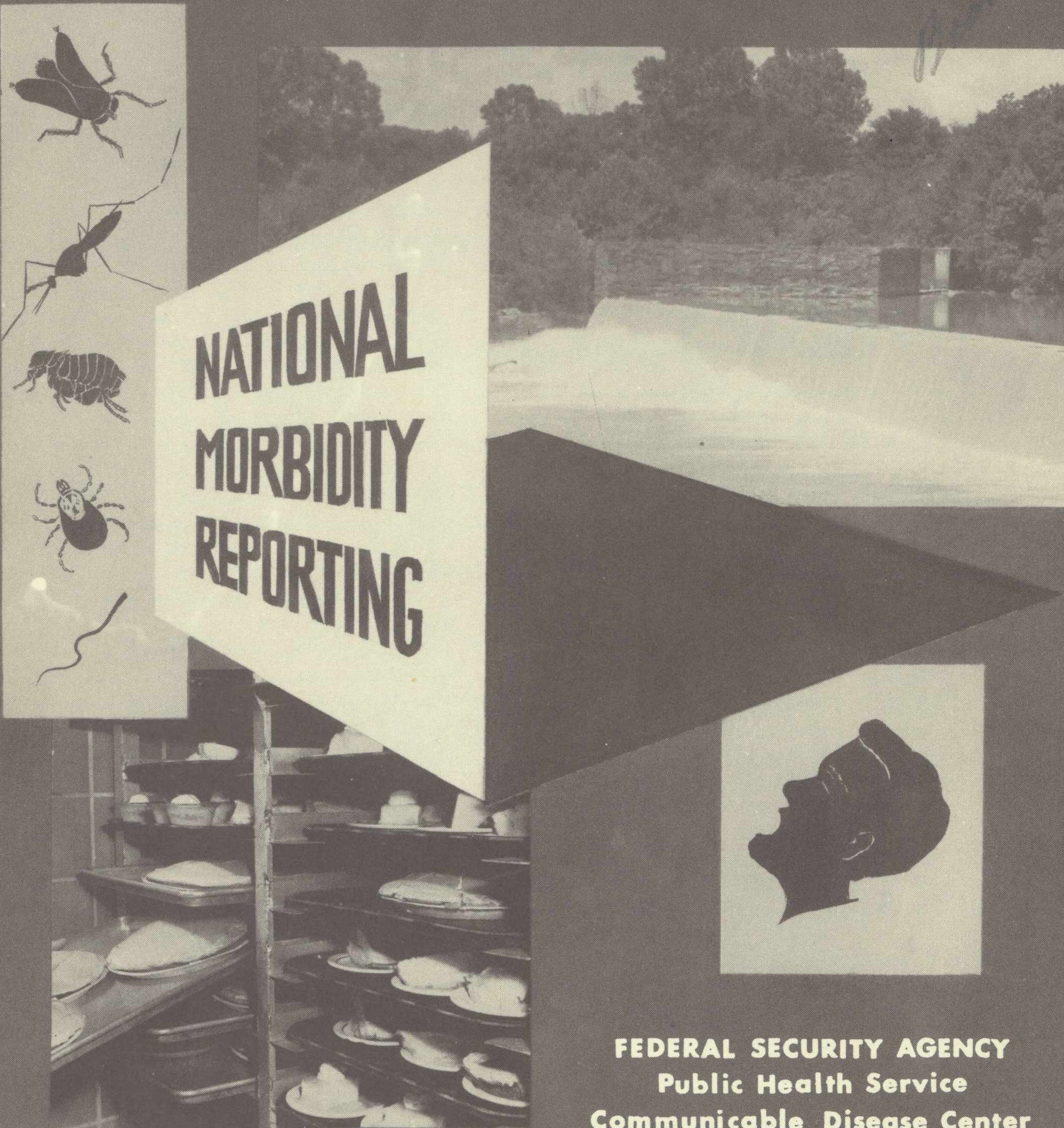
CDC BULLETIN

JULY-1951



FEDERAL SECURITY AGENCY
Public Health Service
Communicable Disease Center
Atlanta, Ga.

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Contents

COVER: The cover depicts various sources of disease – water, food, insects, parasites, and personal contact. At the Conference of State Epidemiologists on National Morbidity Reporting, the importance of prompt reporting of diseases was stressed. The first four articles were presented at this Conference, which was held April 18-20 at the Fulton County Academy of Medicine, Atlanta, Ga., under the sponsorship of the Communicable Disease Center and the National Office of Vital Statistics, U. S. Public Health Service.

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• Civil Defense Against Biological Warfare* •

ROBERT H. FLINN** and NORVIN C. KIEFER***

In this brief introductory talk, I want to explain to you the need for a national civil defense program and the type of Federal organization that is being developed.

I am certain that all of you know that a Federal Civil Defense Administration has been created by Public Law 920, and that the Honorable Millard F. Caldwell, former Governor of Florida, has been appointed its Administrator. There are to be six Assistant Administrators. One of them, Colonel W. L. Wilson, heads a Health and Welfare Office. The Health and Welfare Office consists of two Divisions: the Welfare Division and the Health and Special Weapons Defense Division.

The Health and Special Weapons Defense Division, headed by Dr. Norvin C. Kiefer, is responsible for such civil defense needs as casualty services; public health and sanitation; services to minimize the effects – on people, animals, and crops – of atomic, biological, and chemical warfare; the recruitment and training of professional, technical, and other personnel needed for these services; the provision of an effective emergency hospital and first aid system; and the plans for the procurement and use of supplies, equipment, and facilities essential to these activities.

These are only some of the most important responsibilities, not all of them. Even this abbreviated list is a most formidable one. Realization of such a program will require herculean efforts, painful sacrifices, a heavy financial burden, intelligent planning, good judgment, and unselfish cooperation.

Lest you underestimate the dimensions of the civil defense program, let me set for you a proper stage and background for your further acts and considerations:

First, Russia has the planes and the bombs to deliver an atomic attack, in force, on a dozen or more of our cities at any time.

Second, after we extend our air defense system, at least 70 percent of an attacking air force could get through. This is the estimate of General Hoyt Vandenberg, Chief of Staff of the United States Air Force. This means, then, that we cannot stop an air attack on our civilians.

Third, such an attack could be made at any time, with little or no warning. If the attack came today – and it could – we would perhaps have only one or two minutes warning. As our radar and warning systems are developed, this period may be extended to as much as one-half hour.

Fourth, our civilians may face greater personal danger than our armed forces. As Governor Caldwell recently stated, "You must realize that your own back yard may be the next front line."

Fifth, one atomic bomb may cause tens of thousands of deaths and serious injuries. Remember that one nominal bomb caused about 80,000 deaths and 100,000 injuries at Hiroshima. It is thus entirely possible that mass attacks on our country might result, in a week or even a day, in millions of casualities.

Sixth, the atomic bomb is not the only source of peril to our civilian population. Incendiary and high explosive bombs in the second World War took tolls of human lives that in some cases were as frightful as the destruction at Hiroshima and Nagasaki. In addition, there can be no doubt of the feasibility of an attack on American civilians by biological warfare or the nerve gases. To these real dangers must be added the probability of widespread sabotage.

To summarize these points, enemy attack, in force, by any of these methods, could be made at any time with little warning; we could not stop it, and many thousands, even millions, of civilian casualties could result.

We are not being deliberately pessimistic. We are reporting to you either established facts or the considered estimates of our Nation's most competent authorities. The sooner these grim possibilities are recognized, the sooner they will be accepted in true American spirit, as challenges which must be met head-on.

*Presented by Dr. Flinn to the Conference of State Epidemiologists on National Morbidity Reporting, April 18-20, 1951, Atlanta, Ga.

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But the damaging effect of such attacks can be greatly reduced by sound planning, hard work, and thorough organization. In fact, our ability to survive may well depend on the extent of our success in such endeavors. I hardly need to tell this audience that nowhere in civil defense is such planning, work, and organization more important than in health and special weapons defense services.

Let us consider the question of responsibility for civil defense. I will begin by saying bluntly that there is too much tendency to depend on the Federal Government to do this job.

I can assure you that the Federal Civil Defense Administration will do everything in its power to furnish national leadership and guidance, to provide information and advice, to establish civil defense training methods, and to help construct from individual State and local efforts an effective Nation-wide civil defense program. We have recommended Federal stores of certain health supplies to back up those in target areas and Federal grants-in-aid to help provide initial supplies within or nearby such target areas. We also have proposed expenditures for further research to devise better methods of coping with many civil defense health and special weapons defense problems, and to provide training for key personnel.

But it is State and local efforts that comprise the real substance of our civil defense program. It is the contribution of each citizen that, collectively, will determine the strength of our civil defense health and special weapons defense services.

With this in mind, let us turn now to specific considerations of biological warfare defense. I told you earlier in this speech that this phase of civil defense — whether for humans, animals or crops — is a responsibility of the Health and Special Weapons Defense Division in the Federal Civil Defense Administration.

In States, however, the organization may be slightly different because at that operating level existing agencies may be responsible for the various aspects of the program without a central coordinating agency of technical experts. Thus, the State health department may be charged — under the supervision of the State civil defense agency — with responsibility for biological warfare defense for humans; the State veterinarian, for animals; and the State agricultural department and its extension agents, for crops.

The primary interest of this group would seem to be in defense against biological warfare on people. You have heard of some of the possible methods of using biological warfare against people. I therefore am going to confine the remainder of this talk to defense measures for humans.

Defense measures can be divided into five broad categories:

1. **Detection.** A wide variety of instruments are available for air sampling, but better methods are needed and are now being devised. Recognition of the presence of biological warfare agents in air, or in water and food, is initially a task for local laboratory technicians who will need special training for this purpose. Identification of unusual agents can be made, in many instances, by State and local laboratory personnel if they have special training. The Federal Civil Defense Administration hopes to make such training available through existing Government facilities, such as the Communicable Disease Center of the Public Health Service.

Ultimate, exact identification would, in most cases, require technicians with highly specialized skills and equipment. For this we hope to use existing Federal or Federally-sponsored laboratories, organized on a regional basis that will assure adequate geographical coverage. Shipment of specimens to such laboratories should usually be by air.

