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Malaria Control in Iran

Résumé of reports made by Dr. Justin M. Andrews and Lawrence B. Hall *

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Iran, formerly called Persia, is a relatively large country with an area of about 628,000 square miles, the equivalent of one-fifth of the area of the United States.

Iran lies between 25° and 40° north latitude and 44° and 64° east longitude. It is bounded on the north by the Russian Caucasus, the Caspian Sea, and Russian Turkestan; on the east, by Afghanistan and Pakistan; on the south, by the Gulf of Oman and the Persian Gulf; on the west, by Iraq and Turkey. From the standpoints of climate and topography, it is comparable to California, New Mexico, Arizona, and Texas. The country varies in elevation from the height of Mount Demavend, 18,600 feet above sea level, to the shores of the Caspian Sea, 85 feet below sea level.

Of the 16 million estimated population, some 11 million reside in about 43 thousand small villages of about 50 families or 250 persons per village. It is in these village populations that most of the malaria occurs. Two-fifths of these villages are located in areas of intense malaria endemicity and another fifth where malaria is present intermittently. The remainder of the population lives in malaria-free areas. The most urgent operational problem is to provide house-spraying services for the 4,400,000 Iranians (880,000 families) living in the highly malarious environments.

Malaria in Iran is considered such an intensified and serious problem that it constitutes a substantial hindrance to the economic development of the country. Its reduction would go a long way toward the achievement of self-sufficiency in agricultural production, and a consequent improvement of the standard of living.

Although malaria is reported in all of the 10 Iranian provinces, it is most prevalent in those bordering the Caspian Sea and in those

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At the request of the Iranian Government for assistance by a United States malaria control expert, Dr. Justin M. Andrews, was sent by the Public Health Service to Iran in November and December 1948 to make a tour of inspection and to advise on the planning of a national malaria control program for that country. Lawrence B. Hall was in Iran from March to May 1949, to train spraying supervisors and to assist in establishing the malaria control demonstrations suggested in Dr. Andrews' report. This résumé summarizes Dr. Andrews' observations and proposed plans and Mr. Hall's follow-up program on malaria control. Both Dr. Andrews and Mr. Hall were in Iran under supervision of the Division of International Health.

with irrigated river valleys or impounded waters. In the Caspian provinces, malaria mosquitoes breed in natural swamps and in rice fields.

Iran has been called the meeting place of anophelines from the Mediterranean and Indian regions. A considerable number of species has been reported in that country, including *Anopheles superpictus*, *A. sacharovi*, *A. stephense*, *A. maculipennis*, *A. d'thali*, *A. apoci*, *A. sergenti*, and *A. pulcherrimus*. Of these, only the first four are probably of significance with respect to malaria transmission in Iran. In the northern part of the country, the malaria season extends from May to October, cases being most numerous in July. The prevailing type during August and September is *falciparum* malaria. In the southern part, the malaria season starts somewhat earlier and extends a little later.

Few laboratories in Iran examine blood films routinely for presence of malaria parasites. Reported cases of malaria, therefore, are based primarily on clinical observations, confirmed at times by reactions to antimalaria drugs. From 400,000 to 500,000 cases of malaria are estimated to have occurred annually in recent years.

Previous Malaria Control Efforts[1]

In 1944. The United States Army 111th Malaria Control Unit carried on larva control measures around the road camp near Khorramabad. Ministry of Health and Iranian Army personnel were sent for 2-week courses with this unit. They continued the control measures in the Khorramabad area the rest of the malaria season under the supervision of the United States Army.

In 1945. The U. S. Army unit introduced DDT into its malaria program in Iran and left quantities of DDT bombs for the Iranians to use when it departed at the end of that year. Personnel trained at Khorramabad the previous season also undertook larva control measures at Khorramabad, Isfahan, and Shiraz. At Isfahan, the Iranians

[1] Information obtained by Dr. Andrews from Dr. Bennett F. Avery, American Adviser to the Minister of Health o fIran.

directed extensive control measures, using up to 1,500 laborers furnished gratis by landowners. At Shiraz, Iranian Army personnel trained at Khorramabad held a training school for other Iranian Army personnel and, working with the Ministry of Health officials, accomplished considerable control. The landowners voluntarily contributed funds for purchase of 500,000 atabrine tablets for free distribution in their villages.

In 1946. Control measures were continued in the above three areas and were extended to Sanandaj, Kermanshah, and Bushire. At Kermanshah, the Anglo-Iranian Oil Co. cooperated in larva control over a considerable area near its refinery. At Sanandaj, the Iranian Army contributed soldiers and officers. At Bushire, the only breeding areas seemed to be the water storage tanks from which the drinking and washing water of the city was obtained. These tanks were treated with kerosene each week.

In 1947. Control was continued in the areas listed for 1946 and was extended to Khorramashahr, Ahwaz, Palisht area, and Parchin. Because of extensive floods in Khuzistan, there was a minor epidemic of malaria near Ahwaz and a large one in the Khorramashahr-Abadan area. Extensive control measures were carried out, primarily by oiling the collections of stagnant water and by treating malaria cases. As the waters receded, breeding was also found in the irrigation ditches of the palm groves so that these had to be oiled.

The Near East Foundation, in cooperation with the Ministry of Health, began routine larva control in the Palisht group of villages in 1947, but in the main relied on DDT residual spray. About 26 villages received the latter treatment with excellent results.

Parchin was protected by a large-scale larva control project involving the river bed and marshes.

In 1948. The Near East Foundation, with help from the landowners, extended the area of DDT residual spraying.

According to further information obtained through the Near East Foundation's Iranian Area Annual Report for July 1, 1948 to June 30, 1949, the Foundation also undertook a DDT spraying program in the Caspian region as an experiment and as a demonstration. Another spraying program which it completed in 1949, at the request of the Governor General of Baluchistan province, was also highly successful. Malaria mosquitoes and other disease bearing insects were eradicated in 3 cities and 51 villages in Baluchistan; the Ministry of Health supplied all the DDT, the Ministry of War assigned soldiers as laborers, and the Sazeman Shahanshahi, an Iranian health organization, provided all the necessary funds.

Ministry of Health. At present the Ministry of Health is operating a large medical welfare service. Expenditures during the Iranian year 1325 (March 21, 1946 to March 20, 1947) were 177,984,500 rials

($4,312,000) or 2.9 percent of the total government expenditures for that year. According to the Adviser to the Minister of Health, Dr. Bennett T. Avery, nearly 95 percent of the total appropriation for the Ministry is used for maintenance of free medical facilities; only 5 percent is used for preventive medical activities. In and near Tehran, the Ministry of Health operates two tuberculosis sanatoria with about 525 patients, and four hospitals with a total of 700 beds. In the provinces it operates two leprosy sanatoria with about 400 patients, and 83 small hospitals with a bed capacity of 1,988. In addition, there are some 300 dispensaries operated by the Ministry. During the Iranian year 1327 (March 21, 1948 to March 20, 1949) the personnel employed by the Ministry of Health was as follows:

Types of Personnel	*Tehran Area*	*Provinces*
Graduate doctors	193	346
Licensed doctors, dentists, pharmacists, behdars, and midwives	95	357
Pezeshkiars (assistant doctors)	148	441
Vaccinators	40	400
Others	761	1,740
Total	1,237	3,284

Seven Year Plan. A development of the last 2 years may present the opportunity for Dr. Avery to accomplish his objective of increasing the preventive activities in the government's health program. Following World War II, Iran, like numerous other countries with vast increases in expenses of government, found itself without corresponding increases in revenue. The poverty of the people made further taxation out of the question. It was necessary, therefore, to seek means of improving the living standards of the people, to increase exports and to decrease imports.

On December 17, 1946, the Iranian Ambassador to the United States contracted for the Morrison-Knudsen International Co., Inc., to survey Iran's potentialities and facilities and to formulate a program for the development and exploitation of its natural resources, existing industries, and other fields of production.

