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THE EPIDEMIOLOGY OF AGING

A. Michael Davies

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EPIDEMIOLOGY AND THE CHALLENGE OF AGING

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Jerusalem

December 1984

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Abstract

Reductions in fertility, in infant mortality and in deaths from infectious diseases have resulted in the increasing survival of populations to later life. Starting in richer countries and spreading at various rates to most others, there has been a continuous rise in both the numbers and the proportions of elderly. Not only have populations grown older, there are now increased proportions of the very old and frail in the elderly population itself.

The present paper, which is based on a lecture to the International Epidemiological Association (10th Scientific Meeting, Vancouver, August 1984), briefly reviews the antecedents and consequences of aging populations. It seeks to delineate the questions of major research importance facing the epidemiological community.

After a survey of the contributions of mortality and fertility to population aging in more developed and less developed regions, Section 2 raises some of the resultant problems of social organization. Section 3 addresses the causes of the drop all in mortality that has accompanied these population changes, with particular attention to the changing causes of death.

Increasing survival brings increasing frailty and morbidity. Section 4 explores the accuracy and limitations of current epidemiological data on morbidity among the elderly. Sections 5 and 6 survey the state of the art in the development of indices of functional incapacity and health.

The end-point, the paper suggests, of these epidemiological explorations should be the measurement of the loss of autonomy among the aged and its antecedent causes. If the purpose of health and social services is not only to prolong life but to maintain its quality for as long as possible, then that quality requires a defineable degree of functional independence. By addressing itself to this research task, epidemiology can fill an essential role in the planning and evaluation of services for the elderly.

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1. Introduction

Reductions in fertility, in infant mortality and in deaths from infectious diseases, have resulted in the 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 the proportions of elderly persons. 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 (United Nations, 1982a, 1982b). For not only have populations grown older, the old themselves have aged, with yielding increasing proportions of the very old and frail (Hoover and Siegel, 1982).

The causes and consequences of aging of populations are so many, complex and intertwined 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 have been made along the lines of scientific disciplines, such as in cellular aging, sociology of aging, demographic changes, and the physiological, psychological and economic consequences of aging. There have been few attempts at integrated or holistic approaches, particularly quantitative ones. It may be that we still lack conceptual frameworks appropriate to the problems. But developments in the care of the elderly, including health care - especially in Britain and Northern Europe, 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.

The operational definition of old age, necessary for purposes of administration and inquiry is determined by custom and legal definition of retirement age rather than by objective criteria. Most of the geriatric literature seems to accept age 65 as the cut-off point, as does the World Health Organization (1984) and it is difficult to better the 1972 Scientific Group on Psychogeriatrics, which wrote: "For the purposes of the present report... old age or senescence is taken to mean that period of life when impairment of mental and physical functions becomes increasingly manifest by comparison with previous periods of life. For statistical purposes it is necessary to come to an agreement about an arbitrary threshold and the Group has selected the age limit of 65 years as marking the beginning of old age. This corresponds fairly well with the generally agreed age of retirement and completion of professional activity in most countries." (WHO, 1972)

Epidemiologists will recall the considerable range of human variation and the effects on specificity and sensitivity of a fixed cut-off point when applied to different groups. Moreover, the over-65's may span 30 years and their social, economic, family and health characteristics differ dramatically in different age subgroups. Thus there is need for caution in the interpretation of aggregated data.

In this paper we shall survey in brief the antecedents and consequences of aging populations, the available data on mortality,

morbidity and disability and the need for new approaches. My main purpose is to indicate the fascination and the scope of this latest challenge to epidemiological skills.

2. The Demographic Transformation and Its Consequences

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 (Grinblat, 1982).

The demographic process of aging of populations derives, in the main, from changes in mortality and fertility. 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 thousand today, so that the proportion of infants surviving to adult life has increased considerably. A similar trend in developing countries during the past few decades, albeit muted by fertility that has sustained the population pyramid's wide base, has lead to a population explosion that has become the major public health problem of many societies (Figure 1). In the long-term, the larger cohorts of surviving young people produce considerable increase in the numbers of the elderly even if mortality at higher ages is not changed. When this happens, the size of the elderly population becomes even greater.

The most influential factor historically in the aging of populations has been the decline in fertility. A dramatic example is that of Japan, which in 1950 had a young population structure like that of many developing countries. Today, 7.7% of its population is

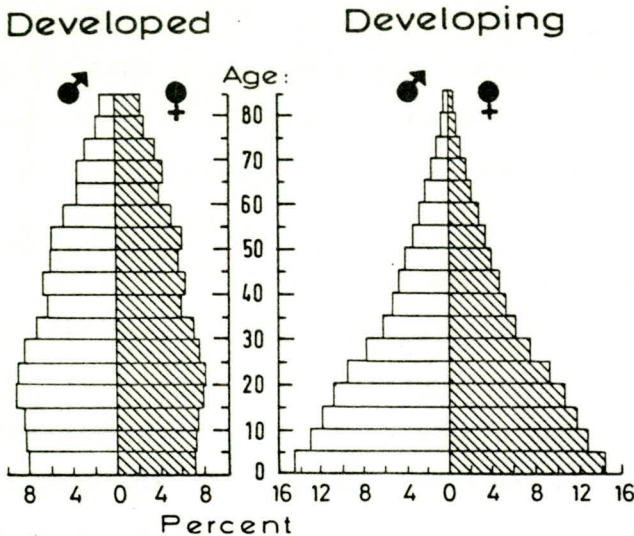


Figure 1

aged 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 '2000 (United Nations, 1982a). 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. The proportion of older age groups thus increases automatically, even without any increase in expectation of life. Simulation models show that changes in mortality are in fact of secondary importance (United Nations, 1956). All populations with a falling birth rate therefore age, their rate of aging increasing as mortality falls.

