diagnose the case as typhus.

Orders isolation of the patient (if suspect).

Orders quarantine of the family of the suspect for 14 days.

Reports suspect case within 2 hours after discovery to the nearest local health office by messenger or phone.

b. Nurses

Lists family names. Requires family to have any absentees report to the local health office by noon of the following day for processing.

Questions patient, and household members, and neighbors as to possible source of infection. Secures names of possible contacts (relatives, visitors, etc.)

Takes temperatures of the family members.

Organizes and performs vaccination with 1 cc typhus vaccine of all members of the family and/or household.

c. Workers

Apply dust (DDT 10% powder) to:

Patient: head, clothing, bedding, and his extra clothing, (patient should be transferred to clean clothing and bedding where possible).

Family members: head, clothing, extra clothing (especially that clothing which is worn at odd times), extra bedding.

Floors of house, particularly around the bed of the patient.

Apply spray (pyrethrum emulsion in water plus 2 to 3% cresolis content) to:

Floors, bedding of patient, clothes of patient. Apply the spray to inside of garments, along the seams of bedding. (DDT spray, residual effect may be used if the fire hazard is not considered to be too great.)

Note: In some localities there are disinfection teams for the disinfection and isolation of contagious disease cases. These can be utilized in the above program by changing the solution used in spraying from their present 3% lysol or cresolis content in water to a 3% lysol or cresolis content in either pyrethrum emulsion in water or DDT spray, residual effect. This will relieve the case finding team of additional equipment and avoid duplication of work.

(d) Typhus Control in Rural Areas, smaller towns, labor camps, etc.

1. General principles

a. When one or more cases of typhus fever occur in a civilian community of less than 1000 (and not more than 5000) population:

Isolate patient(s)

Quarantine household 14 days.

Disinfect every individual.

If possible, vaccinate everyone living in the community using one dose technique of 1 cc. (Full Prescribed course of vaccine if possible).

Disinfest all patients and known contacts with 10% DDT insecticide powder and treat the homes with either DDT residual effect spray plus 2 to 3% cresolis content, or pyrethrum emulsion plus 2 to 3% cresolis in the final dilution where the fire hazard is great. Repeat disinfesting operations in 7 and 14 days.

Vaccinate all family or household contacts (two 1 cc doses one week apart)

Apply "focal" disinfesting and vaccination procedures.

Disinfesting work is to be done house to house.

b. When typhus appears in towns above 5000 population and in cities, a complete typhus control program should be established as outlined, but modified to fit the existing local situation.

c. If typhus fever cases appear in labor camps, camps of displaced persons and refugees, dormitories, barracks, etc., the following applies:

Disinfest all inmates, staff personnel and attendants, their extra clothing, bedding.

Vaccinate all inmates, staff personnel and attendants with full course of typhus vaccine.

Use residual effect spray and cresolis 2% content and/or pyrethrum emulsion spray and

cresolis 2% content on the floors, halls, store-rooms, kitchens, etc., as outlined in RICKETTSICIDAL SPRAY PROGRAM (see addenda 6)

Quarantine of such camps and institutions should be imposed for 14 days after appearance of the last case.

Necessary regulations should be issued preventing unnecessary civilian travel into or out of such areas until typhus has been controlled.

(e) Port Quarantine Procdures

(See Memorandum For: Imperial Japanese Government, AG 014.33 (5 Nov 46)GC, (SCAPIN 927/10) APO 500, dated 5 November 1946, Subject: Repatriation.

(f) Proper care of Disinfesting Equipment

Responsible men with mechanical skill should be trained in the proper use of the gasoline driven outfit and charged with responsibility of proper maintenance of the machine and dusting heads. On Sanitary (disinfesting) teams, some one person should be responsible for conditioning of the hand dusters and spray equipment.

1. Outfit, Delousing, gasoline engine driven.

a. Clean equipment after each day's operation.

b. Clean all air filters after each day's operation.

c. Operate engine in open away from dust if possible.

d. When available, use accessory outfits alternately to relieve the load on any one outfit.

e. Use proper grade lubricating oil (S.A.E. - 20)

f. Clean and oil control valve on dusting heads.

2. Hand dusters

a. Clean the inside of the pump each day.

b. Clean and oil the leather plunger after each day's operation.

c. Exercise care so as not to dent the cylinder pump walls.

3. Spray equipment

a. Clean spray nozzle.

b. Tighten hose clamps.

c. Clean screen filters.

d. General maintenance.

2. MURINE (FLEA-BORNE) TYPHUS: Manchurian Fever.

a. General

Murine typhus is an acute infectious febrile disease caused by Rickettsia prowazeki, var. mooseri, usually characterized by sudden onset of severe headache, chills, and fever that is continuous for 12 to 14 days. A roseate, macular, exanthematous rash appears about the 5th day. The disease is relatively mild and has a low mortality as compared to louse-borne typhus and scrub typhus.

Unfortunately, in Japan, statistics prior to 1945-1946 do not distinguish between epidemic and murine typhus. The general belief is that most of the sporadic cases reported from 1923 to 1945 were cases of murine typhus. These cases occurred in the prefectures of Akita, Aomori, Hyogo, Iwate, Tokyo-To, Yamagata, Osaka, and Yamaguchi. Undoubtedly this disease could be found in nearly all prefectures of Japan. The disease is also present in southern Korea.

b. Clinical Course.

The disease may start gradually after an incubation period of 4 to 14 days with irregular development of symptoms, the temperature rising step by step. Usually the onset is abrupt. In general, the clinical course is similar to that of louse-borne typhus, but the disease pursues a comparatively mild course. Complications are rare and the mortality low. During invasion the temperature rises to 38.5° C to 40.0° C (101.2° F to 104.0° F) in 3 to 6 days, and terminates in rapid lysis about the 14th day. The mental condition is much less altered than in louse-borne typhus. Delirium is almost wholly lacking. The

most characteristic finding is the rash which appears about the 5th day. This rash characteristically consists of rose or dark red macules which fade into the surrounding areas and do not disappear on pressure. The eruption is less extensive and petechiae are less common than in louse-borne typhus. The exanthem may last from 2 to 10 days disappearing rapidly.