Concurrently with this study by foreign experts, the government of Iran activated a Supreme Planning Board, under the direction of Dr. Ali Amini, to carry on more extended studies of the social and political economy of the country and to make recommendations for its fiscal improvement.

The report of the Morrison-Knudsen Co. contains a vast amount of information about existing utilities and resources together with suggestions for their expansion and development. The cost of the projects catalogued in this report totals about $1,250,000,000, an amount known to be beyond the present financial competence of the

country. Accordingly, two programs were prepared embodying the highest priority projects which could be accomplished by expenditures of $500,000,000 and $250,000,000, respectively.

The public health section of the report, which is additional to projects for water purification and sewage disposal for the seven largest cities in the country, consists of three parts: (a) the prevention of disease; (b) education of medical and public health personnel; and (c) treatment facilities.

The plan involves the construction of 780 health centers, one for each 14,000 inhabitants; a central laboratory and executive headquarters at Tehran; 15 quarantine stations; 10 contagious disease hospitals of 50 beds each; and an institute for training personnel to operate public health centers and hospitals. Together with operational expenses, this would call for about $540,000,000 to be spent within a 7-year period. While the authors of the Morrison-Knudsen report admit the thorough desirability of such an expenditure, it was obviously impossible to include it within the limits set for their recommendations. Therefore, they eliminated the entire treatment program, 390 of the local health centers, all the quarantine stations and the contagious disease hospitals, half of the construction for medical educational facilities, and 40 percent of the operating expenditures. This reduced the public health allotment to $48,294,000, or 9.6 percent, of the $500,000,000 program. In the $250,000,000 program the same public health expenditures were recommended, amounting to 18.6 percent of the total.

On November 10, 1947, Dr. Mosharaf Nafici was invited by the Prime Minister to prepare, with the assistance of the Supreme Planning Board, studies with reference to the report of the Morrison-Knudsen Co., and a program for the economic improvement and development of Iran. His recommendations were made available within a month in a mimeographed document entitled "Preliminary Report on the Persian Seven Year Plan."

The essence of Dr. Nafici's report was later drafted into a document which was submitted to the Majlis, the Iranian Parliament, on May 4, 1948, for consideration. In July 1949, this bill was enacted.

The visit of Dr. Andrews to Iran coincided with that of a group from Overseas Consultants, Inc., a private American concern engaged by the government of Iran to review the allocation of funds and to establish priorities for the more important projects to be activated within the 7-year program. Dr. Andrews accompanied this group on a trip to the Caspian Sea in the northern and northwestern areas of Iran.[2]

[2] In February 1949, after it had presented a brief preliminary report of its findings and suggestions to the Iranian Government, Overseas Consultants, Inc. (OCI), at the request of Iran made a larger, more comprehensive survey which it later presented in a 5-volume printed report entitled "Report on Seven-Year Development Plan for the Plan Organization of the Imperial Government of Iran." Public health is one of a large number of subjects discussed in the OCI survey.

Of the 21 billion rials ($656,250,000) estimated for expenditures for the Seven-Year Plan for economic development, Dr. Nafici allocated 1.5 billion rials ($46,875,000), or 7.2 percent, to public health. In proposing this expenditure, Dr. Nafici followed the plan for the Revised Seven-Year Health Program submitted by Dr. Avery. This provides a national health institute, 12 quarantine stations, 780 health centers (if three-fifths of the cost of training can be met from special educational funds; if not, only 520 health centers can be built), and special funds for the control of such communicable diseases as smallpox, diphtheria, typhus fever, malaria, trachoma, venereal disease, leprosy, and tuberculosis. Money is also provided for the care of mothers and children, sanitation and water supply, the operation of quarantine stations, and the control of epidemics. Over 208 million rials are allocated for the education of public health personnel, if special health educational funds are available for health training; otherwise, 346 million rials will be used for this purpose.

For malaria control, Dr. Avery proposed the following expenditures per year: first year, 2.9 million rials; second year, 11.4 million; third year, 18.2 million; and, fourth, fifth, sixth, and seventh years, 18.7 million each, or a total of 107,300,000 rials.

Malaria Control Recommendations to the Iranian Government[3]

The following recommendations were made by Dr. Andrews for the development of a national program for the control and prevention of malaria in Iran.

I. *Decentralization of Program and Development in Three Stages*

Dr. Andrews proposed that administrative direction and control, coordination, and technological improvement come from or through Tehran; the actual selection of areas to be treated, the planning and scheduling of operations, the execution of the work, and the appraisal of its benefits should be accomplished at the provincial level.

Malaria control is peculiarly a local health problem, he pointed out, involving essentially the mass relationships of bodies of water in which infesting mosquitoes develop and the houses in which people live. The factors of proximity and accessibility between these two relatively fixed entities in and around the 43,000 villages of Iran should be more familiar to resident health officers in the provinces

[3] Abstract of the report made by Dr. Justin M. Andrews, March 1949, on the basis of his malaria control survey in Iran in November and December 1948, at the request of the Iranian Government. Dr. Andrews' recommendations depended primarily on information in available studies on malaria, on routine morbidity reports, and on the opinions of others more closely and extensively associated with the problem in Iran; also, on some observation of spleen enlargement in children and on observation of anopheline mosquitoes in various malarial areas.

than to individuals whose responsibilities require them to be stationed in Tehran.

Demonstrational Phase. Country-wide malaria control and prevention in Iran cannot be accomplished overnight or in a single season as there is not enough transport, spraying equipment, or insecticide on hand to make more than a beginning where conditions are worst. Extension of activities must depend upon popular persuasion by visual proof that spraying residual insecticide within premises will prevent malaria.

Until the health-educational background essential for popular cooperation has been established and the necessary funds and trained personnel produced to execute a nation-wide program technologically adapted to the specific needs of each different area, Dr. Andrews recommended concentration of the resources at hand primarily on the single method of malaria reduction having the greatest general applicability and effectiveness in Iran. The method proposed is the treatment of the interior surfaces of human habitations and domestic animal shelters with residual insecticides in quantities sufficient to deplete malaria-carrying mosquitoes within homes to the point where transmission diminishes to insignificance or extinction. This practice is expected to reduce Iranian malaria to public health unimportance wherever it is properly applied. It might actually eradicate vectors and malaria in the more isolated villages.

Accordingly, he suggested that the first phase in development of this program be limited to demonstrational applications of DDT in areas where malaria is known to be hyperendemic. This phase was to continue 1 year, mainly at the expense of the national government working through provincial health organizations and with the cooperation of various voluntary agencies interested in public health. More than 50 long tons of 100 percent technical grade DDT and some 400 hand sprayers belonging to the Ministry of Health, and the abundant supply of kerosene available throughout the country were considered sufficient for spraying 42,000 houses twice during the first season. This is estimated to be nearly 5 percent of the country's total village housing in highly malarious areas and should constitute an excellent demonstration of the effectiveness of 5 percent oil-borne DDT.

It was recommended, also, that the demonstrational phase of the program include a single application of water-wettable DDT to as many houses in areas of high malaria endemicity as are being treated with the two applications of oil-borne DDT to compare the residual effectiveness of the two DDT formulations under Iranian conditions. Conclusions were to be based primarily on afternoon counts of anophelines found resting in occupied houses. The services of a malaria biologist were considered valuable in making these determinations.

To make such a comparison, Dr. Andrews suggested, before he left

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Tehran, that the Ministry of Health purchase 60 long tons of 50 percent water-wettable DDT and 100 sprayers of the type which can be used for spraying DDT suspensions as well as solutions. This was enough DDT to spray 50,000 houses once.

Dr. Andrews recommended that DDT and sprayers be allocated by the Ministry of Health to the provinces on the basis of their relative malaria incidence. These supplies were to be dispatched to the provincial health officers.

Health officers were to be advised at the same time regarding the nature and objectives of the demonstrational program and to be instructed (1) to store the materials and equipment securely and hold them until trained personnel is available; (2) to choose three pezeshkiars to be ready to proceed to Tehran in the spring for training in the technique of DDT application; and (3) to select several demonstration spray areas, both for oil-borne and water-wettable DDT spraying in their own provinces, where malaria is known to be a major factor of premature death, sickness, and physical nonproductiveness.

