

# Epidemiological Bulletin

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## Health Research: Policy and Priorities at PAHO

The questions facing health research policy in developing and developed countries of the Region are quite similar: Why is research needed? Which type? How much? Responses to those questions will vary depending on the situation in each country. Society needs science and places demands on it because it is a powerful tool for the solution of problems, and since public funds are committed, resource allocation should be aimed at meeting society's most pressing needs. Science in general, and health research in particular, cannot evolve in isolation from the cultural, political, and economic reality of the country in which it is carried out. Only to a limited degree can science develop more rapidly than the society in which it is generated. Therefore, it is understandable that the status of health research and the importance attributed to it reflect the level of development reached in each country of the Region.

For many years, research in Latin America has been stronger in the biomedical sciences than in other areas of knowledge. Almost every country has had one or several excellent groups of scientists well recognized locally and abroad for the quality of their research. Traditionally, medicine has been a prominent and prestigious profession, and medical schools have developed more rapidly than schools of other disciplines. In addition, medicine has been a natural focus for providing solutions to health problems through research. Within this broad context, the development of laboratory re-

search was less common, and later such research was limited to the description of unusual cases. Still lagging behind research in the biomedical sciences were epidemiological, social, and behavioral research as well as research on public health administration and practices—essential prerequisites for the effective design and operation of health programs and service delivery. In some countries a lack of a tradition of research may explain why these latter areas have not been considered immediately relevant to national health problems and thus have not been utilized as a tool for generating new or evaluating existing knowledge.

In the early 1950s, organization of research at the national level began to be considered imperative for enhancing the pertinence of research. At first, collegiate advisory bodies began to promote research and later on to coordinate it. Often these bodies were nearly autonomous, with very strong ties with the universities carrying out most of the research. In the late 1960s and early 1970s units in governmental agencies responsible for planning at the national level started to appear with the charge of formulating policies and plans for science and technology. Since then, the role of science and technology in development has been increasingly emphasized and its importance recognized at the highest political levels in countries throughout the Americas. Toward the late 1960s, research councils or analogous bodies began to be established. Nevertheless, a lack of research coordination still prevails

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among universities, institutes for technological development, and ministries of health.

In the second half of the 1970s, some countries showed a growing interest in formulating research policies specifically aimed at the health field and in establishing research planning units in the ministries of health. The final declaration of the Pan American Conference on Health Research Policies, held in Caracas, Venezuela, in 1982, states that health research "has as its fundamental objective the development of knowledge and technologies which will lead to the solution of current and future health problems" and, consequently, "health research will lead to an improvement of the well-being of our populations, so it represents a need and not a luxury." Despite this declaration, and the general recognition it reflects of the importance of health research, instruments and mechanisms to put it into practical effect are still lacking in most countries of the Region.

Although health research is essential to the acquisition of the knowledge required to devise appropriate measures for improving human health, it cannot compensate for incompetent managers, unskilled health workers, and scarce resources to implement intervention measures. As a consequence, a proper balance must be reached between research and service, between the development of new and the utilization of existing knowledge. In fact, most current health problems could be ameliorated by applying knowledge already available. To reach and maintain this balance, the social function of health research—achieved through the practical application of research findings—must always be kept in the forefront.

## **The Role of PAHO**

In PAHO, the aim of research in the broadest sense may be described as finding the ways and means of attaining the most effective, economical, and durable impact on health, by developing tools, methods, and approaches appropriate primarily to national and local needs, within the framework of the strategy to achieve health for all.

One of the basic principles of the mission of PAHO is the administration of knowledge. This concept encompasses the generation of knowledge through research activities, its collection, critical review, and dissemination, and cooperation aimed at its most efficient use within the countries. In promoting research, there

must be a determination to assure its appropriateness for the analysis of national health problems, and a firm intent to remove obstacles to equal access to health services, reduce existing inequalities in technological capacities among countries, and foster national self-reliance.

As the Organization's resources are limited in comparison with those available in most of the countries, it would be impossible for PAHO to be involved in all research activities currently being carried out or to be carried out in the future at the national level. Therefore, its involvement should be highly selective and directed at the critical areas in which research is needed to solve cardinal health problems. Extensive use should be made of national resources, either individual or institutional; resources should be mobilized so as to assure that technical cooperation will have some permanent effect. In addition, as people and institutions in the countries represent a considerable unexploited potential, the Organization should encourage them to bring their weight to bear on political decisions concerning health research and to further their commitment to health and social development. Moreover, the differences in the research potential of the various countries of the Region make it necessary to foster collaboration among countries so that research activities are carried out in a more productive and efficient manner.

The Organization's recently reformulated research policy is intended to make it possible to achieve optimal use of PAHO's resources. Much of the research to be conducted will be evaluative in nature, and many of the efforts are designed to identify critical areas for research, to promote research in those areas, and to act as a regional clearinghouse for disseminating the results. Given the diversity of research needs and capabilities, the Organization will cooperate with the countries in the determination of their own particular research requirements, which may range from operational research directed at problems in health service delivery to basic research into biological and genetic questions of major complexity.

Within PAHO, the Office of Research Coordination (DRC) advises the Director on research policy and is responsible for the administrative aspects of the PAHO/WHO Research Grants Program, one of the principal instruments of cooperation in matters of research.

The Advisory Committee on Health Research (ACHR), a group of distinguished investigators from various health-related fields, is responsible for the continuing review of PAHO's research policy.

To guide the implementation of this policy, an Inter-

nal Advisory Committee on Research (IACR) advises the Director in the following areas:

- Establishment of priorities for the PAHO/WHO Research Grants Program.
- Use of research grant funds.
- Review of research projects.
- Coordination of activities among technical programs.
- Identification of institutions qualified to contribute to research activities.

The highest responsibility for the promotion and technical support of specific research areas rests with the technical programs, and their major functions in the respective fields are the following:

- Identifying gaps in knowledge that is essential to solving health problems.
- Promoting and supporting the generation of the knowledge needed to fill the identified gaps, while taking into account the needs and possibilities of each country.
- Identifying national researchers and institutions that can collaborate with the Organization's research efforts and stimulate the formation of research networks.
- Collecting, analyzing, and disseminating information on research findings so that it is readily available to researchers, administrators, and policy makers.
- Promoting and supporting research training efforts.