Populations pass through the stages of what has been called the "epidemiological transition", representing the shift from high mortality/high fertility to low mortality/low fertility and thus from a low proportion of elderly to a high proportion (Omran, 1977). This

transition began earlier in developed countries , so that today the proportion of older persons is much higher than in developing countries: 15% over age 60 in the more developed regions (MDR) compared to 6.2% in the less developed regions (LDR) in 1980. The elderly of the MDRs are older: half of those aged 60 and more are already aged over 70 compared to 37% in LDRs.

The proportion of older people will increase in all regions from 1980 until at least 2020 (United Nations, 1982a; Hoover and Siegel, 1982; also Figure 2). But on the whole, LDRs will show smaller gains due to higher fertility and higher mortality. In terms of absolute numbers, however, the majority of persons over 60 are already found in the less developed countries of the world (Figure 3) and their contribution to the world total will increase considerably by the end of the century.

It is the changes in mortality at different ages that fashion the final shape of the population curve. Figure 4 shows the age-specific mortality in different countries at different times. Note the wide ranges - particularly in infant and child mortality and the much smaller differences at the highest age groups.

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

Figure 5 shows the survival curves for American women in 1900 and 1980. There is an initial drop due to infant mortality at the beginning of the century and the fact that 50% of those born could

PERCENTAGE OF POPULATION
60 YEARS AND OVER

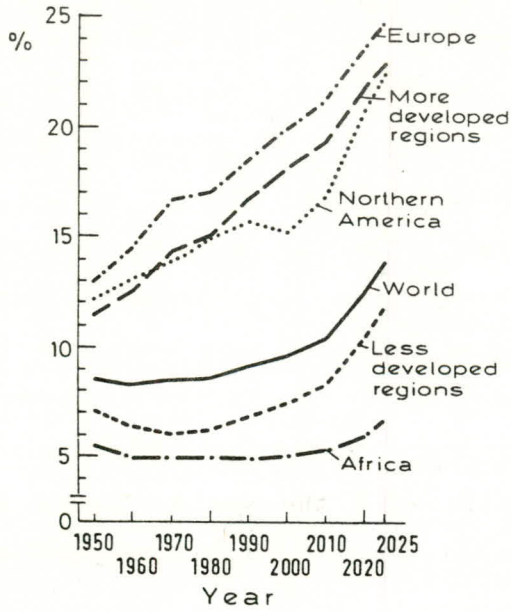


Figure 2

WORLD ELDERLY POPULATIONS, 1980
AND 2000 IN MORE (MDR) AND LESS
(LDR) DEVELOPED REGIONS

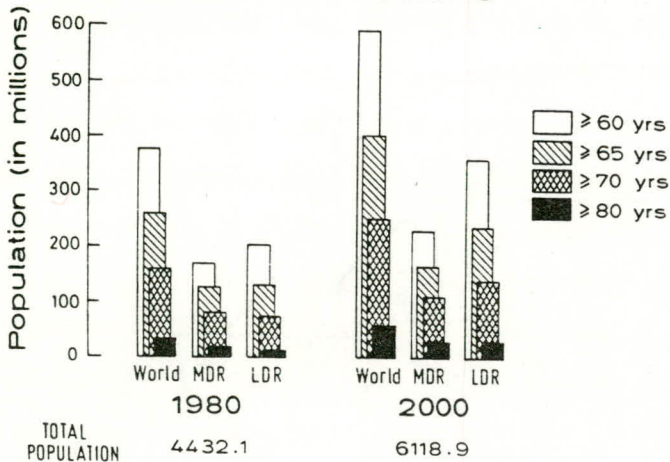


Figure 3

AGE SPECIFIC MORTALITY RATES
FOR SELECTED COUNTRIES
(Log Curves)

