Chapter 1

INTRODUCTION

Evaluation of the immunization status of a health jurisdiction requires examination of the population by two major characteristics, the socioeconomic or cultural patterns of the community and its age distribution. For effective health program management the socioeconomic and cultural classification of the population must be by geographic area.

Classification by age is necessary since immunization procedures are scheduled by age and influenced by varying external factors at different ages. For the very young child the attitudes and resources of the parents are controlling. As the child approaches school age the regulations of school authorities become of importance. For the adult the advice of the family physician and recommendations of health authorities and medical societies are influential.

In appraisal of immunization levels the use of averages must be limited to specific age groups within which comparisons are made by socioeconomic or cultural areas. A statement to the effect that 70 percent of the population of a city has received a complete series of oral poliovaccine is of little value as an epidemiological measurement. The same average value may be found in a city in which the children living in certain areas are very poorly and in other areas very well protected, or in a city in which the children in all parts of the city are moderately well protected. In some immunization programs response of adults has been very good with unsatisfactory achievement among very young children. An average rate for the entire population will not reveal such an outcome.

The Data

The data to be collected are histories of artificial immunization obtained for each member of the family by questioning an adult, usually the mother. Since many respondents are not well informed on the details of immunological procedures the interview method must be
used with care to avoid the introduction of errors resulting from misunderstanding of the questions and from faulty memory. The use of interviewers acquainted with the elements of preventive medicine and well versed in immunization practices is essential. Utilization of lay volunteers with subsequent verification of findings by examination of clinic and physician records is sometimes proposed. This procedure is not recommended since the record-locating operation is time consuming and costly, the quality of physician and clinic records is variable, and the compilation of record files for individuals participating in community-wide immunization programs has rarely been found feasible. These difficulties, augmented by the mobility of many families, lead to inadequate verification for many persons in the sample, especially among those groups in which low immunization levels are common.

A direct estimate of seroimmunity in the population can be made through laboratory analysis of blood samples collected by the interviewers (physician-nurse teams). This procedure will undoubtedly become of increasing practicability with continuing advances in rapid and economical laboratory techniques requiring small quantities of blood. With suitable modification in field procedures the present sample designs may be used for this purpose.

Plan of the Survey

The methods presented were chosen from a large number of sampling procedures which might be used. Choice of methods was based on the use of planning data that are readily available for any city or rural area, and on reduction to a minimum of variations in procedure. The survey design is analytical with the objective of making comparisons among subgroups of the population.

A health jurisdiction is first divided into geographic areas possessing distinctive socioeconomic and cultural characteristics. In each of the areas a random sample of families is selected and an adult household member is interviewed. From this person the Immunization history of each family member is obtained. For analysis the persons in the sample of each area are classified by age and a calculation is made, for each immunization
agent, of the percentage of persons in the sample for whom a history of adequate protection was reported. Comparisons are then made, between areas, of the percentage adequately immunized in each age group.

The sample size for each area is determined in such a manner that sufficient precision, of approximately the same magnitude in each area, will be obtained for the age groups of epidemiological importance with respect to each immunizing agent. In the present survey plan information is obtained on oral and inactivated poliovaccine, DPT (combined antigens for diphtheria, pertussis and tetanus) and smallpox vaccination. Since these antigens are administered early in life, children in the age group 1-4 (those one year of age and up to five) were chosen as an index group to be used in calculation of sample size. Children under one year of age were not included in the index group since the definition of adequate protection in infants may have two meanings—a three-month-old child that has received its first DPT dose has met the requirements of routine procedure but will not be considered "adequately protected" until the series has been completed, some months later. At one year of age a child should have received the basic series of all the antigens of interest and may then be classified as adequately protected (or not) without ambiguity. It is thus preferable to examine the small group of children under one year of age separately, rather than combine them with the 1-4 year-olds. Use of the 1-4 age group as an index group for calculation of sample size will insure an adequate sample in the older age groups.