2. **Epidemic Intelligence.** In many cases, particularly in diseases with short incubation periods, the first positive evidence of biological warfare attack is likely to be the occurrence and diagnosis of actual cases of the disease caused by the agent. Prompt diagnosis, followed by immediate reporting of such diseases, would be imperative. For this purpose our existing epidemiological and reporting systems require expansion and expediting. Careful integration of State and local epidemiological information into a Nation-wide network, sponsored by the U. S. Public Health Service, and close coordination with official civil defense agencies will be needed.

The cooperation of physicians in private practice, and of hospitals, would be essential to the success of such epidemiological intelligence. For actual investigations, mobile teams of qualified epidemiologists, sanitary engineers, veterinarians, public health nurses, and other professional people should be organized and available.

3. **Personal Protection.** The civil defense agency and the official health agency in each target community should be prepared to initiate a

rapid, wide-scale immunization program at any time that it is advised of the necessity of doing so. This program might consist of active or passive biological immunization if suitable preparations to combat the specific agent were available. Mass chemoprophylaxis, using drugs or antibiotics, should also be planned.

In addition, methods and materials for treatment of large numbers of victims, using biological preparations, antibiotics or drugs, should be well-organized and ready for any emergency.

4. **Collective Protection.** Protection of air in public buildings should be assured. Air conditioning systems of buildings must be protected against sabotage and any air-raid shelters that might be installed should be equipped with adequate filters.

Although security measures to protect buildings are not a responsibility of Federal, State, or local health services, advice on the effectiveness of protective measures and devices should be furnished by civil defense health and special weapons defense experts.

5. **Decontamination.** For the ground, streets, or buildings, flushing with a fire hose or, in some instances, washing with hypochlorite or other disinfectant solutions might be necessary to remove biological warfare agents. Indoors, the usual washing, airing, and sunning procedures should be used. Assurance and supervision of these services is a responsibility of the sanitation units of the State and local civil defense health and special weapons defense services.

These are, briefly, the chief categories of biological warfare defense services. Don't forget, however, that there is another large group of biological agents that State and, particularly, local civil defense services must be prepared to combat. I am referring to diseases well known to this country which always offer potential hazards following disasters.

An atomic bomb attack, for example, might result in deprivation of water, in flooding, or in loss of water sanitation facilities. Homeless people would have to use communal kitchens and thereby incur all of the risks of food poisoning and spread of diseases associated with improper food handling, loss of refrigeration, and lack of adequate dish washing and other sanitation equipment. Crowded billeting after widespread destruction of homes could greatly increase the hazard of spread of air-borne and other communicable diseases.

These possibilities constitute another or indirect form of biological warfare for which we must be prepared. Unlike biological warfare, in many instances the risk of secondary cases and extensive epidemics would be great. Furthermore, this latter form of biological warfare is more likely than any other because it can be a result of any form of enemy attack.

• Potentialities of Biological Warfare* •

KARL HABEL**

Popular books and, recently, governmental manuals have given general coverage of the subject of biological warfare. Dr. Victor Haas, Director of the Microbiological Institute of the National Institutes of Health, has published an article on the biological warfare problem and its defense in the Journal of the American Medical Association (1), and just a few weeks ago Dr. Alexander D. Langmuir of the Communicable Disease Center presented an epidemiological appraisal of the potentialities of biological warfare in Public Health Reports (2). Even television programs have presented this subject to the public. The purpose of my talk today is to emphasize one current and emergency aspect of the background problems against which the discussions planned in the next 3 days will take place. Here, in the form of the potentialities of biological warfare against man in the United States, is another practical need for the communicable disease information that can

*Presented at the Conference of State epidemiologists on National Morbidity Reporting, April 18-20, 1951, Atlanta, Ga.
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• Antimicrobial Therapy of Acute Infections* •

VERNON KNIGHT**

Today, most of the bacterial and rickettsial infections, formerly responsible for high morbidity and mortality in our population, can be successfully treated with antimicrobial agents. These dramatic results are largely achieved by the use of six antimicrobial agents; penicillin, streptomycin, the sulfonamide drugs, aureomycin, chloramphenicol, and terramycin. A consideration of the therapy of acute infectious disease may, therefore, be conveniently presented as a discussion of the use of these agents. The newest of the six agents are the broad spectrum antibiotics, aureomycin, chloramphenicol, and terramycin. This name has been applied to them because of the breadth of their spectrums of antimicrobial activity. They are active against some of the large particle viruses, the rickettsiae, Gram-negative bacilli, Gram-positive cocci, Gram-positive bacilli, and even in some of the protozoal infections.

In addition to their broad spectrums, they possess other valuable properties which enhance their effectiveness, i. e., activity after oral administration, and elimination in high concentration in the urine. Moreover, the emergence of resistant organisms has not been a problem in therapy.

As with many oral medications, gastrointestinal intolerance has occurred in a minority of cases. Nausea and vomiting and diarrhea have been the principal causes of difficulty. No successful means of counteracting these side effects has yet been evolved aside from the discontinuance of therapy when the symptoms become severe. Chloramphenicol, in our experience, has been the best tolerated of the three agents.

The therapy for many of the acute infections which are encountered today is described in table 1. The choice of agents is indicated in the order of preference. When the activity of the agent is not known, it is shown by the letter "U". In a few instances, combinations of agents are the choice of therapy and these are appropriately indicated.

*Presented before the Conference of State Epidemiologists on National Morbidity Reporting, April 18-20, 1951, Atlanta, Ga., (with additions).

**Second Medical Division Bellevue Hospital and Cornell University Medical College, New York, N. Y. Consultant CDC.

There has been a tendency in recent years to minimize the importance of pneumococcal pneumonia. This has largely resulted from the development and widespread use of specific antimicrobial therapy in its treatment. It should not be forgotten that pneumococcal pneumonia is still a common cause of serious illness and, as an example, in the past 3 years in the Cornell Service at Bellevue Hospital, an average of 75 cases of pneumococcal pneumonia has been treated. In addition to the pneumococcal pneumonias, there is a group, almost as large, in which the etiology is undetermined. These are for the most part presumed to be bacterial in origin. A number of such patients give a history of treatment with penicillin or other agents before admission to the hospital which probably explains the failure to isolate pneumococci from their sputa. The response of both groups of patients to antimicrobial therapy has been satisfactory with a somewhat greater uniformity of response among the patients with known pneumococcal infections. The broad spectrum antibiotics in particular have provided excellent results and it is felt that they can be appropriately used in any usual case of pneumonia. Their effect in complications of pneumonia is at present being evaluated. It should be noted that in a large group of patients under our observation, the serious complication, empyema, has not occurred once after therapy has been thoroughly established.

Typhoid was first effectively treated with chloramphenicol in 1948 by Woodward and Smadel, and their associates (1). Since then a host of reports have appeared which confirm their observations. One of the problems which they and others observed was a latency of effect of drug therapy for as long as 3 or 4 days after start of treatment. In seriously ill patients, this interval was sufficient to permit the grave complications of massive gastrointestinal hemorrhage or perforation of the small bowel to occur. In an effort to avoid this dilemma, Smadel and his associates (2), and Woodward, *et al.* (3), have recently reported the use of cortisone as an adjuvant in the treatment of typhoid. When used in sufficiently large doses in conjunction with chloramphenicol, defervescence occurred in one group

Table 1
ANTIMICROBIAL THERAPY OF ACUTE INFECTIONS*

Disease or Infective Organism	Aureomycin	Chloramphenicol	Terramycin	Other agents or combinations
Hemolytic streptococcus, Group A	II	II?	II	I = Pen
Subacute bacterial endocarditis				
Streptococcus viridans	II	U	U	I = Pen
Streptococcus, Group D	II	U	U	I = Pen + SM
Staphylococcus				
Furunculosis	I	U	U	I** = Pen; SM; AM; TM; in various combinations
Osteomyelitis	II	U	II	
Bacteremia	II	U	U	
Pneumococcal pneumonia	II	II	II	I = Pen
Urinary tract infection				
Escherichia coli	I	I	I	
Aerobacter aerogenes	I	I	I	
Bacillus proteus	III	III	III	Combination with SM may improve results
Pseudomonas aeruginosa	III	II	III	
Typhoid	III	I	III	Cortisone may be valuable adjuvant in critical cases
Bacillary dysentery	II	II	U	
Acute and chronic brucellosis	II	II	II	I = Broad spectrum agent + SM
Plague	II	II	II	I = SM alone, or + SDZ, AM, or CM
Tularemia	II	II	II	I = SM alone, or + AM, CM, or SDZ
Friedlander's bacillus infection	II	II	II	I = SM + one of the broad spectrum agents
Influenza bacillus meningitis	II	II	U	I = CM + SDZ + serum
Pertussis	II	II	U	I = to be determined
Anthrax	II	U	II	I = Pen
Meningococcal meningitis	II	U	U	I = SDZ, Pen = II
Gonorrhea	II	II	II	I = Pen
Syphilis	II	II	II	I = Pen
Lymphopathia venereum	I	I	I	
Primary atypical pneumonia	I	I	I	
Ornithosis-psittacosis	I	I	I?	
Rickettsial infections	I	I	I	
Amebic dysentery (enterocolitis)	II	III	II	AM and TM may prove to be I
Fungus infections	O	O	U	

*Key to symbols:
- I - drug of choice
- II - effective; requires further evaluation
- III - slightly active; not dependable
- O - no effect
- U - unknown

- SM - dihydrostreptomycin or streptomycin
- Pen - penicillin
- SDZ - sulfadiazine
- AM - aureomycin
- CM - chloramphenicol
- TM - terramycin

**Selection based on *in vitro* sensitivity tests.

of patients, reported by Smadel, in an average period of only 15½ hours after start of treatment. This is an impressive result, and although evaluation of untoward effects after cortisone are not complete, the required interval of cortisone therapy is so short as to suggest that it could be safely employed in patients seriously ill with typhoid.

The treatment of brucellosis has changed radically since the broad spectrum agents have become available. It has been found that the acute manifestations of the disease are regularly controlled with these agents alone. Relapses have occurred frequently, however, and this presented an additional therapeutic problem. Herrell and Barber (4) have recently met this situation by the administration of streptomycin in combination with one of the broad spectrum agents, aureomycin. No bacteriologic relapses were observed in a 35-case study and in only one instance were symptoms observed which suggested a recurrence of the infection. These results offer convincing evidence of the benefit of this combined therapy and consequently it has been incorporated into table 1.