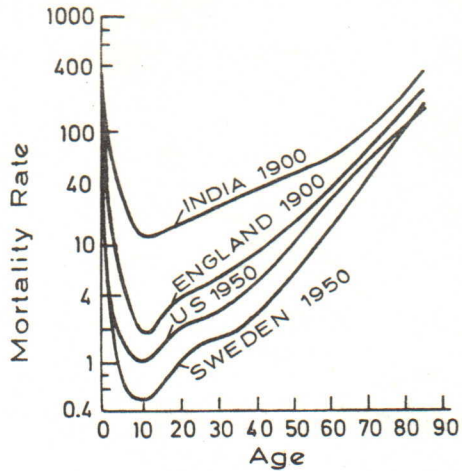


Figure 4

MORTALITY SURVIVAL CURVES
FOR U.S. FEMALES IN 1900 AND 1980

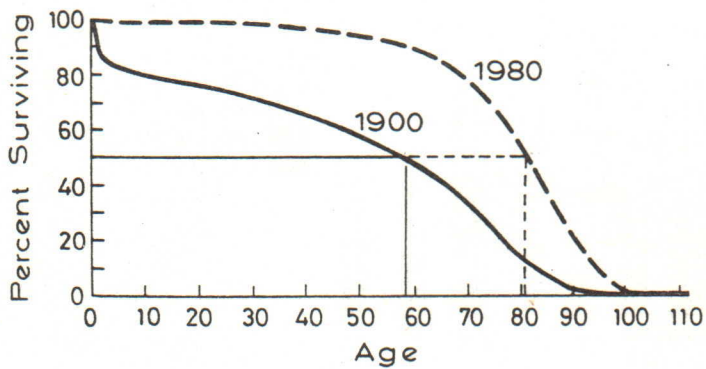


Figure 5

expect to survive to age 58. The expectation of life at birth was 49: for the 1980 birth cohort it was 77.5. In fact, half of the women subjected to the mortality risks of 1980 can expect to survive to age 82 (WHO, 1984) and the curve approaches the rectangular. What does not emerge from this curve is the fact that the highest ages achieved have not changed and there appears to be a biological upper limit. Of those reaching 85, less than 1 in 10,000 can hope to reach 110. What is of importance here is the increased probability of reaching 85, meaning that the absolute number of centenarians is growing.

The group aged 65 and over, as already mentioned, is far from homogeneous. Frailty and dependency increase much more rapidly after 75 than before. In planning services it is useful to distinguish between the "young-old", ages 65-74, and the "old-old", those over age 75. Even these cut-off points may need to be varied in different populations.

Not only are populations getting older, the old themselves are living longer and the mortality at all ages is falling - as illustrated by the curves for England and Wales redrawn from Grundy's (1984) recent paper (Figure 6). Over the last decade, life expectancy at age 85 increased from about six months to 4.6 years for men and 5.6 years for women. In many countries the 80+ age group is the fastest growing one and is expected to double in size by the end of the century (Siegel and Hoover, 1982).

Changes in death rates at advanced ages have little effect on the age structure of the population as a whole, but they do have a major impact on the composition of the elderly population itself.

PERCENTAGE FALL IN AGE
SPECIFIC DEATH RATES
(ENGLAND AND WALES: 1891-1980)

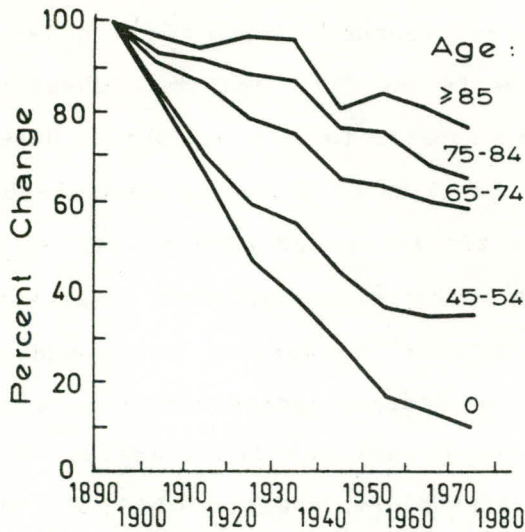


Figure 6

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. At age 60 there is a 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. As Paillat (1981) said "In Europe, the population pyramid is being replaced by a column-like Nelson's column but with an elderly woman at the top of it!" Many of the social consequences of population aging are due in fact to this sex imbalance, and widowhood is an important risk factor.

The effects of population aging are profound on almost every aspect of social organization. As production is mainly in the hands of those under age 65, a rise in the number of those over 65 (as in those under 15) increases the proportion of the population that is not productive - i.e. the dependency ratio. This in turn affects, and is affected by, retirement policies and pension schemes with the increasing chances in recent years of survival beyond actuarial predictions (United Nations, 1982a; Siegel and Hoover, 1982; Feldman and Rice, 1983).

In developing countries, migration patterns and rapid urbanization often leave old people in the rural areas, unsupported, while the out-migration of younger people leaves gerontic enclaves in the inner cities of more developed regions (United Nations, 1982b; WHO, 1984). 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. As the absolute number of those requiring care increases, so does the drain on the communal and public purse. The miracle of increased longevity becomes the "problem" and the "burden" of old age.

3. Causes of Death

The fall in mortality at higher 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? This is a field of legitimate epidemiological concern which may give clues to intervention programs in the future. We can only give a partial answer to the question, however, 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 age 65 are attributed to cardiovascular diseases and cancer, with ischemic heart disease and malignant neoplasms contributing about a quarter each (Hanada and Lopez, 1982). There is considerable variation, however, in the proportion of deaths ascribed to specific causes in different countries; 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 falling in recent decades in some industrialized countries (e.g. the US, Australia, Finland and Belgium), although not in others (e.g. Sweden). Mortality from cerebrovascular diseases is declining, albeit at a different rate and with the exception of Eastern Europe (Siegel and Hoover, 1982; Hanada and Lopez, 1982; Feinleib and Havlick, 1979; Garraway et al., 1979). The percentage of deaths due to ischemic heart disease in industrialized countries for the 65-74 age group varies from 7.7% in

Japan to 39.3% in Sweden, a five-fold difference (Hanada and Lopez, 1982). Japan and Portugal, with the lowest percentage contribution of ischemic heart disease to total mortality, show the highest contribution of cerebral vascular diseases.