For older persons an age grouping of 5-14, 15-39 and 40 and over, which will distinguish children of school age, younger adults and older adults, is recommended. For more detailed analysis it may be desirable to separate out the 15-19 year-olds, a heterogeneous group of older children in high school, in college, the military services and the labor force. If this is done the number in the age group 20-39 will be adequate but the number of 15-19 year-olds may be somewhat smaller than the minimum size specified for the 1-4 age group.

In summary, the health jurisdiction is subdivided into epidemiologically useful areas and a random sample of the
families living in each area is interviewed. The community immunization status is evaluated by comparison between areas of the proportion adequately protected within each age group.

A Preschool Child Immunization Index

The method which has been outlined provides an estimate of immunization levels for all age groups within the population. In immunization programs concerned primarily with preschool children the field work of the survey may be reduced significantly if the procedure outlined above is modified by obtaining immunization histories only for families in which there is a child under 5 years of age. If this method, which will be designated as the Preschool Immunization Index Survey, is used, generalization to the population may be made only for children under 5. Immunization rates calculated for persons 5 years of age and older will apply only to the select population of families which have one or more preschool children. However, the older persons in families which include a preschool child form an epidemiologically important group. Although the data obtained for the 5-14 and 15-39 age groups in these families cannot be generalized to the population as a whole the information on the proportion immunized in this select population is of value if used with appreciation of its limitations.

The advantage of this method is reduction in field work since in approximately 75 percent of families there is no preschool child and for these families the interviewing time is reduced to asking whether there is a preschool child in the family. If not, no further question is asked. If there is a preschool child in the family, immunization histories are obtained for all members of the household.

In visits made to families during the daytime no member of the family will be at home, on the average, at approximately 35 percent of the households visited. Callbacks, by telephone or revisit, must be made to obtain the immunization histories. On visits made to families with preschool children only about 20 percent, on the average, are found to be not at home and the number of call-backs is thus reduced.
In a comparative study of the two survey methods in Atlanta, Georgia in July, 1963 it was found that the field work required, per child under 5 in the sample, was reduced by about 40 percent if immunization histories were obtained only for families in which there was a preschool child.

Requirements of the Health Department

The present survey procedures have been developed in order to provide a technique that can be carried out as a health department operation with little or no outside consultation. Procedures are described with numerical examples which can be followed without specialized training in survey theory or practice.

Training in survey methodology although desirable is not essential for the person in the health department to whom planning and direction of the survey is assigned. Administrative experience and seasoned judgment are necessary since, as in any application of theory, adjustments and compromises must be made to adapt to local situations. Care must be taken that such modifications do not alter the basic design in a manner that will introduce bias in the estimates.

The survey director will require clerical and typing assistance and the cooperation of other program directors to provide interview teams. Interviewing is carried out by teams of two persons who travel together in one car but interview different families at the selected sites in urban and rural areas. Teams formed of nurses and communicable disease investigators have been found most satisfactory. Health educators and professionally trained sanitarians may also serve as team members but will require more extensive briefing on immunization practices. A nurse should be used as a teammate for each interviewer without training or experience in communicable disease control and immunization methods.

The number of team-days required will depend on the number of areas within a jurisdiction for which an estimate of immunization levels is to be made and also on the number of children per housing unit in each area. The sample sizes recommended have been chosen with due consideration of the work load that a survey imposes on regular activities of the health department staff.
By the time that interviewers are ready to go into the field the health department will have invested a considerable amount of time in planning the survey and scheduling interviews. Unless the data are collected with care the return on this investment will be small. The principal virtue of a small sample lies in the fact that each detail of planning and execution can be given careful attention with a resultant high quality of performance.

Presentation of Methods

Chapters 2 through 9 present the successive stages in carrying out an immunization survey from the definition of socioeconomic and cultural areas through tabulation of the findings and preparation of a report. In these chapters procedures are explained with numerical examples based on immunization surveys. Chapter 10 describes modifications which may be required in other applications. General formulas and derivations are given in Chapter 11.