Anthrax was a serious disease in earlier times in this country and is still an important problem in many parts of the world. Occasional importations of wool or goat hair or other animal products have been followed by localized outbreaks of the infection in the United States. One occurred recently in Philadelphia. Untreated, the disease may be very serious and is often fatal. When appropriately treated, however, the recovery is uniform and rapid. In figure 1 may be seen photographs of a patient with a malignant pustule of anthrax over her left cheek. It developed several days following the slaughter of a beef animal. Cultures yielded a heavy growth of *Bacillus anthracis*. At the time the first picture was taken she was started on terramycin by mouth, 4 gm. daily. In the succeeding two photographs, she is seen at 24 and 72 hours after start of therapy. The rapid clearing of the infection was easily apparent and is evident in the photographs. Cultures of the lesion after start of therapy were negative on several occasions and recovery was entirely uneventful and satisfactory. Penicillin and aureomycin are likewise effective in the treatment of anthrax infections.

One of the most important groups of communicable diseases today for which effective therapy is still not available are the virus infections. Among the more serious are poliomyelitis, influenza, hepatitis, the encephalitides, and the exanthematous diseases. One of the latter, smallpox, periodically causes great apprehension when it appears sporadically in large population centers. In figure 2 may be seen a photograph of a patient with smallpox. This picture was taken about the tenth day of the patient's illness. At the time he was under treatment with terramycin. He improved only gradually following treatment and it was felt that this agent did not influence the course of his illness. Penicillin has similarly been used in the treatment of smallpox and the results of these studies as well as the present observations suggest that antimicrobial therapy is useful only in controlling a secondary infection which may occur in the disease. All of the antimicrobial agents

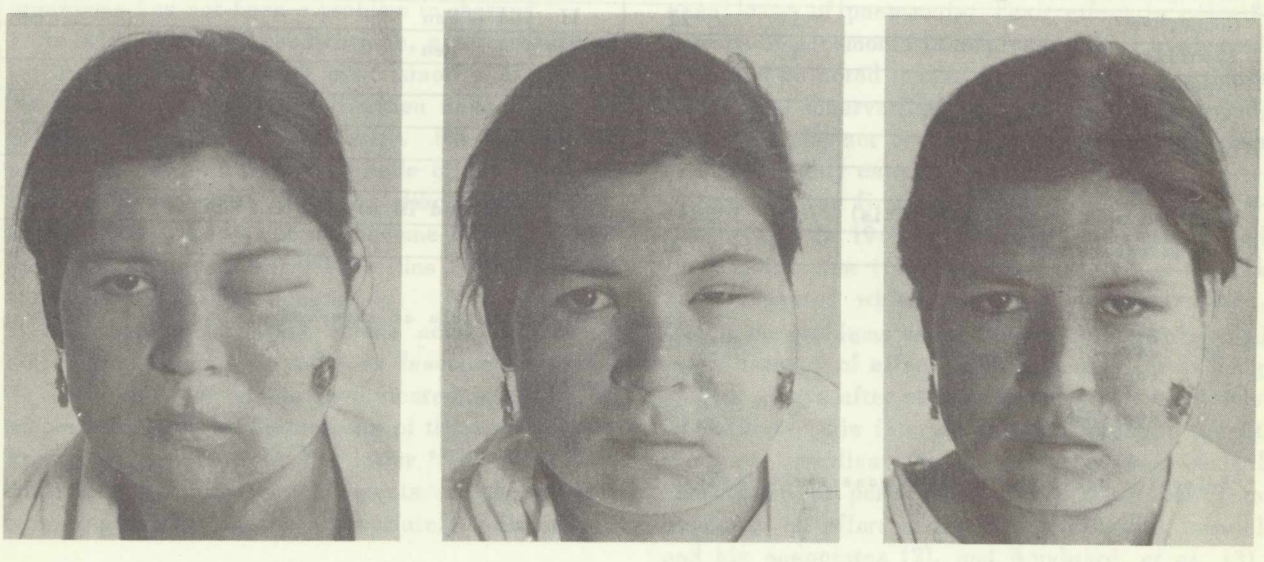

Figure 1. Course of anthrax infection following terramycin. **Left:** Before treatment. Cultures positive for anthrax bacilli, intense inflammatory reaction. **Center:** Twenty-four hours after start of terramycin. Definite reduction in local reaction. Cultures no longer positive for anthrax bacilli. **Right:** At 72 hours, asymptomatic. Recovery uneventful. (Reproduced from Knight, V., N. Y. State J. Med. 50:2177, (Sept. 15) 1950 with permission).

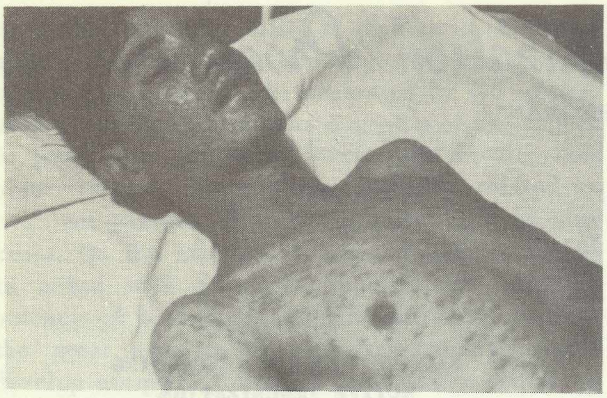

Figure 2. Patient in tenth day of illness with smallpox. He was treated with terramycin without definite evidence of activity although recovery ensued. (Photograph by courtesy of Dr. Amado Ruiz-Sanchez, Guadalajara, Mexico).

have been extensively tried in most of the serious virus infections without any evidence of specific activity. At present it seems best to employ antimicrobial therapy in these diseases only when secondary bacterial infections occur in the course of the illness.

Another problem of antimicrobial therapy which may face any of us is that of caring for the victims of an atomic attack. It is estimated that in such a situation every individual who sustained an injury of any consequence would require some type of antimicrobial therapy. The majority of the cases would likely be flash burns and blast injuries with only about one-fifth of the injuries resulting from exposure to ionizing radiation. The benefits of antimicrobial therapy in the former two groups are well known by experience with burns and blast injuries from other sources and need not be discussed.

Antimicrobial therapy of large numbers of cases of radiation disease is largely predicated upon the results of animal studies. From the standpoint of infection, radiation causes two important types of injury. First, there is widespread destruction of the blood-forming organs and lymphoid tissue; second, the skin and gastrointestinal tract may be so damaged that necrosis and ulceration occur. The effect of these injuries is to deprive the body of defense mechanisms against infection and at the same time provide a pathway for the entrance of pathogenic organisms into the body. Experiments in animals have revealed that the large bowel is a particularly important source of infection in radiation injury, and the causative organisms are frequently Gram-negative bacilli. It was found that streptomycin and the broad spectrum agents, alone and in combination, were helpful in prolonging the life of mice exposed to large amounts of ionizing radiation, and it is anticipated that they would be highly effective in a similar situation in humans. Many other types of infection are known to have complicated radiation disease in humans, and it would be difficult to exaggerate the demands for antimicrobial therapy, or the benefits from its use in the event of an atomic bombing.

In summary, aureomycin or chloramphenicol, terramycin, penicillin, streptomycin, and the sulfonamide drugs provide specific therapy for many of our most serious infectious diseases. Virus diseases, in general, remain outside the range of effective therapy of these and other agents. Cortisone as an adjuvant therapy in typhoid has been described. Finally, the problem of antimicrobial therapy in an atomic disaster is briefly discussed.

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• Recommended Immunization Procedures* •

MYRON E. WEGMAN**

Proper use of immunization procedures in the control of communicable disease may be approached through review of the official statement on "The Control of Communicable Diseases in Man," published by the A.P.H.A., 7th Edition, 1950. An interesting division of recommendations regarding immunizations is presented in table 1. For 61 diseases there is a statement that no immunization procedure is indicated. For 13 diseases immunization is recommended with certain limitations or restrictions, and for only 4 diseases, smallpox, diphtheria, whooping cough, and tetanus, is routine immunization recommended.

It is to be noted that even where immunization is recommended routinely, it is aimed primarily at the younger age groups in the population. The age distinction is significant and may be interpreted as directing the procedure at a portion of the lifetime of the entire population rather than a particular group of the population per se. As will be pointed out subsequently, there is strong argument for not treating immunization as a specialized effort, but rather for integrating it with a general plan for child health supervision.

Every physician has at least two objectives in regard to any immunization. First he wishes to raise the individual's immunity to the highest level possible. Secondly he realizes that the protection afforded any one person is a composite of his own status and the status of those to whom he may be exposed. Interest in raising the general level of immunity in the entire community thus becomes a matter of enlightened self-interest as well as a realization of social responsibility. The community is fundamentally a collection of individuals. This concept becomes of particular importance in planning all-inclusive programs. Furthermore, proper planning is closely related to accurate morbidity reporting, which can directly help to indicate the desirable focus in a particular community at a particular time.

Table 1

RECOMMENDATIONS* REGARDING ACTIVE IMMUNIZATION

I. No immunization recommended: 61 diseases	
II. Immunization under special circumstances:	
Cholera	Rabies
Influenza	Rocky Mountain spotted fever
Leptospirosis	Tuberculosis
Mumps	Typhus
Paratyphoid Fever	Typhoid Fever
Plague	Yellow Fever
Pneumonia	
III. Routine immunization:	
Diphtheria	Tetanus
Pertussis	Smallpox

*Control of Communicable Disease in Man – 7th Ed., 1950 American Public Health Association.

Of the standard procedures, smallpox vaccination, the oldest and perhaps most widely practiced technique, receives first attention. Little that is new has been added. Fresh vaccine, applied by multiple pressure to the upper arm, early in the first year of life, with revaccination desirable at school entrance, are still most important considerations. Perhaps too little emphasis has been placed on the need for taking family history, and on the realization that the only real contraindication to smallpox vaccination is the presence of an active skin eruption in the patient or an unvaccinated sibling. We see far too many cases of eczema vaccinatum in younger siblings of children vaccinated in a grand round-up at school entrance.

Diphtheria immunization is a tested procedure which has played an important role in the decline

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in incidence and mortality of diphtheria. There is general agreement that two doses of alum toxoid, totalling at least 80 lf., separated by 4-6 weeks, are essential. Infants under 6 months of age appear to produce protective levels less readily than older infants, a condition probably related to transient passive immunity, acquired via the placenta. On the other hand, when diphtheria toxoid is mixed with pertussis vaccine the antigenic potency of both appears to be enhanced so that the great majority of even very young infants develop adequate protective levels. The difference between early and late immunization thus is quantitative and the general effectiveness of early immunization permits ready integration with a planned program of child health supervision. To insure proper and prolonged protection adequate booster injections are necessary, one a year or less after the primary series and another at school entrance. How many other boosters are needed will depend to some extent on the prevalence of diphtheria in the community, another indication of the need for accurate and complete morbidity reporting.