Manton (1982) has combined direct and underlying causes of death for a sample of U.S. 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 death at the

Table 1: Age-specific Death Rates for U.S. White Males,
for Ischemic Heart Disease and Stroke: 1968-1977
(rates per 100,000)

Cause of Death	Age	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

Source: Manton (1982).

highest ages. The table also shows that the oldest groups shared equally in the fall in IHD and stroke mortality in the decade following 1968. Data for non-white males showed similar trends. As Patrick and associates (1982) have documented, U.S. statistics for white female deaths from heart disease show a continuous decline with parallel slopes for successive birth cohorts from 1886 onwards. For white males, heart disease mortality rates increased until 1965 since when there has been a reversal, each successive cohort showing a decrease. It should be noted 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 the rubric (Epstein, 1983).

Mortality in the elderly from neoplastic diseases is on the rise in about half of the industrialized countries studied by Hanada and Lopez, 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. A recent, careful analysis of 1,000 French death certificates of persons over 65 shows that senility as a direct or underlying cause of death was recorded in 2-3% of certificates at ages 70 to 89, but rose to 25% at ages 90 and over. The overall rate for those over 65 was 10.6%, but senility was given as the leading cause in only 3.6% of cases. In most cases it was possible to use ICD coding rules to classify the cause of death satisfactorily (Table 2). The most prevalent causes of

death were diseases of the cardiovascular system (41% of men and 45% of women), neoplasms (28.6% and 17.5% respectively), with injuries and poisoning, diseases of the digestive system and ill-defined signs and symptoms each accounting for $5.3 \pm 1.1\%$ of male deaths and $7.2 \pm 0.5\%$ of female deaths. This, of course, begs the whole question of the effect of coding rules on certification practice and on reported statistics in the face of multiple organ disease and other studies have shown a higher proportion of deaths ascribed to senility. In the Gothenborg study, where cohorts of 70-year olds are carefully examined, up to a third of those dying are deemed to die of "old age", there being considerable difficulty in ascribing death to failure of any single organ system (Svanborg *et al.*, 1982).

Table 2: Main Causes of Death as Recorded in 1,000 Certificates of Persons Aged 65 and Over: France, 1983 (percentages)

I.C.D. Coding	Women (N = 518)	Men (N = 482)
Circulatory system	45.0	40.9
Neoplasms	17.5	28.6
Injury and poisoning	7.7	4.2
Digestive system	7.3	6.4
Symptoms, signs, ill-defined	6.7	5.6
Respiratory system	5.8	6.0

Source: Unpublished data from WHO "Study of the Term Senility or Equivalent Terms on Medical Certificates of Cause of Death" DES/ICD/C/84.7, 1984.

4. Morbidity in the Elderly

Increasing survival brings increasing frailty and morbidity, mainly from chronic disease (Gruenberg, 1977; Brody, 1982). The ill elderly live longer and because of this, in developed countries, there are more cases of disease that are managed or controlled rather than cured (Feldman and Rice, 1983).

The patterns of morbidity in the elderly have many facets and each of the sources of information currently available illuminates a different one. Combinations of different sources will hopefully provide a general framework and point out the missing pieces of the mosaic.

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 problems with which epidemiology is familiar - definition, identification, measurement and enumeration.

Accurate morbidity data based on population samples is available from only a handful of developed countries. Even here comparisons are difficult due to lack of methodological standardization. Grimley Evans (1982) makes the point that "normal aging can neither be defined nor measured and there is an abundant literature on the confused and heterogeneous nature of conditions that society or professions find it convenient to call disease." Without agreement on definitions, let alone cut-off points, it is too much to expect comparative data on the

prevalence of disease.

Symptoms in the elderly are often less clear cut than in younger people and may not cause them to seek care or to receive it when they do. Many symptoms may be regarded by the elderly (and by their doctors too) as normal or expected in the old and thus not be investigated seriously. Others may interpret the decrements of aging as disease and overtreat (WHO, 1983; Svanborg et al., 1982). These facts are further affected by the cost, availability and accessibility of health services which affect utilization statistics more for this group than perhaps for any other.

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 65-74, 7.0 at ages 75-84 and 7.9 at age 85 and above (Bond and Carstairs, 1982). The same trends have been observed in Manitoba, Canada (Roos et al., 1984) and in England and Wales (Owen, 1977), among others. It should be noted that 18% of those over 65 in Manitoba, 25% in the U.S. (Kovar, 1982) and 36% in England and Wales did not see their doctor at all during the study year.