### **The PAHO/WHO Research Grants Program**

After careful review of the research priorities specified by each of the technical programs, a research strategy was defined whose application will depend on analyses of the health situation in the countries. These analyses are expected to provide a continuing source of hypotheses and input into the priority-setting process; and, accordingly, regional research priorities will be revised periodically.

Currently, two broad groups of research topics have been identified. The first group comprises seven topics that, together, support analyses of the health situation in the countries. The second group consists of four topics that focus on health problems of specific population groups.

The first group covers research on:

- Country health profiles, to strengthen the process of planning and evaluation.
- Technological development processes, including the development, dissemination, and use of health technologies.
- Policy-making processes, to enhance the understanding of decision-making and underlying value systems.

- The health labor market, to focus on imbalances in the production, distribution, and utilization of health personnel.
- Utilization and accessibility of health services, to make them available to all social groups.
- Financing of the health sector, including the sources and flow of funds for health and appropriation procedures.
- Environmental sanitation services, namely their utilization, accessibility, efficiency, and effectiveness.

Topics in the second group are:

- Child survival.
- Chronic diseases of the adult.
- Workers' health.
- Health problems of the aging.

Within the PAHO/WHO Research Grants Program, the development of each research topic is the responsibility of a working group comprised of staff of the responsible program and of other support programs as well, to ensure needed technical coordination. Each of these groups prepares a development plan including an analysis of the topic for which the group is responsible, the objectives of the research, and the possible methodological approaches. Together with PAHO's Country Representative, the working group identifies national research teams on the basis of technical excellence, in consultation with national and institutional authorities, and with their concurrence.

The national teams, together with the Country Representative and staff from the working group, prepare the research protocols according to the development plan, and adapted to the national situation as necessary. The final protocols are sent to the Office of Research Coordination, for review and recommendations by the IACR.

Once approved by the Director, the protocols become research projects funded by means of a technical services agreement between PAHO and the executing institution. In addition, these projects receive technical support from the working group, which is responsible for supervising the research, publishing the results of the same, and preparing and publishing a comparative analysis of the findings of different research topics.

Thus, rather than merely receiving and reviewing research proposals developed independently by individual researchers or groups, the PAHO/WHO Research Grants Program, newly oriented, calls for PAHO Technical Programs and Country Representatives' Offices to play an active role in the design, development, and supervision of research projects, and in the publication of the findings. However, the funds of the Grants Pro-

gram will not be utilized for protocol development.

PAHO's research funds are modest; consequently, it must be understood that they are intended to be used as catalytic resources to propel the implementation of research on the topics that have been given priority. It is hoped that this approach of the PAHO/WHO Research Grants Program will address two major needs: first, the need for greater coordination within the Organization in order to prevent imbalances and avoid

wasting the exceedingly limited resources available for the support of research; and, second, the need to identify and mobilize existing resources in the countries so that over time truly cooperative research programs in all priority fields may be developed, thus enhancing the countries' self-reliance.

(Source: Office of Research Coordination, PAHO.)

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## Epidemiology and the Challenge of Aging

### Introduction

Reductions in fertility, in infant mortality, and in deaths from infectious diseases have resulted in increasing survival of populations to later life. Starting in the richer countries and spreading, at varying rates, to most others, there has been a continuous rise in both the numbers and proportions of elderly people. This demographic transition has had a profound impact on economic and social organization and its effects promise to spread, with global implications, by the end of the century (1,2). For not only have populations grown older; the old themselves have aged yielding greater proportions of the frail and very old (3).

The causes and consequences of aging of populations are many, complex, and intertwined so that their study is difficult and demands an interdisciplinary approach. Gerontological research has developed exponentially in recent years with a literature explosion that already resists digestion. Most of the advances, however, have been made along the lines of scientific disciplines, such as in cellular aging, sociology of aging, demographic changes, physiological, psychological, or economic consequences, and so on; there have been few attempts at integrated or holistic approaches, particularly quantitative ones. But developments in the care of the elderly, including health care, have shown the complexity of the interactions between social, economic, and environmental variables and their effect on health and function. With a few outstanding exceptions, epidemiologists have been notably absent from this field although the very nature of its complexity

would seem to demand the application of epidemiological skills.

This paper reviews the antecedents and consequences of aging populations, the available data on mortality, morbidity, and disability, and the need for new approaches. Limitations of space dictate a brief survey, and most of the epidemiology of specific diseases has been omitted as it is familiar to an epidemiological audience. The main purpose is to indicate the fascination and the scope of this latest challenge to the skills of the epidemiologist.

### The Demographic Transformation and its Consequences

#### *Global Aging*

An increase in the proportion of the elderly, a decrease in the proportion of young people, and an increase in the mean age are all measures used to define aging of a population. They are not necessarily equivalent, however, and a population may become older by one measure and younger by another (4).

The demographic process of aging of populations derives, in the main, from changes in mortality and fertility.

*Mortality.* The average lifespan is increasing mainly due to the drop in infant and child mortality. Infant mortality in the developed countries has fallen from 150 or more in the 19th century to about 10 per 1,000 today so that the proportion of infants surviving to

adult life has increased considerably. With a similar trend, albeit muted, in developing countries during the past few decades, but with fertility maintained, the base of the population pyramid is widened, and this has led to the population explosion that has become the major public health problem of many societies.

In the long term, the larger cohorts of surviving young people produce the considerable increase in the numbers of the elderly even if mortality at higher ages is not changed. When this does happen, the size of the elderly population becomes even greater.

**Fertility.** The most influential factor historically in the aging of populations has been the decline in fertility. The dramatic example is that of Japan which in 1950 had a young population structure like that of many developing countries today, 7.7% of the population being 60 or over. The birth rate was halved in a few years by a disciplined program of family planning and this will lead to a doubling of the percentage of the elderly by the year 2000 (1). Each drop in fertility shortens the base of the population pyramid so that the size of each age group is less than the preceding one and the proportion of older age groups automatically increases even without any increase in expectation of life. In fact, simulation models show that changes in mortality are of secondary importance (5).

Thus all populations with a falling birth rate become older, the speed of aging being increased as mortality falls.

### Developed and Developing Countries

Populations pass through the stages of what has been called the "epidemiological transition," representing a shift from high mortality/high fertility to low mortality/low fertility, and thus from a low proportion of elderly to a high proportion (6).