One of the three trained pezeshkiars was to be appointed malaria control officer in each province. Together with the other Tehran trainees, he would teach the technique of DDT application to enough appliers so that they would be able to supervise the application of the DDT allotted to each province. Vaccinators were to be used for this work. Equipment was to be unpacked, tested, and used for training practice; spraying was to be under way by the end of April for most of the country. The second application of DDT was recommended for July, following the same order of execution as scheduled for the first treatment with some modifications of this timetable possible around the Persian Gulf and in areas where the summer heat either kills mosquitoes or drives them out of the houses. Wherever there is a bimodal distribution of domestic anopheline density, the DDT in kerosene was to be applied just at the beginning of each house-frequenting cycle.

The size of the spray crews had to be adjusted to each situation, but a group of three sprayers with a foreman-driver was considered the most efficient village unit. Labor for demonstrations would be hired and trained in the village where the work was to be done.

A budget proposed for the demonstrational year of the program was estimated at about 8,000,000 rials for operating costs.

Operational Phase. In principle this is similar to the demonstrational phase except that efforts will have to be made to extend DDT spraying to every village in which malaria is a serious health problem, Dr. Andrews indicated. Cooperative arrangements should be promoted and worked out by the provincial malaria control authorities, with the costs to be divided between the government and the landowners. The foremen, to be selected from the vaccinator component of per-

sonnel in the provincial health organizations, should be instructed in spraying techniques during the winter by the provincial malaria-control officers who directed the demonstrational program in 1949. By that time, it was to have been experimentally determined whether or not DDT water suspensions are superior to DDT oil solutions for use in Iran and how many applications are required per year. Program logistics and operations were to be adjusted accordingly.

Malaria is predominantly a rural disease, although it occasionally invades the outskirts of cities. The primary aim of the nation-wide operational phase of the malaria-control program is to reduce, as rapidly and extensively as possible, disabling malaria morbidity in village populations located in hyperendemic and endemic areas. The operational problem in Iran is to provide house-spraying service for the 4,400,000 Iranians (880,000 families) living in highly malarious environments.

It is believed practicable to plan to achieve this maximum coverage over a 3-year period. The demonstrational phase suggested includes the treatment of some 92,000 houses. It is proposed to increase the number of houses sprayed by almost 300 percent each year. For the first 4 years of operation, the cumulative total of houses sprayed would be as follows:

1949	92,000 houses
1950	350,000 houses
1951	620,000 houses
1952	880,000 houses

Budget estimates do not contain the original cost of motor transport necessary to implement completely the nation-wide operational phase of the program, but repair and replacement costs are included. No allowance has been made for local contributions of labor, materials, or funds. According to provisional figures, the maximal recurring total and unit costs for insecticiding homes in the more malarious villages of the country would rank among the phenomenally low health investments in the world for malaria control, as follows:

	Oil-borne DDT[1]	*50% water-wettable DDT*[2]	*90% water-wettable DDT*[2]
	Rials[3]	*Rials*	*Rials*
880,000 houses	86, 064, 000	50, 600, 000	40, 128, 000
50-house village	4, 890. 0	2, 875. 0	2, 280. 0
House	78. 8	57. 5	45. 6
Person protected	19. 7	11. 5	9. 1

[1] Two applications per year.
[2] One application per year.
[3] One rial is equivalent to 3 cents at official rates of exchange.

If it is determined that one application of 50 percent water-wet-

table DDT per year is the most effective and durable type of application for Iran, according to Dr. Andrews, the annual increase in recurring antimalaria expenditures during the first 4 years of the program at the rate suggested above for augmenting house coverage each year would be approximately as follows:

1949	8,000,000 rials
1950	22,000,000 rials
1951	36,000,000 rials
1952	50,000,000 rials

Additional outlays for trucks and other transportation equipment were estimated at over 3 million rials for each of the first 3 years.

Maintenance Phase. Most of the secondary malaria foci usually disappear spontaneously after the primary expanses of endemicity have been eliminated. Nevertheless, an alert watchfulness for inconspicuous but genuine areas of malaria occurrence must be maintained; these should immediately be investigated and controlled if the existence of transmission is verified. Recognition of malaria-free areas and their maintenance as such requires careful diagnosis and conscientious case reporting by physicians, and vigilant attentiveness by provincial health officers and malaria control officers. If such malaria-free or vector-free areas develop, every effort should be made to extend their borders, at the same time watching to apprehend and nullify reintroduction of parasites or vectors.

If the Seven-Year Plan is activated as proposed, numerous new and additions to old irrigation projects will be established. These are necessary for the development of agriculture in the arid sections of Iran. Irrigation systems, improperly constructed and used, may be prolific sources of anopheline mosquitoes and are probably responsible for much of the malaria in Iran, Dr. Andrews points out. The Malaria Control Unit and provincial malaria control authorities have to take an active part in advising and educating those concerned in the development and operation of these facilities to prevent the enlargement of the country's malaria problem.

The situation to be avoided is that of undertaking domestic insect control on a malaria control budget alone. If it is decided to augment the DDT spraying program to protect against typhus, sandfly fever, leishmaniasis, and possibly trachoma and infections transmitted by flies throughout the country, and to relieve the general population from the nuisance and discomfort of mosquitoes, flies, fleas, lice, etc., an expansion of the operating organization, its activities, and fiscal support will be necessary. It would require from three to four times as much technical personnel, labor, equipment including vehicles, and insecticidal materials. Moreover, fundamental improvements in basic sanitation will also have to be considered.

Adjunctive Malaria Control Measures. Additional measures which can be employed advantageously and be made a part of the general malaria control program are: (1) suppressive antimalarial medication in villages where silkworms are raised and where use of DDT would destroy the silkworms as well as the anophelines; (2) mosquito control in private garden pools or reservoirs through use of insectivorous top-minnows that feed on mosquito larvae; and (3) improvement in water impoundment and irrigation methods.

II. *Technical Assistance Through Malaria Control Unit*

An interim Malaria Control Unit, consisting of a malaria control engineer and a malaria biologist, was recommended for the Ministry of Health. If possible, a qualified malaria control operations expert should be hired to conduct the program until Iranian personnel are capable of maintaining it. Plans were to be made, also, for forming and training a permanent Malaria Control Unit of Iranians, consisting of a medical malariologist, a malaria control engineer, and a malaria biologist. Both the interim and permanent Malaria Control Units were to coordinate and give technical guidance to provincial malaria control programs.

Dr. Andrews recommended that, in addition to the 30 pezeshkiars, a limited number of nongovernmental trainees also be trained, if commercial or voluntary organizations using DDT in Iran wished to send some of their employees to Tehran to take advantage of this opportunity.

Instruction was to include (1) the preparation of spraying mixtures of DDT, both kerosene solutions and water suspensions; (2) special indications for use of oil-borne or water-borne DDT; (3) the use, care, maintenance, and repair of sprayers; (4) practice in the application of the correct amounts of spray to different types of surfaces and preparation of houses for spraying; (5) precautions to be taken against causing fires or contaminating food in homes; (6) necessity for spraying behind and under furniture; (7) marking and keeping a record of sprayed houses. Where mosquitoes are most commonly found resting in houses, how they should be caught for identification and how to make simple biological assays of previously sprayed surfaces to determine whether they are still lethal to insects, were to be additional points of instruction in this 1- to 2-week course given by the malaria control engineer.