The danger of pertussis is greatest in the first few months of life and it has been demonstrated repeatedly that immunization in this period is safe and practical. Although the majority of infants develop adequate immunity at this early age, a substantial portion do not and even those who do are not likely to have adequate protective levels until 2 months after immunization is begun. Thus it becomes important to immunize and maintain immunity in the other children in the family who may bring pertussis to the infant. To achieve this end, as in diphtheria prophylaxis, the plan must be integrated with the general program of child health supervision, in order to reach the maximum number.

An important consideration favoring early immunization is the ease of reaching the largest portion of the infant population. Experience in child health conferences indicates that the attendance decreases as age advances. It is probably a safe assumption that the same thing is true in the physician's office, as the need for feeding advice and general supervision becomes less apparent to the mother.

The most effective vaccine appears to be an alum precipitated or adsorbed concentrate of killed phase I *Hemophilus pertussis*. Difference of opinion exists as to size of dose and number of injections. Three injections containing at least 10,000 million bacteria per injection, 4-6 weeks apart, are generally used, although successful results have been reported with only 2 injections of this size. Others insist that superior results are obtained only when the total dose reaches 80,000 million. Again booster doses are important, a year after the primary series and at school entrance.

The value of tetanus toxoid seems to be so unequivocal and the ability of even newborn infants to produce adequate protective levels so consistent that routine inclusion of tetanus toxoid is now generally practiced. A device for informing hospital and accident room attendants of prior active immunization in tetanus still needs to be developed. Too often tetanus antitoxin is given needlessly.

Of the procedures employed under special circumstances, passive prophylaxis of measles in intimate household contacts between 6 months and 3 years requires emphasis. Here a direct connection with complete morbidity reporting is apparent. Early knowledge of the case allows provision for insuring that younger siblings receive gamma globulin. On the other hand, it appears logical that major effort to accomplish this end needs to be directed at education of physicians to initiate action when the diagnosis is made. Plans depending on reporting serve primarily as secondary adjuncts.

Typhoid immunization is a measure to be reserved for special indications. The disease has by no means been wiped out, but measures other than immunization are more important in control. Children are less likely to be exposed than adults and routine immunization of children is thus not widely practiced.

Immunization against influenza has been complicated by rapid discovery of new strains. There seems little justification for routine administration of even so-called polyvalent material to infants, children, or even adults unless there is evidence that a particular epidemic is related to a strain contained in the vaccine.

The point was made earlier that effective continued immunity, protecting children against pertussis and its serious complications in the first months of life, or against diphtheria with its serious complications in the preschool years, demands effective integration with an organized plan of child health supervision. A typical plan now in use on the Louisiana State University Service at Charity Hospital in New Orleans is presented in table 2. It is designed to accomplish essential procedures with a minimum of visits during the

Table 2

CONDENSED MINIMUM SCHEDULE OF WELL BABY VISITS AND IMMUNIZATIONS

Newborn Period	- Discussion with mother on parent-child relations, schedule and feedings.
1 month	- Examination and conference with mother.
2 months	- Conference. First injection diphtheria - tetanus - pertussis combined.
3 months	- Conference. Second injection D - T - P.
4 months	- Conference. Third injection D - T - P.
5 months	- Conference. Vaccination against smallpox.
6 months	- Conference and examination. Record result of smallpox vaccination and revaccinate if necessary.
7½ months	- Conference.
9 months	- Conference.
12 months	- Conference and examination. Booster dose D - T - P.

period when parents are most likely to seek care for their well babies for general reasons of feeding and growth and development, and to maintain and improve this immunity through feasible booster doses. Furthermore, immunization is placed in proper perspective in relation to other components of child health supervision.

Visits for conference and examination should be made every 6 months thereafter, although more frequent discussion of habit development in the second year is desirable. A second booster dose for diphtheria, pertussis, and tetanus may be given at about 3 years of age. A booster for diphtheria and tetanus should be given at school entrance.

If the intervals between injections exceed the one specified, continue the immunization schedule unchanged.

Well planned immunization procedures are an important component in the control of childhood disease, toward which morbidity reporting is primarily directed. They may be applied effectively in a limited number of diseases. Attention to proper age for initiation and booster doses with regard both to individual immunity status and ease of reaching the largest proportion of the population, are essential to success.

Have you read ---?

DEFENSE

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BIOLOGIC WARFARE

Haas, Victor H.: Medical aspects of civil defense in biologic warfare. J.A.M.A. 145(12): 900-905 (1951). This paper constitutes a timely discussion of the problems which the use of biologic warfare by an enemy nation would create. In the second section, the author points out some defensive measures which could be taken to combat this type of warfare. This paper is one of a series requested by the Council on National Emergency Medical Service of the American Medical Association to inform the medical profession on problems pertaining to civil defense.

AIRPLANE LARVICIDING

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• Motion and Time Study •

RESIDUAL HOUSE SPRAYING EQUIPMENT AND CREW-SIZE COMPARISON

JOHN F. DWIGGINS, J. A. Sanitarian (R)* and J. W. CULLER**

During the 1950 malaria control season, a cooperative study of residual house-spraying equipment and techniques was undertaken by personnel of the Communicable Disease Center, and the South Carolina State Department of Health. The data gathered, indicating crew size and equipment which are most economical of operational time, will be useful for future planning. Although the comparative economy of some individual factors is indicated in this report, the final basis for comparison is the net cost per house-spray application.

OBJECTIVES

The study had two principal objectives:

1. To compare the operating data of one- and two-man crews, both crews using similar types of hand-spray equipment, in order to ascertain reasons for differences in the crews as measured by cost per house sprayed.

2. To compare the operating data for (a) standard 4-gal. hand cans, (b) standard cans with the hand pump replaced by a Schraeder valve and a truck-mounted air reservoir, (c) a constant-pressure hand can with self-contained air reservoir, and (d) power-spraying equipment, in order to ascertain major factors affecting the cost per house sprayed.

METHODS

Timing observations were made in rural areas of two counties where residual spray programs had been conducted during the five previous seasons. Local factors such as types of roads, distance between houses, and types and sizes of houses could be considered typical of rural areas throughout the residual spray program. Plans for field timing observations were made to permit collection of data without changing or interfering with normal operational or crew-activity schedules. Table 1 summarizes basic data of the observed operations.

Householders were customarily contacted in advance to obtain permission to spray their dwellings, and to allow them time to prepare for the spraying. The crew members allotted two 15-minute periods each day for contact purposes, one before lunch and one just before quitting time in the afternoon. This procedure usually was satisfactory. Occasionally, however, when a high refusal rate was encountered, it became necessary to spray houses at the time permission was given to spray. In these instances no charge was made for contact time since it was impractical to separate accurately the time devoted to selling the spray job and that recorded under elements 5 and 6 (table 2). The quantity of data resulting from the observations outlined in table 2 was considered the minimum from which reliable results could be obtained. Four experienced spray men were selected for observation in crew comparisons and one of the four was observed for equipment comparisons. All were classified as "Good" by the State and county supervisors. In determining the extent of spraying at each house the following policy was used:

1. If the house was not well screened, DDT spray was applied to all inside rooms, the privy, weather-protected porch surfaces, eaves, and a band outlining windows and the undersurface of the house next to the outside sills. If householder refused inside spraying, no surfaces were treated.

2. If the house was well screened, procedure was the same as in 1, excluding inside rooms.

Time data for all activities during the day were recorded during field observation by readings to the nearest 5 seconds taken from a continuously running watch. The beginning and ending times for each operation at a house were recorded on time sheets similar to the sample shown in table 2. The amount of emulsion discharged at each house was obtained by weighing the spray can after completion of each house and calculating the weight of material discharged. Speedometer readings to the nearest one-tenth mile also were recorded at each stop.

FIELD OBSERVATIONS

To summarize operational time value data, man-

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Table 1

TABULATION OF OBSERVATIONS AND PURPOSES

Crew Size and Number	Man No.	Experience	Days Observed	Purpose of Observation
PART I				
One-Man Crew No. 1	Man No. 1	6 years (Power, Hand Cans)	4	One-Man Crew and Standard Hand Can Efficiency
One-Man Crew No. 2	Man No. 2	6 years (Power, Hand Cans)	4	One-Man Crew and Standard Hand Can Efficiency
Two-Man Crew No. 3	Man No. 1 Man No. 2	6 years each (Power, Hand Cans)	4	Two-Man Crew Efficiency
Two-Man Crew No. 4	Man No. 3 Man No. 4	2 Years each (Hand Cans)	4	Two-Man Crew Efficiency
PART II				
One-Man Crew No. 1	Man No. 1	2 years each (Hand Cans)	3	Hand Can Schraeder Valve No Hand Pump
One-Man Crew No. 1	Man No. 1	2 years each (Hand Cans)	3	Constant Pressure Spray Can
One-Man Crew No. 1	Man No. 1	2 years each (Hand Cans)	3	Power (Hose) Spraying Equipment

minutes of similar elements of table 2 were combined for each size crew. Totals of these values are shown in table 3. Totals for distances traveled between base and field, and amount of emulsion discharged also are shown.

The actual cost per house sprayed was selected as a basis for comparison of crew size efficiencies. The average cost of spray crew labor on the South Carolina program is $0.787 per hour. A transportation cost of $0.0488 per mile, including operation, maintenance, and depreciation was determined from annual automotive cost records for the State.