This transition began earlier in developed countries so that today the proportion of older people is much higher than in developing countries, 15% over 60 in the more developed regions (MDR) compared to 6.2% in the less developed regions (LDR) in 1980. The proportion of older people will increase in all regions from 1980 until at least 2020 (1,3), LDRs, on the whole, showing smaller gains due to higher fertility and higher mortality (Figure 1). In terms of absolute numbers, however, the majority of people over 60 are already found in the less developed countries of the world, and their contribution to the world total will increase considerably by the end of the century (Figure 2).

Figure 1. Percentage of population 60 years and over in different regions. UN data and predictions, 1950 to 2025 (2).

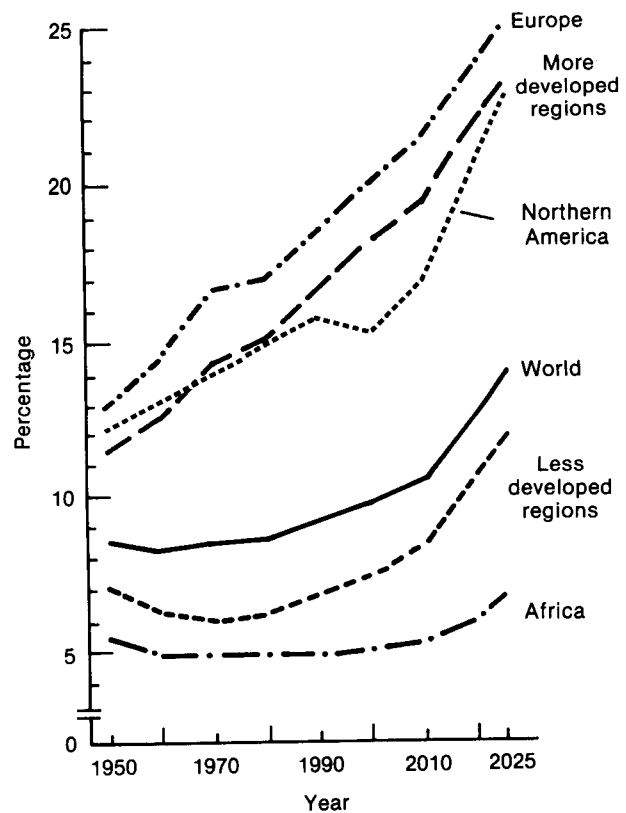
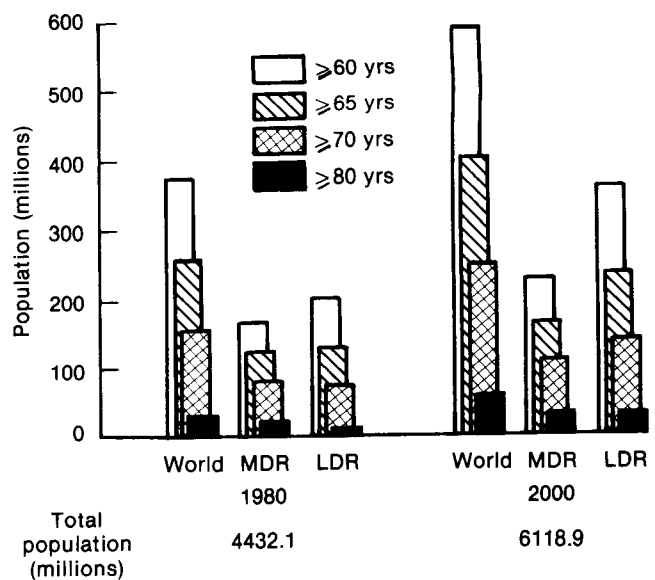


Figure 2. Distribution of elderly populations of the world, 1980 and 2000. UN data and predictions, drawn from data in Siegel and Hoover (3). MDR: More developed regions. LDR: Less developed regions.



The elderly of the MDRs are older; half of those aged 60 and more are already aged more than 70 compared to 37% in LDRs.

### *Mortality and Expectation of Life*

It is the changes at different ages which fashion the final shape of the population curve.

Age-specific mortalities in different countries at different times show considerable differences, particularly in infant and child mortality, but with much smaller differences at the highest age groups.

Using life-table methods, age-specific mortality can be conveniently converted to survival curves which summarize the forces of mortality at different ages and, applied to a hypothetical birth cohort, can be used to deduce expectation of life.

### *Heterogeneity of the Elderly*

The group aged 65 and over, as already stated, is far from homogeneous. Frailty and dependency increase much more rapidly after 75 than before and in planning services it is useful to distinguish between the "young old," 65 to 74, and the "old old," over 75, while even these cutoff points may need to be varied in different populations.

Not only are populations getting older, the old themselves are living longer and mortality at the higher ages is falling. Over the last decade, life expectancy at age 85 in England and Wales increased by about 6 months to 4.6 years for men and to 5.6 years for women (7). In many countries the group of 80 is the fastest growing and is expected to double in size by the end of the century (3).

### *Sex Differences*

At all ages, male deaths exceed those of females so that the effect of excess of male births is lost by age 35 in MDRs and by age 60 in LDRs (3). At age 60 there is a sex difference in expectation of life of 3.2 years in developed countries and 1.3 years in LDRs. The discrepancy in the sex ratio increases with age and with the premature death of men. Old age in industrialized countries is typically associated with widowhood, one-person families, reduced income, and greater risk of poverty and institutionalization.

### *Societal Consequences*

The effects of population aging are profound on almost every aspect of social organization. As production is mainly in the hands of those under 65, increases in those over 65 (as in those under 15) expand the proportion of the population which is not productive, i.e., the dependency ratio. This in turn affects, and is affected by, retirement policies and pension schemes, with increasing chances, in recent years, of survival beyond actuarial predictions (1,3,8).

In developing countries, migration patterns and rapid urbanization often leave old people in the rural areas, unsupported, while the out-migrations of younger people leave gerontic enclaves in the inner cities of more developed regions (2,9). Moreover, the lower fertility that characterizes populations that are aging yields fewer children to support their parents and distance may preclude them from fulfilling their filial role.

While the majority of the elderly are capable of maintaining their autonomy, a proportion, increasing at each age, becomes frail and in need of support, care, or institutional life for the rest of its days. As absolute numbers of those requiring care increase, so does the drain on the communal and public purse, and the miracle of increased longevity becomes the "problem" and the "burden" of old age.