Recovery is usually by the 16th day when the temperature has returned to normal. Convalescence to complete recovery varies from 2 to 4 weeks after normal temperature has been reached.

c. Complications are usually few. A bacterial pneumonia is most common.

d. Prognosis is usually good.

e. Diagnosis:

(1) Differentiation: requires differentiation from louse-borne typhus, scrub typhus, relapsing fever, typhoid fever, malaria, and Weil's disease.

(2) Serological Differentiation:

	Weil-Felix			Complement Fixation	
	OX-19	OX-2	OX-K	Louse	Murine
Louse-borne Typhus	xxx	x	-	xxx	-
Murine Typhus	xxx	x	-	-	xxx
Scrub Typhus	-	-	xxx	-	-

(a) The Weil-Felix agglutination reaction using Proteus OX-19 is positive after the 6th day of the disease.

(b) Complement-fixation and specific rickettsial agglutination using highly purified murine antigens are the most reliable procedures. These antibodies begin to appear after the second week of the disease.

(3) Animal Inoculation: Inoculation of guinea pigs with infectious material from suspected murine typhus cases produces an obvious scrotal reaction. However, such a reaction has been noted in guinea pigs inoculated with material from known louse-borne cases. Murine typhus produces a febrile disease in laboratory rats

with presence of rickettsia in the scrotal sac.

f. Treatment is symptomatic and supportive such as that in louse-borne typhus.

g. Immunity is usually produced by one attack. It is possible that second infections may occur. Some cross immunity is given to louse-borne typhus.

h. Vaccination is possible but not usually done because of the clinical mildness of the disease and the low mortality rate. A vaccine has been developed and is undergoing a field trial in the U. S..

i. Pathology is similar to the pathology of louse-borne typhus but usually less marked.

j. Etiology and transmission:

(1) Causal agent is Rickettsia prowazeki var. mooseri, an intracellular organism morphologically and possibly (at times) immunologically indistinguishable from Rickettsia prowazeki of louse-borne typhus. Considerable but incomplete cross immunity may exist between the two infections.

(2) Transmission is accomplished from rodent to rodent and from rodent to man chiefly by rat fleas, Xenopsylla cheopis and Xenopsylla astia and to a lesser extent by the rat louse, Polyplax spinulosa and the tropical mite, Liponyssus bacoti. These ecto-parasites become infected by ingestion of blood from infected rodent hosts.

Human lice are capable of acquiring the infection, but die in 10-11 days as a result of feeding on infectious blood. In the flea, the organisms multiply in the epithelial cells of the midgut. In 10-12 days they escape into the lumen of the gut and are discharged with the feces. They may remain viable for at least 36 days. Man becomes infected, not through the "bite" of the flea, but from infective flea excrement rubbed into skin abrasions, or through the conjunctivae, or by inhalation of this material or by accidental ingestion of infected fleas.

(a) Life History of Flea Vector: In general the life history of the flea is similar with few exceptions. The eggs are comparatively large, (0.5 mm long) glistening white and rounded at both ends. The

female deposits from 3 to 18 eggs at one laying, on the host animal or in the nests of their hosts. Under optimum conditions of 18.3° C to 26.7° C (65° F to 80° F) and 70% humidity) the eggs hatch in from 2 to 12 days. The larvae are very active, slender, 13 segmented, yellowish, white with segmentally arranged bristles with biting mouth parts. They feed on faeces of adult fleas and dried blood chiefly. The larvae as a rule pass through 3 developmental stages, and the entire larval period ranges from 9 to 15 days under natural conditions. The larvae then become quiescent, spins a cocoon, and pupate. The pupal stage varies from 18 days to many months before the adult emerges. Longevity of the adult fleas is quite remarkable. Under natural conditions adults may live as long as 376 days (X. cheopis). The average length of life ranges from 30-60 days. The rat fleas show no evidence of disease due to R. prowazeki infection.

k. Epidemiology:

Cases of murine typhus are typically sporadic and are known to occur during the louse-borne typhus season and probably all through the year. In many parts of the world the disease is more prevalent in the summer and fall months. This corresponds to the peak of density of the flea population. Murine typhus is most commonly found among workers on docks, grain elevators, etc. The incidence is the highest among males. The rat is the common reservoir host, but other rodents may play a role.

l. Prophylaxis and Control

(1) Prophylaxis

Control of murine typhus fever in a civilian population is based upon the premise that the typhus infected fleas are the primary agent in the transmission of the disease to man with rodents as reservoir animals of the infection.

Recent experiments indicate that the use of DDT dusts and sprays are effective in the control of fleas and when used as auxiliary measures with the fundamentals of rat control, an effective control of murine typhus should be accomplished.

(2) Control Methods

(a) The general procedures as outlined for the control of louse-borne typhus will apply to a great extent, since each suspect typhus case must be considered as possible louse-borne typhus and must be dealt with accordingly.

1. Case Finding Teams.

No change should be made in the general duties and operation of case finding teams.

2. Vaccination teams.

No change should be made in the general duties and operation of the vaccination teams. (Vaccination against louse-borne typhus. No murine typhus vaccine is available in this theater.)

3. Sanitary (disinfesting) teams

a. Organization

Leader	1
Inspector and clerk	1
Workers	4

b. Duties

Flea control

Sanitary teams should perform their regular duties as outlined for louse typhus control. Additional sanitary teams should be used to carry out a detailed rodent control program (see Insect and Rodent Control).

Consider all suspect cases of typhus as possible cases of louse-borne typhus.

Focal disinfestation (see definition of "focal disinfestation")

In addition to regular disinfestation duties:

Application of 10% DDT dust to:

Rat burrows

Area in front of openings to rat burrows

Rat harborages

(Work to be done in and around all buildings in focal area. Dust may be applied with hand or power dusters).

Cats and dogs. (Dust fur lightly)

Infested areas and grassy lawns may be successfully treated with DDT dust.

