Demographic Aspects in Selecting a Site for a Community Epidemiologic Study

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IN THE FALL of 1963, the town of Sudbury, Mass., was selected for a community health study of gout, rheumatoid arthritis, and diabetes. In the selection of a population for this study, some procedures were followed that other investigators might well consider in planning health surveys and community studies. The study was developed to seek solutions to questions related to screening methods and health programs and to provide a continuing source of data on diabetes and arthritis. The fieldwork for the initial coverage of the population has been completed.

The resources and objectives of a study usually set broad limits on the choice of a study population. Study objectives may determine the general location, size, and type of the population and whether a sampling scheme or complete coverage is appropriate. Resources influence the number of persons who can be covered, the number of questions or physical tests that may be included, and the length of time allocated to data collection. Once a compromise is reached between purposes of the study and resources available for it, these broad limitations may still leave a wide range of possible sites.

The general design of the community health project in which Sudbury was ultimately selected as the community for study called for mailing questionnaires to all residents 15 years and older for them to fill out and mail back. The plan was to invite such residents to make an appointment for a limited physical examination at a central screening point in the town. This examination would include a blood test, a cardiogram, and a brief examination of the skeletal joints by a physician. (Blood determinations were to comprise tests for uric acid, glucose, and serum cholesterol, as well as Bentonite flocculation and sheep cell agglutination tests for the rheumatoid factor.) Additional questions were to be asked the resident during the examination. Confirmatory tests would be given to persons with positive blood tests and private physicians notified when these tests were positive. It was planned to designate a 15 percent sample of the residents over 15 years of age for repeat testing 1 year later. To maximize early results, the community health study was designed so that periods of data collection would be hyphenated by phases of analysis of data.

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Review of Possible Communities

Largely because the laboratory of the diabetes and arthritis program of the Public Health Service was located in the Boston metropolitan area, we restricted the choice of a study site to a 30-mile radius of Boston. Within this area, however, there were more than 20 communities with populations ranging from 6,000 to 13,000 that we wished to consider as candidates for the study. We began as objectively as possible our review of these possible sites. A great amount of detailed data was available from the 1960 U.S. decennial census for the towns within the Boston Standard Metropolitan Statistical Area. These Federal census data were supplemented

by reports of the Commonwealth of Massachusetts on the economic, social, and health characteristics of towns and by annual reports from individual communities.

Before selecting Sudbury, we made a careful study of the age and sex distribution of the population of each town in the area under consideration, its socioeconomic status, and the stability and movement of the population. From figures on births and deaths, we compiled estimates of rates of natural increase and migration. Projections were made for growth in the years immediately ahead. We also considered hospital and other health resources, the number and type of physicians and specialists, and the success or failure of any past health programs at specific locations. All these factors were weighed against one another for each community in order to reach a composite assessment. Certain other considerations, referred to later, such as the community's assimilation of newcomers and the attitudes of its leaders, also influenced these assessments.

Population Size and Age Distribution

Size of population was a major criterion. To determine the optimum size for study, an investigator needs to consider the type of analysis he will perform and how much validity his results need to have. He must evaluate the probable yield of positive findings, the amount of bias and response error, and the effects of these variables on his data. We concluded that an optimum number of 5,000 to 6,000 adults would meet the basic requirements for defining the amount of disease in the population, with some allowance for nonresponse. To arrive at the optimum number we applied crude estimates of the prevalence of rheumatoid arthritis, hyperuricemia, gout, and diabetes to various population sizes. We then estimated the standard errors of the resulting age-specific prevalence rates (proportions) for selected towns to determine a range of sampling error no greater than that which might be expected from usual laboratory errors. The success of these calculations depends on achieving a high rate of population coverage—the higher the proportion covered, the smaller the response error. We based our calculations on an expected response rate of 70 percent. The decision to exclude persons under 15 years of age meant that if we were to examine 6,000 adults, our community should range from 8,000 to 12,000 inhabitants.

By these criteria, some of the possible choices were eliminated. The smaller communities presented the risk that a low turnout would result in relatively large errors in our estimates because of nonresponse since the group covered was already small. The largest towns in the area of possible choice contained a greater population than we could examine adequately in the time allowed for fieldwork.

The age distribution of the population was a second major criterion. In a chronic disease study, it is tempting to select a population with a relatively large proportion of older persons, in order to obtain the greatest yield for the work that goes into the study. Where the results need not be representative or are pertinent to special groups such as a clinic, hospital, or institutional population, such a bias may be acceptable. Where the choice of communities is narrow, some irregularities in the age distribution may be smoothed out by age-specific adjustments.

Even when rather large cities are being considered for population study or screening, age distributions cover a great range. To take two extremes, of all urban places with more than 50,000 in population, Pasadena, Tex., has the smallest proportion of inhabitants 65 years and over—2.2 percent. In St. Petersburg, Fla., on the other hand, 28.1 percent of the population is at least 65 years old. If one wanted to survey all of the known diabetes cases in the Texas town, one would reach, presumably, less than 300 persons with diabetes out of all 59,000 inhabitants (using the U.S. age-specific prevalence rates of diabetes reported in National Health Survey interviews). In St. Petersburg, however, covering an equal number of people would yield more than 1,000 persons with diabetes, or 3½ times as many cases for the same amount of work (*1*).