### **Causes of Death**

The fall in mortality at greater ages is a phenomenon of recent decades which has come to crown the population changes brought about by lowered fertility and reduced infant mortality. What do the elderly die of? We can only give a partial answer to the question, both because of the multiple pathology common in old age and because detailed studies of causes of mortality in representative populations have by and large concentrated on younger age groups.

In the more developed countries three-quarters of deaths over 65 are attributed to cardiovascular diseases and cancer with ischemic heart disease and malignant neoplasms contributing about a quarter each (10). There is considerable variation, however, in the proportion of deaths ascribed to specific causes in different countries, and differences in patterns of care and fashions in diagnosis limit further the value of comparisons based on single main causes of death.

Deaths from cardiovascular diseases have been fall-

ing in recent decades in some industrialized countries, e.g., the United States of America, Australia, Finland, and Belgium, although not in others, e.g., Sweden, and mortality from cerebrovascular diseases is also declining, albeit at a different rate and with the exception of Eastern Europe (3,10-12). The percentage of deaths due to ischemic heart disease in industrialized countries for the 65 to 74 age group varies from 7.7% in Japan to 39.3% in Sweden, a fivefold difference (10). Japan and Portugal, with the lowest percentage contribution of ischemic heart disease to total mortality, show the highest contribution of cerebrovascular diseases.

Manton (13) has combined direct and underlying causes of death for a sample of United States death certificates for the years 1968 and 1977 as a way of estimating the total burden of defined diseases. His data for ischemic heart disease and stroke for white males, shown in Table 1, illustrate the continued importance of these causes of deaths at the highest ages. The table also shows that the oldest groups shared equally in the fall in ischemic heart disease and stroke mortality in the decade following 1968. Data for nonwhite males showed similar trends. United States statistics for white female deaths from heart disease show a continuous decline with parallel slopes for successive birth cohorts from 1886 onwards (14). For white males, heart disease mortality rates increased to 1965; since then there has been a reversal, each successive cohort showing a decrease. It should be noted, however, that there are difficulties in the use of aggregate data on "heart disease" for international comparisons and interpretation of trends, due to the heterogeneity of that rubric (15).

Mortality in the elderly from neoplastic diseases is on the increase in about half of the industrialized countries studied by Lopez and Hanada (10) but falling in

the other half. When there is an increase it is mainly explained by breast cancer in women and lung cancer in men. For those over 75, "senility" and ill-defined causes of death are recorded more frequently, depending on local custom, while the rarity of autopsies in the very old makes reliable information sparse.

### Morbidity in the Elderly

Increasing survival brings increasing frailty and morbidity, mainly from chronic disease (16,17). The elderly sick live longer and because of this, in developed countries, more cases of disease are managed or controlled than are cured (8).

All sources, self-reporting, health service statistics, and health surveys, confirm that total morbidity increases with age and at any given age is greater for women than men. An attempt to summarize the available information, however, reveals all the epidemiological problems of definition, identification, measurement, and enumeration.

The data available, however, do permit a number of generalizations, and the various indicators of morbidity all increase with age. In one Scottish study, annual visits to the doctor were 4.4 at ages 65 to 74, 7.0 at ages 75 to 84, and 7.9 at age 85 and above (18). The same trends have been observed in Manitoba, Canada (19), in England and Wales (20), and in other countries. It should be noted that 18% of those over 65 in Manitoba, 25% in the United States (21), and 36% in England and Wales did not see their doctor at all during the study year.

Not surprisingly, disease prevalence was quite different in general practice statistics. In England and

**Table 1. Age-specific death rates for ischemic heart disease and stroke (direct and indirect causes), white males in the United States of America, 1968 and 1977 (13).**

Cause of death	Age	Rate per 100,000		
		1968	1977	1977/1968
Ischemic heart disease	< 65	162.8	123.1	0.76
	65-74	2,465.1	1,960.2	0.80
	75-84	5,308.4	4,410.9	0.83
	85+	10,525.8	8,985.9	0.85
Stroke	< 65	32.3	22.4	0.69
	65-74	723.1	512.8	0.71
	75-84	2,226.2	1,664.9	0.75
	85+	5,001.5	3,828.8	0.77

Wales from 1970 to 1971, the ranking was respiratory diseases, diseases of the circulatory system, symptoms and ill-defined conditions, diseases of the musculo-skeletal system, and diseases of the nervous system and sense organs (20). The frequency was higher in women and higher at older ages; the ranking remained.

The morbidity patterns from surveys are again different and the number and frequency of conditions recorded vary from survey to survey as do definitions and methods (9). Svanborg's study of a cohort of 70-year-olds in Gothenborg showed angina pectoris or probable myocardial ischemia in 21% of men and 14% of women, hypertension in 23% and 48%, respectively, and chronic bronchitis in 18% and 9% (22). Forty-six percent complained of dyspnea and this was frequently combined with moderate hypertension and increased heart volume. This triad is probably physiological at this age but had been taken as evidence of heart failure and treated as a disease. Moreover, 60% of those with electrocardiographic evidence of previous myocardial infarction had never experienced precordial pain nor were they aware of their condition.

When the elderly are asked, "In general, how do you feel?" or, "How do you rate your health?" most answer, "Well," or, "Very well," and, "Good," or, "Very good." In the WHO 11 countries' study, 78% of men aged 60 to 64 rated their health as good and although this decreased with age, it was still 58% for the 85 to 89 group (23). Responses of the same age-sex groups in different countries, however, showed considerable variation, suggesting a marked cultural effect on the response; those in East European countries tended to rate themselves less healthy.

None of these measures of morbidity gives a reliable idea of the ability of an individual to cope in his daily life. Different individuals react quite differently to the same disease of (as far as one can judge) the same severity. In addition, disorders of mobility, hearing, seeing, and chewing, among others, are of special significance to the elderly but might not be perceived as morbidity. These impairments are common and their frequencies increase with age although, here, too, there are wide differences in reported prevalences even with standardized questionnaires (9,23). The results from one study in Jerusalem (24) are given in Table 2. These impairments are of particular importance as early detection and treatment can prevent much misery to the elderly person as well as prevent a chain of undesirable consequences.

Oral pathology is particularly frequent and neglected in all groups where examinations have been made.