ANALYSIS OF DATA

In order to evaluate statistically the data in table 3, total values of combinations containing elements 18, 19, 20, 21, and 3 (contact time) were averaged as a group for both one- and two-man crews. Elements 1 through 14 included under the heading, "Time at Houses Sprayed" were averaged separately for the different size crews. Numerical values of the averages for time and distance were determined by equating totals from table 3 as follows:

Time and Distance Averages for One- and Two-Man Crews (Data from Table 3)

A = Average Truck Time between Field and Base (both ways)

$$= \frac{1,217.9 + \frac{1,175.9}{2}}{16 \text{ days}} = 50.37$$ truck minutes/day (Elements 18 and 19)*

B = Average Truck Time at Houses Contacted (Elements 1-14 inclusive)

$$= \frac{144.1 + \frac{317.7}{2}}{74 + 130} = 1.49$$ truck minutes/house-to-house trip

C = Average Truck Time between Houses Sprayed and Contacted (Element 21)

$$= \frac{334.4 + \frac{1,300.9}{2}}{74 + 75 + 130 + 106 - 16} = 2.669$$ truck minutes/house-to-house trip

D_1 = Average Time at House Sprayed by One-man Crew (Elements 1-14 inclusive)

$$= \frac{2,690.8}{75} = 35.88$$ man-minutes/house

D_2 = Average Time at House Sprayed by Two-man Crew (Elements 1-14 inclusive)

$$= \frac{4,366.2}{106} = 41.19$$ man-minutes/house

E = Average Time Cleaning and Storing Equipment (Element 20)

$$= \frac{65.7 + 151.4}{24 \text{ cleanings}} = 9.05$$ minutes/man/day

K = Average Number of Contacts per House Sprayed

$$= \frac{74 + 130}{75 + 106} = 1.127$$ contacts/house sprayed

L = Average Distance from Base to Field to Base

$$= \frac{395.52}{16} = 24.74$$ miles

X_1 = Average Houses Sprayed per Day, One-man Crew

$$= \frac{75}{8} = 9.37$$

X_2 = Average Houses Sprayed per Day, Two-man Crew

$$= \frac{106}{8} = 13.25$$

*Elements mentioned are shown in table 2.

Table 2

SPRAY OPERATIONS TIME SHEET

DATE 5/30/50 HOUSE NO. 4-C112 CREW NO. 2 STATE S. Carolina COUNTY Calhoun
NO. ROOMS 5 MAN NO. 2

TYPE EQUIPMENT: HAND X POWER ____ (See Over) 5% EMULSION – GAL. OR 35 #WEIGHT

(Readings are in minutes and seconds)

DO NOT WRITE HERE	TIME			TIME ELEMENTS AND REMARKS
	18:55		1	ARRIVAL AT HOUSE SPEEDOMETER READING 18.1
0015	20:10 20:25	B E	2	UNLOADING SPRAY EQUIPMENT FROM TRUCK
0050	18:55 19:45	B E	3	TALKING WITH HOUSEHOLDER INCL. FEE COLLECTION ☐ CONTACTED PREV. ☐ Walk in and back; Talking
1135	: :	B E	4	FILLING & AIRING CANS (Show number of cans filled and aired) 2315/2350 X 2350/2440 W 2440/2520 C 2520/2535 X 2535/2635 A 3200/3235 RA 3925/4000 X 4000/4130 W 4130/4145 X (over)
1845	: :	B E	5	WALKING AND SPRAYING HOUSE 3445 4325 5000 5940 3900 4920 5505 0310
	: :	B E	6	WALKING AND SPRAYING PRIVY NONE
1145	: :	B E	7	WALKING & SPRAYING OUTBUILDINGS INDICATE NUMBER ____ 2035 2710 3235 0310 2255 3200 3445 0535
	: :	B E	8	PREPARATION OF ROOMS --MOVING ☐ AND COVERING ☐ FURNITURE
	: :	B E	9	RESETTING FURNITURE
0345	: :	B E	10	(INDICATE TIME USE) Walking 2025/2035 WH 2255/2315 WT 2635/2710 WH 3900/3925 WT 4245/4325 WH 5505/5535 WT 5915/5940 WH 0535/0615 WT
0025	: :	B E	11	(INDICATE TIME USE) 1945 Record house number 2010
	: :	B E	12	CLEANING NOZZLE SCREEN
0105	06:15 07:20	B E	13	LOADING SPRAY EQUIPMENT ONTO TRUCK
4825	07 20		14	DEPARTURE (SEE OVER)
—	: :	B E	15	MIXING & LOADING OF CHEMICALS AND EQUIPMENT AT BASE (A.M.)
	: :	B E	16	SERVICING OF VEHICLE
	: :	B E	17	CHARGING AIR TANK
	: :	B E	18	TRAVEL TO FIELD SPEEDOMETER READING (BEGINNING)
	: :	B E	19	RETURN TO BASE SPEEDOMETER READING (END OF DAY)
	: :	B E	20	CLEANING & STORING EQUIPMENT
0610	12:45 18:55	B E	21	(INDICATE TIME USE) Travel from previous house

Note: See reverse side for code.

Table 2

SPRAY OPERATIONS TIME SHEET
(Continued)

a) **GEOGRAPHICAL PORTION OF COUNTY OPERATED** Section C, Adjacent Orangeburg Co. Line

b) **TOTAL RURAL HOUSES IN COUNTY**

c) **AVERAGE NUMBER OF HOUSES PER SQUARE MILE**
FS 3530

d) **VEHICLE: MAKE** Internat'l **TYPE** ½T-PU **MODEL** 48 **CONDITION** VG

e) **AIR COMPRESSOR - (Check) MAKE** - -

f) **RESERVOIR TANK CAPACITY** - -

g) **EMULSION CONTAINER CAPACITY** - - **TYPE** - -

h) **WATER CONTAINER CAPACITY** 55 gal. **TYPE** Commercial

i) **CONCENTRATE CONTAINER CAPACITY** 2 ea. - 5 gal. GI Cans

j) **SPRAY CANS: MAKE** Hudson **NUMBER** 3105 **SIZE** 4 gal. **NOZZLE SIZE** 8002
(60 strokes)
INITIAL PRESSURE 50 # **MODIFICATIONS** Pressure Gauge Added

k) **PRESSURE BY** Hand Only

l) **DUTIES OF CREW MEMBER:** Contacting, routing, spraying

m) **NUMBER OF YEARS OF RESIDUAL SPRAY EXPERIENCE**

n) **REMARKS: (NUMBERS REFER TO TIME ELEMENTS ON REVERSE SIDE)**

4145	4920	5535	5635	5725	5755	5810
A	RA	X	W	C	X	A
4245	5000	5635	5725	5725	5810	5915

Note in Filling and Airing the following code symbols were used:

X - Remove spray can lid

W - Add water to can

C - Measure and pour in concentrate

X - Replace spray can lid

A - Pump with air

RA - Re-air

Note in recording "Walking," Item 10, WH - Walk to house; WP - Walk to privy; and WT - Walk to truck

o) **OBSERVER**

Table 3

TABULATION OF OPERATIONAL MAN-MINUTES AND OTHER DATA

Operational Elements	Element No. in Table 2	One-Man Crews	Two-Man Crews
Travel between Field and Base	18, 19	217.9	1,175.9
Cleaning and Storing Equipment	20	65.7	151.4
Contacts to Arrange for Spraying	1-14, inclusive	144.1*	317.7**
Travel between Houses Sprayed and Contacted	21	334.4***	1,300.9†
Time at Houses Sprayed	1-14, inclusive	2,690.8	4,366.2
Total Time		3,563.6	7,312.1
Total Distance Traveled between Houses (Miles)		80.0	115.5
Total Distance Traveled between Base and Field (Miles)		107.02	288.5
Total Pounds Emulsion Discharged		1,768.5	2,656.0

*74 houses contacted in advance.
**130 houses contacted in advance.
***74 contacted - 75 sprayed
†130 contacted - 106 sprayed.

If one should substitute the average values for related symbols in the formula of table 4, columns 1 and 2, only 462 productive man-minutes or 7.7 hours for a one-man crew work day and 854 man-minutes or 14.2 hours for a two-man crew, columns 3 and 4 would be accounted for. Since payment is made on an 8-hour basis, these totals should be 480 and 960 man-minutes respectively. The cost for labor per house sprayed is then $\frac{8 \times 0.787}{7.7}$ = $0.82/hour or $6.30/day for one-man crews and $\frac{16 \times 0.787}{14.2}$ = $0.89/hour or $12.60/day for two-man crews.

Transportation and Labor Costs (Actual Average):

Cost of One-man Crew.

Base to Field and Return		
24.74 Miles (@) $0.0488	=	$ 1.21
Between Houses Contacted and Sprayed		
0.530 x $0.0488 x 9.37-1	=	0.22
Total Transportation		1.43
Total Labor		6.30
Total Per Day		7.73
Total Per House		0.82

Cost of Two-man Crew.

Base to Field and Return		
24.74 Miles (@) $0.0488	=	$ 1.21
Between Houses Contacted and Sprayed		
0.53 x 0.0488 x 13.25-1	=	0.32
Total Transportation		1.53
Total Labor		12.60
Total Per Day		14.13
Total Per House		1.06

According to these data the cost per house treated by a one-man crew is approximately $0.24 less than the cost of a similar treatment when made by a two-man crew.

To determine the number of houses which could have been treated, had an 8-hour day been devoted to productive work, the formula was made to equal 480 and 960 man-minutes respectively. By substituting known values and solving for X_1 and X_2, the one-man crew should have treated 9.8 houses per day and the two-man crew should have treated 15.5 houses per day. Adjusted values are shown in columns 5 and 6 (table 4). Although the actual and adjusted costs were developed from averaged values, some of these would be expected to vary in other program areas. The following formula is applicable in estimating costs per house (C) in other situations.

$$C = 8W + T(2L + M(X + KX - 1)$$

"W" is the wage rate per hour; and "T", transportation cost per mile. Other symbols are from Time and Distance computations.

Individual time subitems included were statistically analyzed to determine whether there were differences between one- and two-man crews. Subitems showed differences initially but after

Table 4

FORMULAS AND RESULTS OF COMPARISON OF ONE- AND TWO-MAN CREWS

Time Use	FORMULA		ADJUSTED VALUES FROM TABLE OF AVERAGES			
			One-Man Crew		Two-Man Crew	
	One-Man Crew	Two-Man Crew	Man-minutes	% of Day	Man-minutes	% of Day
1. Travel Between Field and Base	A*	2 A	50.37	10.5	100.74	10.5
2. Cleaning and Storing Equipment	E	2 E	9.05	1.9	18.10	1.9
3. Contacting Houses	BKX_1	$2BKX_2$	16.44	3.4	51.96	5.4
4. House to House Travel	$C(X_1+KX_1-1)$	$2C(X_2+KX_2-1)$	52.94	11.0	182.08	19.0
5. Time at Houses Sprayed	$D_1 X_1$	$D_2 X_2$	351.20	73.2	607.12	63.2
Total Man-minutes	480	960	480.00	100.0	960.00	100.0
Houses per Day per Crew			9.788		15.464	
Cost for Transportation @ $0.0488/mile			$1.720		$ 2.030	
Cost for Labor @ $0.787/hour			6.296		12.592	
TOTAL			$8.016		$ 14.622	
Average Cost Per House			$0.820		$ 0.946	

*For explanation of symbols, see "Time and Distance Averages for One- and Two-Man Crews."

the adjustment for number of houses, pounds of emulsion discharged, or number of men in the crew required for each item, significant differences remained only in subitem, "Waiting for Other Man," which occurred in the case of two-man crews. The total continued to show a significant difference that could be explained only by a slight accumulative deviation in the same direction in each of the subitems. Formulas of the equations and distance averages are shown in table 4.