The malaria biologist was not considered essential in the beginning of the demonstrational phase. He was to be available, however, before the end of the 1949 malaria season to gage entomologically the relative effectiveness and durability of DDT in oil solution and water suspension under Iranian conditions. His observations on these points had to be extensive and critical. Operational improvement of

the program in terms of insect destruction would be his most immediate and dominant concern. After the most desirable DDT formulation and schedule of treatment were determined, it was recommended that he devote himself to a study of the speciation, prevalence, and bionomics of the anopheline forms of Iran, with the objective of obtaining further information concerning the more important vectoral forms, their seasonal and geographic distribution, and their breeding, biting, and resting habits, etc. Biological methods of reducing the malariogenic hazard of irrigation projects would have to be explored and tested. The malaria biologist would assist the engineer with the investigation of bona fide complaints of apparent ineffectiveness of DDT, and the provincial health officers in determining the limits of marginal malaria incidence.

The medical officer in charge must be trained in malariology, especially malariometry and malaria control and have administrative, executive, and good public relations abilities. His duties would include: (1) assistance to provincial health and malaria control officers in plotting the relative extent of the malaria problem and in evaluating control operations in their areas; (2) advice regarding modern regimes for suppressive medication and radical cure of malaria; (3) requests for timely estimates of the amounts of insecticide, spraying equipment, transportation, and antimalarial drugs required for the prosecution of the respective programs; (4) active promotion of use of discriminating diagnostic techniques; (5) analyses of records of reported malaria morbidity and mortality and investigation of unusual, irregular, or suspicious events. The medical officer in charge must see that the operational, biological, medical, and epidemiological phases of the program are coordinated to the best possible advantage. He would have to take the lead, also, in stimulating a nation-wide program of community health education on malaria control among the people.

III. *Provincial Malaria Control Organizations*

Dr. Andrews recommended that provincial health officers, malaria control officers (specially trained pezeshkiars), spray crew foremen (specially trained vaccinators), and workers recruited and trained on the job site be activated by the Ministry of Health. These would be responsible for citing, executing, and evaluating the provincial malaria control programs in accordance with specific duties and responsibilities assigned to them.

IV. *Assistance From Other Agencies*

Certain official and voluntary agencies have indicated interest in the proposal to make a systematic and strenuous attack upon malaria

in Iran. Some of them have helped in the planning stages; others have expressed a desire to assist in the future.

The problem is not insuperable, says Dr. Andrews. In addition to money, malaria control requires technically trained and experienced supervisors, placed in positions of authority and supported, financially and morally, by the government to operate a nation-wide program according to accepted principles and practices. Iranians must be developed for such responsibilities through training abroad and experience at home under the guidance of competent authorities.

Agencies interested in Iranian malaria control can help in meeting some of the needs and in eliminating some of the deficiencies. Among these groups Dr. Andrews lists: (1) The World Health Organization which has provided technical assistance for malaria control in other countries; (2) the International Health Division of the Rockefeller Foundation which has signified in various ways its sympathetic interest in public health in Iran and in malaria prevention in particular; (3) the Iran Foundation whose prime objectives are the improvement of standards of health and education in Iran and which has already shown its interest by paying the travel expenses of two Public Health Service officers from the United States to and from Iran on malaria missions; (4) the Near East Foundation which is dedicated to increasing the welfare of rural populations in Levantine countries and is noted for its work of rural sanitation and DDT spraying in some of the Iranian villages; and (5) the Anglo-Iranian Oil Co. which has provided very adequate local health facilities, including malaria control, for its employees in Iran.

V. *Suggestions for Legislation on Imports of Antimalaria Drugs*

The Iranian Government has been charging import duty on DDT sprayers, antimalaria drugs, etc., which have been brought into the country by the government to be used or distributed for the public good without charge. This has varied roughly from 15 to 30 percent ad valorem.

Dr. Andrews suggested that consideration be given to legislation to exempt from import charges or to remit to importers, customs duties collected on such antimalarial supplies.

VI. *Conversion to Water-wettable DDT*

Investigations made by Dr. Andrews indicated that importation of DDT in Iran would be much cheaper than manufacturing it there.

DDT may be imported as 100 percent technical grade and as 50 to 90 percent water-wettable. The latter contains from 10 to 50 percent of an inert diluent such as talc, pyrophyllite, etc. If a suitable clay exists in Iran and can be obtained cheaply it might be worth while to

import only 100 percent technical grade DDT and to mix it with pulverized clay and the adjuvant sticking and wetting agents after it arrives in Iran. This would eliminate payment of costs and freight for the inactive DDT agent.

A summary of specifications for diluent dusts for use with DDT was sent to the adviser to the Ministry of Health.

Follow-Up Program[4]

In March 1949, Lawrence B. Hall went to Iran to establish the demonstrational phase of the program as recommended by Dr. Andrews.

To assist in the malaria control training program, the Public Health Service publication "DDT Residual Spray Operations," revised to make it applicable to the Iranian situation, was translated by members of the staff of the Ministry of Health and mimeographed for distribution to the training classes and to subsequent students.

The first class of malaria control trainees, with 26 representatives from eight provinces (ostans), convened in Tehran April 4, 1949. A number were unable to report on time due to delay caused by snow-blocked mountain passes. By April 18, 31 civilians and 10 officers of the Iranian Army had arrived. The class was extended for students who reported late.

Field demonstrations and practice in spraying the inhabited dwellings of several villages in the Tehran area were included in the course given by Mr. Hall to a total of 47 trainees. These trainees quickly grasped the basic information and, after a very short field experience, were able not only to apply the residual spray themselves but to supervise crews of fellow students in the spraying of relatively large areas.

After termination of the program, the trainees returned to their original stations, in some cases driving trucks containing necessary supplies. Under direction of the health officers in their own areas, they had to assemble crews consisting of other pezeshkiars whom they had to train during the season's operations. By the end of the 1949 malaria season it was expected that there would be 150 to 200 capable spray crew foremen prepared for next season's operations.

Prior to the arrival of Mr. Hall, only limited progress had been made in distribution of sprayers, DDT, and miscellaneous equipment and materials to the field and in selection of operational areas by the provincial health officers. Considerable time was therefore spent in planning for operations and in setting up the necessary machinery within the Ministry of Health. A committee composed of members

[4] From Preliminary Report on Malaria Control Follow-Up Training Program and Summary of Recommendations to the Iranian Government, by Lawrence B. Hall, sanitary engineer, on detail to the Division of International Health, Public Health Service; and consultant to Iran, March–May 1949.

of the Ministry's staff selected areas of Iran in which the malaria control program was to be put into effect and arranged for the distribution of supplies and equipment.

Numerous problems were encountered in the use of DDT in kerosene, particularly the problem of transporting the oil from the main roads to the habitations at a distance from vehicular roadways. For this and other reasons, the use of water-wettable DDT in Iran, when available, appears desirable and its use was urged in succeeding seasons provided that it could be demonstrated that under Iranian conditions the water-wettable DDT was no less lethal to the malaria vector than the oil-borne DDT. To determine the answer to this important question during the current season, the Ministry of Health, assisted by the American Embassy, initiated a request to the United States Department of State for the assignment of a trained entomologist.[5] If the entomologist reached Tehran on or about July 1, at least a rough evaluation of the relative merits of the two systems might be completed during the current season.

Sixty tons of water-wettable DDT and 100 special Lofstrand sprayers were reported to be in a port on the Persian Gulf, but had not reached Tehran at the time of Mr. Hall's departure. Preparations were under way, however, to initiate use of water-wettable DDT on a number of projects as soon as possible. It was recommended to the Ministry of Health that sufficient sprayers and water-wettable DDT be supplied to spray 35 Varamine Plain villages, containing 7,000 inhabitants under direction of the Near East Foundation. After completion of this short-time project, the equipment used was to be diverted to other areas. It was also planned that water-wettable DDT with an appropriate number of sprayers be used to spray a maximum number of houses in the Caspian littoral.

Cooperation of Other Agencies

Two representatives of the World Health Organization were making a survey of the country, at the time of Mr. Hall's arrival, to serve as a basis for a report to WHO on the advisability of sending malaria control personnel to Iran during the 1950 malaria season. They stated they would recommend a WHO malaria control demonstration in a selected area. The secretary of the WHO Expert Committee, seen later in Geneva by Mr. Hall, agreed to recommend to the Expert Committee that the WHO provide an entomologist and a director of malaria control operations to assist the Iranian nation-wide program during the 1950 season rather than attempt a small scale demonstration.