**Table 2. Percentage of elderly reporting disabilities, Baka, Jerusalem, 1979 (24).**

Function impaired	Percentage by age group		
	60-64	70-74	80+
Hearing	14	34	50
Seeing	44	54	69
Chewing	33	39	48
Walking	20	29	62
Talking	6	9	22

From 12 to 60% in different centers of the WHO study reported difficulty in chewing (23). In Jerusalem, the overall percentage was 39; nearly three-quarters of them had dentures, mostly ill-fitting and often painful. Almost all were found to be in need of urgent oral care (25).

Other distressing conditions prevalent in the elderly include problems with feet and varicose veins, aches and pains in the joints, and, of special social significance, deficiencies in control of the sphincters (18, 20,22). To what degree are these inevitable accompaniments of normal aging and to what degree should they be classified as pathological?

### Impairments and Disabilities

Not all of those ill or impaired are disabled. In a British survey in 1971 over a third of those aged 75 and over showed impairments of one kind or another due to defined disease but only 9.2% were handicapped (1,22) as shown in Table 3. In spite of the prevalence of such impairments the majority of elderly continue to lead independent lives. Even in the richest countries fewer than 8% are in long-term-care facilities, including nursing homes (9).

**Table 3. Impairment and disablement at age 75 and above, selected causes, United Kingdom, 1971.**

Disease	Percentage impaired	Percentage severely disabled
Osteoarthritis	10.6	2.7
Circulatory	5.1	1.0
Respiratory	2.1	0.3
Stroke	2.0	1.2
All conditions	35.4	9.2

Source: WHO data, 1982.



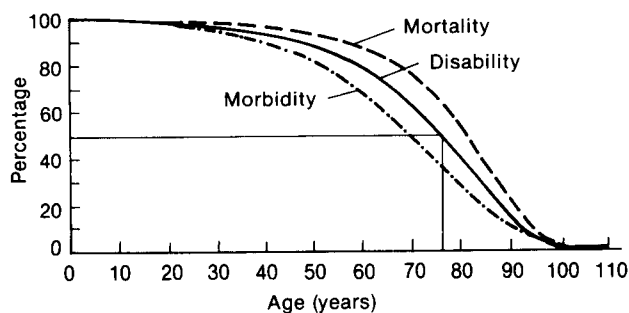
For the elderly themselves and for their families, neighbors, and social services who may need to support them, a diagnosis of the presence of pathology, unless curable, is of limited value. What is important is the ability to cope with daily life in spite of chronic morbidity and the degree to which the elderly may need assistance to continue to do this even at decreased levels of activity. Such functional activity is widely measured by indices of activities of daily living (ADL). The most common index developed and standardized by Katz and his colleagues (26) includes the basic needs of mobility, bathing, dressing, using the toilet, eating, and getting out of bed or a chair. Functional incapacity increased with age, the rates being higher in women than men, but here, too, there is considerable variation from place to place (23). In the pioneer comparative study in Denmark, Israel, Poland, the United Kingdom, and the United States in the late 1960s, Shanas and her colleagues found that 61 to 71% of people aged 65 to 69 and 25 to 45% of those aged 80 and over could still perform all these tasks without assistance (27).

Using different measures of disability, curves can be drawn which will extend the model developed above and indicate the time, in populations, from morbidity to the onset of disability and the duration of disability before death. Such a model is shown in Figure 3 and indicates that half of the women born in the United States in 1980 may expect to live to age 76 without marked disability.

### Toward a Measurement of Health

Given these different measures, morbidity, subjective health, limited activity, use of services, and index of ADL, do we have the beginnings for an index of health of the elderly which would permit us to draw an accurate curve? Not yet. A comparison of four

**Figure 3. Hypothetical morbidity, disability, and survival curves for women in the United States born in 1980. After WHO (9).**

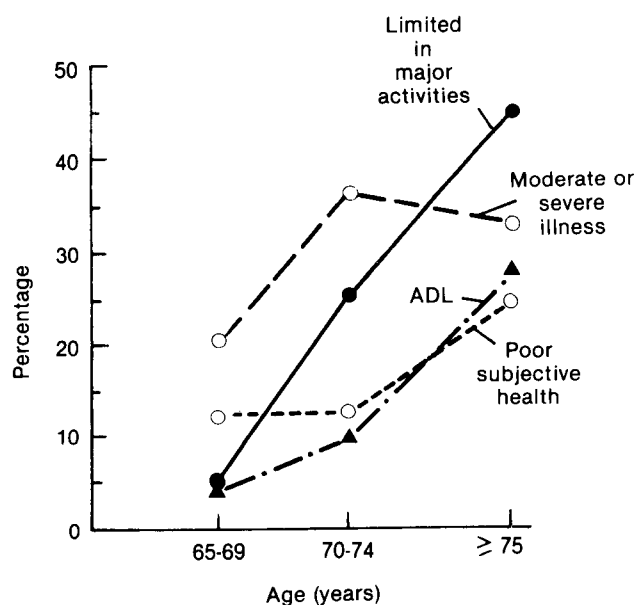


measures in elderly men in a community survey in Jerusalem (28) shows the expected increase with age for each measure although each clearly measures something different (Figure 4). Note the crossover of the upper curves in the oldest group, the survivors being more healthy in the opinion of the physician. The coefficient of agreement between doctors' appraisal and self-appraisal of health was only 22% and similar poor correlation has been reported by others. The same general trends were also obtained for women in this community (29) with women considering themselves less well than men of the same age but having fewer problems with ADL. Ratings were thus affected by age and sex; subjective appraisals were also affected by income and by social class—the poorer, the more pessimistic.

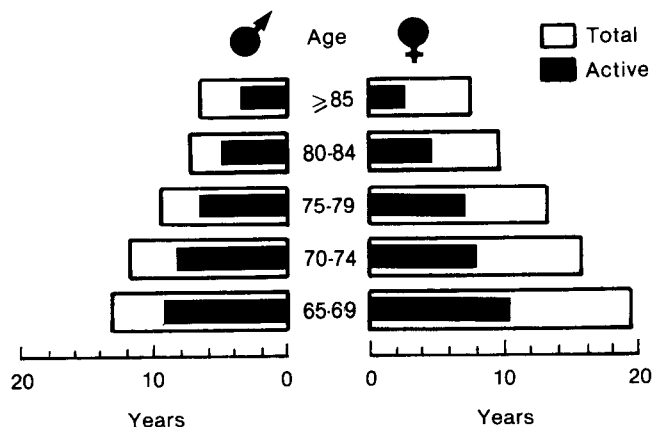
Self-appraisal of health proved to be a better predictor of mortality than doctors' appraisal in a large Canadian study (30). As a predictor of five-year mortality in the Jerusalem study (31), doctors' appraisal of the presence of moderate or severe illness had a sensitivity of 44% and a specificity of 75%, while self-appraised limited capacity or inability to work had a higher sensitivity of 64% but a lower specificity of 6% (32).