Application of 5% DDT spray, residual effect to:

Floors of buildings.

Wall surfaces to a heighth of one meter above the floor. Use at rate of 1 liter per 25 sq. meters of surface. Earthen floors and underneath buildings dosage should be increased to 2 liters per 25 sq. meters of surface.

Beds (if any), mattresses "futon", etc. Apply spray directly to surfaces and into cracks and crevices in beds and along seams of bedding and seams and tufts of mattresses. Use at the rate of 1 liter for each 5 beds and mattresses or equivalent.

Flea breeding and flea harboring areas, sleeping quarters of animals, (cats, dogs) infested barracks, warehouses, theaters, recreation halls, restaurants, railway stations, basements, houses, dormitories, vagrant homes, dog kennels, ground under buildings, railway cars, street cars, buses, public bath houses, etc.

Zonal disinfestation (if necessary)

(see definition of "zonal" delousing)

Disinfestation procedures at Japanese and Korean ports of entry and debarkation.

(see Memorandum For: Imperial Japanese Government, AG 014.33 (5 Nov 46)GC, (SCAPIN 927/10) APO 500, dated 5 November 1946, subject, Repatriation.

Rodent Control

(See section on Insect and Rodent Control)

GROUP II - TSUTSUGAMUSHI FEVER GROUP

1. General

Scrub Typhus (larval mite borne)
Japanese Flood (River) Fever
Rural Typhus (S. E. Asia)
Island Fever (South Pacific)
Tsutsugamushi fever (disease mite fever)
Kedani Fever (Hairy Mite fever)
Akamushi Fever (Red mite fever)
Shimamushi fever (striped mite fever)
Yochubio (mite disease or fever)
Shashitsu (sand mite ache or fever)

Scrub typhus is an acute infectious disease caused by Rickettsia orientalis, usually characterized by the appearance of a "primary" eschar at the site of the mite's bite, sudden onset of headache, sudden fever which is continuous for 12 to 14 days and ends by rapid lysis, and the appearance of a macular exanthematous rash on the 5th to 7th day.

Akita and Niigata prefectures are the only areas involved in Japan as far as is known. Korea also has affected areas in the southern half.

2. Clinical Course

The bite of the mite may occur anywhere on the body but is most common on the neck, in the axillae and groins, and in other locations where the course of the mite is impeded by constrictions of clothing, such as collar line, belt line, top of shoes or boots, etc. Following the bite, incubation takes place in 4 to 16 days.

During the period of incubation a small papule develops which becomes encrusted. By the time of onset of symptoms the "primary lesion" is usually a black eschar 2 to 10 mm. in diameter. Onset is usually sudden and lacks prodromal symptoms. Occasional cases have malaise, anorexia, headache, dizziness, nausea and photopsia. (However, persons bitten by

an uninfected mite may complain of similar symptoms, but these subside in 2 - 3 days).

Sudden fever is the usual onset. It rises step-wise for the first four to six days, until it reaches 38.9° C - 40.6° C (102° F - 105° F) and then may be remittant for 10 to 14 days. General malaise, headache of increasing severity and sudden chills are characteristic. Conjunctivae are injected. Often restlessness, cough and delerium develop rapidly. General lymphadenopathy with tenderness appears early, especially of the regional lymph nodes draining the "primary" lesion. Less commonly slight xanthopsia, tinnitis, slight deafness, dizziness, joint pains and epistaxis are present. The pulse rate is slow and regular as a rule.

From the third to seventh day discrete a raspberry-red macular exanthem appears. Often the rash is not marked and may escape notice altogether. When the rash is apparent, it may spread from the trunk to the upper parts of the extremities. Seldom does it involve the hands, feet or face. Enanthem may appear on the soft palate and is not petechial. The rash may be of short duration.

Signs of pneumonitis are almost always found. Congestion of the nasal, mucosa may be present. Spleen is enlarged and tender during the first week.

Toward the end of the second week and during the third week after the onset of headache and fever, the temperature begins to fall remittently and intermittently to normal. Mild cases are able to resume normal activities in four to six weeks after their temperature returns to normal.

3. Complications

Pneumonia (secondary), gangrenous stomatitis, suppurative lymphadenitis, and cystitis are more frequent complications.

4. Diagnosis

a. Differentiation

In the early stage scrub typhus must be differentiated from plague, louse-borne and murine typhus, dengue, malaria and infectious hepatitis which may be in the same areas. The limited geographical distribution should reduce the error in making a tentative diagnosis. Of great help is the presence of the characteristic necrotic ulcer (eschar) with its regional lymphadenopathy.

b. Serological Differentiation

	Weil-Felix			Complement Fixation	
	OX-19	OX-2	OX-K	Louse	Murine
Louse-borne typhus	-	x	-	xxx	-
Murine typhus	xxx	x	-	-	xxx
Scrub typhus	-	-	xxx	-	-

(1) Weil Felix reaction is used to show agglutinins in rising titre for proteus OX-K in serum taken from scrub typhus patient as soon as the disease is suspected and at 2 to 5 day intervals until the diagnosis is demonstrated by a rising titre. The peak titre is usually reached during the third week and is followed by a rapid decline to negative within several weeks. A titre of 1/160 is significant if only one result is available.

(2) No satisfactory complement fixation test has been devised as yet.

c. Animal inoculation: The blood clot from a specimen taken from a patient is ground with saline, centrifuged at low speed and 0.3 cc of the supernatent fluid injected via I.P. route into white mice. Infected mice die in 10-16 days. Smears of scrapings from the serous membrane of the peritoneal cavity and of the spleen will show the causative Rickettsia when fixed with methyl alcohol and stained with Geimsa.

5. Prognosis

Signs which in combination may indicate a poor prognosis are:

a. Increase in pulse rate out of proportion to the temperature rise;

b. Onset of muscular twitchings, convulsions and coma;

c. Increasing leukocytosis with a relative and absolute decrease in lymphocytes.

