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Epidemiology and Services for the Aged

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"THE CHALLENGE OF APPLYING epidemiological methods to the study of aging is a far more difficult one than applying them to a disease," wrote Adrian Ostfeld after the pioneer research conference on the Epidemiology of Aging, 15 years ago (1). His words have proved to be prophetic, but he could point to some progress, mainly from cross sectional studies, at the second conference 5 years later (2). By 1983, the WHO Scientific Group on the Epidemiology of Aging (3) was able to cite many contributions of epidemiology to the care of the elderly, with most of these having been made by clinicians and service providers rather than professional epidemiologists. The momentum has continued, and the most recent review of geriatric epidemiology (4) encompassed more than 450 recent references on demographic trends and causes of mortality, morbidity, and disability in the elderly. The implications of these studies for policy are many and varied but there are, as yet, no data from intervention trials that would enable us to base operational decisions on a firm scientific footing.

As Ostfeld envisaged, one of the major stumbling blocks for epidemiologists is the absence of

clear definitions of outcome. We are used to teasing out the effects of antecedents and risk factors, as well as of intervention, on precise events, such as incidence of disease or mortality from a specific cause. In this age of new medical technology and our concern for quality of life, age at death is a problematic end point for epidemiologic studies, while the ascribed cause of death in old age is frequently obscure. The proposal that maintenance of individual autonomy is the desirable goal of the health and social services (3) is an attractive one, and the loss of that autonomy could serve as an end point for epidemiologic studies (5,6).

Unfortunately, operationalization of this concept has so far proved a daunting task (7,8). Other end points, such as the individual's breakdown in the community and the need for admission to an institution, have been used by British clinicians (9), but the usefulness of these milestones is very much a function of the philosophy and organization of the health care system (10). For the present, we shall have to use proxy measures such as those of the activities of daily living (ADL) and the expected years of active life for the optimal end point (11).

How to Measure Needs

The needs of the elderly and of those who plan services for them cannot, however, wait for the methodological breakthrough, and planners have used the tools that are available. Like the man in Molière's play, "Le Bourgeois Gentilhomme," who

spoke prose for 40 years without knowing it, my colleagues at the Brookdale Institute have been applying scientific methodology to service planning without knowing that we call it epidemiology.

Nearly 10 years ago we had become aware that provision of services to Israel's elderly was lagging behind real need, and new population projections by Kop and coworkers at the institute predicted a rate of growth of the elderly population far faster than had been expected. These projections, and the anticipated need for expansion of services, formed the basis for a public debate and the enactment of the nursing care insurance law (12), which significantly expanded the provision of long-term care to all who need it and covers most of its costs. As part of the planning process to meet the requirements of the law, the Brookdale Institute, in collaboration with the National Insurance Institute, Ministries of Health and Social Welfare, Sick Fund of the General Federation of Labor (Kupat Holim), and other agencies, has been developing a national data base and planning models to predict needs and monitor intervention strategies. The methodological steps in the estimation and projection of needs have been described by Factor and Habib in articles (13) and in publications of the Brookdale Institute.

Community surveys of disability, some of them by epidemiologists, formed the starting point of the planning process, which was followed by computation of disability rates in population groups defined by age, sex, origin, and living arrangements. These disability levels were then translated into hours of required care by family and informal and formal care givers. At the same time, from census data, the proportion and characteristics of elderly in institutions were derived and applied to population predictions; the same specific prevalence rates were assumed for the future. Use of the population projection model also gave estimates of rates of future disability and the services that would be needed to maintain current levels of care. An evaluation of a sample of the elderly who had applied for admission to institutions or who had already been accepted was the basis for estimates of the community services and support of the kind and degree that would be needed to prevent institutionalization. Alternative groups of community and institutional services were then proposed, and their effect on admission rates computed. From these computations could be derived estimates of the effect of different institutionalization patterns on disability levels of the elderly in the community and the cost effectiveness of alternative approaches.

This planning model, developed in close cooperation with service providers, is already having a major impact on the design of services (see the report of the workshop on forecasting the care needs of the elderly, pages 541-543).

The basis for planning is the community or epidemiologic survey, and we were happy to see the validity of the Brookdale projections confirmed in a national probability sample of 4,186 residents ages 60 and older. This survey of health and living conditions of the elderly, whose results have not been published, was conducted in 1985 by the Central Bureau of Statistics of Israel. We have been fortunate in achieving relatively high response rates in surveys of the elderly, but we have been concerned, like others, with possible systematic biases that could be introduced by nonresponders.