Equipment Compared:

Power spraying equipment consisted of an engine-mounted air compressor with governor set at 90 lb. of pressure per square inch coupled to an 8-gal. air reservoir tank which was in turn connected through a constant pressure regulating valve to a 50-gal. emulsion tank. Pressure on the emulsion tank was maintained at 50 lb./sq. in. A xylene-resistant hose, 125 ft. long, was used in reaching the houses. In unusually large houses pressure occasionally dropped to 45 p.s.i.

The Constant Pressure Hand Can. This hand can is constructed from two concentric tanks connected by a constant pressure valve (40 p.s.i.) with a Schraeder valve tapped into the outer air compartment. When this can was used, the truck air reservoir contained 125 p.s.i. initially and the air chamber of the can was filled with compressed air to 70 p.s.i. Emulsion from the pressure emulsion tank was simultaneously added to fill the inner chamber.

Standard Hand Cans. These were 4-gal. Hudson cans, weight 8½ lb., models 210G and 310G without modification other than the addition of a pressure gage. These cans were charged with 13 pt. of water and 2 pt. of 25 percent DDT concentrate and were pumped 60 strokes to produce an initial pressure of approximately 50 p.s.i. Water was provided from a 55-gal. commercial drum by gravity flow through a ¾-in. hose. Concentrate was measured and poured into the can.

Hand Can With Schraeder Valve, No Pump. This can, weight 7 lb., was the Hudson model 310G with hand pump replaced by Schraeder valve. Emulsion was supplied from the pressure valve set at 50 p.s.i. One and three-tenths gallons of emulsion constituted a charge, and it was seldom necessary to recharge the can with air.

The same type data were collected in the equipment studies as in the crew-size study but only those items which would be affected by variations in equipment were analyzed. Table 5 shows the

Table 5

ADJUSTED AND ACTUAL EQUIPMENT PERFORMANCE DATA ON FOUR TYPES OF RESIDUAL HOUSE-SPRAYING EQUIPMENT

AVERAGE MAN-MINUTES PER HOUSE - ONE- AND TWO-MAN CREWS					AVERAGE MAN-MINUTES PER HOUSE - ONE-MAN CREW					
Equipment Variable Items	Standard Hand Cans* One-Man Crews Base Data		Standard Hand Cans Two-Man Crews		Hand Can, No Hand Pump With Schraeder Valve		Constant Pressure		Power (Hose) Equipment	
	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted	Actual	Adjusted
Unloading Spray Equipment	0.39	0.39¼	0.56	0.56	0.29	0.29¼	0.32	0.32¼	0.25	0.25½
Filling and Airing Cans	8.41	6.94	7.76	7.30	2.61	4.19	3.55	2.59	0.20	0.20
Spraying Inside House, Privy, and Outside Surfaces	21.28	21.28	19.90	18.72	13.93	23.15	14.85	18.90	14.61	16.05
Walking Between Truck, House, and Privy	2.80	2.80	3.10	2.92	2.05	3.41	2.27	2.89	1.14	1.25
Loading Spray Equipment	0.90	0.90	1.04	1.04	0.38	0.38	0.42	0.42	0.75	0.75
Washing Hands	-	-	-	-	-	-	-	-	0.07	0.08
Moving Spray Truck	-	-	-	-	-	-	-	-	0.06	0.06
SUBTOTAL	33.78	32.31	32.36	30.54	19.26	31.42	21.41	25.12	17.08	18.64
Other Items at House										
Talking with Householder, Preparing House Recording Data, Cleaning Nozzle Screen, and Other Details	3.57	3.57	8.83	8.72	3.57	3.57	3.57	3.57	3.57	3.57
TOTAL	37.35	35.88	41.19	39.26	22.83	34.99	24.98	28.69	20.65	22.21
Pounds 5 percent DDT Emulsion per House	23.58	23.58	25.06	23.58	14.19	23.58	18.5	23.58	21.47	23.58
Actual and Adjusted Houses per Day	9.375	9.788	13.250	15.464	14.667	9.994	12.000	11.741	13.333	14.313
Cost per Application										
Labor	$0.671	$0.644	$0.950	$0.814	$0.429	$0.630	$0.525	$0.536	$0.472	$0.440
Mileage	0.111	0.176	0.194	0.132	0.079	0.173	0.095	0.156	0.148	0.137
Total	$0.782	$0.820	$1.44	$0.946	$0.508	$0.803	$0.620	$0.692	$0.620	$0.577

*Emulsion for standard hand can was carried in 5-gal. cans; that for hand can with Schraeder valve, in a large drum with delivery hose. This accounts for differences in unloading and loading times since in the former case these operations included also handling a 5-gal. can of emulsion.

selected data for the several types of equipment, before and after adjustment to the house size, used in obtaining the standard hand can data. Insertion of these data in the original formula gives the cost per house results shown in table 5. The actual results are shown for comparison.

ADJUSTMENTS

In the final analysis of data recorded for both crew-size and equipment performance, all operations were brought as nearly to the same basis as possible. This was accomplished by adjusting the data so that the crews and equipment compared would be considered as having sprayed the same average size houses over the same terrain and with the same acceptance rate. For this reason the formula shown in table 4 was developed. The average "Time At House Sprayed" data were adjusted in terms of actual average pounds of emulsion used by a one-man crew per house, using standard hand cans. This common denominator was 23.58 lb. of emulsion per house. In making adjustments, those factors affected by variations in house size were computed on a "man-minutes per pound" basis and multiplied by the average for one-man crews. Other factors remained on an actual average per house basis. The effects of these adjustments are shown in table 5 where actual performance data averages are compared with adjusted values of separate and combined time elements. According to cost of houses sprayed based on unadjusted values (table 5) the most efficient operational organizations are listed in order below:

1. One-Man Crew With----Hand Can Schraeder Valve
2. One-Man Crew With----Power Sprayer
3. One-Man Crew With----Constant Pressure Hand Can
4. One-Man Crew With----Standard Hand Can
5. Two-Man Crew With----Standard Hand Can

When elements are adjusted for time and pounds of emulsion applied, the order of efficiencies occur as follows:

1. One-Man Crew With----Power Sprayer
2. One-Man Crew With----Constant Pressure Hand Can
3. One-Man Crew With----Hand Can Schraeder Valve
4. One-Man Crew With----Standard Hand Can
5. Two-Man Crew With----Standard Hand Can

In the comparisons of spray equipment efficiencies (above), initial cost was not considered. In order to compare the different types of equipment on an equal basis, each unit was evaluated on a perfomance basis (number of houses treated per day by one-man crew) to amortize the initial cost. Factors considered in determining spray equipment cost per house sprayed are summarized in table 6.

The estimate of houses sprayed per year is based on an average of a 3-month or a 65-working-day spray season, multiplied by the adjusted daily accomplishment shown in table 5. The particular constant pressure hand can tested, developed by Technical Development Services, CDC, indicates a high degree of efficiency; however, it is not available commercially.

To determine the time required to amortize the difference in cost of spray equipment, a comparison was made of the standard hand can and the power sprayer performance. The difference between the number of houses treated per day with the hand can and the power unit is 4.5 houses. Cost per house with hand can is \$0.82. Then 4.5 x 0.82 = \$3.70 per day approximately. The difference in cost of the two units is \$225 - 8.50 = \$216.50. Amortization time $\frac{216.50}{3.70} = 58.5$ days, which is less than one normal spray season.

When crew activity element groups were analyzed statistically, a significant difference was noted in the time spent by the different size crews in contacting huoseholders and in travel between houses. In order to determine the economic value of this difference, these data first were analyzed on the basis of actual cost per house sprayed by both one- and two-man crews during the study.

Table 6

SPRAY EQUIPMENT COSTS PER HOUSE SPRAYED

Unit	Original Cost	Service Years	No. Houses Sprayed per Year Adjusted Value	Cost per House Sprayed
Standard Hand Can	\$ 8.50	1	635	\$0.013
Hand Can Schraeder Valve (Including cost of Air Reservoir)	\$ 20.00	2	710	\$0.014
Constant Pressure Hand Can (Including cost of Air Reservoir)	\$ 60.00	5	920	\$0.013
Constant Pressure Power Sprayer With Compressor	\$225.00	10	1,020	\$0.022
Without Compressor	\$ 95.00	10	1,020	\$0.009

The cost of labor, transportation, and materials was included in the cost per house-spray application. On this basis the cost per house sprayed by the one-man crew was approximately $0.24 less than the same operation by a two-man crew. Because of the difference in house size and distance between houses, a cost analysis was made on adjusted values. The amount of operational materials required for an average-size house was used as a basis for data adjustments. When based on adjusted average accomplishments, results indicate that under normal conditions in the rural areas of South Carolina, the total cost per house sprayed by a one-man crew was approximately $0.12 per house less than the cost per house for spraying by a two-man spray crew (table 5).

In comparing relative performance efficiency of different type spray equipment, the same man used four types of equipment for a period of 3 days each. Data collected have been analyzed according to actual and adjusted results. When these are considered, on the basis of houses sprayed per day and together with initial cost, the contact pressure power spray equipment appeared the most efficient and economical of the four types tested.

SUMMARY AND CONCLUSIONS

Operational data pertaining to DDT residual spray crew activities and spray equipment performance are outlined and analyzed. Two one-man spray crews and two two-man spray crews were observed for a period of four full spray days each while operating in typical rural areas of South Carolina. The performance of four different types of spray equipment, used by the same person, was observed for a period of 3 days each. Spray crews were observed while treating 181 dwellings. Activities which normally include 21 elements were timed continuously from the beginning of operations in the morning until equipment was cleaned and stored at night. Related or similar elements were grouped and were averaged for analysis.

