

A SURVEY OF THE ADMINISTRATION, ORGANIZATION AND OPERATION OF AMERICAN MOSQUITO CONTROL AGENCIES

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ABSTRACT. A survey of organized American mosquito control agencies was undertaken in 1978. The major organizational, adminis-

trative and operational features of these agencies were identified and are described.

INTRODUCTION

In 1978 the author undertook a survey of organized American mosquito control agencies. For the purpose of this study an organized mosquito control agency was defined as an agency whose control activities are integrated into a continuous, full-time, professional and scientifically-based program.

The two objectives of the present study were as follows:

1. to determine the basic organizational, administrative and operational components of organized mosquito control agencies in the United States;
2. to determine whether these three components of organized mosquito control agencies in the United States can be modified to apply to a developing country for the effective control of mosquitoes.

The results of the survey as they apply to the first objective only are presented.

METHODS AND MATERIALS

A self-administered questionnaire was distributed to directors of the organized mosquito control agencies at the annual meeting of the American Mosquito Control Association held in Chicago in April, 1978. The questionnaire was also mailed to directors of organized control agencies in the United States who were not present at the meeting. Their names and addresses were obtained from the Directory of the Mosquito Control Agencies in the United States and Canada. The study was

limited to the mosquito control agencies in the United States because the U.S. programs are already established, have a history and record of successful operations against mosquito-related problems, employ advanced technology, and have at their disposal the necessary materials, equipment and funds.

The questionnaire covered various selected topics including organization, administration, budgeting, personnel management, research, use of larvicides and adulticides, public relations, constraints, evaluation, and other specific operations of the agency. Two hundred questionnaires were distributed and there were 154 responses (77% response rate). Seventeen of the responses were eliminated from the analysis because they did not fit into the operational definition of an organized mosquito control agency. The final number of questionnaires used for the analysis was 137, the data from which were coded, tabulated and analyzed.

RESULTS AND DISCUSSION

The three major objectives of the mosquito control agencies in the United States were found to be control of pest mosquitoes, control to interrupt human disease (encephalitis), and control for economic reasons, such as promotion of land reclamation and development and use of recreational facilities and parks.

The majority (78.4%) of the agencies are in states where the minimum temperature in July is greater than 60°F. Almost

all agencies are organized at the county/parish level and 52% of them cover less than 500 square miles. Such organization at the county/parish level reflects the political geography of the United States rather than any functional principle of mosquito control. For most agencies administrative decision-making concerning day-to-day decisions and planning is the responsibility of the agency director. The governing board usually allocates funds for the agency and has responsibility for making major policy decisions. The director is usually responsible to the governing board but in 42.5% of the agencies responding the director has the ultimate decision-making responsibility.

From the organizational charts received from the various agencies, a representative chart was constructed (Figure 1). This chart shows the types of personnel required to carry out the various functions of a mosquito control agency. This chart is an *idealized* example which shows more positions than actually exist in the majority of programs surveyed. It emphasizes organizational and administrative responsibilities at various levels of the control agency's activities. Most of the agencies surveyed were not large enough to employ single individuals in each category described, and an individual might fill two or more of the idealized positions. For example, automotive mechanics and equipment mechanics might be one and the same. The responsibilities of the source reduction supervisor and the field inspection and control operations supervisor might be in the hands of a single chief operations supervisor. The entomologist is likely to be actively involved with field control and not just employed in the laboratory. The director may well be an entomologist.

The source of funding is mainly from the respective counties in the form of property taxes. Ninety-six percent of the agencies surveyed have annual budgets of less than one million dollars. In fact about 74% of all agencies have budgets of less than \$500,000.

The average cost of mosquito control

per capita or per square mile was difficult to assess from the data collected. About 74% of all agencies have annual budgets of less than \$500,000. Eighty percent of all agencies have a service area of ≤ 100 square miles and 72% serve a population area of 10,000–500,000 people. It would appear therefore that about three-quarters of the agencies surveyed spend no more than \$500 per square mile or \$50 per person on control activities. But this is a crude approximation only.

The allocation of budget in terms of percent of total annual budget spent for each of several expense categories was examined in terms of the modal number of responses per category. Approximately 65% of the agencies spend more than 50 percent of their total budget on personnel. Fifty percent of the agencies spend between 11 and 30% on supplies and materials and approximately 62% spend 10% or less on equipment. Other types of expenditure include public relations, insurance, hospital plans, retirement plans, and travel.