[5] Richard Dow, Senior Assistant Scientist, Public Health Service, Communicable Disease Center, Atlanta, Ga., was sent to Iran in August 1949 to make a 3-month survey of the relative effectiveness of water-wettable and oil-borne DDT in Iran. His report is not yet available.

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The Rockefeller Foundation representative in Tehran offered considerable assistance in the training activities and in establishment of the operating program.

The Near East Foundation undertook, at the request of the Ministry of Health, to spray the habitations in the vicinity of Zabol in Ostan VIII, near the Afghanistan border, as well as other areas already indicated. This was a successful operation and a definite accomplishment. Using DDT and equipment supplied by the Ministry of Health, the Near East Foundation has done a considerable amount of residual DDT spraying. This Foundation, however, cannot be expected to expand its malaria control program to the exclusion of its other interests, Mr. Hall stated.

Personnel of Overseas Consultants, Inc., also cooperated extensively with the Ministry of Health in planning the malaria control program.

Summary of Recommendations to the Iranian Government

The following recommendations were made by Mr. Hall:

Organization. Operations should be decentralized under the provincial health officer. These provincial organizations must be assisted by a Malaria Control Unit which would report administratively to the Ministry of Health and would have its own personnel, appropriation, budget, vehicles, office, and warehouse facilities. The purpose of the Malaria Control Unit would be to assist the provincial officials; to procure necessary equipment, materials, and vehicles; to procure and train personnel.

Training. Training should be given at four levels, as follows:

1. Malaria Control Unit technical personnel trained under fellowships either in Italy or the United States for a minimum of 3 months.
2. Malaria control supervisors, in addition to any foreign training, and provincial personnel to be trained under the Near East Foundation through its facilities in Iran.
3. Crew foremen trained in classes given each spring before the malaria season begins. These classes should be conducted by the staff of the Malaria Control Unit and the provincial malaria control supervisors.
4. Crew members trained by crew foremen on the job as is necessary.

Equipment and Materials. Vehicles must be obtained and assigned permanently to malaria control operations. They should be available at the beginning of the season and remain assigned to this duty throughout the operating season without interruption. Animals must be made available for transportation over difficult terrain. The best sprayers procurable and adequate stores of spare parts should be obtained in sufficient quantity to serve the needs of the program.

Nozzles used should be specially designed for the purpose, having a flat spray at approximately an 80° angle. The majority of spraying operations during the next season should be conducted with 50 percent water-wettable DDT. Small scale field trials, utilizing 90 percent water-wettable DDT were recommended. The use of DDT in oil should not be encouraged unless special circumstances require its use and transportation to the area under consideration is not a problem.

Operations. DDT spraying operations should be carried out only during the period immediately prior to the beginning of the malaria season. Spraying should not be done during the winter months. Protection of nomadic tribesmen and roof-top sleepers should receive special attention. The problem of the utilization of DDT in silk-worm raising areas will have to be investigated by carefully conducted field trials if therapeutic measures do not prove entirely effective or are undesirable.

Adjunctive Measures. The use of DDT and other insecticides by individuals as well as by those responsible for the malaria control program should be encouraged by all means possible. These should include duty free importation of the insecticides not produced in Iran and the distribution of insecticides to the public at cost by the government.

Field Test of the Efficiency of the Rodenticide Compound W.A.R.F. 42

By MARTIN W. SCHEIN*

Laboratory studies of Compound W.A.R.F. 42 (*1*) indicate that while this anticoagulant is relatively harmless to handle and use, it is an extremely effective rodenticide if sufficient time is allowed for cumulative action. These tests also indicate that a period of 4–6 days at a concentration of 1 mg./gm. of bait will give a good kill. The results of testing Compound W.A.R.F. 42 under natural conditions in residential city blocks are reported here.[1]

This report does not constitute an endorsement of the technique of employing poisons in rodent control, for it has been demonstrated (*2*) that the effects of poisoning are, at best, short lived. On the other hand, environmental changes, such as reduction in the harborage or food supply, would give more profound and more permanent control, and is therefore to be preferred. However, poisoning has a definite value under a few specified conditions.

Methods

A total of 13 blocks was selected, 6 for poisoning and 7 for reference. The blocks were typical residential slum areas, consisting of two rows of houses separated in the rear by an alleyway traversing the length of the block. The rear yards were invariably surrounded by wooden or wire fences in various states of disrepair. Outdoor toilets were present in about 15 percent of the yards.

Rodent populations were estimated (*3*) for all the blocks and the boundaries of the individual colonies within the blocks were mapped (*4*). After determining the limits of the colonies, bait containing Compound W.A.R.F. 42 was set out in open cigar boxes in the blocks to be poisoned. Usually one box per colony was set out, but in a few heavily populated colonies two boxes were used. The bait was a simple mixture of Compound W.A.R.F. 42 and finely-ground corn at a poison concentration of 1 mg./gm., mixed by hand.

One block, F, was prebaited with ground corn primarily to develop the technique of baiting and secondarily to see if there would be any appreciable difference in bait consumption or kill. There was plenty

*Rodent Ecology Project, Department of Parasitology, School of Hygiene and Public Health, Johns Hopkins University. The work reported was conducted under a grant from the National Institutes of Health, Public Health Service.

[1] We are indebted to the Denver Laboratory of the Fish and Wildlife Service for supplying the Compound W.A.R.F. 42, and to Drs. Karl P. Link and C. A. Krieger for advice on the laboratory results.

of other food available for the rats at all times, as every effort was made to keep the environment unchanged. In some instances, removal of old wooden fences and outdoor toilets was postponed until after the tests were completed.

A measured amount of poisoned bait was set out in each box and weighed at 1- or 2-day intervals to determine consumption. The dry bait invariably gained from 2 to 8 percent in weight due to the absorption of moisture on the first day of exposure, and gained or lost varying amounts on succeeding days, depending upon the relative humidity of the day. Since many bait boxes showed a decided gain in weight on high humidity days, a moisture factor of 3 to 5 percent was subtracted from all the weights for that day; the result was a fairly accurate rate of consumption for each station. The daily totals of all the stations in each block were combined to give the rate of consumption on a block basis.

After the poison operation was completed, an attempt was made to obliterate all rat signs on the blocks in preparation for the final estimate. The final survey was generally made within 2 days after the removal of the poison except in the case of block F, where 6 days elapsed. It was felt that normal population recovery would be negligible for such a short duration of time, and therefore the final estimates would not be significantly affected.

Results

The results of the poisoning are given in the table and chart. All blocks showed a decided reduction in population, which averaged 84.5 percent (weighted) per block; construction work in one yard in block E could account for only a very small amount of the mortality. In contrast, the seven reference blocks, which had been surveyed at 2-month intervals for the past 11 months, showed no unexplainable changes in population (see table). The decline in block M was clearly due to major construction work in 5 yards.