Case fatality rate in Japan varies from 15 to 60%. The higher rate occurs in persons beyond 30 years of age. Age, physical condition, stage of disease on institution of hospital care, and coexistence of other diseases are factors to be considered. Other areas of the Pacific report a lower fatality rate. This may be due to a milder strain or confusion of murine and scrub typhus in areas where both diseases occur.

6. Treatment

a. Symptomatic and supportive

(1) Good nursing care and appropriate supportive therapy.

(2) Maintenance of adequate fluid intake (2000 to 3000 cc daily.)

(3) High caloric diet with high protein diet.

(4) Preferable to use penicillin instead of sulfa drugs for treatment of bacterial complications.

b. The results of experiments in the laboratory with susceptible animals indicates that the sodium salt of para-amino-benzoic acid may have beneficial therapeutic action in scrub typhus. Results of field trials conducted in Burma with this compound in patients are promising.

7. Immunity

Some immunity is conferred by one attack, but second attacks are not uncommon and are relatively mild.

8. Vaccination

No suitable vaccine has been available. Intensive research on the preparation of a scrub typhus vaccine is being carried out in the U. S. A. Laboratory results are promising.

9. Pathology

The gross anatomic changes are not striking. The lymph nodes are enlarged and, in the drainage area of the "primary" lesion, may show great enlargement as well as irregular areas of necrosis. The heart is often pale and flabby. Focal hemorrhagic mottling due to extravasation of blood is seen in the lungs, often with interstitial pneumonitis. The liver is always congested and the spleen enlarged. The brain may show multiple punctate hemorrhages.

Microscopically the section of the primary lesion consists of a necrotic cutaneous lesion with thrombosis of vessels limited to the narcotic zone. Basically the disease is characterized by a disseminated, focal vasculitis and perivasculitis of the smaller blood vessels of the skin, lungs, heart and brain. The predominating cell is a large basophilic macrophage.

The most striking lesion is found in the heart. It is a diffuse, interstitial myocarditis characterized by many large basophilic mononuclear cells. In the lungs a rickettsial pneumonia (interstitial) is found.

Sections of lymph nodes from drainage areas show large foci of necrosis. Kidney sections show changes of early acute glomerulo-nephritis. Brain lesions vary from perivascular collections of histiocytes to a typical "typhus nodule". A diffuse interstitial orchitis is occasionally seen. The arteritis is not as frequently seen in scrub typhus in any of the organs as in louse-borne typhus.

10. Etiology and Transmission

a. Causal agent is Rickettsia orientalis, an intracellular parasite found in lymphocytes and endothelial phagocytes of the tissues in the "primary" lesion, lymph nodes and spleen. It is also recovered in the blood in the incubation period. The organism shows a bluish tint with Giemsa staining and a reddish tint with Machiavello staining. It may be cultivated in the yolk of fertile hen's eggs.

b. Transmission is accomplished through the bite of certain larval mites. The "Kedani mite", Trombicula akamushi, is an orange-red color with hairy body and legs. The infection is inherited from adult mites (the larval mite feeds but once). T. deliensis is also incriminated.

(1) Life History of the Mite Vector

This group of mites of the acrine family, Trombidiidae, are commonly known as "harvest mites" and locally in Japan as "Kedani mites" (hairy mites). Adult female deposits the eggs on the ground during the summer and autumn. Newly hatched larvae usually are found attached to the inside of the ears of field mice and receive their initial infection from these reservoir animals. The engorged larvae drop to the ground, and pass through the nymphal form following which they reach maturity. The following spring adults deposit their eggs and the infection is passed through the egg to the resultant larval offspring. If man accidentally is exposed to the attack of the mites, infection results.

11. Epidemiology and Distribution

In Japan, Formosa, and Korea, the disease occurs most frequently during July and August; less so in June and September. Occasional cases are found in other months. The field mouse (vole) Microtus montebelli is the chief reservoir in Japan although other small rodents may play a role. Persons handling hemp, vegetables, grains and hay during the harvest season in endemic regions are particularly in danger of infection. Conditions that produce a moist, damp soil favorable to the development of the mite are found in fields along the course of rivers subject to frequent inundation.

12. Prophylaxis and Control

In mite infested localities certain precautions should be followed:

a. Avoid sleeping on the ground.

b. Bathe as soon as possible after exposure with strong soap.

c. Anit-mite solutions. Repellent, insect spray, clothing (dimethyl phtalate or dibutyl phthalate).

Impregnation of socks and clothing is a satisfactory method of individual protection. Good results are obtained by spraying with a "wet" or large droplet type sprayer. Two to three ounces are required to impregnant a coverall or shirt and trousers, or uniform. Repelling or killing effect on mites will last one week or longer provided clothing is not washed out.

The larval form of T. Akamushi may be destroyed by spraying infested ground with petroleum emulsion. Clean cultivation of infested areas, burning of grass and debris, flood control in frequently flooded areas and reclamation of flood lands also tend to irradicate the infestation.

OUTLINE OF SUBJECTS TO BE
COVERED IN LECTURES ON
TYPHUS CONTROL TO
PREFECTURAL AND PROVINCIAL HEALTH OFFICERS

I. Introduction: (to include)

A. General History
B. History of typhus in Japan and Korea

II. Entomology and Epidemiology:

A. Entomology of the louse and the course of the infection in the louse (intestinal tract infection which is fatal to the louse in 11 days)
B. Mechanism of infection
C. Incidence effects and mortality as influenced by:
1. Age
2. Sex
3. Season
4. Occupation
5. Resistance and acquired immunity.

(Largely a reflection of infected louse-to-man opportunity of contact)

D. Miscellaneous factors:
1. General hygiene
2. Travel and Crowds (contact chance)

III. Etiological agent and its pertinent bacteriology and immunology:

A. Definition and classification with morphology and viability.
B. Animal reactions in guinea pig, rat, mouse, and monkey.
C. Immunology in Humans: Common and specific antibodies (murine and louse borne) resulting from:
1. Infection
2. Vaccination
D. Bacteriological relationship of murine and "louse-borne" typhus (close).