The mean number of full-time employees in the agencies surveyed was 13.2 with a range from 1 to 58. Data suggested that agencies with a small number of employees are covering smaller areas. The mean number of part-time employees was 10.4 with a range from 0 to 99. Most agencies employ part-time personnel during the summer months when mosquitoes are most active.

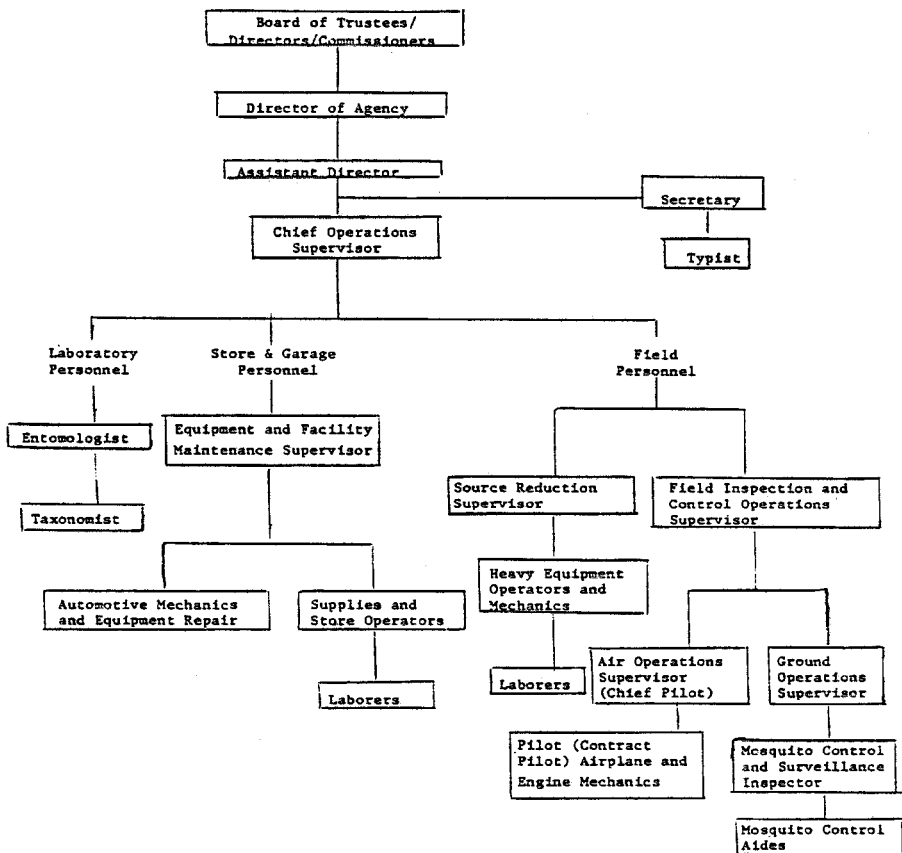
In states where mosquito control is part of the environmental health section of the county health department there may be only 1 or 2 full-time persons in mosquito control who "borrow" workers from other activities when needed. The portion of the study questionnaires inquiring about full-time and part-time personnel did not adequately elucidate the various categories of full-time employment (administrative, operational and technical jobs), and such information cannot be presented here.

Training includes the educational and professional background which each individual brings to the job as well as con-

continuing education provided by the agency for its employees. Approximately 45% of all agency directors have bachelors' degrees, 28% have masters' degrees and 5% have doctoral degrees. Twenty percent have no degree. Considering all full-time employees of the agencies surveyed three-quarters of them have at least vo-

catational certificates and/or bachelor's degrees.

Few of the mosquito control agencies utilize the U.S.P.H.S. Center for Disease Control exclusively for the training of their personnel. Most of them depend on a combination of several outside agencies, such as state health departments and state



universities. On-the-job training alone is the single most commonly used method of training. Training with outside agencies is no doubt a function of closeness of the mosquito control agency to the outside.

Many of the agencies surveyed are involved in various types of research, particularly in an effort to improve their control tools and techniques. Other types of research cited include encephalitis surveillance and prevention, biological control and insecticide resistance. The term "research" was not strictly defined in the questionnaire and the responses cover rather broad categories of research. Such research must depend on the expertise and interests of the individuals in each agency and the needs of each mosquito control area. No agency providing organizational charts showed any specific individual or agency department dealing exclusively with research. However only 10.5% of the responding agencies are involved in no research at all.