There are, in fact, several problems with the use of epidemiologic data, problems of concept and method, which are of direct relevance to the planning process and which should form the basis of epidemiologic activity during the coming years.

These problems are in two groups. The first group is methodological and includes questions of definition of disease and disability to which reference has been made, of accuracy and stability of assessment, and of the presence of confounding variables that affect the data and its interpretation. The second group is concerned with the concepts of intervention and of prevention and cure and the cost effectiveness of different strategies in populations of elderly. We need evidence of the efficacy of approaches to prevention of the major disabilities of the elderly that will permit decisions as to health policy and resource allocation.

Challenges for Epidemiologists

Some of these challenges to epidemiologists may be illustrated from our own studies and those of others.

Cognitive functions of the elderly. The nonresponse rate is particularly important in surveys of mental health (14). Our own search for a screening test for early detection of senile dementia (Davies, unpublished manuscript) has pointed up the importance of nonresponders as well as other potential methodological pitfalls that could have wider significance.

Efforts were made to develop a screening test for cognitive dysfunction that could be administered by persons with minimal training and which would be

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suitable for elderly Israeli populations who are characterized by immigrant status, cultural heterogeneity and, in many subgroups, low levels of education. This test, the Brookdale Cognitive Screening Test (BCST), after validation, would be used in epidemiologic studies of the dementias in different populations. But how could it be validated? Even the standard DSM III diagnostic criteria are not adequate for mild dementia (15), and Israeli psychiatrists are no better than others (16) in diagnosing early Alzheimer's disease. It was necessary to settle for a consensus between a neurologist's diagnosis based on agreed criteria and performance in a specially assembled battery of standardized neuropsychological tests as the gold standard.

It remains to be seen whether these criteria will be valid in other populations. Israel's elderly show great variation in educational level: 25 percent of those ages 75 and older have no formal schooling, and only 58 percent speak Hebrew, so that the well-known educational biases affecting performance on standard tests (17) had to be accommodated in the design of the BCST. Sensitivity in a population sample of elderly was 86 percent for mild dementia (as defined by the "gold standard") and for specificity, 70 percent, compared with 85 percent for sensitivity and 66 percent for specificity for the Iowa screening battery, which is administered by trained psychologists (unpublished manuscript, "Cross Validation of the Iowa Dementia Screening Tests in a Heterogeneous Population," by E. Hallerman and K. Richie).

The question being currently addressed is the suitability of the BCST for other populations. Some questionnaires do not "travel well" because of differences in culture and language, and there will be need for further standardization before we can embark on comparative studies. Such caution may have wider implications. The WHO report "The Elderly in Eleven Countries" (18), who answered translations of the same questionnaire,

demonstrated considerable differences in self-appraisal of health and reported morbidity among the elderly of different countries. In Israel, three-quarters of those ages 75 and older with 0-4 years of education reported their health as poor or bad compared with less than half of those with more education in the 1985 survey of 4,186 residents conducted by the Central Bureau of Statistics of Israel. Country of origin and time in Israel were other confounding variables in reported health status, and both these factors and reported ADL affected performance in cognitive tests.

Fracture of the hip. In Israel, as in the United States (19), England (20,21), and Denmark (22), the frequency of fracture of the neck of the femur is steadily increasing. This increase is due to both change in the age structure of the population and in the incidence rate. Brody and coworkers (19) estimate that the number of cases in the United States will nearly double by the year 2000 due to aging of the population even if the age-specific rates remain constant. In Jerusalem the increase in incidence has been 21 percent in 12 years with a rise in the age-, sex-, and ethnic origin-adjusted rates. There has also been an increase in mean age at fracture, from 72 years in 1967-71 (23) to 76 years in 1979-83, although the Israelis are still younger than the U.S. average age of 79 in 1980. There appears to be a postponement of morbidity with an increased incidence in the oldest population—a shift with profound implications for the burden of care.

Information on fractured femurs comes from retrospective examination of hospital records. One of the challenges in planning services for the elderly will be the development of an ongoing data base that can provide updated trends.

Followup of a cohort of patients for 12 months showed the mortality after hospital discharge to be much higher than expected, reaching 30 percent in one small series (Esther Goldfine and Davies, unpublished data from an MPH thesis). Current mortality statistics give no clue to the severity of the problem, a fact that illustrates again the need for revision of health statistics.