IV. Pathology and Diagnosis:

A. Pathology
B. Diagnosis:
1. Symptoms
2. Signs
3. Laboratory aids:
(a) Bacteriological
(b) Immunological
(1) Weil-Felix
(2) Complement Fixation
(3) Rickettsial Agglutination test.
(c) Animal inoculation and immunity tests.

V. Clinical Course
   A. Prognosis
      1. Without vaccine
      2. With vaccine
         (a) Full course
         (b) One dose
   B. Treatment -- symptomatic

VI. Control Measure (directed at elimination of infected lice and active immunization of potential patients)
   A. Non-specific measures:
   B. Delousing procedures:
   C. Vaccination
   D. Isolation and quarantine

VII. Control Techniques:
   A. Early, rapid reporting of any headache and fever
   B. Checking of reported illness and instituting of control measures:

VIII. Organization
   A. National
   B. Prefectural
   C. Local
      1. City health officers
      2. Ku or machi health officers
      3. Case-finding teams
      4. Disinfecting teams
      5. Immunizing
      6. Special groups:
         (a) Hospitals
         (b) Jails and detention cells
         (c) Vagrant camps, dose-houses, etc.

IX. Supplies - source and amounts

X. Transportation: mobility for increased effectiveness of personnel

XI. Publicity
   A. Schools
   B. Posters
   C. Newspapers and pamphlets
   D. Radio and Movies
   E. Organized groups such as railroad workers, teachers, volunteer firemen etc.

XII. Insect and Rodent Control (emphasis on relation to murine typhus)

XIII. Discussion period.

XIV. Demonstrations - actual field demonstrations of typhus control methods, supplies, and equipment.

ADDENDA 1

TYPHUS SURVEY CARD
(sample)

CASE HISTORY

1. Number _____ 2. Name of Patient _____

3. Age _____ 4. Sex _____

5. Residence _____ Gun _____ Village

Ku _____ Cho _____

6. Place of onset of Illness _____

7. Date of onset 8. Date of first visit of doctor _____

9. Date of reporting 10. Date of hospitalization _____

11. Lice or Not? 12. Dusted or not before onset with DDT ___

Date Dusted _____

13. Vaccinated before onset? 14. Name of Hospital _____
Date vaccinated

Name of Doctor in charge _____

CLINICAL HISTORY

15. Prodromal symptoms:

a. Back pain? _____ i. Muscle pain? _____
b. Anorexia? _____ j. Diarrhea? _____
c. Nosebleed? _____ k. Insomnia? _____
d. Tired? _____ l. Chilly sensation? _____
e. Headache? _____ m. High fever? _____
f. Vomiting? _____ n. Cough? _____
g. Impaired Hearing? _____ o. Lightheaded? _____
h. Chills? _____

16. Observation:

a. Facial expression:
(1) Flushed _____
(2) Conjuctivitis _____

b. Rash: Date of Appearance
(1) Face _____
(2) Chest _____
(3) Arms and legs _____

c. Impaired Hearing _____ d. Stupor _____ e. Delirium _____
f. Excitable _____ g. Coma _____ h. Pneumonia _____
i. Heart: (1) Weak Pulse _____ j. Enlarged: liver _____
(2) Blood pressure _____ spleen _____
k. Gangrene _____ l. Pregnancy _____ (1) month _____
(2) abortion _____

BLOOD EXAMINATION

a. (Weil-Felix) Date of examinations _____ Titre _____

b. (Complement Fixation) Results
Date of examinations _____ _____

DISINFESTATION TECHNIQUES

1. Disinfestation, as applied to the extermination of lice and fleas in clothing, or bedding, may be readily accomplished by dusting with DDT insecticide powder. This procedure is simple and is particularly adaptable to field use.

2. Lice begin to die within six (6) hours after exposure to DDT powder. All are dead within twenty (20) hours after exposure. Louse eggs are not killed by DDT powder and will hatch in 7 - 10 days. Properly treated clothing and bedding remains lousicidal for 21-30 days and if not washed, will kill newly introduced lice and newly hatched nymphs during that period. It is necessary to redust the individual if the dusted clothing is changed or washed before the expiration of the hatching period of the eggs. Fleas begin to die in about four hours.

3. Procedure for Disinfestation

a. It is advantageous to set up sanitary (disinfesting) teams of 6 persons including one well-trained supervisor to direct the operation when hand dusters are used. (12 persons when power dusters are used). Individuals learning the dusting technique should remove the clothing of the first few persons after dusting to note whether the proper amount has been applied.

b. The chamber of each gun is filled to about 3/4's of its total capacity. The procedure as outlined below will deliver approximately 1½ ounces of powder per person. Less than this amount is ineffective.

c. The individual to be dusted is directed to remove hat, loosen collar and belt and to stand or sit with hat in hand.

d. Dust the hair until whited, separating the hair to insure even distribution. Dust inside of hat with band, if any, turned up.

e. Insert nozzle of powder gun in right sleeve at the wrist next to the skin with the arm held straight out to the side and at shoulder height. Direct two full plunger strokes of powder toward the arm-pit. Repeat for the left sleeve.

f. Insert nozzle in front of shirt at collar next to the skin and direct two full plunger strokes each toward the right armpit, toward the belly, and toward the left arm-pit. (3 positions).

g. Insert nozzle in back of shirt at collar next to the skin and direct two full plunger strokes each on top of the right shoulder, toward the right axilla, the middle of the back, the left axilla and on top of the left shoulder. (5 positions). Deposit additional powder on the neck band and under the collar itself where lice frequently abound.

h. Insert nozzle in front of trousers at the waist band next to the skin, with the person standing, and direct two full plunger strokes each toward the right leg, the crotch and the left leg. (3 positions).

i. Insert nozzle in back of trousers, next to the skin and direct two full plunger strokes each toward the right leg, the buttocks crease and the left leg. (3 positions).

j. Insert nozzle at belt line of trousers and deposit powder around the waist.

k. In dusting women an extra quantity of dust can be blown in at the collar, thus dispensing with dusting at the waist. It is much more satisfactory to use women teams for dusting women and infants.

l. Where multiple layers of clothing are worn, it is desirable to dust each layer of clothing.

m. With hand dusters, two full even strokes in each position are required. With the power duster, a momentary pressure on the trigger to release a like amount of powder is all that is necessary; the exact timing is learned by experience.

n. Instruct persons not to shake powder from clothing nor to wash clothing for at least 3 days.

o. Instruct persons not to bathe for 3 days.