Admissions to short-stay hospitals increase even more steeply with age. In the U.S. in 1977-79 there were 265 discharges per 1,000 aged 65-69, rising to 430 at 75-79 and 499 at 85 and over. Days of care and average length of stay increased in tandem. Israeli (Davies, 1983), Canadian (Department of National Health and Welfare, 1983) and Danish (Agnes et al., 1982) series, among others, show the same trend. The most prevalent diagnoses in the U.S. data were diseases of the

circulatory system (one-quarter to one-third of all admissions of the elderly), followed by diseases of the digestive system, neoplasms, diseases of the respiratory system and accidents.

Not surprisingly, disease prevalence was quite different in general practice statistics. In England and Wales in 1970-71 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 (Owen, 1977). The frequency was higher in women and higher at older ages; the ranking remained.

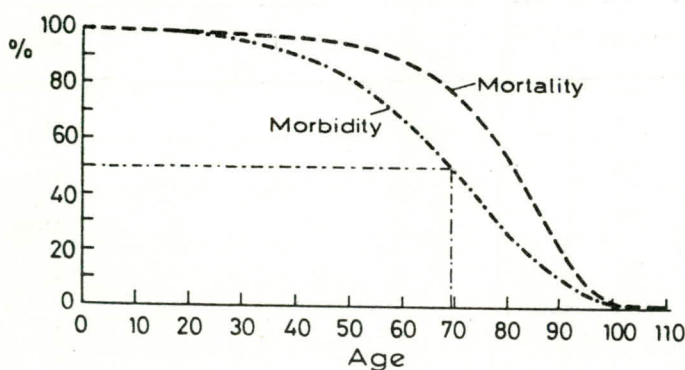
The morbidity patterns from surveys are again different and the number and frequency of conditions recorded vary from survey to survey, as do definitions and methods (WHO, 1984). Svanborg's (1982a) study of a cohort of 70 year-olds in Gothenborg showed angina pectoris or probable myocardial ischemia in 21% of men and 14% of women, hypertension in 23% and 48% respectively and chronic bronchitis in 18% and 9%. 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 and never experienced pre-cardial pain or were unaware of their condition.

However, if the findings of a specific cross-sectional survey (such as the U.S. National Health Survey), are taken at face value, it is possible to compute a model of morbidity from chronic diseases at

each age and then compare the curve with that of mortality (Figure 7). The distance between the curves indicates the length of life with illness before death. On the basis of the 1980 mortality rates and the findings of the 1978 survey, half of the women would be expected to reach the age of 68 without significant chronic disease.

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 a WHO 11-country study, 78% of men aged 60-64 rated their health as good; although this decreased with age, it still stood at 58% for the 85-89 group (Heikkinen, 1983). Responses of the same age-sex groups in different countries, however, showed considerable variation. This suggests a marked cultural effect on the response; those in East European countries seem to be more pessimistic.

MORBIDITY AND MORTALITY SURVIVAL
CURVES (U.S., WOMEN, 1980)



(After WHO 1984)

Figure 7

None of these measures of morbidity give 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 (WHO, 1984; Heikkinen, 1983). The results from one study in Jerusalem (Davies and Fleishman, 1981) are given in Table 3. These impairments are of particular importance inasmuch as early detection and treatment can prevent much misery to the elderly person as well as prevent a chain of undesirable consequences.

Table 3: Elderly Reporting Disabilities, by Age Group: Baka, Jerusalem, 1979 (percentages)

Disability	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

Source: Davies and Fleishman (1981).

Oral pathology is particularly frequent and neglected in all groups where examinations have been made: 12-60% in different centers of the WHO study reported difficulty in chewing (Heikkinen, 1983). In Jerusalem, 39% had such difficulties; nearly three-quarters of them had dentures, mostly ill-fitting and often painful. Almost all elderly were found to be in need of urgent oral care (Fleishman and Peles, 1983).

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

5. 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 disabled (Table 4). 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% reside in long-term care facilities.

For the elderly themselves and for their families, neighbours 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

Table 4: Impairment and Disablement at Age 75 and Over, by Causes:
U.K., 1971 (percentages)

Disease	Impaired	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 (1982).

morbidity and the degree to which the elder 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 (1963) includes the basic needs of mobility, bathing, dressing, using the toilet, eating and getting out of bed or chair.

Functional incapacity increases with age, the rates being higher in women than in men (Figure 8). There is also considerable variation from place to place (Heikkinen, 1983). In the pioneer comparative study in Denmark, Israel, Poland, the United Kingdom and the United States in the late 1960s, Shanas and her colleagues (1971) found that 61-71% of persons aged 65-69 and 25-45% of those aged 80 and over could still perform all these tasks without assistance.