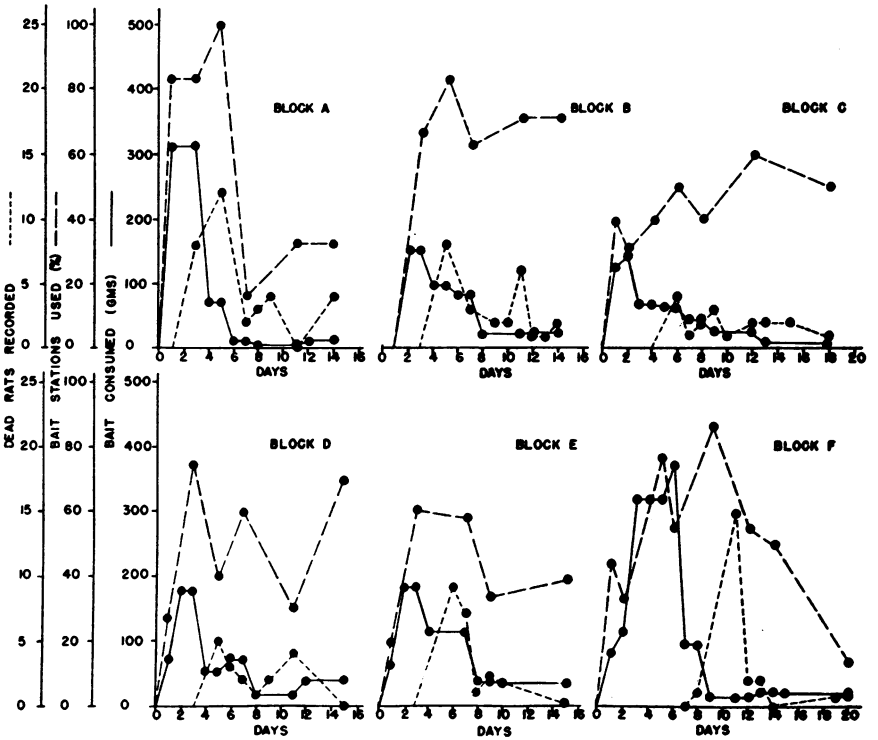
The consumption of poisoned bait showed some noteworthy features. Out of a total of 62 bait stations, 5 were never used, and 19 more were not used until after the third day; all other stations were in use on the first or second day. Delay in use is attributed to the fact that all boxes were placed under either a makeshift or a permanent cover designed to keep out pets, children, and rain. In many instances this necessitated setting the bait a few feet from the runway. Of the 5 completely undisturbed boxes, 3 were in positions that were completely missed by existing rat colonies, and 2 were placed in areas which were subsequently discovered to be no longer inhabited by rats. The percentage of bait stations used per day per block, as shown in the chart, corresponds usually with the amount of bait taken until the second or third day. After that, the curve representing

Comparative data before and after poison

Block	Dwelling units (5)	Bait stations	Population before poison		Days of poison	Population after poison		Percent reduction	Total grams of bait consumed per dead rat
			Date	Rats		Date	Rats		
A	34	6	Aug. 22	50	14	Sept. 9	0	100.0	23.1
B	57	8	do	100	14	do	19	81.0	10.0
C	78	10	do	75	18	Sept. 12	5	93.3	11.5
D	50	11	Aug. 23	130	15	Sept. 10	10	92.3	7.6
E	117	16	Aug. 17	174	15	Sept. 15	54	69.0	9.8
F	73	9	Aug. 20	92	[1] 20	Sept. 20	4	95.6	11.5
G	66		July 9	105		Sept. 9	110	Gain	
H	49		do	41		do	55	Gain	
I	50		July 7	33		do	32	3.0	
J	47		July 5	28		Sept. 10	55	Gain	
K	57		do	43		do	48	Gain	
L	63		July 8	40		Sept. 9	42	Gain	
M	74		do	53		do	31	41.5	

[1] Includes 5 days pre-baited.

consumption dropped sharply while the number of bait stations in use remained fairly static. This would indicate an abrupt loss in consumption on the part of the rats after the second or third day of poisoning, for the prebaited block F showed a normal consumption for the nonpoisoned period (5 days) and then a sharp drop 2 days



Curves for bait consumption, percentage of bait stations used, and recovery of dead rats in each of the 6 treated blocks.

after the poison was introduced. In addition, the figures (table) show that a surprisingly small amount of bait was sufficient to result in the high mortality obtained.

The collection and observation of dead rats provided additional data concerning the results of poisoning. Each of the carcasses seen by the observer was noted as to date found, weight, sex, and location. Furthermore, reports were solicited from the inhabitants when available. In these cases, only the date found, location, and relative size could be noted. It is believed that there is very little overlapping between the dead rats actually seen by the observer and the second-hand reports, for the inhabitants disposed of the carcasses immediately upon discovery. It must be emphasized that only about 20 percent of the inhabitants were questioned, and that many rats were disposed of without any report at all. Therefore, the figures on dead rats seen and reported per day per block, as shown in the chart, are only relative and are by no means total counts. The graphs show the greatest mortality generally between the fifth and sixth day after poisoning, and a gradual decline thereafter with many fluctuations. The data show no differential kill as regards age and sex ratios of recovered rats.

The question arises as to why block E gave such a low percentage of kill as compared to the others. A partial answer to this lies in the relative inaccessability and size of the colonies. In some instances, what was originally plotted as one large colony with one bait station, turned out instead to be two fairly distinct colonies, one of which therefore had no access to the bait station. Such conditions lead to the suggestion that in an exceedingly high population such as this block, either a longer or a more intensive poison period is required for a substantial kill.

The pre-baited block F showed no appreciable difference in data from the other blocks except for a decided increase in bait consumption before poisoning. From the data presented here, there seems to be no need or justification for prebaiting with Compound W.A.R.F. 42 except as far as determining an acceptable bait is concerned.

The changes in numbers of rats in these blocks 3 months after the final post-poison survey may be of interest to indicate the rate of population increase after a sharp reduction. The December survey results were: block A, 4 rats; block B, 70 rats; block C, 16 rats; block D, 35 rats; block E, 43 rats; block F, 5 rats. The average (weighted) gain per block for these 3 months was 88.0 percent. In contrast, estimates of the 7 untreated blocks indicated an average (weighted) loss of 12.4 percent per block which is within the experimental error of measurement (*3*) and therefore should be interpreted as no change in population.

Summary

The object of this experiment was to test the efficiency of the anticoagulant, Compound W.A.R.F. 42, under natural field conditions.

The populations and the boundaries of colonies of rats in 13 blocks were determined. Poison was exposed in 6 blocks; 7 were left for reference. Compound W.A.R.F. 42 was mixed with ground corn, 1 mg/gm. of bait; one cigar box of bait was set out per colony and allowed to remain 14 to 18 days. The consumption was measured at 1- to 2-day intervals.

Populations were again determined after the poisoning period, and kills of 69–100 percent were recorded, with the weighted average kill of 84.5 percent. On the other hand, the populations of the reference blocks showed no unexplainable changes.

Dead rats were recovered in large numbers generally after the fourth and fifth day of poison. However, bait consumption showed a rapid decline after the second or third day of poison, and a relatively low level of consumption thereafter with slight fluctuations.

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Principles on the Education and Utilization of Sanitary Engineers*

On January 15–16, 1950, under the sponsorship of the Division of Engineering Resources of the Public Health Service, a group of 36 persons, including 9 from the Service, met in Washington to discuss, on a broad basis, the education and utilization of sanitary engineers. This group was representative of both the "producers" and the "consumers" of young men educated in sanitary engineering. The views of those connected with universities and colleges, Federal agencies,

*Report from the Division of Engineering Resources, Bureau of State Services, Public Health Service.

State and local health departments, and industry were all heard and general agreement among those present was reached on the following principles:

1. Future programs of study at the university level that are to be pursued in preparation for the practice of sanitary engineering should encompass a minimum of 5 years of study of mathematics, the basic sciences, and the engineering disciplines. This can be accomplished through 4 years of study leading to a bachelor's degree in engineering followed by 1 year of study leading to a master's degree in sanitary engineering, this additional year to include sanitary engineering subjects and adequate instruction in the principles of public health. It is desirable that this be a program of continuous study.

2. Programs of study at the university level that are pursued in preparation for sanitation practice should include instruction in mathematics and the basic sciences adequate to form the foundation for later study in the sciences, the engineering disciplines, or the medical disciplines by those individuals who are qualified to benefit by graduate study.

3. Field training programs can be a supplement but never a substitute for rigorous academic education.

4. No substitution can be made for the skills that the qualified sanitary engineer brings to his work. However, it is realized that within the field of environmental sanitation a wide variety of skills is essential and that trained personnel other than sanitary engineers may possess some of these skills and may apply them successfully in specialized areas.