The communities under consideration in Massachusetts were well within these extremes, although there was one town with 13 percent of its population 65 years and older, a circumstance which offered some advantage of yield.

We hoped that our ultimate choice would be broadly representative of suburban communities

across the nation in age distribution, particularly in the age groups between 25 and 54—those years when the early aspects of certain diseases might be under development. In the town of Sudbury, finally selected, the 1960 age distribution compared with the total urban fringe in the United States as follows (*1*, *2*).

Age group (years)	*Percent in Sudbury*	*Percent in U.S. urban fringes*
Under 25	48.6	44.5
25–54	41.6	40.4
55 or older	9.8	15.0

While the age group 25–54 years compares closely with the fringe or suburban population, the group under 25 years compares more closely with the projected population in 1980 for the whole country. The socioeconomic status of the communities was also carefully reviewed. Towns in which one-fifth or more of the families had incomes of $15,000 or more were eliminated as not typical. The list was further narrowed by considering educational attainment, occupational patterns, and place of work and journey to work of the residents, factors that might affect the degree of success of the study or the representativeness of its population. Considerations of this type led to focusing on those communities with a high average educational attainment, a large proportion of workers in the professional, managerial, clerical, and sales occupations, and with a small number of families having low incomes and unemployed members. In short, the choice was narrowed to a fairly typical middle-class community in terms of socioeconomic characteristics.

Population Growth and Migration

Other major considerations affecting the choice were the growth and migration rates of the various towns and the relationship of these demographic events to stability. At first, we were inclined to consider choosing those areas where the growth of population had been modest during the 1960's. Some thought was given to delineating a census tract area within Boston that gave the appearance of stability of numbers. By updating the birth and death rates for Massachusetts cities and towns for the period 1957–59 (using revised inter-census estimates of population based on the 1960 U.S. census) and using these rates as crude indicators of the vital trends during the decade, we observed that in the larger areas, beneath the surface of stability, there was a large out-migration.

For example, Boston had a crude death rate in 1959 of 13.4 per 1,000 and a birth rate of 23.5 per 1,000, or a rate of natural increase of about 10 per 1,000 population (*3*). During the period 1950–60, the city's population decreased by 13 percent. The natural increase, assuming similar rates throughout the decade, would have added about 80,000 to 90,000 to the 1950 population of 800,000. Since the population declined by 104,000, however, one can assume that the net out-migration was about 180,000, or approximately 23 per 1,000 population per year.

The above calculations are hardly precise but are sufficient to show that the investigator must look beyond simple rates of population change in order to define the ebb and flow of people.

What is perhaps more damaging than loss of numbers is that the age groups between 25 and 44 years tend to migrate from the central cities, leaving behind the older people. In Boston, the median age of males living in the same house in 1955 and 1960 was 41.5 years, whereas the median age for those who moved throughout the State during the same period was 29.8 years (*4*).

Review of these demographic events led us to conclude that in the selection of a study community that will produce a high response, as well as offer reasonable prospects for long-range followup, stability of numbers is less important than stability of social and civic organization. For longitudinal purposes, it should be easier to define a growing population at a point in time than to maintain a dispersing population. Sudbury, the community finally selected, had experienced the most rapid growth of any area on the original list, about 185 percent over its 1950 total. Most of the newcomers, however, were at family-formation ages, undertaking home-ownership and putting out roots in the suburbs. For example, an examination of housing turnover and vacancy data for two of the rapidly growing towns in the area under consideration indicated that their out-migration was much less severe, percentagewise, than in the census tract area of Boston also considered as a study site. A minimum of out-migration is usually

considered vital to the success of such a community study. The place to look for minimum outward movement is where the movement inward is reaching a maximum, rather than where total movement appears to be negligible.

Community Cooperation

It would be idle pretense to say that any selection of a community for study is entirely objective. The point is that the more intensive the preliminary study of available information on possible sites, the more objective can be the final outcome. Our preliminary study narrowed the list of possibilities to three communities, to which more subjective criteria could be applied in the final assessment. At this stage, the investigator needs to seek out knowledgeable sources such as State and local health officials, volunteer agencies, university groups, and leaders in the health fields. He must ask them candidly for their experience and opinions and sift their answers carefully. He needs also to seek out the important leaders of the communities personally and discreetly study them. These efforts are directed toward that elusive goal of community acceptability of the study.