Prevention in old age. Predictions of the frequency of cases are not enough, important as they are, and epidemiologists should be able to make and test proposals for mass prevention. In the light of the conclusions of the latest consensus conference (24) that administration of estrogens and calcium to post menopausal women will diminish osteoporosis

and fractures of the femur and vertebrae, what are the implications for public health policy for the entire elderly population? What would be the impact of changes in lifestyle, cessation of smoking, and regular exercise on incidence? Could we not identify persons at risk to avoid treating everyone? What are the potential dangers of mass administration of steroids? These are the kinds of questions which must be addressed by epidemiologists because the answers are basic to planning strategy.

Cardiovascular diseases. In developed countries, more than half of the deaths of persons older than 65 years are attributed to cardiovascular diseases, and these conditions account for a third of admissions to hospital and more than one-quarter of visits to physicians (25).

Although cardiovascular diseases have been of major concern for a generation of epidemiologists, we know little of the effects of the more classical risk factors in old men and nothing of the effects in older women (26). In particular, there is ignorance of the effects of intervention in old age or even the practicability of intervention, after decades of exposure to risk. Existing evidence has been interpreted differently by the optimists and the pessimists: the only hard data on the treatment of hypertension suggest that there will be little benefit after age 80 (27).

Current debates on prevention and early diagnosis of disease in the community have yet to reach the elderly population. Should the approach to reduction of cardiovascular mortality, for instance, be by mass screening for risk, be left to opportunistic case finding by the physician, require campaigns to change health behavior, or some combination or these (28,29)? It is clear that the policy will depend both on the epidemiologic evidence to be derived from clinical trials and on the approaches to and organization of health care in the community (10).

Epidemiology and Planning

It is in planning and evaluating intervention strategies that the wisdom and dedication of epidemiologists are needed. Such exercises are the highest and most difficult form of the art, but they are also the most useful. Many of our colleagues have avoided involvement in these practical questions, preferring to regard epidemiology solely as an intellectual and scientific discipline separate from public health. However, study of the elderly forces epidemiologists to consider social variables and the

practical usefulness of their findings to the welfare of the population.

There is urgent need for longitudinal studies and use of their results in intervention trials with defined end points if our health policy is to be scientific and our service planning cost effective. But although science is fundamental in epidemiology, there is also much need for art and social conscience and, in this attitude, the epidemiology of the aging may lead the way.

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3. What are the prevalences of major chronic diseases in the group and what is the treatment status of persons with these diseases?

4. What are the personal diet, smoking, and alcohol use habits of group members?

5. What is the distribution of disability and the status of cognitive function of group members?

6. What are their current sources of health care?

7. What are the group's current rates of hospitalization, of admissions to nursing homes, and of discharges from these institutions?

8. What are the mortality rates of component groups of the elderly?

I will try to answer these and closely related questions with the help of data from one of the Established Populations for Epidemiologic Studies of the Elderly (EPESE), a joint program of professional staff of the National Institute on Aging (NIA) and the Yale School of Medicine. In addition to the study population at New Haven, CT, there are three other EPESE sites: East Boston, MA, two rural counties in Iowa, and a semi-rural area in the Piedmont region of North Carolina where local and NIA scientists collaborate. The table shows the study population of 2,802 stratified by type of housing in New Haven, and it also indicates the distributions of important sociodemographic characteristics of the group. About half of the women, but only one-third of the men lived alone; about 16 percent of the men and 30 percent of the women had annual incomes of less than \$5,000. All members of the study group were interviewed in their residence in 1982 at the beginning of the study. They are contacted annually by telephone and are interviewed at home again every third year. Important end points in the followup and the sources for these data are listed in the box.

It is important to note that about 60 percent of black females in the group had an annual income of less than \$5,000, while the other three race-sex groups received somewhat more. The educational level of the population likewise was relatively limited; about one white person in five had less than 8 years of schooling, and educational levels were lower for the blacks. About one-fifth of the men and one-tenth of the women worked for pay.

This brief sociodemographic characterization of the group indicates the kind of health services that the members need. Health services should be close to the population to be served because both private and public transportation are frequently lacking.

Using Epidemiologic Data to Plan Services for the Elderly

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TO PLAN HEALTH SERVICES for the elderly population, the planner needs answers to the following questions.

1. What are the sociodemographic characteristics of the group? Needed are data that characterize their numbers, geographic location, and distribution by age, sex, race, and marital and socioeconomic status.

2. What are their living arrangements and what transportation is available to the group?