DEFINED FUNCTIONAL INCAPACITY
(PERCENTAGE BY AGE AND SEX,
SCOTLAND 1982)

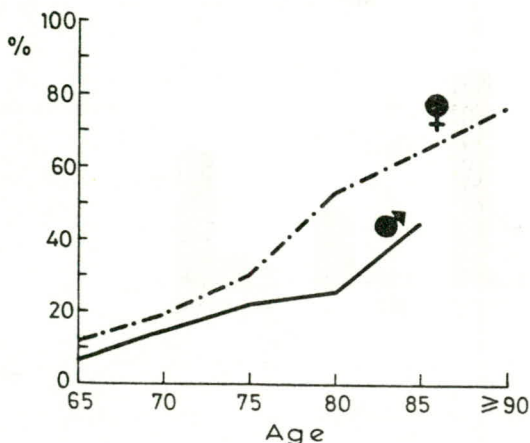


Figure 8

Figure 9, based on the U.S. National Health Survey, shows the percentage of the population at different ages who needed assistance with specific activities of daily living. Figure 10 shows the need to quantify the degree of limitation. Using different measures of disability, curves can be drawn which will extend our model and indicate the time from morbidity to the onset of disability and the durations of disability before death. Such a model is shown in Figure 11.

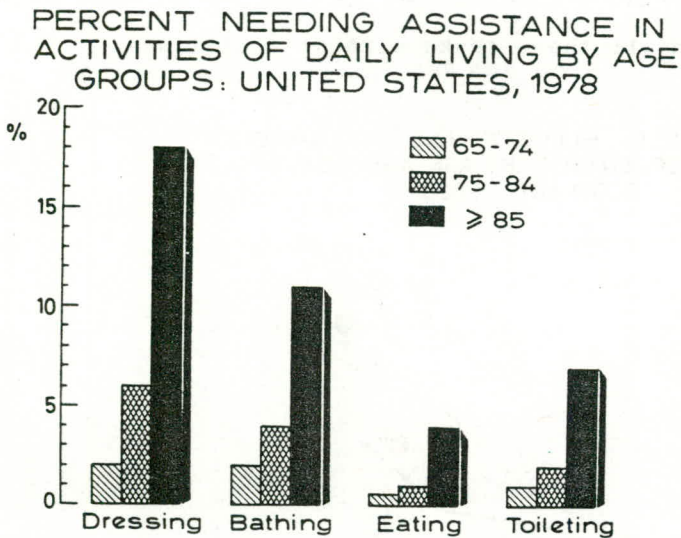


Figure 9

PERCENT WITH LIMITATION OF
ACTIVITY DUE TO CHRONIC CONDITION
BY AGE GROUPS AND TYPE OF LIMITATION:
U.S. 1978

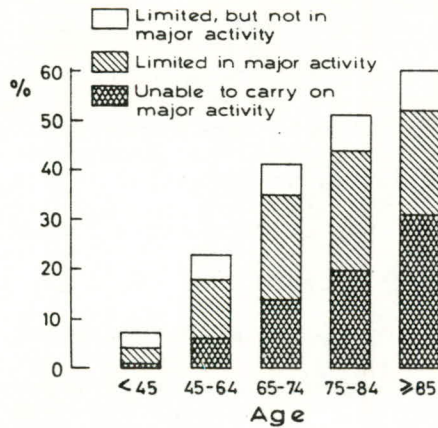


Figure 10

MORBIDITY DISABILITY AND MORTALITY
SURVIVAL CURVES (U.S. WOMEN, 1980)

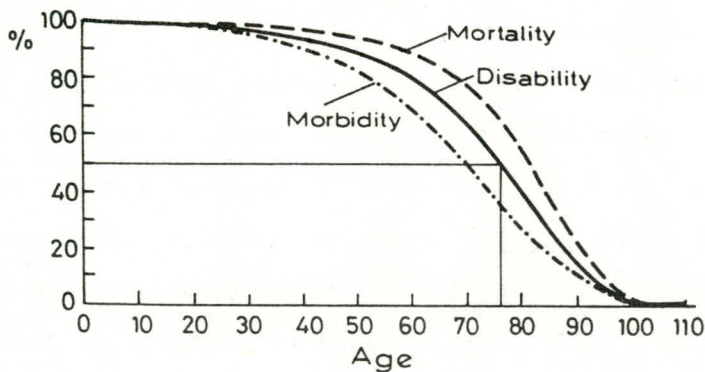


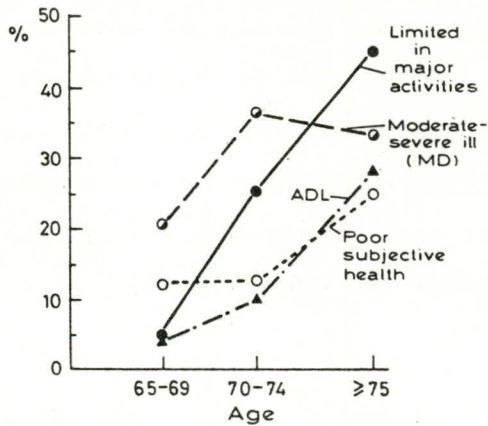
Figure 11

6. 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 measures in elderly men in a community survey in Jerusalem (Gofin, 1982) shows the expected increase with age for each measure although each clearly measures something different (Figure 12). Note the cross-over of the upper curves in the oldest group, the survivors being objectively more healthy. The coefficient of agreement between physicians' appraisals and self-appraisals of health was only 22% and a similarly poor correlation has been reported by others. The same general trends also obtained for women in this community (Gofin et al., 1981), with women appraising themselves as 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, by social class, the poorer, the more pessimistic.