The data presented show that where automotive and spray equipment are available in sufficient quantities to complete a season's spray cycle during the early part of the normal insect production season:

1. A one-man residual spray crew is significantly more economical than larger size crews.

2. The difference in cost is the result of time saved contacting householders and in travel between houses.

3. Under conditions prevailing during equipment comparison study, the contact pressure power spray, when provided with adequate length hose, was considerably more efficient than any of the other types tested. However, there are situations in some States where, due to the inaccessibility of houses, power spray equipment would not be suitable.

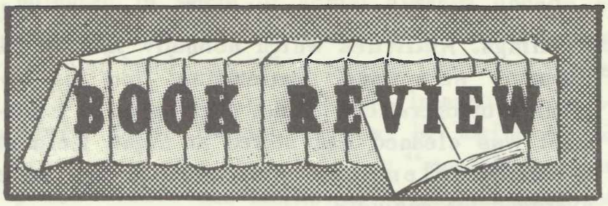
ACKNOWLEDGMENTS

Grateful acknowledgment is made to the persons listed here, and others, for the advice and assistance given in the preparation and review of this report: Messrs. John H. Bright, Porter A. Stephens, Myron J. Willis, James P. Sheehy, and Dr. Robert E. Serfling, CDC, Atlanta, Ga.; Mr. L. B. Hall, CDC, Savannah, Ga.; and Dr. G. E. McDaniel, Mr. C. E. Corley, and Mr. Alexander Epstein of the South Carolina State Department of Health.

MILK COMPOSITION

Information on the "Composition of Milk of Various Mammals" has been compiled for the Zoo Veterinarians by Leonard J. Goss. This is for the use of veterinarians who from time to time find occasion to hand-rear orphaned animals.

Interested persons may obtain this information from: Dr. Patricia O'Connor, Secretary Zoo Veterinarians, Staten Island Zoological Society, Inc., Broadway, West New Brighton, Staten Island 10, N. Y.



DIAGNOSTIC PROCEDURES AND REAGENTS

By a Group of Authors (Edited by RALPH S. MUCKENFUSS)

American Public Health Association, New York, N. Y.,
Third Edition (Illustrated) 1950, 589 pp.

"Diagnostic Procedures and Reagents" is the product of three major contributing factors, each of which is a *sine qua non* of its existence and its excellence. These factors are: (a) careful planning and teamwork by the Committee on Research and Standards and the Coordinating Committee on Laboratory Methods of the American Public Health Association; (b) self-sacrificing coordination during a decade by successive chairmen of the Subcommittee on Diagnostic Procedures and Reagents (Dr. Ralph S. Muckenfuss is to be congratulated as editor of the present edition); (c) all-out creative and productive effort by the collaborating authors and committee members. Each chapter is prepared by an expert on the subject dealt with.

Starting with a relatively modest volume in 1941, "Diagnostic Procedures and Reagents" has, with the publication of the third (1950) edition and the excellent record of the two preceding editions, achieved an outstanding position among methodological manuals covering "Technics for the Laboratory Diagnosis and Control of Communicable Diseases." It should be pointed out here that this volume does not include material on viral and rickettsial infections, as these are dealt with fully in a companion volume, "Diagnostic Procedures for Virus and Rickettsial Diseases," first edition, 1948, published by the American Public Health Association.

The third edition of "Diagnostic Procedures and Reagents" contains more chapters than the previous edition.

The opening chapter contains some general considerations concerning culture media and gives formulas for some 61 media mentioned in the volume. No attempt is made at standardization of methods. The chapters vary in arrangement, style, and content according to the ideas of each author. In some, such as those on the streptococci, malaria, the *Leptospira*, and the gonococcus, there are relatively extended discussions of basic principles, general precautions, sources of error, and other subjects. Some chapters, as those on diphtheria, *Leptospira*, *H. pertussis*, and food poisoning, include extensive bibliographies. Some, as the chapter on brucellosis, give very complete detail with illustrative protocols; others deal in more general outlines of procedure. The chapter on syphilis serology, for example, deals principally with fundamental principles and general problems. Because of the wide variety of methods currently used and their liability to rapid change, detailed directions for each have been omitted. Reference is made to publication, by the Public Health Service, of complete descriptions of techniques by author-serologists. The chapter on Rh testing, while not, strictly speaking, within the field of communicable disease (unless the transfer of an antigen from person to person be so considered), may nevertheless be welcomed in the volume coming as it does from so authoritative a source. The subject is well within the group of interests of many laboratory diagnosticians who deal with communicable diseases.

There are a number of excellent illustrations. The fact that the animal illustrating the virulence test in the chapter on diphtheria appears to be deporting itself somewhat in a manner suggestive of an "Easter wabbit" does not detract from its illustrative value; nor does the lack of coated paper for the halftones, except in a few instances, such as the pathogenic fungi. This would have added greatly to costs; and the pictures, in general, show all that they are intended to show. The use of a color plate for the malaria parasite is a very valuable addition. The format and arrangement of material in the book are convenient, dignified, and attractive. The print is clear and the paper and binding are of good quality. A table of contents and an index add much to the utility of the volume.

This work is a necessary part of even the most modest laboratory bookshelf. It will repay its owners many times over in authoritative guidance in the maze of diagnostic procedures and reagents.

Martin Frobisher, Jr.

C D C TRAINING COURSES

Listed below are some training courses sponsored by the Services of the Communicable Disease Center to be held during the remaining months of 1951. Further information on the courses may be obtained from the *Bulletin of Field Training Programs* and the *Bulletin of Laboratory Refresher Training Courses* issued by the Center.

TRAINING SERVICES

1. **ENVIRONMENTAL SANITATION FIELD TRAINING.** September 24 to December 14, 1951. Twelve weeks. Columbus, Ga.

2. **ENVIRONMENTAL SANITATION FIELD TRAINING.** September 24 to December 14, 1951. Twelve weeks. Amherst, Mass.

3. **ENVIRONMENTAL SANITATION FIELD TRAINING.** September 17 to December 7, 1951. Twelve weeks. Bloomington, Ill.

4. **ENVIRONMENTAL SANITATION FIELD TRAINING.** September 10 to December 1, 1951. Twelve weeks. Buffalo, N. Y.

5. **ENVIRONMENTAL SANITATION FIELD TRAINING.** September 10 to December 1, 1951. Twelve weeks. Pittsburgh, Pa.

6. **ENVIRONMENTAL SANITATION FIELD TRAINING.** August 27 to November 17, 1951. Twelve weeks. Topeka, Kans.

7. **SPECIAL TRAINING PROGRAM IN MILK AND RESTAURANT SANITATION.** October 15-26, 1951. Two weeks. Denver, Colo.

8. **TOPICAL SHORT COURSE – MILK PLANT SANITATION.** September 10-14, 1951. One week. Amherst, Mass.

9. **FIELD SURVEY AND EVALUATION METHODS IN HOUSING SANITATION.** August 20 to September 22, and November 4 to December 8, 1951. Atlanta, Ga. October 1-31, 1951. Syracuse, N. Y. Five weeks.

10. **FIELD SURVEY AND EVALUATION METHODS FOR MEASURING QUALITY OF HOUSING ENVIRONMENT.** September 10-15 and November 26-30, 1951. Atlanta, Ga. August 6-10 and October 22-26, 1951. Syracuse, N. Y. One week.

11. **RAT-BORNE DISEASE PREVENTION AND CONTROL.** October 1-19, 1951. Three weeks. Atlanta, Ga.

12. **SPECIAL TRAINING IN INSECT CONTROL.** October 22 to November 2, 1951. Ten days. Atlanta, Ga.

13. **INSECT AND RODENT CONTROL TRAINING FOR FOREIGN PUBLIC HEALTH PERSONNEL.** August 6-17, 1951. Two weeks Atlanta, Ga.

14. **ADMINISTRATION OF A PUBLIC HEALTH AUDIO-VISUAL PROGRAM.** August 6-10, 1951. One week. Chamblee, Ga.

15. **FUNDAMENTAL METHODS IN PUBLIC HEALTH FIELD TRAINING.** September 7-21, 1951. Two weeks. Atlanta, Ga.

16. **ADVANCED COURSE IN PUBLIC HEALTH FIELD TRAINING METHODS.** November 2-9, 1951. One week. Atlanta, Ga.

LABORATORY SERVICES

1. **LABORATORY DIAGNOSIS OF PARASITIC DISEASES.** Part 1. Intestinal Parasites. September 3-21, 1951. Three weeks. Part 2. Blood Parasites. September 24 to October 12, 1951. Three weeks. Chamblee, Ga.

2. **LABORATORY DIAGNOSIS OF MYCOTIC DISEASES.** Part 1. Cutaneous and Subcutaneous Fungi. November 5-16, 1951. Two weeks. Part 2. Systemic Fungi. November 19-30, 1951. Two weeks. Chamblee, Ga.

3. **LABORATORY DIAGNOSIS OF VIRUS DISEASES.** September 3-28, 1951. Four weeks. Montgomery, Ala.

4. **LABORATORY DIAGNOSIS OF BACTERIAL DISEASES.** General Bacteriology. Part 1. August 27 to September 7, 1951. Two weeks. Part 2. September 10-21, 1951. Two weeks. Chamblee, Ga.

5. **LABORATORY DIAGNOSIS OF ENTERIC DISEASES.** Part 1. Introductory Enteric Bacteriology. September 24-28, 1951. One week. Part 2. Advanced Enteric Bacteriology. October 1-12, 1951. Two weeks. Chamblee, Ga.

6. **LABORATORY DIAGNOSIS OF TUBERCULOSIS.** November 5-16 and November 19-30, 1951. Two weeks. Chamblee, Ga.

7. **LABORATORY DIAGNOSIS OF SYPHILIS.** September 10-21 and October 22 to November 2, 1951. Two weeks. Chamblee, Ga.

8. **PREPARATION AND STANDARDIZATION OF SEROLOGIC REAGENTS USED IN THE LABORATORY DIAGNOSIS OF SYPHILIS.** November 5-23, 1951. Three weeks. Chamblee, Ga.

9. **CLINICAL CHEMISTRY** Part 1. Introductory and General Procedures. October 29 to November 2, 1951. One week. Part 2. Quantitative Analyses. November 5-16, 1951. Two weeks. Atlanta, Ga.

10. **LABORATORY DIAGNOSIS OF PARASITIC DISEASES.** October 22-26, 1951. One week. Chamblee, Ga.