Approximately three-quarters (74.1% of the agencies surveyed have a public relations program. It accounts for less than 5% of the total budgetary expenditures of these agencies. Whether public relations worked out of the director's office or out of its own separate office was not ascertained. Person-to-person contacts, pamphlets and posters, and newspapers, which are cheaper than television and radio, are used by nearly all the agencies to some degree. Sixty-four percent of responding agencies use no television at all and 45.3% use no radio.

There are many larvicides and adulticides available in the market. Of the agencies surveyed 92.3% reported use of adulticides and 99% use of larvicides. For adulticiding more than seventy percent (72.9%) of the agencies use malathion. Abate is the most commonly used organophosphate larvicide (49.6% of the agencies reporting use), but diesel fuel is also popular. There are many reasons why particular adulticides or larvicides are chosen for use over others. In the survey agencies were not asked to com-

ment on the intrinsic properties of these chemical substances, such as species specificity, herbicidal activity and toxicity to humans and animals. However, agencies were questioned about insecticide resistance, initial and eventual magnitude of response by mosquitoes to the insecticide, cost effectiveness, safety, and other determinants of choice. The three most important determinants of insecticide choice reported are effectiveness (90.9%), safety of insecticides (89.3%), and competence of employees (78.6%).

Source reduction is practiced by a large majority of the surveyed agencies (82.4%). Although it is an expensive method of control it is a long-term solution to the mosquito problem. Only 36.8% of the agencies use herbicides to control breeding sites of mosquito larvae. The use or non-use of herbicides did not appear to be related to the size of the service area. Non-use of herbicides may be out of concern for their environmental impact or from inexperience with their use. For surveillance, the most commonly used method of larval collection is dipping. The light traps commonly used for collection of adult mosquitoes are the CDC and New Jersey types. Approximately sixty percent (59.7%) of the responding agencies practice biological control with vertebrate predators. Only a few of the agencies report use of invertebrate predators and 26.1% practice no biological control.

In addition to controlling mosquitoes, 60% of the agencies control other pests and vectors. These may include rodents, ticks, biting midges, flies, bees, wasps, roaches, etcetera.

The mosquito control agencies surveyed were asked to rank a list of constraints in terms of their importance or unimportance. The 3 constraints most commonly cited as important are lack of funds, lack of staff, and legal constraints.

The methods which mosquito control agencies use to evaluate the effectiveness of their work include pre- and post-treatment evaluations, continuous surveillance, tests for mosquito resistance to

insecticides and public opinion. The magnitude of the mosquito problem depends upon many variables including the species of mosquitoes, the types and size of breeding sites, local weather and climatic conditions, human factors (e.g., where people live, work, play, and throw their garbage) and animal factors such as bird migrations. The philosophies of the director and the governing board are also important variables and agencies contiguous to each other and with similar problems may have different approaches and techniques. Because of these variables it is difficult to evaluate the effectiveness of one agency by comparing it with another unless all the factors are standardized or at least comparable. For this reason most mosquito control agency evaluations have been self-evaluations during the season of maximum mosquito activity.

CONCLUSION

This survey has demonstrated the basic organizational, administrative and operational features of organized American mosquito control agencies. It is the author's intention to make use of this information to develop concepts of mosquito control that can be used in developing countries where hundreds of millions of people are still plagued by mosquito- (and other vector-) borne diseases.

Before this can be done several important clarifications must be obtained from the survey data. A better understanding of the organization of personnel in control programs must be obtained. Ten types of professional service for mosquito control programs have been proposed by Gray (1961) including management, entomology, engineering, public relations, training and others.

A better understanding also has to be developed concerning the evaluation of mosquito control activities. As mentioned above it is difficult to standardize work which is so difficult to compare. Hatch et

al. (1973) have proposed a series of guidelines with a scoring system for 9 major categories of control program activities. Such guidelines would need to be modified for developing countries.

In fact one can imagine that almost every factor analyzed in the American agencies will be very different for developing countries, and as much variety seen among the various developing countries: political/geographical organization of agencies, organization of personnel (reliance on minimum of highly trained personnel), sources of funding, budgetary expenditures (e.g., large capital outlay in areas with unestablished programmes), providing for continuing education and training of personnel, research, public relations, availability of insecticides and equipment, non-mosquito vectors and pests to be controlled, legal and other constraints, etc.

It seems certain that only by individualizing all of these factors will one make sense of mosquito control in each mosquito control area.

ACKNOWLEDGMENTS

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