Self-appraisal of health proved a better predictor of mortality than physicians' appraisal in one large Canadian study (Mossey and Shapiro, 1982). As a predictor of five-year mortality in the Jerusalem study (Kark et al., 1979), physicians' appraisal of the presence of moderate or severe illness had a sensitivity of 44% and a specificity of 75%. Self-appraised limited capacity or inability to work had a higher sensitivity of 64%, but a lower specificity of 63% (Abramson et al., 1982).

INDICES OF SUBJECTIVE AND
OBJECTIVE HEALTH
(217 ♂, Jerusalem, 1969-71)



(After Gofin, 1982)

Figure 12

AVERAGE EXPECTATION OF LIFE,
TOTAL AND ACTIVE

MASSACHUSETTS, 1974 (After Katz et al, 1983)

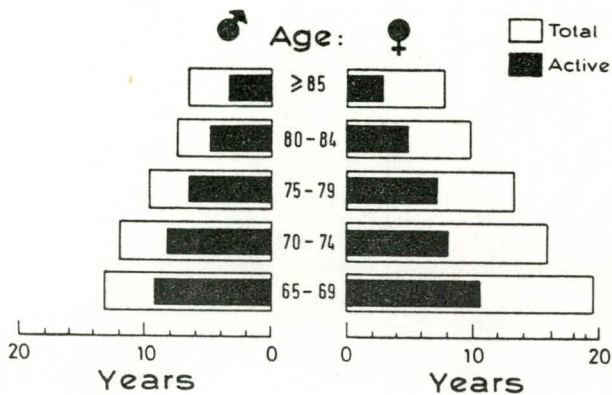


Figure 13

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 the measurement of health status that we seek. Figure 13, based on 1974 data from Massachusetts, shows such an index (Katz et al., 1983). Men have a shorter life expectancy but a more independent one. Indices based on a 1979 French survey show similar trends (Robine and Colvez, 1984).

7. Autonomy

In the current state of knowledge we cannot prevent the majority of the diseases and impairments of old age. 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 into impairments and impairments into handicaps.

The application of the epidemiological method requires a defined and measurable end-point. I suggest that the end-point we seek is loss of autonomy. If we agree that the purpose of health and social services is not only to prolong life but to maintain quality of life 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. Epidemiology would thus fill its essential role in the planning and evaluation of services.

In a stimulating review, Grimley Evans (1984) examines that implications of this approach. He suggests that autonomy "be operationalized primarily by measures of capability of achieving culturally appropriate objectives".

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), physical environment (accidents and poor housing), degree of social support (depression in those left alone), and the attitudes of society (provision of services). Table 5 shows risk categories of the elderly found to be of practical value in a study in Scotland (Fries, 1980). Some of the risk factors can be modified, others can only serve to alert people and services to avoidable outcomes.

Table 5: Groups of Elderly at Risk of Illness and Breakdown

Age over 80
Recently discharged from hospital
Minimum income
Live alone
Childless
Socially isolated
Single/divorced/separated
Recently widowed
Recently moved
Social class V

Source: Taylor, Ford & Barber (1983).

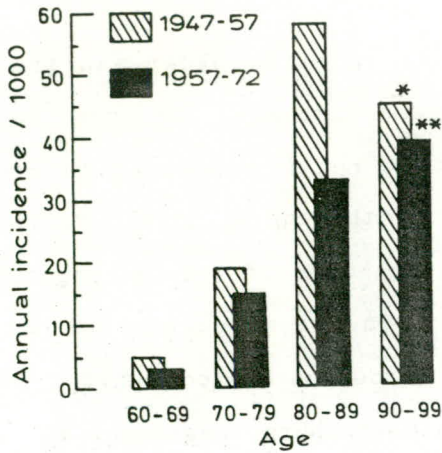
8. The Future

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. While there is some evidence for the former, expectation of life at higher ages is still increasing and there is no evidence, from the U.S. at least, of a decline in morbidity or of the burden on the community.

On the other hand, Svanborg (1982b) in Gothenburg, has begun to show that successive cohorts of 70-year-old Swedes are objectively healthier than those who went before. Feinleib et al. (1975) find lower cardiovascular risk factors in the offspring of the Framingham study subjects than in their parents 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 one longitudinal study in the literature (Oittagwell, 1981) from Lundby in Sweden, shows a fall in incidence over time (Figure 15). And finally, a collage of indicators from different surveys in Japan (Koizvni, 1982) shows a higher proportion of healthy elderly than in Western countries (Figure 14).

These are, of course, mere straws in the wind. Many will point out their limited foundations and the methodological problems involved in such extrapolations from uncontrolled data. And they will be right. But that is the kind of data currently available.