Expectation of life at different ages is clearly of limited value, expectation of active life brings us nearer to the kind of measure that is needed for the planning of services and, for the time being, might serve as a proxy for a measurement of health status. Figure 5, based on 1974 data from Massachusetts, shows such

**Figure 4. Four indices of health status in an elderly population in Jerusalem. Data from Gofin (28). ADL: Activities of daily living.**



**Figure 5. Average expectation of life by sex and age group, total and active, Massachusetts, 1974.**  
Data from Katz *et al.*(33).



an index (33). Men have a shorter life expectancy but a more independent one and indices based on a 1979 French survey show similar trends (34).

### Autonomy

In the current state of knowledge we cannot prevent the majority of the diseases and impairments of old age, but if we are to make a start it will be necessary to study the epidemiology of these conditions and measure the risk factors. This will involve the epidemiology of the specific diseases prevalent in the elderly, osteoarthritis, cardiovascular diseases, osteoporosis, senile dementia, senile cataract, and the like. In addition, it will involve study of the aggravating factors which change disease to impairments and impairments to handicaps. The application of the epidemiological method requires a defined and measurable endpoint. The desirable endpoint proposed to and accepted by the WHO Scientific Group (9) is loss of autonomy. If we agree that the purposes of health and social services are not only to prolong life but to maintain its quality as long as possible, then that quality requires a degree of independence that we must be able to define. The amount of health care and social support needed to achieve some acceptable minimum quality of life in those handicapped to various degrees could then be computed and epidemiology could fulfill its essential role in the planning and evaluation of services.

The variables involved are much broader than those linked to pathological change alone and cover the whole range of human activity. It is already possible to define risk factors in the economic environment and

social support (widowers living alone have a greatly increased chance of being admitted to hospital), the physical environment (accidents and poor housing), the degree of social support (depression in those left alone), and the attitudes of society (provision of services), to name but a few.

### The Future

Populations are aging, the elderly are getting older, and the prevalence of disease and disability increases with age. Is there no hope? Fries has made a case for the future rectangularization of mortality and the compression of morbidity at the end of life (35). While there is some evidence for the former, as we have seen, the expectation of life at greater ages is still increasing (13) and there is no evidence, from the United States at least, of a decline in morbidity or of the burden on the community (8,17,36).

On the other hand, Svanborg has begun to show that successive cohorts of 70-year-old Swedes in Gothenburg are healthier, objectively, than those who went before (37). Feinleib finds lower cardiovascular risk factors in the offspring of the Framingham study subjects than in their parents (38) and the mortality from cardiovascular disease and stroke continues to fall. Even for senile dementia, a group of diseases with a particularly acute rise with age, the single longitudinal study in the literature, from Lundby in Sweden, shows a fall in incidence over time (39). The situation is thus dynamic and prophecy shaky without much more epidemiological evidence.

### The Challenge

These data, of course, are mere straws in the wind. Their foundations are limited and the methodological problems involved in such extrapolations from uncontrolled data are considerable. But that is the kind of data currently available.

The submission of this paper is that the needs of the elderly are so complex that they require and deserve the scientific base that can only come from the holistic and unifying approach of the epidemiologist. The research opportunities are unlimited and the need for scientific study of the many variables is clear. Not only because of the intrinsic importance and urgency of the problems, not only because of the methodological and intellectual challenges, but also because of

enlightened self interest. The elderly of tomorrow are ourselves!

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(Source: Adapted, with the permission of the author, from: A. Michael Davis. Epidemiology and the challenge of ageing. *International Journal of Epidemiology* 14(1):9-19, 1985.)

# Diseases Subject to the International Health Regulations

## Cholera, yellow fever, and plague cases and deaths reported in the Region of the Americas up to 31 August 1985.

Country and administrative subdivision	Cholera Cases	Yellow fever		Plague Cases
		Cases	Deaths	
BOLIVIA	—	45	28	—
Cochabamba	—	1	—	—
La Paz	—	44	28	—
BRAZIL	—	7	5	26
Bahía	—	—	—	11
Ceará	—	—	—	15
Mato Grosso	—	5	3	—
Pará	—	1	1	—
Rondônia	—	1	1	—
COLOMBIA	—	4	4	—
Antioquia	—	1	1	—
Guaviare	—	2	2	—
Meta	—	1	1	—
ECUADOR	—	—	—	3
Loja	—	—	—	3
PERU	—	26	15	21
Cajamarca	—	—	—	10
Cuzco	—	7	5	—
Huánuco	—	6	2	—
Junín	—	7	5	—
Madre de Dios	—	2	1	—
Piura	—	—	—	11
San Martín	—	4	2	—
UNITED STATES OF AMERICA	—	—	—	8
New Mexico	—	—	—	8

### YELLOW FEVER IN PRESIDENTE PRUDENTE, SÃO PAULO, BRAZIL

The city of Presidente Prudente, a center of heavy agricultural activity in the western region of the State of São Paulo, is situated on the route that connects the City of São Paulo with Cuiabá and Campo Grande in the State of Mato Grosso. The infestation of this city by *Aedes aegypti*, detected in April 1985, and the considerable movement of people toward areas where jungle yellow fever is endemic increase the vulnerability of Presidente Prudente to urban yellow fever.

Two truck drivers who had been travelling together in the State of Mato Grosso since 4 May 1985 returned sick to Presidente Prudente on 20 May. Their illness with symptoms of fever, lumbago, and arthralgia had started on 18 May. One of them recovered within days of his arrival, but the other was hospitalized on 21 May with a tentative diagnosis of hepatitis or malaria. In the hospital the patient presented jaundice, vomiting (sometimes of blood), tarry stools, and acute renal and hepatic insufficiency. He died on 24 May. The same day another truck driver, from the same region of Mato Grosso, presented fever, headache, nausea, vomiting, and muscle aches. His condition worsened in the next few days, and on 27 May he was hospitalized in Presidente Prudente. The patient was later transferred to the Hospital of the Clinics in the City of São Paulo, where he died on 1 June of yellow fever, the diagnosis of which was then confirmed.