4. Disinfesting by Individuals

a. This is readily achieved by disciplined workers who instruct each individual to shake half of the contents of a 2 ounce can of louse powder onto the head, axillary, and pubic hair; the inner surfaces and seams of underwear, shirt and crotch of trousers. Instructions should be given to take special care to rub the powder well about the inner surfaces of the collar and armpits of the underwear and shirt, particularly the seams, since lice are ordinarily found in these locations.

5. Disinfestation of Clothing and Bedding.

a. Clothing not on the person of the individual may be disinfected by dusting with louse powder. (Bedding may be treated similarly). All surfaces, including the seams and inner folds of clothing and bedding, should be treated. It is desirable to fold and arrange extra bedding in piles. Dust is applied to surfaces by inserting the nozzle between layers. Two persons should work together—one to operate the dust gun and one to manipulate the bedding. A minimum of 20 hours after exposure is required to insure death of all lice. Eggs are not destroyed by this method and louse powder must remain in the clothing and bedding

for about 10 days, or until all eggs have hatched in order to kill all newly-hatched nymphs.

b. Exposure of infested clothing and bedding to a temperature of minus (-) 23.3°C (-10°F) or colder for at least 2 hours and storage at ordinary temperatures for 3 - 4 weeks thereafter will destroy lice and their eggs. Laundering of clothing with hot water and soap will serve to disinfest such garments, but provision should be made to prevent infestation of the laundry and operators and the reinfestation of clothing subsequent to laundering or cleaning.

c. Heat. Clothing and bedding exposed to high temperatures will kill lice.

(1) Dry Heat -- a temperature of 60° C. for 30 - 45 minutes in a dry heat chamber is effective. Temperatures effective against lice will also kill the eggs and rickettsia.

(2) Steam Sterilization -- 15 lbs. pressure 15 - 20 minutes.

(3) Boiling water - 5 minutes.

6. Disinfection of Clothing and Bedding

a. Delousing with DDT louse powder does not kill Rickettsia prowazeki, the causative agent of typhus fever. Therefore, hospitals admitting patients with typhus fever must take proper precautions to disinfect the clothing of such patients. This is readily accomplished with steam sterilization or boiling in the case of articles of clothing or bedding not injured by heat. In case of woolens, leather and other such articles, disinfection should be achieved by application of cresol solution or use of dry heat.

b. Use of rickettsicidal spray (residual DDT and cresol (2% content); or pyrethrum emulsion with 2% cresol content) - (see Rickettsicidal Spray Program).

7. Disinfection and disinfestation of buildings, etc. (See Rickettsicidal Spray Program and under Murine typhus, flea control).

"ASSEMBLY LINE" DUSTING TECHNIQUE

The "assembly line" method of dust application is designed for use in mass disinfesting operations where large groups of repatriates or other persons are to be treated. This method serves to:

1. Speed up the processing operations
2. Insure a more complete application of dust
3. Distribute duties so each person employed as a worker is responsible for only one or two steps of the dusting procedure.
4. Simplify training of workers.
5. Simplify ease in supervision of work.

PROCEDURE

A. Application of insecticidal dusts to clothing of individuals should follow the recommended steps of procedure, using either power dusting equipment or hand operated dusters.

B. The Sanitary (Disinfesting) team is composed of 14 to 16 persons (7-8 men; 7-8 women) as follows:

1 - General Supervisor
1 - Assistant Supervisor (man) 1 Assistant Supervisor (woman)

Worker #1 (man)	Worker #1 (woman)
" #2 (man)	" #2 (woman)
" #3 (man)	" #3 (woman)
" #4 (man)	" #4 (woman)
" #5 (man)	" #5 (woman)

1 - baggage duster (if needed)
1 - supply man
1 - mechanic

C. Duties of team members

Worker #1 (man & woman) - dusts hat and hair
Worker #2 (man & woman) - dusts up both sleeves and under collar
Worker #3 (man & woman) - dusts down front and around neck band
Worker #4 (man & woman) - dusts down back and over shoulders.
Worker #5 (man & woman) - pants (front & rear), around waist.

D. Duties of Supervisors:

Chief - In charge of dusting operations
Assistant - (man) - Supervises work of men dusters
Assistant - (woman) - Supervises work of women dusters

E. Duties of additional personnel:

Baggage duster - applies dust to baggage
Supply man - tends to powder supply, keeps extra guns filled.
Mechanic - responsible for care of dusting equipment.

F. Operation

1. Individuals to be dusted are divided into 2 lines - one line for men and a second line for women and children.

2. Individuals leave baggage (if any) on platform where a person employed as a worker applies DDT to extra clothing, blankets, etc.

3. Individuals file by workers in proper line, where each "worker" executes the step in the procedure for which he or she is responsible.

4. Individuals, when dusted, claim their baggage and are guided to another area, or placed on board boat or train (in case of repatriates).

5. Supervisors walk between line of dusters and can easily watch the progress of the work and make corrections.

"ASSEMBLY LINE" DUSTING PLAN

MEN DUSTERS	Supply Table	Outfit Delousing	WOMEN DUSTERS
Men			Women
WORKER #1			WORKER #1
Hat and Head			Hat and Head
WORKER #2			WORKER #2
Both sleeves & under collar			Both sleeves & under collar
WORKER #3			WORKER #3
Down front & around neck band			Down front & around neck band
	Supervisor's Walk		
WORKER #4			WORKER #4
Down back & over shoulders			Down back & over shoulders
WORKER 35			WORKER #5
Pants Front & Rear Around Waist			Around Waist Front & Rear

RICKETTSICIDAL SPRAY PROGRAM

1. Circumstantial evidence has gradually been building up as regards the role that infective fecal material from lice and fleas may play in the spread of typhus fever. Experiments have shown that a spray containing a 2% cresolis content is effective in killing the causative organism of typhus fever, Rickettsia prowazeki. Based on the above information, a spray schedule, coordinated with the regular control program appears advisable.