5. The procurement of young men for the sanitary engineering profession rests on the intellectual and financial attractions of the job. Means should be developed for the advancement of sanitary engineers in their profession and for the lifting of sanitary engineering salaries to higher levels.

6. There is evidence that increased opportunities in public health beyond the technical sanitary engineering field are available to qualified and capable sanitary engineers.

7. It is desirable that the Public Health Service make studies of (a) the need for sanitary engineering personnel in all areas of work where engineering disciplines may contribute to the promotion of health, which study should be sufficiently broad to include both current and future needs, and (b) the rate of loss from the sanitary engineering field, after graduation, of those receiving academic training in sanitary engineering.

8. The principle is reaffirmed that the planning and direction of local environmental sanitation programs should be by competent sanitary engineers and that organization and employment to that end should be advocated and promoted by all public health agencies.

Recovery of *Brucella melitensis* from the Hog

By S. R. Damon, Ph. D., and J. H. Scruggs, D. V. M.*

Isolation of *Brucella melitensis* from cow's milk in Indiana has been reported by Damon and Fagan previously (*1*). Recovery of this organism from hogs in Iowa has been recorded by Jordan and Borts (*2*), and in Minnesota by Kabler and MacLanahan (*3*) and by Kabler, Bauer, and Nelson (*4*). Its isolation from the hog in Indiana is recorded here for the first time.

In this laboratory it is routine procedure to culture the clots from blood specimens submitted by physicians for agglutination tests; and, from a patient (W. D.), *Br. melitensis* was recovered from such a clot. Epidemiological investigation of the case brought out the facts that the patient had already been diagnosed clinically as having brucellosis and that as a farmer he had frequent contact with both cattle and hogs. Accordingly, blood specimens for agglutination tests were obtained from the 2 dairy cows and 18 breeding swine on the premises, with the result that 1 cow and 8 of the sows reacted to some degree with a *Brucella* antigen.

Cultures in crystal violet tryptose broth were made from the blood clots of all the above specimens, and after incubation in a CO_2 atmosphere for a week, crystal violet tryptose agar plates were streaked from the broths. On the plates made from one of the swine specimens, colonies came up which were serologically identified as *Brucella*. Further study of this culture demonstrated that in its H_2S production and dye inhibition it corresponded to *Br. melitensis*. So far as can be determined, this is the first time *Br. melitensis* has been shown to be present in the hog in Indiana. This observation serves to extend our knowledge of the animal distribution of *Br. melitensis* and to throw further light on a possible source of human infection in this area.

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INCIDENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED FEB. 25, 1950

For the current week in the Nation, reported cases of influenza decreased from 16,223 to 14,556 from the preceding week or 10 percent. For the corresponding week last year, 4,542 cases were reported. The 5-year (1945–49) median for the week is 5,192. The cumulative total for the United States is 64,196 for the calendar year as compared with the corresponding cumulative total of 36,750 for 1949 and 155,013 for 1946.

The West North Central Division decreased from 227 cases last last week to 108 currently, and the West South Central Division decreased from 11,703 to 9,390. Increases over the previous week are noted in the South Atlantic (from 3,005 to 3,469), East North Central (from 36 to 74), East South Central (from 416 to 478), Mountain (from 813 to 981), and Pacific (from 18 to 44). The two remaining divisions showed slight increases.

Texas reported incidence of influenza for the current week was 22 percent below the previous week (from 10,980 to 8,549). For the corresponding week of 1949, 2,172 cases were reported. The 5-year (1945–49) median for Texas for the week is 2,465. Of the States reporting cases in excess of the 5-year (1945–49) median for the week, the 5 highest (excluding Texas and Virginia) were Colorado, 266; Georgia, 209; Oklahoma, 543; Montana, 383; and West Virginia, 770.

Reported incidence of measles (8,172) for the current week, although increasing over last week, remained below the 24,133 cases for the corresponding week last year and the 5-year median of 15,725. Michigan reported 2,148 cases of measles as compared with 1,240 last week and a 5-year corresponding median of 462. Other States reporting measles above the 5-year median for the week are Arizona, Iowa, Kansas, Mississippi, and Utah.

Reported cases of whooping cough decreased from 2,701 last week to 2,447 currently but remained above the 5-year median of 2,251. The cumulative total of 19,498 was above the corresponding 5-year median of 17,994. Michigan reported the largest number of cases with 313. Other States reporting above median incidence for the week were Missouri, 33; West Virginia, 55; and Wisconsin, 142.

Three cases of smallpox were reported, 1 in South Dakota and 2 in Wyoming.

Telegraphic case reports from State health officers for the week ended Feb. 25, 1950

[Leaders indicate that no cases were reported]

Division and State	Diphtheria	Encephalitis, infectious	Influenza	Measles	Meningitis, meningococcal	Pneumonia	Poliomyelitis	Rocky Mt. spotted fever	Scarlet fever	Smallpox	Tularemia	Typhoid and paratyphoid fever [1]	Whooping cough	Rabies in animals
NEW ENGLAND														
Maine			3	36		12	1		6				14	
New Hampshire			1			2			3					
Vermont				35		1			6				21	
Massachusetts	4	2		165	1				126			1	103	
Rhode Island	1			11		2			9			1	28	
Connecticut			1	41	2	42			34				92	
MIDDLE ATLANTIC														
New York	3	1	[2] 5	561	4	254	11		[2] 144			1	200	17
New Jersey	3		2	494	2	57	3					2	129	
Pennsylvania	4			292	9	52	4		132			4	223	2
EAST NORTH CENTRAL														
Ohio	4		5	198	10	93	3		287			1	212	13
Indiana	10	2	25	238		11			57				49	11
Illinois	1		12	178	4	109	2		101		1		89	4
Michigan		2		2,148	4	59	5		169			1	313	3
Wisconsin			32	306	6	15			101			1	142	
WEST NORTH CENTRAL														
Minnesota	4			57	1	19	9		30				19	
Iowa		1		786		4			11				2	6
Missouri	3		2	11	1	10			30				33	
North Dakota	1	1	46	5		9			8				1	
South Dakota	1			49		2			3	1				
Nebraska			5	59		5			13				8	
Kansas	1		55	86	1	22			40				9	2
SOUTH ATLANTIC														
Delaware				46	1		1		9				9	
Maryland	4		8	41	1	72			31				40	
District of Columbia			4	92	2	17			2				1	
Virginia	1		2,377	61	3	126	1		32		3		51	2
West Virginia	3		770	162	3	16			18			4	55	9
North Carolina	6			148	3		2		31		1		30	
South Carolina	4		93	100		9			5			2	4	5
Georgia	11		209	46	1	23	1		13		4	3	21	8
Florida	1		8	33		11	5		4				3	1

EAST SOUTH CENTRAL														
Kentucky	2		27	45	2	32			22			2	12	11
Tennessee	5		123	85	3				43			1	30	6
Alabama	10		295	54	2	112	2		13		1	4	13	11
Mississippi	8	1	33	112	2	40	8		11		2			7
WEST SOUTH CENTRAL														
Arkansas	3		297	9	2	83			9		3	1	36	3
Louisiana	7		1	73		38	4		1		2	11	1	
Oklahoma	3	1	543	3	1	75	1		18		1	1	9	5
Texas	24	1	8,549	323	4	884	12		44			3	189	32
MOUNTAIN														
Montana			383	45	1		1		9					
Idaho			68	85		2	2		7				1	
Wyoming	1		28	24		1			3	2			3	
Colorado	2	2	226	143		36			14			1	7	8
New Mexico	2			22		13	2		10		2		2	
Arizona	1		258	142	1	22			9			1	51	
Utah			18	238					4				21	
Nevada						1								
PACIFIC														
Washington			12	43		1	1		37				60	
Oregon	5		11	23		21			23				27	
California	7	2	21	218	8	42	16		130				84	2
Total	150	16	14,556	8,172	85	2,457	97		1,862	3	20	46	2,447	168
Median, 1945-49	261	7	5,192	15,725	101		38	1	3,116	3	21	40	2,251	
Year to date, 8 weeks	[4] 1,346	89	64,196	45,001	696	18,659	898	6	13,838	12	188	[4] 363	19,498	1,137
Median, 1945-49	2,443	59	36,750	69,199	709		353	4	22,009	30	189	333	17,994	
Seasonal low week ends	(27th) July 9		(30th) July 30	(35th) Sept. 3	(37th) Sept. 17		(11th) Mar. 19		(32d) Aug. 13	(35th) Sept. 3		(11th) Mar. 19	(39th) Oct. 1	
Since seasonal low week	[4] 5,617		94,726	64,131	1,609		43,380		30,277	19		[4] 3,736	38,587	
Median, 1944-45 to 1948-49	10,009		73,020	95.323	1,639		19,323		47,391	84		3,861	40,470	

[1] Including cases reported as salmonella.
[2] New York City only.
[3] Including cases reported as streptococcal sore throat.
[4] Deductions, week ended February 18: Diphtheria, Georgia 3 cases; typhoid fever, Arkansas 1 case.
Alaska: Measles 42.
Hawaii: Diphtheria 2, influenza 3, whooping cough 1.