The presence of yellow fever patients in the viremic phase in an *Aedes aegypti*-infested city, most of whose population was not immunized against the disease, posed a major threat of the reurbanization, after 43 years, of yellow fever in Brazil. The health authorities considered the situation an emergency, and, as soon as they had the confirmed diagnosis of the first case, initiated a campaign against *A. aegypti* that included the application of organophosphorus insecticides and mass vaccination of the population. In five days 165,830 persons were vaccinated—the whole population of Presidente Prudente along with thousands of persons in neighboring cities. To date, no indigenous cases have been reported.

With the spread of *A. aegypti* to different areas of the country and the great movement of people in the Amazon region toward some of these areas, it is possible that other incidents similar to the one in Presidente Prudente will occur.

(Source: Ministry of Health of Brazil.  
*Informações Epidemiológicas SUCAM* 3(32), 1985.)

## What the Vital Statistics System Can and Cannot Do

An assessment of maternal mortality statistics in the United States of America (1) compares in detail the statistics on maternal mortality published by the National Center for Health Statistics (NCHS) from death records for 1974-1978, and records which were identified by state vital records offices as cases of maternal mortality. The authors express concern over the fact that the NCHS data understated the actual number of maternal deaths by 20% or more, and urge a systematic study to determine why 400 deaths in the five-year period were identified by the states, but not classified by NCHS, as maternal deaths.

Births and deaths are registered according to state laws. A state's vital records system<sup>1</sup> is primarily a set of records concerning individual persons, to be used for legal matters: identification; proof of citizenship, age, or death; and evidence of cause of death, if needed to collect insurance. The only content that is really required for legal purposes is the time and place of the vital event, and enough information to uniquely identify the individual who was born or who died.

Birth and death registers were begun in America's colonial period (2). At a relatively late point in history, the federal government assumed responsibility for developing uniform standards and compiling national statistics (the Bureau of the Census from 1903 to 1946, followed by the U.S. Public Health Service) (3). A model state vital statistics law was first promulgated in 1907. By 1919, all the states had birth and death records on file for their entire area, but not until the 1930s did all the states comply with the model registration law, and use the standard type of certificate. The nation could then claim to have a national vital statistics system.

Meanwhile, the content of birth and death records expanded. The thrust to add new information came largely from federal agencies, researchers, demographers, and epidemiologists seeking statistical information about births and deaths. Today, the registration of a birth requires details not only about the new baby and its parents, but also about the parents' education, the mother's current and previous pregnancies, and the circumstances of delivery. Registration of a death requires background on the decedent's parents, citizenship, marriage, military service, and occupation; details about the causes of death,

both direct and contributing; social security number; and the precise location of death (home, hospital, and so forth). All this information must be gathered from a vast number and variety of persons—such as doctors, nurses, and funeral directors—few of whom are trained as data recorders; and the records must be indexed, processed, and filed by a state or local registrar.

Registrars must focus their efforts on the complexities of managing the registry: receiving, processing, and filing certificates; issuing copies; amending and correcting certificates; maintaining a secure repository; and instructing the inexperienced data recorders on whom they must rely about changes of definition and content. In addition, the registrars deliver copies of the certificates, or computer tapes of coded data, to NCHS for the national system, provide information to a broad array of users, and cooperate with researchers requesting access to their tapes or certificates.

The national vital statistics system is an invaluable and essential resource. The information it has provided over the years has profoundly influenced the direction of public health efforts, and our understanding of the causes of death and illness. Vital records provide us with a national scorekeeping system on health status, and the latest scores make front-page headlines.

Modern computer technology, coupled with the excellent user service programs of NCHS and of state health agencies, has now made it a routine matter to access and analyze large files of birth and death data. Births and infant deaths have been studied in great detail, with every possible linkage of variables explored. Deaths due to specific chronic causes have been examined to determine trends and linkages; deaths have been studied by age, race, and geographic location (4-9); deaths have been related to heat waves in Texas (10), cold waves in Minnesota (11), and economic fluctuations (12).

In fact, the collection of state record systems which began and function as registries is now looked upon by the health community as an ongoing national statistical supersurvey. Most researchers accept its imperfections as a small price to pay for having so comprehensive a store of information readily available on all segments of the population. Others, however, are frustrated when the system turns out to be less complete, less accurate, and less uniform than a controlled clinical trial. They demand that the accuracy of cause-of-death coding must be improved (6, 13, 14), or that items must

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<sup>1</sup>Registration areas for births and deaths include the 50 states, New York City, and Washington, D.C. References to "states" include all these areas.

be added to the registration form to meet newly perceived needs for information (1,15,16).

There is ample documentation of the lack of precision in cause-of-death specification by physicians, and of biases in the data on the underlying cause of death that are a result of the coding protocols used. Authors have noted these problems, for example, in relation to studies of hypertension (5), diabetes (6,17), cancer (14), influenza and pneumonia (18), and now in maternal mortality (1). But it has also been pointed out that there are limits to the precision that can be expected (19, 20). Given the multiplicity of health problems involved in most deaths, the judgmental nature of diagnosis, the detailed differentiation available in the *International Classification of Diseases (ICD)* codes, and the circumstances of filing a certificate as part of the formalities involved in a death, it is unreasonable to expect that practicing physicians will be considering specific research needs when they certify a cause of death. Given the need to process millions of records into computer-readable form in a standard manner, it is inevitable that automated coding procedures will sometimes distort the information that is available from the certificate itself. Given the limitations of the registration process, it is not surprising that most research that goes beyond broad trends, or major categories, must turn to additional sources of data to gain the desired depth of information.

It has been known for at least 50 years that the vital statistics system is inadequate for the study of maternal mortality (21). The procedure of individual case study, using all available records plus professional evaluation, was established in the 1930s, when maternal mortality study committees began operating in various states and localities. The American Medical Association's *Guide for Maternal Death Studies* was published in 1957 and revised in 1964 (22). It defines maternal death as "The death of a woman dying from any cause whatsoever, while pregnant, or within 90 days of the termination of pregnancy." These deaths are further divided into those resulting directly from the pregnancy or related complications and interventions, those resulting from some other disease that was aggravated by the pregnancy, and those that are "nonrelated", such as accidents and homicides.