2. Materials Available.

Sprays

Insecticide spray, DDT residual effect.

Emulsions

Pyrethrum emulsion (30X)
Pyrethrum emulsion (10X)

Cresolis

Cresolis compound - or local preparations containing cresol

Apparatus

Knapsack type sprayer
Hand, continuous operation, sprayer

3. Method of Preparation of Sprays

a. Stock materials obtained should be mixed in quantities desired, immediately preceding actual use, in areas where work is to be undertaken or at a central point and sent out with the proper typhus control teams.

b. The sprays should have a 2% cresolis compound content in the finished product. Mixing may be done in any convenient barrel, drum or tub.

c. Formulae of Sprays

Spray #1

Insecticide spray, DDT residual effect - - - 30 Liters
Cresolis compound - - - - - - - - - - - - - - - 600 cc
Add cresolis compound slowly to spray material stirring continuously with wooden paddle until thoroughly mixed. This spray to be used for residual effect DDT and for rickettsicidal effect.

Spray #2

Pyrethrum emulsion (30X) - - - - - - - - - - 1 Liter
Water - 30 Liters
Cresolis Compound - - - - - - - - - - - - - 600 cc
Add pyrethrum slowly to volume of water desired. Stir continuously until mixed. Add cresolis in same manner to mixture of emulsion and water.

This spray to be used for quick killing of fleas and for rickettsicidal effect.

Spray #3

Pyrethrum emulsion (10X) - - - - - - - - - - - 3 Liters
Water - 30 Liters
Cresolis compound - - - - - - - - - - - - - -600 cc.

This spray is prepared and used for the same purpose as spray #2 if the pyrethrum (10X) emulsion is furnished instead of the pyrethrum (30X) emulsion.

4. Spray #1 - residual effect DDT - cresolis spray

Schedule of use

Twice monthly

Railway Stations and large transfer points.
Corridors - floors and walls, seats or benches
Staircases - steps, walls, hand rails
"Rest" rooms (if any) - floors walls, stools, etc.
Offices and miscellaneous rooms.

Railway cars and coaches used for passenger transportation.
Floors, walls, ceiling, seats or benches.
Based on a III Class coach of approximately 16 x 2½ x 2½ meters, about 5 - 6 liters of spray would be required for one car.

Streetcars - Floors, walls, ceiling, seats or benches.

Buses - Floors, walls, seats or benches.

Jails and prisons - Floors and walls of cells, corridors, latrines, offices.

Infectious Disease Hospitals - Typhus wards

Vagrant houses - Floors and walls of all rooms, corridors, bath houses.

Orphanages - Floors and walls of rooms, toilets, bath houses.

Dormitories, poor farms, similar institutions, if lice are detected or cases occur.

Railway cars, street cars and buses should be marked in a prominent place with a date on which work was done.

Method of Application

Dosage rate for interior application for DDT residual effect should be approximately 1 Liter per 35 sq. meters of space.

Application

A rather coarse, wet spray should be used. Hold nozzle of sprayer close to surface to be treated, (10 - 20 cm.).
Surface should be moistened but with no run-off.
Liquid may also be applied with a large paint brush if no other equipment is available.

Precautions

Use competent trained personnel.
Open fires, electric motors, light bulbs, heating equipment, etc., should be kept out of direct contact with the spray.
Do not "fog" the spray with high pressure atomizers.
Leave doors and windows open during processing and for several hours after, until drying and ventilation is complete.
Workers should avoid prolonged contact of spray with the skin as the solvent, kerosene, will cause a mild dermatitis.

5. Spray #2 or Spray #3 - Pyrethrum - cresolis spray

Schedule of use.

These sprays are to be used in places where fire hazard is great in addition to general use.

Twice Monthly - on alternate weeks with spray #1

Railway Stations and large transfer points
Corridors, staircases, waiting rooms, "rest" rooms, offices.
Railway cars and coaches

Streetcars
Buses
Jails and Prisons
Vagrant houses
Infectious disease hospital wards

Once each week

Theaters - floors, seats, rest rooms, lounging rooms, store rooms, kitchens, sleeping quarters.

Immediately

Typhus houses - floors, beds (if any), extra clothing, bedding, mattresses. Care should be taken to treat the cracks and crevices in floors, between mats, etc. Also seams of clothing, bedding, mattresses.

This work should be done immediately following dusting operations in the home of a suspect typhus case. This work should be repeated at weekly intervals over a three week period.

6. The spray program should be coordinated with the general typhus control procedures, and should be vigorously executed during the months of December, January and February. If the typhus situation during the spring warrants a change in tactics, this spray program may be modified to meet the changing conditions.

7. The larger centers of population should receive strict attention: in particular:

Sapporo, Hakodate } Hokkaido
Aomori
Sendai
* Tokyo-Yokohama area
Nagoya
Kyoto
* Osaka-Kobe area

* Important areas.

INFORMATION CONCERNING DDT

DDT ("dichloro-diphenyl-trichloroethane") was first prepared in 1874 by Zeidler. The reaction of anhydrous chloral and chlorobenzene in the presence of concentrated sulfuric acid produced a material which in chemically pure form is a white crystalline solid, practically odorless, with low volatility, rather stable, and insoluble in water, but soluble in many organic solvents. It has the following chemical name:

1-trichloro-2.2-bis(p-chlorophenyl)ethane.

Preparation: "The compound is prepared from 1 molecule of chloral or chloral hydrate and 2 molecules of monochlorobenzene in the presence of sulfurnic acid (oleum is used commercially)."