PLAGUE INFECTION IN NYE COUNTY, NEVADA, AND LEA COUNTY, NEW MEXICO

Nevada

Under date of February 21, plague infection was proved in 46 fleas, *Thrassis gladiolis*, taken from a ground squirrel, *Citellus lateralis*, found dead January 24, 1950, 15 miles north of Pahrump, then 3 miles east on Mile Road in Nye County.

New Mexico

Under date of February 21, plague infection was proved in Lea County, south of Maljamar, in the same general area where a resident of this town shot rabbits on January 6, 1950, and 3 days later developed bubonic plague. The specimens were as follows: Ten fleas, *Thrassis fotus*, taken from 5 grasshopper mice, *Onychomys leucogaster*, trapped February 8, 1950, on U. S. Highway 83 at Maljamar; a tissue from one cottontail rabbit, *Sylvilagus auduboni*, found dead 1 mile south of Maljamar, February 9, 1950, and 7 fleas, *Hoplopsyllus affinis*, taken from the dead rabbit; tissue from 2 wood rats, *Neotoma albigula* (both positive), found dead 2 miles south of Maljamar, February 9, 1950; thirty-five fleas, 12 *Echidnophaga gallinacea* and 23 *Orchopeas sexdentatus* obtained from 2 wood rats' nests located 2 miles south, then eight-tenths mile west of Maljamar; a tissue from one cottontail rabbit, *Sylvilagus auduboni*, found dead February 10, 1950, on Black Top Road, 1.7 miles south of Maljamar, and 13 fleas, 11 *Hoplopsyllus affinis* and 2 *Echidnophaga gallinacea*, taken from the dead rabbit; nineteen fleas, *Orchopeas sexdentatus*, collected from a wood rat, *Neotoma*, nest found 3 miles south of Maljamar, February 11, 1950; and nine fleas taken from 2 wood rats, *Neotoma albigula*, trapped February 11, 1950, 2 miles south of Maljamar and then eight-tenths mile west of a Maljamar dump.

TERRITORIES AND POSSESSIONS

Hawaii Territory

Plague (in fleas).—Under date of February 20, 1950, plague infection was reported proved on January 24, in a mass inoculation of 19 fleas taken from rats trapped in District 7A, Honokaa, Hamakua District, Island of Hawaii, T. H.

FOREIGN REPORTS

CANADA

Provinces—Notifiable diseases—Week ended February 4, 1950.—During the week ended February 4, 1950, cases of certain notifiable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox	1		55		315	352	46	43	53	120	985
Diphtheria				1	6	2					9
Dysentery, bacillary					2	2				1	5
German measles			28		8	212		36	285	74	643
Influenza			66			3	1			11	81
Measles			10		423	533	86	134	71	166	1,423
Meningitis, meningococcal							1		1		2
Mumps			103		194	734	9	48	111	368	1,567
Poliomyelitis			2		20		2		1		25
Scarlet fever	1				71	54	20	1	63	16	226
Tuberculosis (all forms)	34		3	17	114	79	8	11	1	25	292
Typhoid and paratyphoid fever				1	12						13
Undulant fever						1					1
Venereal diseases:											
Gonorrhea	9		10	11	102	55	31	7	40	66	331
Syphilis	4		5	8	87	42	4	6	4	11	171
Whooping cough	1		9		139	125	1	14	7	16	312

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

Note.—The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Cholera

India.—During the week ended February 11, 1950, cholera was reported in certain cities in India as follows: Calcutta, 177 cases, 62 deaths; Masulipatam, 17 cases, 3 deaths; Tellicherry, 10 cases, 2 deaths. For the week ended February 18, 110 cases were reported in Calcutta.

Plague

China.—Kwangtung Province.—According to information dated

February 13, 1950, an outbreak of plague had been reported in Southwest Kwangtung Province, China. Later information, dated February 23, states that the exact location of this outbreak was in the coastal town of Anpu, and that no spread of the disease was reported after February 5. No figures on the number of cases occurring were given.

Smallpox

Arabia.—Jedda and Mecca.—Information from Jedda, Arabia, dated February 20, 1950, states that the epidemic of smallpox which has been occurring in that locality was regarded as of that date as being in its closing stages. During the week ended February 18, 8 new cases with 3 deaths were reported in Jedda, and 17 cases, 8 deaths in Mecca.

Burma.—During the week ended February 11, 1950, 330 cases of smallpox, with 100 deaths, were reported in Burma, including 179 cases, 43 deaths in Bassein, and 109 cases, 49 deaths in Rangoon. For the week ended February 18, Bassein reported 147 cases, Rangoon 104 cases.

China.—Eight cases of smallpox were reported in Shanghai during the week ended February 11, 1950. During the period February 1–10, 60 cases were reported in Swatow.

French West Africa.—During the period January 21–31, 1950, 79 cases of smallpox were reported in Niger Territory, and 86 cases were reported in Dahomey during the period February 1–10.

India.—Smallpox has been reported in Calcutta and Madras, India, as follows: Week ended February 11, 1950, Calcutta 224 cases, Madras 227 cases; week ended February 18, Calcutta 217 cases, Madras 249 cases.

Indochina (French).—During the week ended February 11, 1950, 13 cases of smallpox were reported in Rachgia, Cochinchina.

Typhus Fever

Colombia.—During the month of December 1949, 200 cases of typhus fever were reported in Colombia.

Yellow Fever

Panama.—On January 23, 1950, 1 fatal case of yellow fever was reported in Panama. This case was stated to have been contracted in a jungle area near Palmas Bellas. Death occurred in a hospital in the city of Colon.

YELLOW FEVER INOCULATION REQUIREMENTS FOR AIR TRAVELERS TO PAKISTAN

On January 30, 1950, the Embassy of Pakistan in Washington, D. C., informed the Secretary of State that the Government of Pakistan has imposed quarantine restrictions against yellow fever on all aircraft arriving in Pakistan from the West, regardless of whether or not they have been in a yellow fever area. Therefore, in order to avoid the possibility of quarantine detention, it is desirable for all air travelers to Pakistan to possess a valid Yellow Fever Inoculation Certificate.

DEATHS DURING WEEK ENDED FEB. 25, 1950

	Week ended Feb. 25, 1950	Corresponding week, 1949
Data for 94 large cities of the United States:		
Total deaths	9,563	9,419
Median for 3 prior years	9,811	
Total deaths, first 8 weeks of year	77,034	79,247
Deaths under 1 year of age	598	649
Median for 3 prior years	649	
Deaths under 1 year of age, first 8 weeks of year	5,006	5,409
Data from industrial insurance companies:		
Policies in force	69,870,523	70,595,642
Number of death claims	10,977	10,489
Death claims per 1,000 policies in force, annual rate	8.2	7.7
Death claims per 1,000 policies, first 8 weeks of year, annual rate	9.6	9.6