It was obvious from the start of efforts of these committees that death certificates from the vital records system would not identify all the deaths they wished to examine. A variety of other data sources have been used, such as hospital records, contacts with physicians, and matching of death records of women of

childbearing age with certificates of live birth. These studies have consistently identified pregnancy-related deaths that were not designated as maternal mortality through usual vital statistics classification (23).

Part of the problem is the lack of consensus, and the changing definitions, as to what constitutes a pregnancy-related death. The American Medical Association, the *ICD*, and the various maternal mortality committees have used different definitions. Until 1979, the *ICD* required a specific maternal condition rather than an association with pregnancy. Some researchers have extended the time period being considered, so that even deaths long after delivery, if they could be attributed to complications resulting from pregnancy, were labeled as maternal mortality (15). For indirectly related deaths—those stemming from another disease that was aggravated by the pregnancy—there may be differences of individual physician judgment as to whether the death should be called "maternal". And in addition to this lack of a consistent definition, the death certificates clearly do not contain enough information for maternal mortality case studies; the committees always have carried out data collection of their own. Since these problems have been evident for so many decades, and since maternal mortality study committees have been operating with some degree of continuity in most states, and since there is agreement on terminology and procedures, why is there not a national maternal mortality data base available from the aggregate of maternal mortality studies? Some states have included a pregnancy question on the death certificate, and it has been suggested that this item be made part of the standard data set. But is it reasonable to introduce yet another infrequently needed item into the registration process? Would it ever be recorded with the degree of completeness and accuracy needed for maternal mortality studies?

A similar issue of how much to expect from the vital records system extends to the study of perinatal mortality. Infant death rates have declined markedly in recent years. Attention is now focused on the core problems related to the remaining deaths: preterm delivery and very low birth weight. Some 7% of the babies born in the United States are delivered preterm, compared to 4% in the Scandinavian countries (24). Why? It is unlikely that vital records data, however stratified and analyzed, will yield clues to the reasons for this problem—the data can only confirm associations that are already known. Vital records are no more accurate in the recording of causes of infant deaths than they are for other deaths—in fact, they may be

far less accurate. Particularly in the case of deaths of prematurely born babies who were barely able to live through the birth process, there is no great concern about establishing the precise cause of death. "Live birth" is determined according to definition, but is highly subject to judgment—was there or was there not a flicker of life? A comparison of vital records with other sources of information provides evidence that in some areas a significant number of early neonatal deaths are never registered at all (25, 26). Some maternal mortality study committees, and many health departments, now carry out individual examinations of neonatal, perinatal, or infant deaths, using data from many sources, in the same manner that maternal deaths have been studied.

With the current need for research on causes of preterm delivery, we must also reconsider the historical categories locked into the vital records system. An important part of our national scorekeeping is the infant mortality rate, which includes all deaths up to one year of age. Fetal deaths—deaths after the 20th week of pregnancy but before or during delivery—are recorded separately. Study of the problem of preterm delivery may require an erasing of the distinction between fetal death and early neonatal death, to consider all pregnancies in which the fetus was unable to survive to full development. Similarly, it may be useful to link maternal deaths with outcome of pregnancy. Since lowering our infant mortality rate is a national priority, and since the numbers are now so few that committees and health agencies can do in-depth studies of each death, should we not be looking toward a national perinatal mortality data base assembled from the findings of cases studies?

Through cooperative efforts of NCHS and state health agencies, the vital records system has continually improved to enhance its role as a multipurpose source of health-related data. There are many examples of notable advances in recent years:

- Coding of multiple causes of death makes all of the diagnostic information on the death certificate available for computer analysis, providing a better clue to the true prevalence of diseases such as diabetes.

- The National Death Index recently established by NCHS makes it possible for a researcher to ascertain the fact of a death, and the place of death, of any sufficiently identified individual. Death certificate information can then be obtained from the appropriate state vital records office.

- Linked birth/infant death data files combine birth information with the record of each infant death. They are invaluable

for broad insights into the factors related to infant deaths.<sup>2</sup>

These enhancements of the vital records system will make it more useful and valuable than ever—for those applications for which it is suitable. No doubt researchers will find new causes of frustration. Information on multiple causes of death is sometimes inaccurate or incomplete, and may be biased by the coding and processing procedure used. The National Death Index involves the inconvenience of filing requests with many different vital records offices. Information in linked birth/infant death records is no more accurate than were the data in the individual records. Moreover, since the files are assembled for birth in a given calendar year, and since a second year must elapse before all infant deaths can have occurred, the data are at least two years old before they become available. Each improvement of the vital statistics system opens up both a treasure chest, and a Pandora's box.

The challenge to public health and other researchers is to document the types of application that are and are not suitable for the vital records system, and to move toward the establishment of other supplementary uniform national data sets, instead of posing unrealistic expectations for birth and death registration.

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## Editorial Comment

In discussing the possibilities of using data originating in the vital statistics systems, this article points out the limitations which their use entails in some types of research, even in countries where the statistical systems produce highly reliable data. In Latin America and the Caribbean, besides limitations and deficiencies in quality noted there are others, which, however, should not inhibit the cautious analysis of the available information.

In a large part of the Region, the main problem arises from underregistration of vital events, usually greater for births than for deaths, especially deficient in regard to the deaths of small children and, in general, for all vital events occurring in rural areas, in contrast to urban ones. Vital events, even when registered, often contain incomplete or incorrect information, due either to lack of knowledge or to negligence. Defects in cause-of-death certification are due less to mistakes made by certifying physicians than to the low coverage of health care services, as reflected in the low percentage of death certificates signed by physicians.

These deficiencies have been cited all too frequently to explain the lack of analysis and use of birth and death statistics from the vital records system. Nevertheless, it would seem just as improper to ignore these data as to use them carelessly.

Before requesting special studies to obtain new information, the quality and coverage of the existing information ought to be checked. Knowledge obtained from this information will facilitate better study designs for those specific problems requiring more detailed analyses. Available data will often suffice to identify and describe the principal health problems and their trends; in many cases, this is all that is required for decision-making.



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