11. **LABORATORY DIAGNOSIS OF BACTERIAL DISEASES.** October 22-26, 1951. One week. Chamblee, Ga.

12. **LABORATORY DIAGNOSIS OF MYCOTIC DISEASES.** October 29 to November 2, 1951. One week. Chamblee, Ga.

13. **LABORATORY DIAGNOSIS OF TUBERCULOSIS.** October 29 to November 2, 1951. One week. Chamblee, Ga.

14. **LABORATORY DIAGNOSIS OF VIRUS DISEASES.** October 8-12, 1951. One week. Montgomery, Ala.

15. **MICROBIOLOGY FOR PUBLIC HEALTH NURSES.** August 27-31, 1951. One week. Chamblee, Ga.

VETERINARY PUBLIC HEALTH SERVICES

1. **LABORATORY DIAGNOSIS OF RABIES.** October 1-5, 1951. One week. Montgomery, Ala.

FOREIGN VISITORS TO CDC

During the months of April and May the following public health officials of foreign countries were visitors to CDC:

Dr. Franz Bauhofer, Medical Officer, State Department of Public Health, Danube, Austria.

Dr. Paul Slezak, Medical Officer, Ministry of Public Health, Vienna, Austria.

Dr. Hidetoshi Shiga, Chief, Department of Public Health Administration, Institute of Public Health, Tokyo, Japan.

Dr. Mirza Ali Ahmad, District Health Officer, Health Department, Dacca, East Bengal, Pakistan.

Dr. Joseba Kelmendi de Ustaran, Department of Epidemiology, School of Hygiene, Santa Fe', Argentina.

Mr. George Pliatsikas, Inspector of Public Health Health Center, Lamia, Greece.

Dr. Aaron Amramy, Director, Division of Sanitation, Ministry of Health, Jerusalem, Israel.

Dr. Kikuko Hori, Attending Physician, Department of Communicable Disease, Tokyo Komagome Hospital, Tokyo, Japan.

Dr. Junjiro Okanishi, Chief, Koichikowa Health Center, Tokyo, Japan.

Dr. Eiichi Wakamatsu, Epidemiologist, Communicable Disease Prevention Section, Public Sanitation Bureau, Ministry of Welfare, Tokyo, Japan.

CORRECTION

CDC Bulletin X(6): 8, June 1951:

The last sentence in the first paragraph under the heading "MURINE TYPHUS CONTROL ACTIVITIES:" should read, "During the period January through March of this year, only 68 cases were tentatively reported as compared to 137 for the same period of 1950." The figure 137 should be substituted for 168 as reported in the above-mentioned CDC Bulletin.

☆U. S. GOVERNMENT PRINTING OFFICE : 1951 O— 951989

RECENT PUBLICATIONS BY CDC PERSONNEL

Crowell, R. L., and Fay, R. W.: Preliminary experiments in the use of hot DDT and other halogenated hydrocarbons for residual applications. J. Nat. Malaria Soc. 10(1): 8-16 (1951).

Donaldson, A. W., Steele, J. H., and Scatterday, J. E.: Creeping eruption in the southeastern United States. Proc. Book, Am. Vet. M. A., 87th Annual Meet. 83-88 (1950).

Gilbertson, Wesley E.: Sharpening the focus of sanitation measures. The Journal Lancet, 71(4): 160 (1951).

Gordon, M. A.: Rapid permanent staining and mounting of skin scrapings and hair. Arch. Dermatol. & Syph. 63: 343-346 (1951).

Hill, Elmer L., Morlan, Harvey B., Utterback, Bernice C., and Schubert, Joseph H.: Evaluation of county-wide DDT dusting operations in murine typhus control (1946 through 1949). Am. J. Pub. Health 41(4): 396-401 (1951).

Jensen, J. A., Sumerford, W. T., and Fay, R. W.: Rosin as an Insecticide Adhesive. Soap & Sanitary Chem. (Nov. 1950).

Melvin, I., Klein, G. C., Jones, W., and Cummings, M. M.: An evaluation of media for diagnostic cultures of tubercle bacilli. Am. Rev. Tuberc. 63(4): 459-469 (1951).

Paffenbarger, R. S. Jr.: Tick paralysis: Implicating *Amblyomma maculatum*. New Orleans M. & S. J. 103(8): 329-332 (1951).

Pratt, H. D., and Lane, J. E.: *Hoplopleura oryzomydis* new species, with notes on other United States species of *Hoplopleura* (Anoplura: Haematopinidae). J. Parasitol. 37(2): 141-146 (1951).

Pratt, H. D., and Lane, J. E.: Rediscovery of *Tarsopsylla coloradensis* (Baker) in Colorado. Proc. Ent. Soc. Wash., 52(6): 305-307 (1950).

Simmons, Samuel W., and Upholt, William M.: Disease control with insecticides. Bull. World Health Org. 3: 535-556 (1951).

Steele, James H.: Tropical veterinary public health. Proc. Book, Am. Vet. M. A., 87th Annual Meet. 93-94 (1950).

Thurman, D. C. Jr., and Mortenson, E. W.: A method of obtaining an index to *Aedes* densities in irrigated pastures. Mosq. News 10(4): 199-201 (1950).

Wilcomb, Maxwell J., Jr.: State and local health departments are important in rat and fly control. Okla. Health Bull. 9(5): 17-20 (1951).

FIELD TRAINING COURSE IN EPIDEMIOLOGY FOR PUBLIC HEALTH NURSES

This 12-week training program, to be held August 27 to November 17, 1951, at Atlanta, Ga., and Jackson, Miss., is designed to give an understanding of the fundamentals in epidemiology and communicable disease control and activities, and new information in this field. It is offered to public health nursing supervisors, educational directors, public health nursing coordinators, and well qualified staff public health nurses.

The Atlanta section of the course, approximately 3 weeks, is designed to orient the student in the epidemiological approach to disease control and the principles of field investigations; and, through demonstration and practice in the laboratory, to provide an opportunity to understand the rationalization of specimen collection.

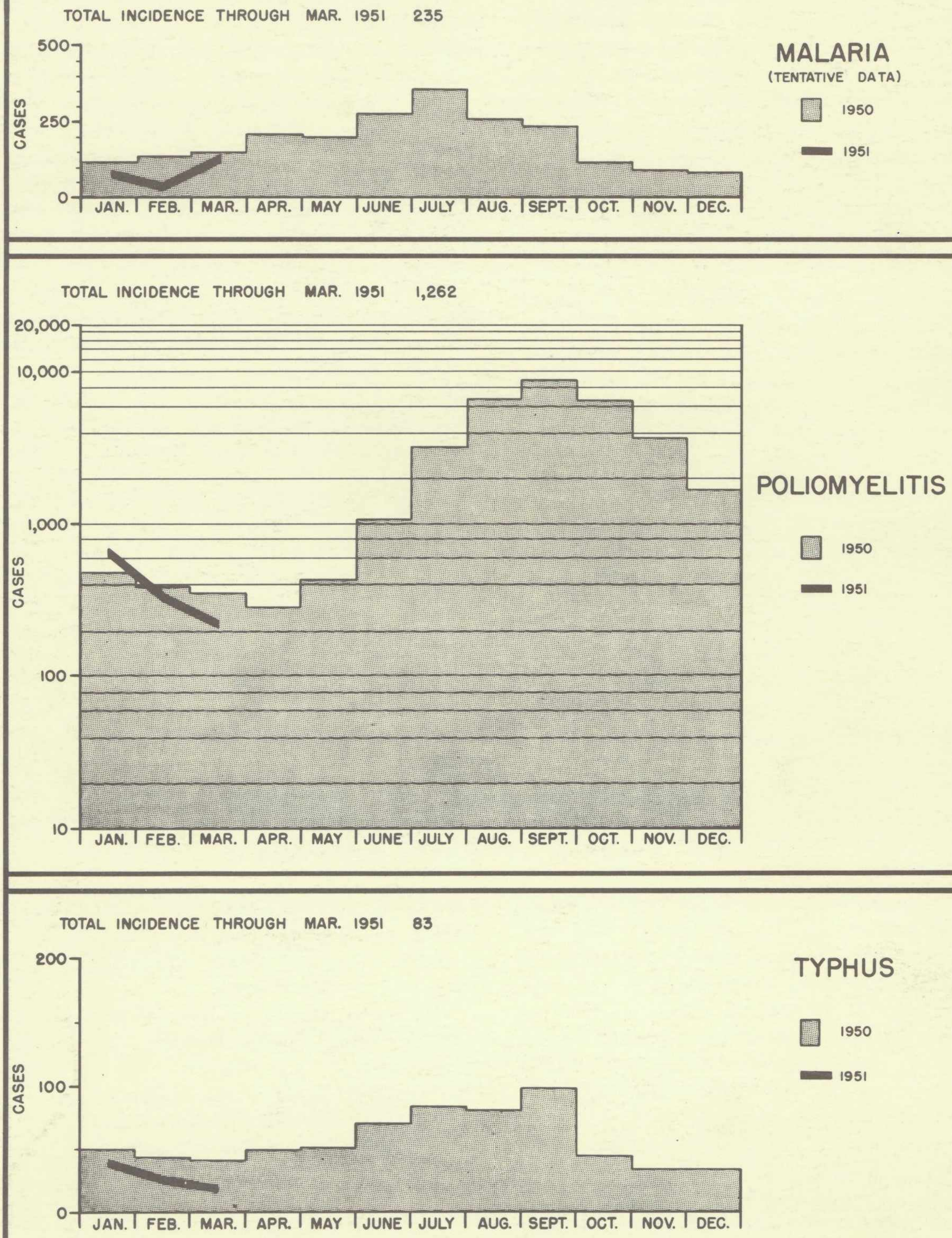
The remaining 9 weeks will consist of field experience in Mississippi.

Application should be made through the State Public Health Nursing Director and should be addressed to:

Medical Director in Charge
Communicable Disease Center
U. S. Public Health Service
Fourth Floor
50 Seventh Street, N. E.
Atlanta 5, Ga.
Attention: Chief Nursing Consultant

MORBIDITY TOTALS FOR THE UNITED STATES *
MALARIA, POLIOMYELITIS, TYPHUS

1950 . COMPLETE 1951 . AS REPORTED



FSA-PHS-CDC ATLANTA, GA.

*SOURCE OF DATA: NATIONAL OFFICE OF VITAL STATISTICS