AGE PSYCHOSES IN LUNDBY
1947-57 & 1957-72
(MEDIUM AND SEVERE CASES -
(ANNUAL INCIDENCE /1000)



* 1 case
** 5 cases

Figure 14 (above)

SURVIVAL HEALTH AND TREATMENT
STATUS
(JAPANESE WOMEN, 1979)

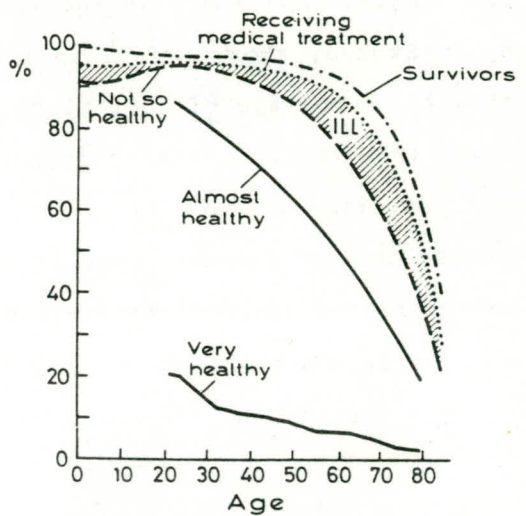


Figure 15 (right)

[Source : WHO, 1984, after Koizumi, 1982]

This paper submits that the needs of the elderly are so complex that they require and deserve the scientific base that can only come from holistic and unifying approach of the epidemiologist. The research opportunities are unlimited and the need for scientific study of the many variables is clear. These problems should be addressed not only because of the intrinsic importance and urgency of the problems, not only because of the methodological and intellectual challenges, but also out of enlightened self-interest. The elderly of tomorrow are ourselves!

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האפידמיולוגיה של ההזדקנות

א. מיכאל דיוויס

פורום בינלאומי

פב-2-84

ג'וינט ישראל
מכון ברוקדייל לגרונטולוגיה
והתפתחות אדם וחברה בישראל

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BR-IF-2-84

The epidemiology of aging /

Davies, Michael A.



000495653811

תאריך

12 מאי 1989

המכון

הוא מכון ארצי למחקר
נוסד ב-1974 ופועל ב-
אמריקה, בעזרתן של ק

בפעולתו מנסה המכון ל-
הבריאות והשירותים ה-
של מומחים מהאקדמיה
מחקר לבין מימוש מסקנ

סידרה בינלאומית

המאמרים מציגים מימצ-
של אנשי אקדמיה באר-
החורגים מעבר להקשר ו-
גיות בעלות עניין בינלאו-
טיבה בינלאומית ההלכה

הממצאים והמסקנות המו-
של המכון או של פרטים ו

האפידמיולוגיה של ההזדקנות

א. מיכאל דיוויס

ביה"ס לבריאות הציבור ורפואה קהילתית
הפקולטה לרפואה בביה"ס לרפואה של האוניברסיטה העברית-הדסה;
ומכון ברוקדייל לגרונטולוגיה והתפתחות אדם וחברה בישראל

ירושלים

דצמבר 1984

הירידה בפוריות, בתמותת תינוקות ובמוות כתוצאה ממחלות מידבקות הביאה לאריכות ימים מוגברת בקרב האוכלוסיה. עליה בלתי פוסקת חלה הן במספרי הקשישים והן בשיעוריהם בקרב האוכלוסיה, עליה שהחלה בארצות העשירות יותר והיא מתפשטת במהירויות שונות לרוב המדינות בעולם. לא זו בלבד שהאוכלוסיות מזדקנות, אלא גם בקרב האוכלוסיה הקשישה עצמה קיימים כיום שיעורים גדולים יותר של ישישים ושל תשושים.

בעבודה זו, המבוססת על הרצאה שניתנה בפני האגודה הבינלאומית לאפידמיולוגיה (ועידה מדעית מס' 10, ונקובר, אוגוסט 1984), נסקרים בקצרה הגורמים והתוצאות של הזדקנות האוכלוסיות. נעשהנסיון לעמוד על השאלות המחקריות המרכזיות העומדות בפני הקהילה האפידמיולוגית. לאחר שנסקרת תרומתן של התמותה והפוריות לתהליכי ההזדקנות של האוכלוסיה באזורים מפותחים יותר ומפותחים פחות, מועלות בפרק 2 כמה מן הבעיות הנובעות מדפוסי הארגון החברתי. פרק 3 מתייחס לגורמים לירידה בתמותה אשר ליוו את השינויים האלה באוכלוסיה, תוך שימת דגש מיוחד על השינויים בסיבות המוות.

יתר אריכות ימים מביאה ליתר תשישות ותחלואה. פרק 4 בודק את מידת הדיוק ואת המיגבלות של הנתונים האפידמיולוגיים הקיימים על תחלואה בקרב הקשישים. פרקים 5 ו-6 סוקרים את המצב השורר כיום בנוגע לפיתוח מדדים של אי-תפקוד ובריאות.

העבודה מעלה את הרעיון שמטרתם הסופית של מחקרים אפידמיולוגיים אלה היא להגיע לדרכי מדידה של אובדן העצמאות בקרב הקשישים. אם בריאות ושירותים חברתיים נועדו לא רק לתרום לחיים ארוכים יותר אלא גם לשמור על איכות החיים האלה לתקופה ארוכה ככל האפשר, הרי שאיכות זו דורשת מידת עצמאות תפקודית שניתן להגדירה. ההתמודדות עם אתגר מחקרי זה תאפשר לאפידמיולוגיה למלא תפקיד חיוני בתכנון ובהערכה של שירותים לקשישים.

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