"The DDT crystalizes from the reaction mass, and the sulfurnic acid is then removed by washing. The compound contains many isomers, in which the chlorine atoms on the benzene rings are attached in other positions, and other impurities. If pure p.p'-DDT is desired, it may be obtained by recrystallization of the technical material from ethyl alcohol. Several recrystallizations are necessary to obtain a pure product."

Technical DDT is a fine white powder which varies from yellowish white to white in color. Storage at high temperatures or exposure to sunlight does not cause deterioration. Under conditions of high humidity it tends to cake. Some producers offer a product so treated as to prevent hard clumping.

DDT insecticide is covered by patents assigned to J. R. Geigy, Basel, Switzerland, the first application for a patent being filed in Switzerland on 7 March 1940.

Toxicity: DDT acts both as a contact poison and a stomach poison for insects. The toxic effect is exerted principally on the nervous system and results in characteristic "DDT tremors", progressive paralysis and death. DDT when applied in the form of a spray or powder will continue to kill insects which come in contact with treated areas for several weeks or months.

DDT is a toxic substance to humans and care should be exercised in handling. All persons working with this material should be well trained in methods of application. Poisoning may occur from ingestion of DDT or by absorption of solutions of DDT through the skin. Therefore care should be taken to prevent contamination of foods (particularly butter, milk, etc.) by DDT. Contact with oil and organic solvent DDT spray solutions should be avoided. Inhalation of dusts containing DDT is not particularly dangerous, but when the dust cloud is dense, use of respirators is advisable.

Emulsions for impregnation of garments containing 1% DDT are safe for this use but during processing tongs should be used to handle the clothing in solution.

DDT Insecticide Preparations: DDT may be incorporated in the preparation of various insecticidal and miticidal formulae.

1. Dusts

a. Insecticide powder, louse

DDT (concentrate) 10%
Pyrophyllite 90%
To form a 10% DDT content dust

b. Larvicide DDT, powder, dusting:

DDT (concentrate) 10%
Talcum 90%
To form a 10% DDT content dust

Manufacture of 10% DDT Insecticide Dusts

"Either pyrophyllite or talc can be mixed with DDT to produce louse powder. While 10% is used in the standard Army product, the concentration is not critical and from 5% to 10% will be effective. The pyrophyllite or talc should be neutral or very slightly acid. Alkaline dusts will cause the DDT to decompose.

A hammer mill should be used for this operation. Do not attempt to use a stone mill, ball mill, paint mill or edgerunner, since the frictional heat developed will cause the DDT to soften and cake-up. A hammer mill of the blade type is to be preferred to the saddle type.

If either the pyrophyllite or the DDT is lumpy, break up the larger lumps by hand and mix 25 lbs. of DDT with 25 lbs. of pyrophyllite. This mixing can be done in any type of mechanical agitator or in a tumbler drum. Put this mixture through the hammer mill once, then add 200 lbs. of additional pyrophyllite. Mix and put through the hammer mill a second time. Do not try to put unmixed DDT through the hammer mill.

Mixing and milling equipment should be avilable in Japan and Korea. Blade type hammer mills should be available in plants which formerly ground pyrethrum flours for export."

In the specifications for DDT louse powder as used by the Army, the following is stated:

90% should pass U.S. Standard mesh #325
99% should pass U.S. Standard mesh #100
99% of the finished material should go through the U. S. Standard mesh #80.

The approximate particle size corresponding to these meshes are as follows:

Mesh #325: 44 micra
Mesh #100: 149 micra
Mesh # 80: 177 micra

2. Solutions: Several types of solutions for use as sprays may be prepared.

a. Insecticide spray, residual effect

DDT (concentrate) 5%
Methylated naphthalene 15%
Kerosene 80%

For use in the control of roaches, bedbugs, mosquitoes, houseflies, phlebotomus flies, fleas, ants, etc. A solution, giving residual effect, may be prepared by dissolving 7 pounds DDT concentrate in one gallon of kerosene. Use at rate of one quart per 250 sq. ft.

b. Insecticide, liquid, finished spray

DDT (concentrate) 1.0%
Thanite 2.5%
Kerosene 96.5%

For use as a general insecticide where the spray is applied directly on the insect by means of an ordinary hand spray gun. This spray should not be used to give a residual effect as the DDT content is too low.

c. Insecticide spray, delousing (stock solution)

DDT (concentrate) 6%
Benzyl benzoate 68%
Benzocaine 12%
(ethyl p-amino benzoate)
Tween 80 (wetting agent) 14%
Prior to use dilute with 5 parts (by volume) of water to form 1% DDT content.

Designed for use on individuals against louse infestation of the hairy parts of the body. This spray is lousicidal and ovicidal. 2/3 oz. required per individual.

Solution may also be used in the treatment of Scabies, by application to effected parts.

d. Insecticide DDT emulsion concentrate

DDT	25%
Xylene	65%
Triton x-100 (emulsifier)	10%

To be used as a 2% water dilution for louse proofing of clothing. May also be used in emulsions for preparation of larvicides, residual spraying against mosquitoes, flies, bedbugs, etc.

For impregnantion of clothing, mosquito bar, etc., dilute 1:11 by weight to form 2% aqueous emulsion. 30 gallons is sufficient for 125 suits of winter (50% wool) underwear (or garments of similar weight). One quart of solution per suit of underwear is required. 2% of dry weight of garment should be DDT.

e. Rickettsicidal Sprays (See Rickettsicidal Spray Program)

List of component ingredients of DDT insecticide products:

DDT - Technical (concentrate)

Dusts

DDT - technical
Pyrophyllite
Talcum

Solutions and sprays

DDT - technical
Methylated naphthalene
Thanite
Benzyl benzoate
Benzocaine (ethyl p-amino-benzoate)
Xylene
Kerosene - Diesel oil - Fuel oil
Tween - 80 (wetting agent)
Triton x-100 (emulsifier)
Creolis compound

RICKETTSIAL DISEASES IN JAPAN AND KOREA

Contents

ADDENDA