The investigators in the Framingham Heart Study have said that community acceptability is the sine qua non of community studies and that absence of it is probably the only disadvantage that cannot be overcome (*5*). Statistical techniques may allow adjustment for some limitations but not for an indifferent community. In our study it was important that the community selected enter into the project with enthusiasm, provide leadership, set up committees, volunteer facilities and assistance, and assume a sense of responsibility about the outcome. Ideally, the leadership of a study community should be free of long-standing factions, and the community's organizations should attract and welcome newcomers. We found through polling State and local health and medical authorities and community leaders that Sudbury residents possessed these qualities and that the community afforded that all-important element—rapid assimilation of new residents into community life. Sudbury satisfied other criteria too. The principal hospitals used by the population were located close-by, and the local health department staff was enthusiastic about the proposed study.

No community is ideal in every respect for a community health study; each investigator seeks the best possible compromise between purpose and resources. In the initial phase of our study, however, we believe that the results have validated the methods we used in choosing a study community. During the 12 weeks of intensive study activity from late January through early April 1964, 80 percent of the 6,000 residents of Sudbury 15 years and older filled out the detailed questionnaire, and 75 percent were examined at the screening site. Much credit for this success goes to the dedicated and persistent volunteers of the town.

Summary

The criteria for the selection of Sudbury, Mass., as the site for a community health study of gout, rheumatoid arthritis, and diabetes were both objective and subjective.

On the basis of data extracted from the 1960 decennial census of the U.S. Bureau of the Census, from reports of the Commonwealth of Massachusetts on the economic, social, and health characteristics of towns in the area under consideration, and from annual reports of those communities, the all-important fact of the stability of the social and civic structure of Sudbury was established. Data on population size of the community, its age distribution and socioeconomic status, and statistics on its growth and migration, projected for the coming decade, contributed to this conclusion. A polling of State and local health and medical authorities and community leaders showed that the community health study would likely attain high public acceptance in Sudbury.

Preliminary results in the epidemiologic study seem to justify the selection of Sudbury. Eighty percent of the adult population have filled out a detailed questionnaire and 75 percent have been examined.

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Program Notes

Priority on Sewage Disposal

Sewage disposal, often the last element considered, is getting priority in a move to attract developers to an area of northern Virginia.

On county-owned land near Dulles Airport, Fairfax County authorities are building four compact, modified activated sludge sewage treatment plants designed to meet the needs of more than 10,000 persons.

Eye Donors

In 1963, 1,112 eyes were donated to the Eye-Bank for Sight Restoration, Inc., an organization founded in 1944 to handle sight-saving elements from donor to patient and to conduct a research program. One-half of the 1963 eye donations were found suitable for corneal grafts; the remainder were used for detached retinal surgery and as research material.

S.C. Campaign on Disease

The County of Greenville, S.C., seeks to immunize all its citizens against poliomyelitis, DPT, and smallpox. It hopes to establish a program whereby each county resident will begin immunizations at the age of 6 to 8 weeks, complete them on schedule, and maintain them throughout life. Residents will be encouraged to make up immunizations they have missed.

As part of an investigation of a widespread fungus infection that caused 40 cases of erythema multiforme in the town of Greenwood, S.C., the Public Health Service gave high school and junior high school students skin tests. Erythema multiforme, a rare disease, is believed related to histoplasmosis.

Water Pollution Abatement

In 1947 when the New England Interstate Water Pollution Control Commission was established, sewage treatment works had been provided for only 39 percent of the sewered population. Now treatment plants are in operation for 66 percent; new treatment works are under construction or about to be constructed to serve 20 percent more; engineering reports have been approved to accommodate an additional 10 percent.

Aid in Poison Identification

An infrared spectrophotometer aids chemists at the Florida State Board of Health in identifying poisons, drugs, and narcotics. The instrument can "name" any one of over 20,000 organic substances in 10 minutes.

Rheumatic Fever Concepts

In persons susceptible to rheumatic fever, massive monthly injections of penicillin, rather than small daily doses, do a better job in preventing streptococcal throat infections, and sulfadiazine pills are as effective as the more expensive penicillin. The extent of permanent heart change does not depend on the number of rheumatic fever attacks; if damage is going to occur, it will be as a result of the first attack. Absence of a sore throat does not mean there is no "strep" infection; nor does the presence of one necessarily indicate "strep" infection.

These findings, which refute some generally accepted concepts, resulted from a 10-year study conducted by Irvington House, a New York City voluntary agency (reported in a 1964 supplement to *Annals of Internal Medicine*).

"Bathtub" Drug Manufacturers

Thirty-two one-man-operation drug manufacturers went out of business in Pennsylvania in 1963. Many were the type that use a bathtub to mix concoctions and would have needed additional help to check procedures as required by law. In 933 inspections during 1963, the special services and plant inspection unit of the Pennsylvania State Department of Health uncovered 704 violations of the 1962 State Drug, Device and Cosmetic Act.

Medical Self-Help Training

More than 28,000 Pennsylvanians were graduated from medical self-help training courses in the first 22 months of the program's operation, according to Dr. C. L. Wilbar, Jr., State Health Secretary. Forty-five of the State's 67 counties had provided complete courses as of December 1963.

The medical self-help training program combines first aid techniques with some more advanced procedures. It is designed to enable laymen to provide emergency medical care in a disaster when physicians and other professional help may not be readily available.